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How do video games affect mental health? A narrative review of 13 proposed mechanisms

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Abstract

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 are rarely enumerated, and underlying causal structures are rarely made explicit. Here, we overview 13 proposed effects of gaming on mental health. For each, we attempt to draw out (often implicit) counterfactuals—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 (DAGs). In doing so, we hope to provide a bird's eye view of the field and encourage more focused and collaborative efforts to propose, falsify, and iterate on (causal) theories. 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, mental health, wellbeing, review, causal inference

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. Games can support positive emotions (Jones et al., 2014), develop social capital (Mandryk et al., 2020), help users actively cope with or manage difficult life circumstances and stress (e.g., Iacovides and Mekler, 2019; Kowert, 2020; Reinecke and Eden, 2017), and more. 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 and Weinstein, 2019), but gaming can also displace other important activities (Drummond and 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 and Zendle, 2021), among others. However, despite numerous examples that games *can* affect mental health, recent evidence suggests that average relationships between simple time spent playing games and mental health or well-being are very small (Johannes et al., 2021; Vuorre et al., 2022).

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 rigour 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 games 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 and potential effects, but poor in terms of theory and the causal inferences that would unite them (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 and Fiskaali, 2021) and players themselves seek ways to monitor and regulate their own play behavior. 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

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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 games affect wellbeing 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 games influence mental health (Cekic et al., 2024).

We aim to present concrete examples of various proposed causal effects. For each topic, we propose an explicit causal contrast: what feature 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 paper presents a birds-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**: Causal contrasts in games can exist at various analysis levels: in-game content, mechanics or features, player experience factors, and more. We develop a framework that enumerates these levels and their constituent exposures, clarifying study communication and identifying natural groupings of widely studied effects.

3. **Highlight implicit causal contrasts**: Using DAGs and the framework, we suggest explicit causal contrasts to clarify how causal effects may be tested. This provides a template for researchers to design studies and analysis plans, and a starting point for rigorous model falsification for each research topic.

Below, we first develop a conceptual framework of the different *exposures* provided by video games. 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 and Reinecke, 2020), 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 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. Exposures may therefore include playing for escapism vs 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 do video games 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.

Box 1. Approaches (boxes) and levels of analysis (bold terms) at which exposures can be defined in video games research. For each level of analysis, we list possible exposures (non-exhaustive).

Context-centered approach

Temporal Context
- Play volume (e.g., Playtime, Play frequency, etc.)
- Time use and displacement (e., Sleep, Work, Exercise, Education, Media Consumption, Social activities, etc.)
- Time of day (e.g., Morning, Afternoon, Night, Weekday, Weekend, etc.)

Social Context
- Social relationships (e.g., Online friends, Offline friends, Strangers, etc.)
- Community participation (e.g., Discord groups, Forums, Streaming, etc.)

Spatial Context
- Physical behaviour (e.g., Posture, Sedentary lifestyle, etc.)
- Location (e.g., Remote, Co-locating, Public, On the go, etc.)

Game-centered approach

Device
- Console
- PC
- Handheld
- Virtual reality
- *etc.*

Business model
- One-off purchase
- Freemium
- Loot boxes
- *etc.*

Content
- Violence
- Drug use
- Sexualized characters
- *etc.*

Genre
- Sandbox
- First-person shooter
- Action role-playing game
- *etc.*

↪ **Game**
  - Call of Duty
  - Pokémon Go
  - Candy Crush
  - *etc.*

↪ **Game mode** (e.g, PvP, PvE, Solo, Co-op, *etc.*)
  - Player vs Player
  - Co-op
  - Solo
  - *etc.*

↪ **Feature**
  - Avatar
  - Leaderboard
  - Guild
  - *etc.*

Player-centered approach

Playstyle (How do people play?)
- Competitive/cooperative
- Social/antisocial
- Exploratory/goal-oriented
- Mastery/casual
- *etc.*

Purpose (Why do people play?)
- Escapism
- Identity formation
- Social interaction
- Competition
- *etc.*

Personal Characteristics (Who is playing?)
- Personality
- Socio-economic status
- Gender
- Ethnicity
- *etc.*

Player Experience (What do people experience during play?)
- Need satisfaction
- Flow
- Nostalgia
- Immersion
- *etc.*

Enumerating 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

Imagine Bukayo, a teenager who regularly plays multi-player sports games on Xbox. To understand how his play-time 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 playing games (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) forms a causal contrast. The difference in outcome (how Bukayo feels) between these scenarios is our causal effect, defined as $Y^{games} - Y^{book}$.

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 vs read a book. Formally, exchangeability means that given the observed variables, the assignment of treatment (gaming) is independent of potential outcomes (stress).

Often, we cannot randomize identical groups of people to play games or read books, and instead simply observe certain people doing so. In observational research, causal contrasts are likely confounded: other factors may affect both a person's likelihood of playing a game vs reading and their stress level. 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 directed acyclic graph (DAG) (Pearl, 1995), which can be used to visualize and analyze the causal relationships between variables. A 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.

An example from the field's history is illustrative. Early studies on violent video games often compared a game with violent content to one without (e.g., Anderson and Dill, 2000). However, later research showed these games inevitably differed in more ways than just violent content (e.g., one could be more competitive or faster-paced) (Adachi and Willoughby, 2011), meaning no singular causal contrast could be estimated. While violent video games research has since improved by using two modified versions of a game differing only in violent content (e.g., Hilgard, Engelhardt, Rouder, et al., 2019), other research topics still face these challenges.

