How do games affect mental health? A narrative review of 13 positive and negative effects through a causal lens

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Abstract

Researchers have proposed a wide variety of ways that playing video games might affect mental health, both for better and for worse: by displacing other more psychosocially beneficial activities, satisfying or frustrating basic psychological needs, relieving stress, improving executive function, and many more. However, these potential mechanisms are rarely enumerated, and the causal structures that underlie them rarely made explicit. In this paper, we provide an overview of 13 theoretical mechanisms connecting video game play to mental health. For each, we attempt to draw out the (often implicit) counterfactuals at play—that is, what aspect of concrete aspect of gaming would change in a hypothetical alternative universe to produce the effect of interest—and illustrate these with example research questions and simplified causal models. In doing so, we hope to provide a bird's eye view of the field, encourage more focused and collaborative efforts to propose, falsify, and iterate on theories and causal models, and draw attention to methodological best practices that can help us progress more effectively. Only in doing so, we believe, can the field of media effects realize its potential to inform interventions, regulation, game design, and the behavior of players and parents.

Introduction

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. We have rich and varied evidence that playing digital games can have both positive and negative effects on many players. 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 by displacing other important activities (Drummond and Sauer, 2020), leading to dysregulated or disordered use (Przybylski and Weinstein, 2019), exposing players to toxicity, harassment, or extremism (Kordyaka et al., 2020; Kowert et al., 2022), or preying on vulnerable user's finances (Petrovskaya and Zendle, 2021). Complicating matters, however, is the fact that despite these numerous examples that games *can* affect mental health, most players appear to experience only minimal positive *or* negative effects: recent evidence supports the absence of any meaningful relationship between time spent playing games and mental health—both at an aggregate population level and for the majority of individuals (Johannes et al., 2021; Vuorre et al., 2022).

The central challenge for this research area is to take anecdotal 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, our methods and evidence base are largely misaligned with this goal. Researchers are encouraged to default to euphemistic language of associations, even when their interests are ultimately causal in nature (Hernán, 2018). Researchers also work under 'publish or perish' incentive structures that pressure us towards quick-to-conduct cross-sectional analyses, bivariate relationships, and individual novelty over collective growth. 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 theory and causal inference that unite these (Ballou, 2023; Rohrer, 2018).

Changing this state of affairs will be difficult, but necessary to address stakeholders' critical needs. Parents are looking for actionable guidance about how to manage children's play (Lieberoth and Fiskaali, 2021). Players of all ages are looking for ways to monitor their play

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behavior, and to ensure that they regulate it effectively alongside other responsibilities (e.g., using tools such as https://playtracker.net). Game developers are looking for design guidelines that produce more engaging games for a wider audience without pushing into the realm of so-called dark patterns that harm players (Aagaard et al., 2022). Policymakers are looking for evidence that can shape decisions about how to regulate technology companies and in some cases even whether individuals should be limited in their ability to play (Colder Carras et al., 2021). Clinicians are looking for ways to recognize when gaming has become problematic and how to treat that effectively without unfairly maligning the hobby for healthy players (Aarseth et al., 2017; Greenfield, 2018). Only with causal information about the risks and benefits of gaming can we begin to intervene in ways that will help these groups maximize the positive impact of the billions of hours spent gaming and minimize the negative.

This sets up the goal of the current work. Here, we seek to summarize previous research on video games and mental health and concretize various families of causal mechanisms that have—often implicitly—been proposed. For each mechanism, we give an example of an explicit causal contrast: what experience or feature would need to be 'switched on or off' to predict the relevant mental health outcome? We hope this can serve several purposes:

1. **Provide an overview of the field**: We hope to give a birds-eye perspective of the ways gaming might affect mental health, both positively and negatively. 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)

2. **Highlight (implicit) causal contrasts**: Researchers working on the effects of digital technology are in agreement that understanding the causality is one of our foremost priorities. However, studies and theories are not always clear on precisely what the exposure—the specific factor, treatment, or intervention that may potentially influence an outcome of interest—is. Exposures in games can exist at various levels of analysis: some are concerned with in-game content, others with mechanics or features, others with player experience factors, and so on. By giving specific examples of a potential exposure and the level of analysis at which it sits, we hope to draw greater attention to the level of counterfactual clarity we need for theory development to be successful.

3. **Encourage incrementalism and visibility**: Studies working on the same topic frequently operate in parallel, providing overlapping or conflicting results on the same topic but not directly challenging or building upon each other. In large part, this may be because the studies adopt different theoretical frameworks (or perhaps none at all). We hope that providing an umbrella label for various research domains can encourage a more concrete shared goal

for researchers working on a topic—a well-specified and predictive causal theory.

While the first of these points is self-explanatory, we expand on the latter two below.

Counterfactuals and Causality

Imagine we want to understand how Bukayo, a teenager who regularly plays multiplayer sports games on Xbox, is affected by the amount of time he spends playing. We track his playtime for a week and then ask him about his stress levels. Our ultimate interest here is a *counterfactual*: we know how Bukayo is currently feeling, but we want to know how he *would have* been feeling in an alternative universe where everything in his life was the same except for his gaming—perhaps in this alternative universe, he spent that time reading a book instead. The difference in the exposure between these two universes—that is, gaming during that period vs reading a book—forms a *causal contrast*; and the difference in outcome—stress—between these two universes is our causal effect.