In observational studies and those where the exposure is a psychological construct, defining causal contrasts is even more challenging. An observational study estimating an effect one additional hour of video game play (e.g., Burke and 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., 2021) might consider the exposure to be the presence or absence of (1) a gaming feature that supports e.g., autonomy (Peng et al., 2012), (2) a motivational disposition towards seeking out need satisfaction (Poeller et al., 2021), (3) a quasi-random 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 causal contrasts and mechanisms, can accelerate progress on these questions.

Exposures vs Mechanisms

Researcher and public interest often extends beyond the estimate of a causal effect to understanding *why* that effect materializes. For example, does engagement with loot boxes affect mental health because it increases the likelihood of problem gambling, or because people feel frustrated with low-value rewards? For this, we must also look at causal *mechanisms*: the chain of events linking the explanans to the explanandum (Elster, 1989).

It is beyond the scope of this piece to fully explain and address causal mechanisms (for a starting point, see Hedström and Ylikoski, 2010). However, we note them briefly because mechanisms are of primary interest to researchers, if not players and policymakers. In the example models to come, we therefore include proposed causal mechanisms that connect gaming exposures to mental health outcomes—for example, by including relevant mediators in each model, as indicated by prior research.

We ground these potential mechanisms in the Multi-level Leisure Mechanism framework (MLMF; Fancourt et al., 2021), which 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. Gaming effects can be categorized within this taxonomy: for instance, gaming's effect on stress relief is a micro-level psychological process within the affective states category, including mechanisms like 'decreased experience of negative emotions.' For each research topic, we match it with MLMF categories, thereby promoting future linking of gaming topics with analogous non-gaming topics.

Present Work

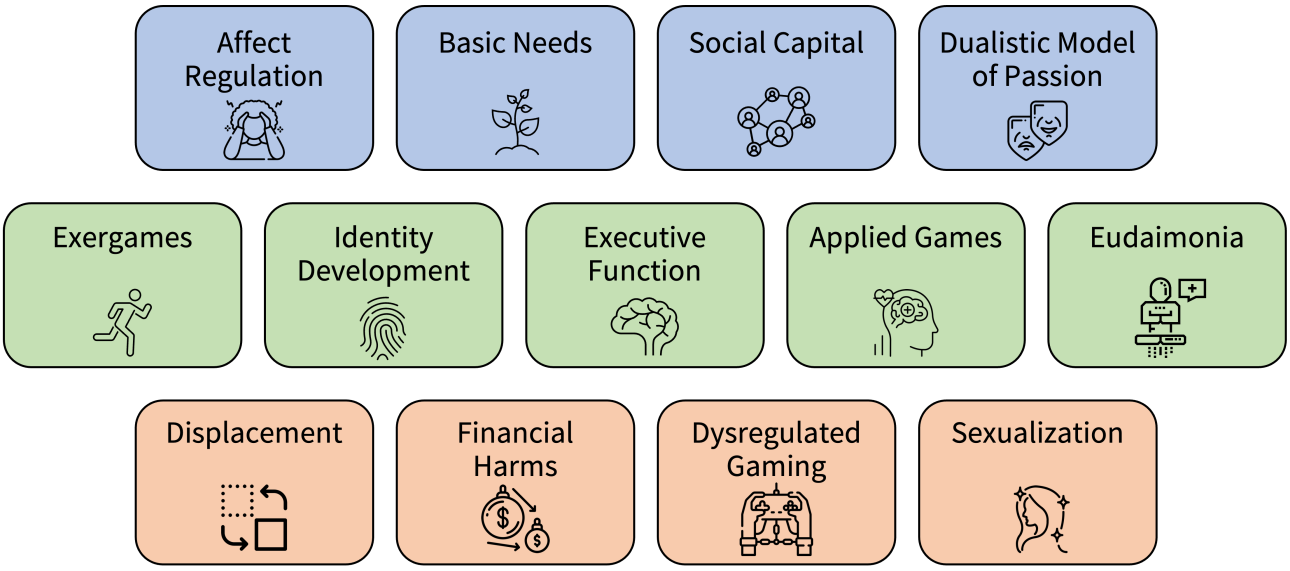
Below, we briefly overview 13 distinct ways games might affect mental health. For each, we attempt to construct an illustrative causal model. This is an ambitious endeavor, and one where we will inevitably fall, owing to (at least) three key limitations.

Caveat 1: Comprehensiveness It is impractical to summarize the vast literature on video games and mental health—a Feb 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' (pg. 8), incorporating elements of hedonia, eudaimonia, and the absence of psychopathology (Martela and Sheldon, 2019; Meier and Reinecke, 2020). For clarity, we constrain example models

Figure 2. Overview of the 13 research topics. Blue topics include pathways to both positive and negative effects; green include positive effects; and orange include negative effects.



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 Games 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 2). 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 directed acyclic graph (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. We take several liberties in the graphic representation of our DAGs, either for visual clarity or to encode further information from the research literature not strictly necessary to define a DAG. Specifically, our DAGs include:

- **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.

Ambivalent Effects of Games 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.