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 very much like Bukayo, of whom some happen to spend more or less time playing games during the observation period. Comparing these two groups allows us to estimate what *would have* happened to Bukayo—or indeed any average individual in the sample—had they played vs read a book. Formally, exchangeability means that given the observed variables, the assignment of treatment is independent of potential outcomes.

Viewing it through these terms highlights the causal fuzziness endemic to much of the games literature. For example, when we discuss the potential effect of playing video games on narrative identity formation (Granic et al., 2020), there are various causal contrasts we might imagine: playing any game versus not playing any games, playing a game with certain social features versus playing a game without such social features, playing with close real-world friends vs playing with strangers, and so on. When we look at time, we might imagine playing games versus reading a book, playing games versus doing homework, playing games versus hanging out with a friend, and so on. Some of these lend themselves to potential intervention, others less so. But until we have defined some set of specific causal contrasts, we are largely unable to test the causal effects of games.

To summarize, 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 as comprehensively as possible, and report all this transparently so that the community can take causal models and improve upon them as a community.

Incrementalism and Visibility

When researchers are explicit about causal models, and put in a position to (a) severely test them against evidence and (b) have them scrutinized by the larger community, our chances of converging on the truth are greatly increased. However, this is only possible when researchers are working within the same umbrella.

At present, research in our field can operate in parallel to, rather than in cooperation with, similar work around it—researchers cite previous findings, derive inspiration from other studies, and present at similar venues, but may not directly challenge others' results, test theories or models head-to-head, or dissect studies with divergent findings to understand why this might occur. As a result, the field is rife with often directly contradictory literature, as evidenced by '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), cognitive benefits of action game play (Bediou et al., 2018; Hilgard et al., 2019), and others.

While much divergence may be explainable by factors such as publication bias and methodological choices, another significant portion is likely attributable to the fact that studies ostensibly addressing the same research question have subtly different (implicit) causal contrasts: one study estimates the effect of playing a violent game vs the same game with no violence, another estimates the effect of playing violent games versus non-violent games (which naturally differ in a wide variety of features), another estimates the effect of playing violent games versus doing something else besides playing games, and so on. Things become even more difficult when we investigate psychological factors—is the causal contrast the presence or absence of a gaming feature that supports e.g., immersion, or of an individual motivational tendency towards seeking out immersion, or of a quasi-random manifestation of an immersive player experience in one particular session but not another? Until we are clear about these differences and the evidence that underlies each of them, we will continue to fall short of robust and generalizable causal knowledge about games.

To help create guidelines for defining different types of causal contrasts in the games domain, the next section presents a framework that differentiates several levels of analysis.

Levels of Analysis in Games Research

Researchers have long recognized that video games are far from a single construct—it is not just the fact that a player has played any game that determines the outcomes of that play, but the specifics of who, what, when, why, and how much (Hartanto et al., 2021). To this end, one of the reasons for the high heterogeneity of effects in games research may be the conceptual diversity with which video game play is operationalised. Many studies and reviews seem to work from narrow, unsystematic approaches to video game effects research, investigating widely different exposures (e.g., playtime, genres, player enjoyment, violent content, loot boxes, action mechanics, social interaction, etc.) that all operate at distinct levels of analysis. Without a framework that systematizes these levels of analysis, there is no counterfactual clarity on what part of the play experience is affecting an outcome, and the causal contrast of the found associations cannot be systematically evaluated. Inspired by a similar model for social media presented by Meier and Reinecke (2020), we used concept mapping (Booth, 2016) to organize the disparate video game elements that are operationalized in the games literature according to their common and varying properties to identify basic levels of analysis that range from general to more specific and differentiate between contextual, game-centered, and player-centered approaches (Figure 1).

The distinction between the three approaches is critical because they imply drastically different explanatory foci when relating a video game exposure to a mental health outcome. The **context-centered approach** argues that the exposure of contextual determinants, such as the temporal, social, or spatial configurations, are what form the relation between video game play and mental health. Context-centered levels of analysis are measures external to video game play itself and instead focus on the environmental setting in which gaming occurs; they describe *when, how long, with whom,* and *where* people play. These variables can in principal be observed but are nonetheless still often measured via self-report.

The **game-centered approach** offers a technologically deterministic framing that argues that the exposure to (some aspects of) the video games themselves are related to mental health. Game-centered levels of analysis are, therefore, descriptive measures that focus on specific games and game-design elements that can often simply be observed (e.g., digitally tracked) or classified. Within the game-centered approach, we hierarchically distinguish seven levels of analysis, whereby emphasizing each lower level (e.g., a single feature) can be nested in a higher level (e.g., a specific game). This means that information from lower levels (e.g., whether a game has a guild system) can be incorporated at higher levels (e.g., guild membership in World of Warcraft). Note that empirical research may inadvertently combine information from several levels of analysis into a single exposure. For instance, 'Action mechanics in Call of Duty played on Xbox' includes information on a specific feature, a unique branded game, and the device it is played on. Finding that such an exposure affects mental health raises the question of whether this is caused by the action mechanics (but not other features), playing Call of Duty (but not other games), or by playing it on Xbox (but not other devices).

The **player-centered approach** explains any relation between video game play and mental health through the individual characteristics or personal experience of players. The exposures in the player-centered levels of analysis are psychological measures and demographic variables that aim to capture the human side of gaming; they describe *who* is playing, *why* they are playing, *how* they are playing, and *what* they are experiencing. Some of these variables can be observed, but most can only be measured via self-reports.

We note that, in principle, the proposed levels of analysis in all three approaches can be operationalized in a variety
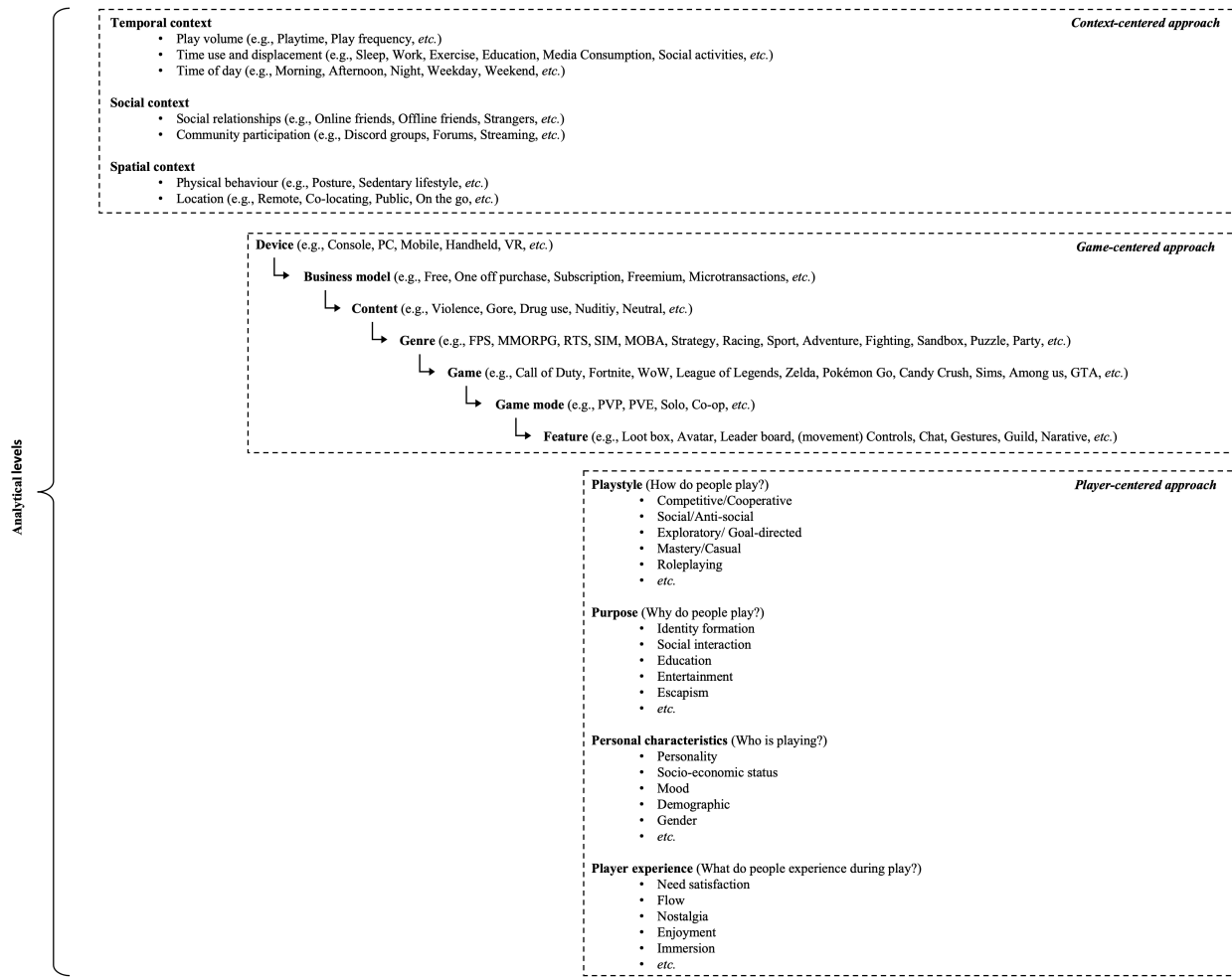
Temporal context *Context-centered approach*
- Play volume (e.g., Playtime, Play frequency, *etc.*)
- Time use and displacement (e.g., Sleep, Work, Exercise, Education, Media Consumption, Social activities, *etc.*)
- Time of day (e.g., Morning, Afternoon, Night, Weekday, Weekend, *etc.*)

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.*)