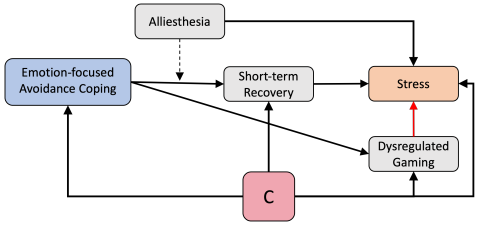
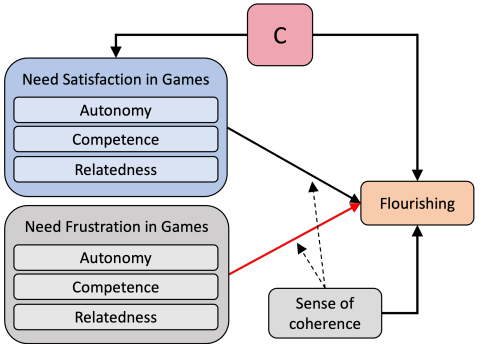
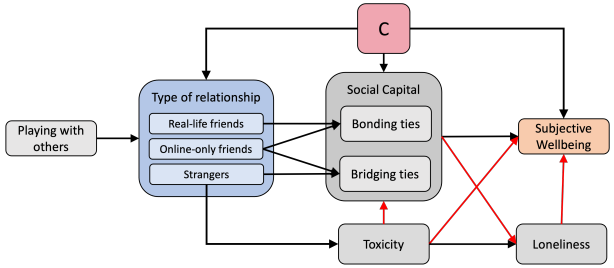
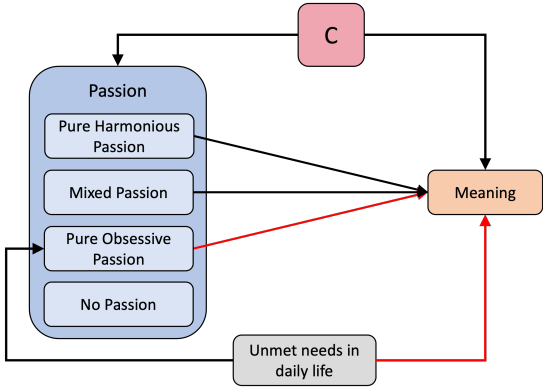
Affect Regulation

Games 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 and 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).

Coping Players use games to facilitate these regulatory strategies: For example, people report playing games to cope with unemployment (Lee and Chen, 2023), loss of loved ones, loneliness, mental health problems, and more (Iacovides and Mekler, 2019). To understand these *purposes* of play, the transactional model of stress and coping (*Stress, Appraisal, and Coping*, 2015; Wolfers and Schneider, 2021) differentiates *problem-focused coping* (changing person–situation transactions

Table 1. Research topics that address both positive and negative potential effects on mental health

Research Topic	Level of Analysis	Multi-level Leisure Framework Mechanism(s)†	Example Causal Contrast	Abstracted Causal Model
Affect Regulation	Temporal Context Purpose (Why)	Psychological > affective states Psychological > resilience	Compared to otherwise identical game play behavior, to what extent does playing games with one unit greater emotion-focused avoidance coping motivation affect stress?	
Basic Psychological Needs	Game Feature Playstyle (How) Purpose (Why)	Psychological > flourishing	Compared to otherwise identical game play behavior, to what extent does experiencing one unit greater need satisfaction affect flourishing?	
Social Capital	Game Mode Playstyle (How)	Social > social activity Social > social resources Social > social relationships	Compared to playing an identical game alone, to what extent does playing with online-only friends affect subjective wellbeing?	
Dualistic Model of Passion	Purpose (Why) Player Experience (What)	Psychological > flourishing Psychological > sense of self	Compared to otherwise identical game play behavior, to what extent does changing one unit of harmonious passion for games into one unit of obsessive passion for games affect meaning in life?	

Note: Causal models are illustrative examples for one research question, and are not intended to depict the full body of knowledge on the topic. The placeholder box C indicates confounds, or any factors that jointly cause the exposure (some aspect of engagement with games, in blue), any mediators, and/or the outcome (some aspect of mental health, in orange). All factors within C need to be controlled for in order to estimate an effect of the exposure on the outcome.
†Most relevant categories from Fancourt et al. (2021)'s Multi-level Leisure Framework. For simplicity, we refer only to the category level, which in turn contain several submechanisms.

by, for example, searching for further information) from *emotion-focused coping* (dealing with emotions—for example 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: Avoidant coping, for one, can have harmful effects on mental health (Cheng et al., 2015).

Mood management Mood Management Theory (Zillmann, 1988) and Resilience in Entertaining Media Use (R^2EM) (Reinecke and Rieger, 2021), among others, propose that games can support *homeostatic regulation*—maintaining physiological states in an optimal range—by way of *alliesthesia*; perceiving stimuli as pleasant or unpleasant depending on their contribution to rebalancing moods. Games, through this lens, can help counterbalance high arousal states (e.g. stress, anger) by calming, low arousal states (e.g. boredom) by exciting, and negative emotions by providing positive experiences of pleasure. These short-term regulatory effects need not accumulate or have lasting impacts. Indeed, an overreliance on games for mood management can help address moods in the short-term but lead to long-term adverse effects (Wegmann et al., 2023): 'short rejuvenating vacations from one's offline life change into more permanent inhabitations [...], with such long-term avoidance of one's problems potentially magnifying rather than relieving distress' (Snodgrass et al., 2014, p.256).

Emotion regulation Through short-term coping and mood management strategies, players might develop long-term emotion regulation skills such as self-efficacy beliefs, social support networks, or a greater sense of coherence (the trait-like, global orientation to embrace life as comprehensible, manageable, and meaningful; Schneider et al., 2022), fostering greater resilience in future emotional challenges (Reinecke and Rieger, 2021). Similarly, experiencing emotions that players do not likely experience regularly in daily life may allow players to rehearse adaptive emotion regulation strategies (Villani et al., 2018).

A proposed causal model. In Table 1, we sketch a model where gaming for the purpose of emotion-focused coping causes short-term recovery effects, 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, see Vuorre et al., 2023). Short-term recovery can lead to the development of longer-term resilience and emotion regulation capacity, enabling players to manage future unpleasant emotional states better. Both short-term recovery and long-term resilience support mental health. However, excessive emotion-focused avoidance coping can lead to a dysregulated pattern of play whereby players over-rely on games to manage short-term emotional states, at the cost of longer-term coping and emotion regulation resources.