Device (e.g., Console, PC, Mobile, Handheld, VR, *etc.*) *Game-centered approach*
Business model (e.g., Free, One off purchase, Subscription, Freemium, Microtransactions, *etc.*)
Content (e.g., Violence, Gore, Drug use, Nuditiy, Neutral, *etc.*)
Genre (e.g., FPS, MMORPG, RTS, SIM, MOBA, Strategy, Racing, Sport, Adventure, Fighting, Sandbox, Puzzle, Party, *etc.*)
Game (e.g., Call of Duty, Fortnite, WoW, League of Legends, Zelda, Pokémon Go, Candy Crush, Sims, Among us, GTA, *etc.*)
Game mode (e.g., PVP, PVE, Solo, Co-op, *etc.*)
Feature (e.g., Loot box, Avatar, Leader board, (movement) Controls, Chat, Gestures, Guild, Narative, *etc.*)

Playstyle (How do people play?) *Player-centered approach*
- Competitive/Cooperative
- Social/Anti-social
- Exploratory/ Goal-directed
- Mastery/Casual
- Roleplaying
- *etc.*

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

Personal characteristics (Who is playing?)
- Personality
- Socio-economic status
- Mood
- Demographic
- Gender
- *etc.*

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

Analytical levels

Figure 1. Levels of analysis in games research

of ways, such as playtime, frequency, strength, etc. The real question is; playtime, frequency, and strength of what?

Ultimately, this framework offers an incomplete but necessary simplification of video game exposures; we are certain that many other determinants and dimensions of play can and will be identified (Granic et al., 2014). However, we hope that by reflecting on the conceptualization of video game exposures through this parsimonious framework, researchers will be able to better identify at which level(s) of analysis their investigation operates and avoid conflating exposures. This will improve construct validity and facilitate the systematic comparison of findings. Moreover, our hope is that these levels of analysis will be iteratively adapted and improved upon in the face of scientific progress and technological change.

Present Work

This brings us back to the goal of the present paper. Below, we briefly overview 13 distinct mechanisms previous research has suggested might explain how games 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 (gaming OR game) AND ((mental health) OR wellbeing) returns over 8,000 results. Thus, rather than conducting a systematic or scoping review, we rely on the authors' collective knowledge of gaming research to narratively review the mechanisms that we are aware of. Collaboratively, this led to the 13 mechanisms identified and presented below. We do not claim that these are the only studied or possible mechanisms; they simply represent as complete a summary as we could generate, and we hope that future research can correct any omissions.

Caveat 2: Causal Accuracy

Our attempts to explicate causal models from previous work will inexorably be crude. Given a literature base

that often neglects to explicitly specify hypothesized causal structures and collective expertise that varies across each of these mechanisms, we can only construct simplified models and acknowledge that we will not necessarily do so accurately. Our goal is simply to provide a plausible example model at a high level of abstraction. We see each model as fractal: zooming in will reveal additional nodes, moderators, time lags, and other details needed to specify precise relationships—many of which may be present in previous literature. In particular, we are hopelessly ill-equipped to list all possible confounds that might cause both the exposure and outcome (in cases where randomization of the exposure is not possible); to symbolize this, we include a placeholder C in each model and invite the reader to speculate about what factors might this might include.

In short, we fully expect to be (wildly) off base with each model we propose, but hope this can inspire other researchers to prove us wrong with better ones.

Caveat 3: Simplified Mental Health

Mental health is an umbrella term that describes a wide range of experiences, orientations, and abilities (Huta, 2016), from which we give only selective examples. For the purposes of this paper, we follow the Extended Two-Continua Model of Mental Health proposed by Meier and Reinecke (2020). Under this model, mental health can be thought of as consisting of three related but partially independent components: *hedonic wellbeing* (the presence of high positive affect in the form of pleasure, enjoyment, or fun, and the absence of negative affect in the form of pain or discomfort)*, *eudaimonic wellbeing* (a life that is meaningful and actualized—what might be considered 'a life well lived'), and *illbeing* ('actions, emotions, motivations, and cognitive and regulatory processes [...] that cause personal distress or impair significant life functions, such as social relationships, education, work, and health maintenance'; Lahey et al., 2017, p. 143).

In constructing our example causal models, we thus content ourselves to selecting one mental health construct that is commonly studied in that research area, but acknowledge that each mechanism is likely to affect not just one, but many aspects of mental health with varying degrees of strength. Teasing these apart constitutes another important challenge for the field, and we refer interest readers to the following for further details about taxonomizing and operationalizing mental health (Huta, 2016; Martela and Sheldon, 2019; Meier and Reinecke, 2020).

Ambivalent Effects of Games on Mental Health

With those caveats, we move on to theoretical mechanisms that connect gameplay to mental health. We begin with the mechanisms that specify pathways for both positive and negative effects—highlighting how media has the innate potential for both kinds of outcomes. Later, we present mechanisms for 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 (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 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.XYZ).

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*Combined with a cognitive appraisal element of satisfaction, hedonic wellbeing is also referred to as subjective wellbeing (Diener, 2000).