Emotion regulation in games is an active area of research, and we are optimistic that the crude model here will soon be supplanted by much more nuanced and well-validated ones. One promising topic that can shed light on when emotion regulation does or does not succeed is escapism; recent work has differentiated maladaptive escaping *from* ('self-suppression') and adaptive escaping *to* ('self-expansion'), which may overlap closely with approach and avoidance coping (Stenseng et al., 2021).

Basic Psychological Needs

Self-determination theory (Ryan and Deci, 2017) argues that humans have three innate and universal psychological needs: *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). Basic psychological needs are theorized to be vital nutriments for a person to live a fully functional life: satisfaction of basic needs promotes positive mental health, whereas the active thwarting of basic needs results in illbeing and psychopathology (Ryan, 2023; Ryan and Deci, 2017).

Games are adept at satisfying players' basic psychological needs. For example, Peng et al. (2012) show that *features* such as avatar customization, skill upgrades, and dialogue options supported autonomy in an exergame. Tamborini et al. (2010) analyze *game modes* and show that playing *Brunswick Pro Bowling* in multiplayer mode (as opposed to single-player) led to greater relatedness satisfaction. Deterding 2011, 2016 looks at the *temporal context* level, showing that players arrange their environment (e.g., 'clearing their calendar' such that they have the earned freedom to engage at will with games), supporting autonomy. The satisfaction readily available in games is often used to compensate for deficiencies elsewhere in day-to-day life (Allen and Anderson, 2018; Mills et al., 2018).

Although gaming is typically need-satisfying, games can also actively thwart or *frustrate* needs, which manifests as feelings of coercion (autonomy frustration), failure (competence frustration), and loneliness (relatedness frustration). Need frustration is distinct from, and 'more than' the absence of need satisfaction (Vansteenkiste et al., 2020). Experiencing need frustration in games is negatively related to motivation for play and game enjoyment (Allen and Anderson, 2018; Ballou et al., 2023), and can lead to negative experiences such as boredom or anger, and negative outcomes such as churn or disordered play (Kosa and Uysal, 2021; Pusey et al., 2021). Where needs are frustrated, years of SDT-informed research shows that poorer mental health will follow (Ryan and Deci, 2017).

Self-determination theory underpins several models of media use and mental health, including the R^2EM model (Reinecke and Rieger, 2021), the IM^3UNE model (Schneider et al., 2022), and the BANG model (Ballou and Deterding, 2023). All these models share the implicit causal contrast of need satisfaction (or frustration) during play vs. playing without experiencing these needs, an exposure at the level of player experience.

A proposed causal model. Drawing from the BANG and the IM^3UNE models (Schneider et al., 2022), we propose an example model in Table 1. Experiencing greater need satisfaction in games, compared to not having those experiences during the same play session, has a

direct positive impact on flourishing—both immediately and through repeated experiences, enhancing one's holistic sense of flourishing. Conversely, need frustration in games has a negative effect. Following 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

Social aspects of gaming are widely studied: A recent systematic review found 101 papers focused on contextual levels of analysis, 200 on game-centered levels of analysis, and 70 on player-centered levels of analysis Gonçalves et al. (2023). Many papers studied multiple determinants across these levels, often conflating them into a single exposure. The subset focusing on mental health outcomes was relatively small (n = 19) (2023), but proposed several causal mechanisms.

Multiplayer games facilitate social interactions integral to wellbeing by initiating connections between gamers (Dabbish, 2008; Hernandez et al., 2014), maintaining or enhancing pre-existing relationships (Wohn et al., 2011), developing trust and social closeness with strangers (Depping and Mandryk, 2017), and reducing loneliness (Depping et al., 2018). The main theoretical explanation for these effects is rooted in the social capital framework (Putnam, 2000), which distinguishes 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). Video games can support both bridging and bonding ties (Mandryk et al., 2020). 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. The type of relationship may therefore act as a mediator between social gaming and social capital (2018).

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 wellbeing, potentially leading to depression, anxiety, and in extreme cases, suicide (Kwak et al., 2015).

A proposed causal model. We propose a model of social gaming and mental health in Table 1. Here, the exposure is the type of relationship the player has with others in their gaming environment (e.g., teammates, opponents, co-located 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 wellbeing, for better and worse respectively.

Passion

Passion is defined as a strong inclination toward a valued activity into which time and energy is invested (Vallerand et al., 2003). Passion for life activities (e.g., gaming) affects engagement and eventually becomes adopted as part of their self-identity (e.g., being a 'gamer') (2003).

The Dualistic Model of Passion (2007) differentiates two types of passion: harmonious and obsessive. Harmonious passion (HP) is characterized by a positive, balanced, and meaningful relationship with the beloved activity. In contrast, obsessive passion (OP) is characterized by uncontrollable urges, preoccupation, and inflexible persistence. Harmonious passion for games is positively associated with mental health outcomes such as relaxation, creativity, and post-play energy (Johnson et al., 2022; Mandryk et al., 2020; Przybylski et al., 2009; Tóth-Király et al., 2019). Obsessive passion is related to problematic (over)use of games, procrastination, and post-play tension (Johnson et al., 2022; Mandryk et al., 2020; Przybylski et al., 2009; Tóth-Király et al., 2019). 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).