Table 1. Theoretical mechanisms connecting video gaming to both positive and negative effects on mental health

Theoretical Mechanism	Level of Analysis	Key Features/Experiences	Proximal Outcome	Example Causal Contrast	Abstracted Causal Model
Affect Regulation	Hobby Purpose (Why)	Problem-focused coping Emotion-focused coping Alliesthesia Self-expansive escapism Self-suppressive escapism	Stress reduction Mood management Emotion regulation skills Anxiety Dysregulation	Playing games with 1 point greater emotion-focused avoidance coping motivation *vs* playing games without elevated emotion-focused avoidance coping motivation	
Basic Psychological Needs	Game Feature Playstyle (How) Purpose (Why)	Need satisfaction Need frustration	Enjoyment Engagement	Experiencing 1 point greater need satisfaction while playing a game *vs* not experiencing elevated need satisfaction while playing that game	
Social Capital	Game Mode Playstyle (How)	Multiplayer features	Social capital Loneliness Depression	Having in-game social interactions *vs* not having social interactions	
Quadripartite Dualistic Model of Passion	Purpose (Why) Player Experience (What)	Hobby Social Relationships Need Satisfaction Passion	Wellbeing Social capital Loneliness	Playing with an exclusively Harmonious Passion *vs* playing with an exclusively Obsessive Passion	

Note: Causal models are illustrative examples of a model 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 both the exposure (some aspect of one's engagement with games, in blue) and 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.

Emotion regulation Through shorter-term coping and mood management strategies, players might then develop longer-term emotion regulation skills such as self-efficacy beliefs, social support networks, or 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: the need 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 that one is valued by others and values them in return). Basic psychological needs are referred to as such because they are theorized to be vital nutriments required for a person to live a fully functional life. Substantial evidence shows that the satisfaction of basic needs is a direct antecedent of positive mental health, whereas the active thwarting of basic needs results in negative mental health outcomes (illbeing and psychopathology) (Ryan, 2023; Ryan and Deci, 2017).

Research shows that games are usually adept at satisfying players' basic psychological needs. As one of the most well-developed topics in this research area, need satisfaction has been studied at various analytical levels. For example, Peng et al. (2012) analyze the *feature* level, finding that avatar customization, skill upgrades, and dialogue options supported the need for autonomy during

playtesting of an exergame. Tamborini et al. (2010) analyze *game modes* and show that playing *Brunswick Pro Bowling* in multiplayer mode (as opposed to single-player) was associated with greater relatedness satisfaction. Deterding 2011, 2016 looks at the *personal 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.

Although gaming is need-satisfying for the majority of players the majority of the time, it can also actively undermine those needs. This phenomenon is known as need *frustration*: the experience of basic psychological needs being actively thwarted, which manifests as feelings of coercion (autonomy frustration), failure (competence frustration), and loneliness (relatedness frustration). Although a more nascent research area, studies show that need frustration is distinct from, and 'more than' the absence of need satisfaction, and experiencing need frustration in games is negatively related to motivation for play, game enjoyment, and mental health indicators (Allen and Anderson, 2018; Ballou et al., 2023). Need frustration appears applicable to games in multiple ways: people often play to compensate for deficiencies (i.e., need frustrations) in their day-to-day life (Allen and Anderson, 2018; Mills et al., 2018), and they may also experience need frustration during the gaming itself, leading to negative experiences such as boredom or anger, and negative outcomes such as churn or even 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).

In contrast to many of the proposed mechanisms described in this paper, basic psychological needs theory has seen a relatively high degree of theoretical specification and causal models. Self-determination theory has served as the foundation for several more formalized models of media use and mental health, including the aforementioned R^2EM model, (Reinecke and Rieger, 2021), the Integrative Model of Mobile Media Use and Need Experiences (IM^3UNE) model (Schneider et al., 2022), and the Basic Needs in Games (BANG) model (Ballou and Deterding, 2023). At their core, all of these share the implicit causal contrast of experiencing need satisfaction (or frustration) during play vs playing the same content without experiencing need satisfaction (or frustration); this is therefore a causal contrast at the level of the player experience.

Drawing in particular from the Basic Needs in Games Model and the (IM^3UNE) model (Schneider et al., 2022), we depict an example model of need satisfaction and frustration in Table 1. Here, experiencing greater need satisfaction (or frustration) in games, as compared to not having those experiences during the same play session, directly impacts flourishing (first in the immediate moment of play, and through repeated experiences one's more holistic and enduring sense of flourishing). Following Schneider et al. (2022), this effect is moderated by sense of coherence—the trait-like, global orientation to embrace life as comprehensible, manageable, and meaningful: the models predicts that people who are higher in sense of coherence will benefit more from their need-satisfying

experiences in games, and be better buffered against need-frustrating experiences.

Social Gaming

The social aspect of gaming has been widely studied with a great diversity of exposures and outcome variables. In a recent systematic review of 263 social gaming papers, Gonçalves et al. (2023) found that 101 papers focused on contextual levels of analysis, 200 on game-centered levels of analysis, and 70 on player-centered levels of analysis. Perhaps unsurprisingly, many papers simultaneously studied multiple determinants across several levels of analysis; habitually conflating them into a single exposure. Although the subset of social gaming studies focusing on mental health outcomes is relatively small (n = 19) (2023), the proposed causal mechanisms for this relation have been relatively well specified.

Multiplayer games have been found to facilitate social interactions that are 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 feelings of loneliness (Depping et al., 2018). However, the same features, games, and gaming contexts that promote social capital can also give rise to toxicity, which, in turn, has a detrimental effect on wellbeing (Kwak et al., 2015). The main theoretical explanation for these effects is rooted in the social capital framework (Putnam, 2000). This framework distinguishes between two kinds of relationships: bridging ties, which refer to tentative relationships that broaden social horizons by exposing players to different opinions and world views; and bonding ties, which refer to strong personal relationships in which players feel social and emotional support (Mandryk et al., 2020; D. Williams, 2006). Video games have repeatedly been demonstrated to be capable of forming both bridging and bonding ties (Mandryk et al., 2020). Furthermore, Perry et al. (2018) investigated whether different types of relationships in video games, such as playing with real-life friends, online-only friends, or strangers, influence in-game social capital and showed that real-life friends were positively associated with bonding social capital, strangers with bridging social capital, and online-only friends with both. Thus demonstrating that the type of relationship acts as a mediator between social gaming and social capital (2018).

However, while there is strong evidence that video games are an effective means for building social capital and thereby increasing wellbeing, this is again not universally the case. In other cases, players experience toxicity, harassment, and bullying in gaming environments. As would be expected in any domain, toxic behavior in video games has been shown to thwart the development of in-game social capital (Depping et al., 2018), lead to social exclusion or loneliness (Birk et al., 2016), and harm wellbeing by leading to depression, anxiety, and even in extreme cases suicide (Kwak et al., 2015). Taking this all together, the proposed abstract causal model of how social gaming affects mental health looks is shown in Table 1.

Passion

Passion is defined as a strong inclination toward a beloved activity that is valued and in which time and energy is invested (Vallerand et al., 2003). The passion that people have for the activities in their life (e.g., gaming) affects their engagement with those activities, eventually creating highly engaged players that internalize their passion and adopt it as part of their self-identity (i.e., that of a "gamer") (2003). The relationship between passion, engagement, and mental health is complex, where some but not all highly engaged players report negative associations with wellbeing, need satisfaction and life satisfaction (Mandryk et al., 2020; Przybylski et al., 2009). To better characterize the nature of passionate players, researchers have turned to the Dualistic Model of Passion (Vallerand et al., 2007), which differentiates between 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 and uncontrollable urge, preoccupation, and inflexible persistence toward the loved activity.

Within video game research, harmonious passion is typically associated with improvements to mental health outcomes, such as skill development, relaxation, creativity, post-play energy, life-satisfaction, and wellbeing (Johnson et al., 2022; Mandryk et al., 2020; Przybylski et al., 2009; Tóth-Király et al., 2019). Whereas obsessive passion has shown to be related to problematic use and overuse of videogames, procrastination of daily activities, and post-play tension (Johnson et al., 2022; Mandryk et al., 2020; Przybylski et al., 2009; Tóth-Király et al., 2019). However, consistent with findings in other domains (Curran et al., 2015), a harmonious passion for gaming is not always associated with reduced negative outcomes and obsessive passion is not always related to reduced positive outcomes (Mandryk et al., 2020; Tóth-Király et al., 2019). Hence, 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 simultaneous consideration of both constructs. It distinguishes between 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). With regards to video games, the extended quadripartite model is consistent to the dualistic findings with pure harmonious passion predicting positive and pure obsessive passion predicting negative mental health outcomes, with mixed passion and no passion explaining the often found, and previously unexplained, lack of effects (Johnson et al., 2022; Schellenberg et al., 2019).

Lastly, some studies have argued that the harmful effects of obsessive passion for gaming can be the result of compensatory behaviors that predict both obsessive passion and negative mental health outcomes (Johnson et al., 2022; Kowert et al., 2015). The notion is that players engage with video games to compensate for preexisting social difficulties and unsatisfied needs in daily life, causing an obsessive passion whilst at the same time directly

negatively influencing their mental health (Johnson et al., 2022). Table 1 shows an abstracted causal model depicting the relationship between the quadripartite extension of the dualistic model of passion, and compensatory behaviors.

Positive Effects of Games on Mental Health

Eudaimonia

Moving on to positive hypothesized effects, a growing area of research in recent years looks at eudaimonic or self-actualizing experiences during play. In contrast to research on hedonic experiences of pleasure and enjoyment, here researchers are interested in feelings of meaning or the attainment of one's full potential (i.e., self-actualization). Despite sometimes being characterized as thoughtless and vapid entertainment, video games are actually adept at fostering such deeper experiences, as evidenced in a review by 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.

As defined above, eudaimonic wellbeing is one component of mental health. It therefore stands to reason that having eudaimonic experiences during video game play would contribute to improved mental health. Though causal inference is challenging in this domain (given the general inability to randomize certain players to experience eudaimonia, but not others), observational evidence supports a relationship between eudaimonic gaming experiences and general mental health. To give a few examples, previous research has found that 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, in other media domains, eudaimonic media exposure has been linked to outcomes such as prosociality and improved vitality (Janicke et al., 2018; Schnall et al., 2010).

While it is undoubtedly the case that certain (combinations) of game features or content are more likely to produce eudaimonic experiences than others, it remains the case that different experiences will resonate with different players, and it can be hard to predict what will be meaningful versus simply entertaining. As a result, we view the primary causal contrast in eudaimonia research as a player experience one: having a eudaimonic experience during gameplay vs playing a maximally-similar game but not having a eudaimonic experience. Our abstracted 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 in this model. Here, eudaimonic experiences in games are comprised of several sub-aspects of eudaimonia, 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—this is a common measure in eudaimonia research (e.g., Tyack and Wyeth, 2021), aligning with the fact that we would expect the largest impact of eudaimonic experiences on eudaimonic wellbeing.