In response to findings from games and other domains that harmonious passion is not always associated with positive outcomes and obsessive passion is not always related to negative outcomes (Curran et al., 2015; Przybylski et al., 2009; Tóth-Király et al., 2019), scholars have started considering passion as a quadripartite construct (Schellenberg et al., 2019). Where the dualistic model of passion treats obsessive and harmonious passion as independent, the quadripartite model allows for co-existence across four profiles: pure harmonious passion (high HP and low OP), pure obsessive passion (high OP and low HP), mixed passion (moderate to high HP and OP), and no passion (low HP and low OP). In video games, pure harmonious passion predicts positive mental health outcomes and pure obsessive passion predicts negative outcomes, with mixed passion and no passion having no consistent effect (Johnson et al., 2022; Schellenberg et al., 2019).

A proposed causal model. Table 1 shows a proposed causal model depicting the relationship between the quadripartite extension of the dualistic model of passion, and compensatory behaviors. Here, pure harmonious passion and, to a lesser extent, mixed passion are expected to positively impact the person's experience of meaning in their life. On the other hand, pure obsessive passion—which is produced by a feeling of unmet needs elsewhere in daily life—is proposed to negatively affect meaning.

Positive Effects of Games on Mental Health

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

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 and Baldwin, 2020), and more.

Eudaimonic wellbeing is a component of mental health, suggesting that eudaimonic experiences during gameplay can directly contribute to improved mental health. Observational evidence supports this: in-game flow is related to emotional wellbeing (Vella et al., 2013), meaningful experiences in *Pokemon Go* are related to life satisfaction and flourishing via nostalgia (Wulf and Baldwin, 2020), and eudaimonic media exposure in other domains is linked to prosociality and improved vitality (Janicke et al., 2018; Schnall et al., 2010).

While certain game features or content combinations are more likely to produce eudaimonic experiences, different experiences resonate with different players, making it hard to predict what will be meaningful versus simply entertaining. Thus, we view the primary causal contrast as a player experience: having a eudaimonic experience during gameplay vs. playing a similar game without a eudaimonic experience.

A proposed causal model. Our proposed model (Table 2) 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 are comprised of several sub-aspects, including meaning, nostalgia, and social connectedness (eudaimonic experience is thus envisioned here as a formative, rather than reflexive, construct; e.g. Van Rooij et al., 2017). The experience of eudaimonia in games then contributes to vitality—a common measure of eudaimonic wellbeing (e.g., Tyack and Wyeth, 2021).

Exergames and Physical Activity

Substantial research has investigated how playing exergames—games involving physical movement—can positively influence mental health. The logic is straightforward: exercising is strongly linked with improved mental health (Mikkelsen et al., 2017), and exergames leverage the motivational strengths of video games to promote engagement with exercise. Popular exergames include *Ring Fit Adventure*, *Fit XR*, and *Dance Dance Revolution*.

Playing exergames can lead to a robust increase in physical activity (Sween et al., 2014). Knock-on effects include potential reduction in depression symptoms (J. Li et al., 2016), anxiety symptoms (Viana et al., 2020), and greater positive (and less negative) affect (Zheng et al., 2020), across age and geographic regions. However, it is not always clear that exergame interventions outperform other (control) interventions in improving mental health, pointing at a need for more gold-standard randomized control trials.

Exergames are sometimes viewed as a genre, but since various game types can be made into exergames (e.g., role-playing games, puzzle games), we consider this exposure at the level of a game feature—the presence of movement controls or body tracking that encourages or requires physical activity to play.

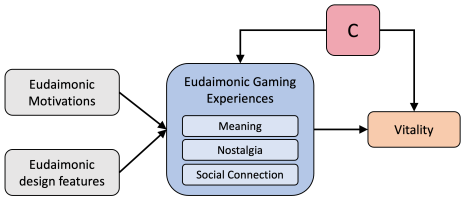
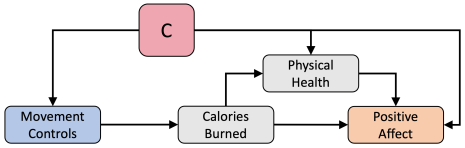
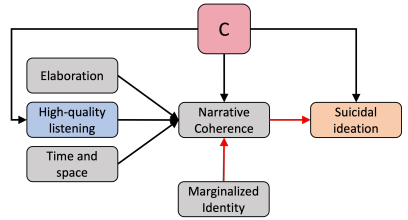
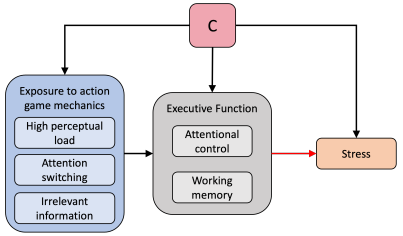
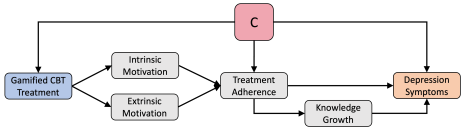
A proposed causal model. We present an abstracted causal model in Table 2, where the exposure is playing a game with movement controls versus playing the same game without movement controls. We predict that movement controls lead to greater calories burned, producing short-term positive affect consistent with previous exercise research (Hogan et al., 2013). Longer term, calories burned also lead 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?' Identity formation involves reconstructing and making sense of past events (narrative identity) and forward-thinking exploration and commitment to particular ideologies, roles, and labels in a given domain (e.g., joining an esports community and dedicating time to competitive play) (McLean and Pasupathi, 2012). Media use can support identity development by affording *elaboration* (asking probing questions, making evaluative comments, encouraging expression of viewpoints), *high-quality listening* (listening to understand personal meaning, validating self-narratives, giving integrateable feedback), and *time and space* to grapple with identity paradoxes (supporting narrative contradictions and changing self-representations without losing esteem) Granic et al. (2020).