Exergames and Physical Activity

Substantial research has investigated how playing a particular class of games known as 'exergames'—games that involve physical movement—can positively influence mental health. The logic here is straightforward: exercising is strongly and reliably linked with improved mental health (Mikkelsen et al., 2017), and exergames leverage the motivational strengths of video games to create more opportunities for people to experience the positive psychological and physiological effects of such exercise. Popular past or current exergames include *Ring Fit Adventure*, *Fit XR*, and *Dance Dance Revolution*.

Various studies have found support for an effect of this nature. Playing exergames leads to a robust increase in physical activity (Sween et al., 2014). Knock-on effects of such physical activity 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), in samples that range from young to old from a variety of countries. 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.

A present an abstracted causal model representing this mechanism in Table 2. Here, we might have considered exergames as a genre, but given that a wide variety of game types can be made into exergames (e.g., role-playing games, puzzle games, etc), we choose here to operationalize this as research focused on a game feature—movement controls (or similar body tracking that encourages or requires physical activity to play the game). One potential causal contrasts, therefore, is playing a game with movement controls versus playing the same game with no movement controls. We predict that movement controls lead to greater calories burned, which in turn produces short-term feelings of positive affect in line with previous research on exercise (Hogan et al., 2013). Longer term, calories burned also leads to improved physical health, which has further benefits for positive affect (Cadenas-Sanchez et al., 2021).

Identity Development

Another mechanism through which games and media might support mental health is via identity development. Especially in adolescence, but throughout one's lifespan, people engage in identity construction—that is, answering the question 'who am I?' This involves both processes of reconstructing and making sense of past events (narrative identity), as well as forward-thinking exploration and eventual commitment to particular ideologies, roles, and labels in a given domain (e.g., choosing to be part of an esports community and dedicate substantial time to improving one's competitive play) (McLean and Pasupathi, 2012).

Table 2. Theoretical mechanisms connecting video gaming to positive effects on mental health

Theoretical Mechanism	Level of Analysis	Key Features/Experiences	Proximal Outcome	Causal Contrast	Abstracted Causal Model
Eudaimonia	Purpose (Why), Personal Context (Who)	Meaning, Nostalgia, Social connectedness	Eudaimonic experiences, Appreciation, Vitality, Prosocial behavior	Experiencing self-actualization during a gaming session *vs* playing the same game but not experiencing it	Eudaimonic Motivations, Eudaimonic design features → Eudaimonic Gaming Experiences (Meaning, Nostalgia, Social Connection) → Vitality; C
Exergames	Feature	Movement controls	Physical fitness	Playing a game with movement controls *vs* playing the same game with no movement controls	Movement Controls → Calories Burned → Physical Health → Positive Affect; C
Identity Development	Purpose (Why)	Elaboration, High-quality listening, Time and space	Self-confidence, Group membership, Diminished self-discrepancy	Playing a video game with others who demonstrate high-quality listening *vs* playing with others who do not demonstrate high-quality listening	Elaboration, High-quality listening, Time and space → Narrative Coherence → Suicidal ideation; Marginalized Identity; C
Executive Function/Cognition	Genre, Feature	Action game mechanics - Fast pacing - High perceptual/motor load - Frequent attention switching - High clutter/distraction	Attentional control, Emotion regulation	Playing a game with action mechanics *vs* playing a similar game without action mechanics	Exposure to action game mechanics (High perceptual load, Attention switching, Irrelevant information) → Executive Function (Attentional control, Working memory) → Stress; C
Applied Games	Content	Intrinsic Motivation, Extrinsic Motivation	Treatment Adherence, Knowledge growth	Gamified treatment *vs* non-gamified-treatment	Gamified CBT Treatment → Intrinsic Motivation, Extrinsic Motivation → Treatment Adherence → Knowledge Growth → Depression Symptoms; C

Note: Causal models are illustrative examples of a model 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 both the exposure (some aspect of one's engagement with games, in blue) and 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.

A useful framework for understanding what factors support successful identity development—and how media use might contribute to this—comes from Granic et al. (2020). In this paper, the authors list three interpersonal factors that can support identity development: *elaboration* (others asking probing questions and making and eliciting evaluative comments, while encouraging the individual to express their point of view), *high quality listening* (listening with the intent to understand personal meaning and without distraction, validating the other's self-narrative, and responding and giving feedback in a way that can be perceived and integrated), and having the *time and space* to grapple with identity paradoxes (environments that can support narrative contradictions and changing self-representations without the person losing esteem).