Gaming can support all three factors. For example, elaboration might be supported in discussions about metagame health and balance, prompting the player to elaborate on their experience (e.g., as a player of other games in that genre, or with a particular background such as design). High-quality listening can be supported by the low-stakes social frame created by games (Deterding, 2009), giving players a shared locus of attention and an opportunity to connect with teammates more cohesively than in less structured social interactions (Ballou et al., 2022). Games afford time and space to experiment with characters and avatars with different identity and personality characteristics than one's own (e.g., playing more assertively, as a caretaker, and so on). This provides emotionally powerful opportunities to grapple with identity

Table 2. Research topics that address positive potential effects on mental health

Research Topic	Level of Analysis	Multi-level Leisure Framework Mechanism(s)†	Example Causal Contrast	Abstracted Causal Model
Eudaimonia	Purpose (Why) Personal Context (Who)	Psychological > flourishing Psychological > personal transformation Behavioral > personal location	Compared to otherwise identical game behavior, to what extent does experiencing one unit greater nostalgia during a gaming session affect vitality?	
Exergames	Feature	Psychological > affective states Behavioral > behavioural drive Physical > performance Biological > cardiometabolic systems	Compared to playing an otherwise identically-designed game, to what extent does the addition of movement controls affect post-play positive affect?	
Identity Development	Purpose (Why)	Psychological > sense of self Psychological > personal transformation Social > social resources	Compared to otherwise identical solo game behavior over 6 months, to what extent does playing a video game with others who demonstrate high-quality listening affect suicidal ideation?	
Executive Function/Cognition	Genre Feature	Psychological > psychological capabilities Biological > nervous system	Compared to playing an otherwise identically-designed game that expert designers assess as low cognitive demand 1x per week for 6 months, to what extent does playing a game experts rate as high-cognitive demand for the same period affect stress?	
Applied Games	Content	Psychological > psychological capabilities Social > learning and traits Behavioral > development of habit Health behaviors > engagement in healthy behaviors	Compared to an otherwise identical non-gamified cognitive-behavioral therapy treatment, to what extent does engaging in a gamified treatment affect depression symptoms?	

Note: Causal models are illustrative examples for one research question, and are not intended to depict the full body of knowledge on the topic. The placeholder box C indicates confounds, or any factors that jointly cause the exposure (some aspect of one's engagement with games, in blue), any mediators, and/or the outcome. All factors within C need to be controlled for in order to estimate an effect of the exposure on the outcome.
†Most relevant categories from Fancourt et al. (2021)'s Multi-level Leisure Framework. For simplicity, we refer only to the category level, which in turn contain several submechanisms.

challenges that often reflect back on offline identity concerns, in an environment where such contradictions typically go unnoticed or are treated with acceptance.

This might be especially important for marginalized players, such as gender-diverse and neurodiverse youth (Di Cesare et al., 2023). Players use avatars to explore, develop, and rehearse gender expression in a low-stakes environment, affirming their feelings and supporting well-being (McKenna et al., 2022; Morgan et al., 2020). Other examples include autistic children using Minecraft to develop social skills (Zolyomi and Schmalz, 2017), dyslexic players playing games to improve reading skills and confidence (Puccio et al., 2023), and children with ADHD using games to aid in social development and school performance (Bassiouni and Hackley, 2016). Designing games that best support neurodivergent players' needs remains an ongoing challenge (Spiel and Gerling, 2021).

A proposed causal model. In our proposed model (Table 2), we draw from Granic et al. (2020)'s interpersonal factors to predict that playing alongside other players who exhibit high-quality listening, as compared to playing with others who do not exhibit high-quality listening, 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, a causal contrast at the player experience and social context levels. Greater narrative coherence is predicted to result in reduced suicidal ideation, an 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). Findings indicate 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., 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 improve through gaming might benefit mental health across the life span (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 (2017). Interestingly, the link between cognition/executive function and mental health has not featured prominently in research on (action) video games, although Hemenover and Bowman (2018) posit that the cognitive skills developed through playing games may support emotion regulation (see above).

A proposed causal model. Our proposed model is presented in Table 2. 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).

Applied Games for Therapeutic Benefits

This review is focused primarily on commercial games. However, we would be remiss not to mention *applied* games that are designed with a specific (mental health) goal in mind. Applied games have been used to treat anxiety in children (van Rooij et al., 2016), treat phobias with exposure therapy (P. Lindner et al., 2020), deploy cognitive-behavioral therapy for people with depression (Roepke et al., 2015), and much more. Promisingly for causal inference, many studies have been experimental, comparing the effectiveness of the applied game against other non-game interventions, no treatment, or an alternative game (version). A recent review of randomized controlled trials found benefits for social skills, memory, anxiety, depression and ADHD, and other outcomes (Wols et al., 2024).

Examples are varied. A game targeted at developing social skills among children with autism was found to be more effective than a caregiver-supported cognitive skills training game at improving social competencies and reducing behavioral problems (Beaumont et al., 2021). Another applied game, EndeavorRX, made headlines in 2020 after receiving FDA approval as a treatment for child ADHD (Kollins et al., 2020)—though not without controversy (Evans et al., 2021). Two versions of game *Superbetter*, one applying cognitive-behavioral therapy strategies to target depression and an alternative applying general self-esteem and acceptance strategies were equally effective at reducing depression symptoms (Roepke et al., 2015).

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 have strong potential to positively impact mental health, and are poised to become an increasingly common medium for therapeutic interventions (Fleming et al., 2017). Applied games are also a mainstay in research on educational engagement and attainment (Girard et al., 2013); an exciting area we do not cover here as it is less directly related to mental health.

A proposed causal model. Our simplified causal model is depicted in Table 2, showing mediation via motivation and treatment adherence. The core idea is that having a gamified (vs a non-gamified) 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 (CBT) treatment for depression, the model indicates that people who received the gamified treatment are more 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 non-gamified 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 Games on Mental Health

In this last section, we discuss research topics that cover negative hypothesized effects, summarized in Table 3.

Displacement

The *displacement hypothesis* posits that time spent on a media activity zero-sum displaces other, more psychosocially beneficial activities. The displacement hypothesis dates back to television research in the 1950s (Mutz et al., 1993), and re-emerged with new media, including video games (Fisher, 2012). Displacement encompasses several related potential harms of gaming as a less physically, cognitively, or emotionally adaptive behavior than alternatives, such as proposed links between gaming as a sedentary behavior and obesity (i.e., displacement of physical health behaviors) (Kohorst et al., 2018; Marker et al., 2019).

Commonly-cited displaced activities include gaming leading to lost sleep (Guo et al., 2022), lower performance at work or school (Drummond and 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).

Critiques of the displacement hypothesis are similarly long-standing, including that people's time budgets are flexible; that activities typically 'displace' similar activities, thereby serving the same psychosocial functions; or that the hypothesis often surfaces adults' normative views of about what kinds of activities children and young people *should* engage in, regardless of whether these activities are actually most developmentally appropriate or psychosocially beneficial (Mutz et al., 1993).

The displacement hypothesis targets the temporal context level of analysis: the causal contrast of *any* gaming as compared to time spent doing a non-gaming activity. 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 e.g., time-use diaries, interviews, and ecological analyses can help shed light (Orben, 2021).

A proposed causal model. Our example causal model Table 3 reflects this ambiguity. Here, the model indicates that greater playtime directly 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 lower physical fitness (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 high playtime (Ballou et al., 2024; Vuorre et al., 2022). As such, this is a model where the confounders C are numerous and vital: 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 wellbeing is fruitless.

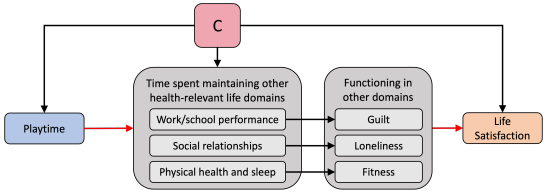
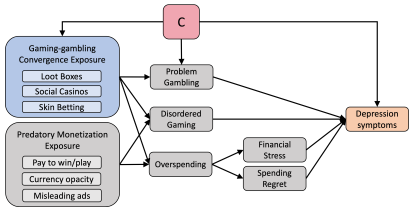
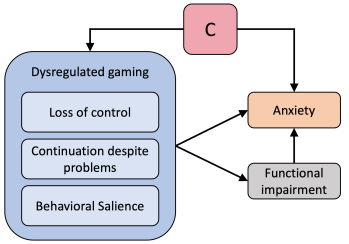
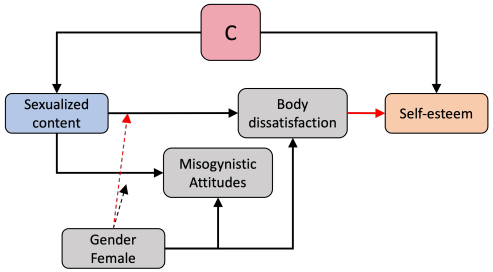
Financial Harms

Widespread research concern about potential financial harms—resulting from game features such as loot boxes, dark patterns, and predatory monetization—developed around 2018 when a series of papers demonstrated a robust correlation between how much money people spend on loot boxes (in-game items purchasable for real-world currency and whose contents are unknown at the time of purchase) and their level of problem gambling (Zendle and Cairns, 2018; 2019; Zendle et al., 2019). Researchers suggested either that loot boxes might be preying on people with gambling problems, or that loot boxes might be causing people to become gamblers—and in either case, that certain monetization strategies are causing harm to player mental health.

Since then, the conversation has expanded beyond loot boxes, with concerns about other areas of gaming-gambling convergence (Denoo et al., 2023), predatory design such as misleading advertising (Petrovskaya and Zendle, 2021), and connections between risky in-game spending and disordered gaming (W. Li et al., 2019; Raneri et al., 2022).

A proposed causal model. Our proposed causal model in shown in Table 3, based on a causal contrast in game features and business models. In the model, playing a game with gambling-like features (e.g., loot boxes or skin betting options) vs playing the same game with no gambling-like features leads to higher likelihoods of (1) the player spending beyond their means, (2) developing problem gambling habit, and (3) developing a dysregulated or disordered relationship with games. 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 and Zendle, 2023). A competing exposure is playing a game with non-gambling predatory monetization features (e.g., 'pay to win'/'pay to skip' mechanics, layers of virtual currency that disguise the true cost of items) versus playing the same game without those predatory monetization features.

Table 3. Research topics that address negative potential effects on mental health

Research Topic	Level of Analysis	Multi-level Leisure Framework Mechanism(s)†	Example Causal Contrast	Abstracted Causal Model
Displacement	Temporal context	Social > social activity Behavioral > personal location Health behaviors > disengagement from healthy behaviors	Compared to spending one hour reading, to what extent does spending one hour playing video games affect vitality?	
Financial Harms	Business model	Behavioral > behavioral decisions Health behaviors > Engagement in unhealthy behaviors	Compared to playing an otherwise identical game with no predatory monetization mechanics for 6 months, to what extent does playing a pay-to-win game affect depression symptoms?	
Dysregulation	Spatial context (where and how) Temporal context Game Genre Business Model Purpose (why)	Psychological > flourishing Social > social resources Behavioral > development of habit Behavioral > behavioral decisions Health behaviors > Engagement in unhealthy behaviors	Compared to otherwise identical game behavior, to what extent does experiencing one unit greater withdrawal when not playing video games affect anxiety?	
Sexualization	Content	Psychological > sense of self Psychological > group attitudes	Compared to playing an otherwise identical game with no sexualized content, to what extent does playing a game with a sexualized female main character affect self-esteem?	

Note: Causal models are illustrative examples for one research question, and are not intended to depict the full body of knowledge on the topic. The placeholder box C indicates confounds, or any factors that jointly cause the exposure (some aspect of one's engagement with games, in blue), any mediators, and/or the outcome (some aspect of one's mental health, in orange). All factors within C need to be controlled for in order to estimate an effect of the exposure on the outcome.
†Most relevant categories from Fancourt et al. (2021)'s Multi-level Leisure Framework. For simplicity, we refer only to the category level, which in turn contain several submechanisms.

Dysregulation

Dysregulated gaming describes the long-studied phenomenon of players losing the ability to control their gaming in a healthy way, leading to excessive play accompanied by significant psychological distress and/or functional impairment (King and Delfabbro, 2019). Dysregulated gaming has been formalized as 'internet gaming disorder' in the DSM-5 as a condition for future study (American Psychiatric Association, 2013), and as 'gaming disorder' in the ICD-11 (World Health Organization, 2018), with the two conditions sharing significant conceptual overlap but key differences in diagnostic criteria. Dysregulated gaming has been linked with greater likelihood of skipping school and worse grades (Rehbein et al., 2015), depression and loneliness (Ballou and Zendle, 2022), social problems (Müller et al., 2015), lower self-esteem (Ballou and Zendle, 2022), obesity (Ko et al., 2020), and various other outcomes.

The causal direction between mental health and dysregulated play is debated; some evidence suggests dysregulated gaming may be a symptom of underlying disorders (Van Rooij et al., 2018), and might be better classified as a maladaptive coping mechanism, a subclinical problematic behavior, or something else (Aarseth et al., 2017; Ferguson and Colwell, 2020). The relationship is likely bidirectional, with poor mental health causing players to withdraw and become more reliant on games at the expense of other responsibilities, thus further undermining mental health (Przybylski and Weinstein, 2019).

Not all highly-engaged players will exhibit signs of impairment (Deleuze et al., 2018; Griffiths, 2010; Van Rooij et al., 2011), leading to repeated calls for more work on differentiating high-engagement vs disordered patterns of play (Billieux et al., 2019; Deleuze et al., 2017; Ferguson et al., 2011).Experentially, disordered play stems from gaming *interfering* with what one wants to be, do, and have, whereas highly-engaged non-problematic players report that gaming experiences *represent* what they want to be, do, and have (Karhulahti et al., 2022).

The causal contrast of interest in dysregulated gaming research is play characterized by dysregulation symptoms vs play without such dysregulation symptoms—a contrast that spans the temporal context, purpose, and player experience levels. This is complemented by research that investigates whether certain genres (e.g., Laconi et al., 2017), monetization models (W. Li et al., 2019, e.g.,), or features (e.g., Flayelle et al., 2023) are more likely to produce dysregulated play.

A proposed causal model. An abstracted model depicting a one-directional relationship is shown in Table 3, whereby dysregulated gaming is a formative construct comprised of the criteria specified in the WHO condition: a loss of control over play, continuation of play despite negative consequences, and increasing behavioral salience such that other areas of life suffer (see also displacement). 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.

Sexualization

Earlier in the paper, we reviewed research on violent content in games. A second area of inquiry related to game content looks at the effects of sexualized characters. 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, which include 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). Researchers and policymakers have expressed concern that exposure to such sexualized content might result in body dysmorphic disorder (BDD) (D. Lindner et al., 2020; Sylvia et al., 2014) and more misogynistic attitudes (among male players; Yao et al., 2010). Among women especially, this can be framed as a mental health concern.

As with many other domains, evidence is decidedly mixed. Recent preregistered studies have found that a short-play session of a game with sexualized characters does not appear to impact self-objectification or hostile sexism (Read et al., 2018; Skowronski et al., 2021a), in line with meta-analytic results showing a null effect (Ferguson et al., 2022). However, a longitudinal study found a relationship between use of sexualized video games and a disposition toward valuing appearance over competence 6 months later (Skowronski et al., 2021b). It may, therefore, be the case that sexualized content in games has longer-term, small but accumulative effects on players.

A proposed causal model. To our knowledge, there are few theories that put forth an explicit causal model for how such effects accumulate. One counter-example is cultivation theory, a loose framework positing that long-term exposure to media content can affect the perception of social realities and the attitudes toward those (Breuer et al., 2015). An example model is depicted in Table 3, whereby exposure to sexualized game content results in lower body satisfaction for women, and greater misogynistic attitudes for men. For women, the effect of greater 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 games 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 finally, 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 games' 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 be having positive effects on players—for example, that games 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.

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 directly comparable—i.e., 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 causal contrasts. 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 are affecting 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. When working with a player to manage their gaming, guidance 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 10pm' (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.

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 wellbeing?). 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 (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 and 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 towards 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 causal contrasts, estimate causal effects accurately, and report transparently so that the community can collectively design, improve, and test causal models most effectively. Otherwise, our conclusions might not only be incorrect but not even wrong.

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 towards 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 towards 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 towards ways to best support players' digital well-being.

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Visualization: TH, NB
Writing – original draft: NB, TH
Writing – review & editing: NB, TH, MV, KM, AKP

Conflicts of Interest

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