Gaming has the potential to support all three of these factors. For example, elaboration might be supported by participating in discussions about development decisions that best support a healthy metagame, which can involve prompts to elaborate on one's experience in a particular role, as a player of other games in that genre, or a particular educational background (e.g., design) that inform one's opinion. High-quality listening can be supported by the low-stakes and welcoming environment or social frame (Deterding, 2009) created by games, as evidenced for example by players who report that playing video games gives them a shared locus of attention and allows them to connect with their teammates in a more cohesive way than without the game (Ballou et al., 2022). And time and space to grapple with identity paradoxes can be supported by the role and avatar affordances that players have when playing games, where players can regularly build, interact, and do battle through characters with different identity and personality characteristics than their own—providing them with emotionally powerful opportunities to grapple with identity challenges that often reflect back on offline identity preferences and concerns. Players can experiment with being more hostile or more cooperative, taking on leadership roles, or roleplaying as a character with radically different perspectives to one's own—all in an environment where such contradictions typically go unnoticed or are treated with acceptance.

Games' ability to support identity development might be especially important for people from marginalized backgrounds, such as gender-diverse youth (Di Cesare et al., 2023). Players report using avatars to explore, develop, and rehearse their gender identities and expressions in a low-stakes environment, affirming their feelings and supporting their well-being (McKenna et al., 2022; Morgan et al., 2020). Similarly, this might be particularly valuable for neurodiverse players; research has found rich examples of 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), children with ADHD experiencing benefits from gaming for social development and school performance (Bassiouni and Hackley, 2016), and more. Designing games that best support neurodivergent players' needs remains an unresolved challenge; at other times, games marginalize or fail to serve neurodivergent players (Spiel and Gerling, 2021).

In short, playing games—particularly via the social structures that form within and around them, but perhaps also in other ways—can support identity development. In our example model (Table 2), we draw from Granic et al. (2020)'s interpersonal factors. In this model, we 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 environmental context levels. Greater narrative coherence is then 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 skills (Bediou et al., 2018; Hilgard et al., 2019). The focus of this work has been on games with so-called action mechanics: mechanics that require intense temporal processing demands, simultaneous attention to task-relevant items in both the focal area of the screen and on the periphery, the presence of visual clutter (for determining task-relevant items), complex motor response demands, and high perceptual and cognitive demands (Green et al., 2016). Previous research identified the presence of such action mechanics as one of the key determinants of potential cognitive benefits of video game play (2016).

Under this theoretical mechanism, frequent exposure to and engagement with action video game mechanics improves key aspects of executive function (e.g., working memory and attentional control). Many results support this, with previous research finding that regular (action) game players can better integrate multiple sources of sensory information, process stimuli more quickly, selectively attend to relevant stimuli more adeptly, and other related effects (see e.g., 2016, for a review).

Improved executive function has then been linked to improved mental health across the life span (P. G. Williams et al., 2017). Reduced executive function predicts increased symptoms of psychopathology as much as 2 years later (Halse et al., 2022). To cite a few examples, executive function appears to protect against overeating and substance use disorders (P. G. Williams et al., 2017), aid in stress management and recovery (2017), and act as a resilience factor in the development of illbeing in the form of depression and anxiety (Letkiewicz et al., 2014). Interestingly, this latter 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).

Putting this together results in the abstracted model presented in Table 2. With the level of analysis being game feature(s) (that is, action game mechanics), one possible causal contrast at play is playing a video game with action

mechanics vs playing a maximally similar game with no action mechanics. The game with action mechanics is predicted to lead to improved executive function in the form of working memory and attentional control (and perhaps also other dimensions), 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 a wide class of *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 (Lindner et al., 2020), deploy cognitive-behavioral therapy for people with depression (Roepke et al., 2015), and many other use cases. There is substantial evidence backing the effectiveness of certain applied games for both clinical and non-clinical samples (Wols et al., 2024). Most promisingly for our goal of causal inference, many studies in this area have been conducted as experiments, and the effectiveness of the game compared against other non-game interventions, no treatment, or sometimes alternative games or game versions—a recent review of randomized controlled trials found evidence ot support applied games' effectiveness for benefiting social skills, memory, anxiety, depression and ADHD, and various other outcomes.

(e.g., Scholten et al., 2016). For example, 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. Another applied game, EndeavorRX, made headlines in 2020 after receiving FDA approval as a treatment for child ADHD on the back of their trial results (Kollins et al., 2020)—though not without controversy (Evans et al., 2021). In other cases, evidence supports the effectiveness of applied games, but equally to other, non-targeted interventions: for example, a version of the game *Superbetter* which used cognitive-behavioral therapy strategies to target depression was effective, but no more so than an alternative version focused on general self-esteem and acceptance strategies (Roepke et al., 2015).

Together, research thus supports the conclusion that applied games can—but will not always—be beneficial for health outcomes. In contrast to commercial games, where mental health benefits may be largely incidental relative to the designers' intentions, applied games involve careful consideration of how to avoid 'chocolate covered broccoli', or a superficial layer of gamified elements around the primary applied goal. As such, not all applied games will be successful, or be effective for every member of their target audience. Nonetheless, well-designed applied games have strong potential to positively impact mental health, and games are poised to become an increasingly common medium for therapeutic interventions (Fleming et al., 2017). Applied games are also a mainstay in research on improving educational engagement and attainment (Girard et al., 2013); this is an equally exciting area of research, but one we do not cover here as it is less directly related to mental health.

A typical theoretical mechanism used to explain the potential effectiveness of applied games 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 this 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, given that many applied games are focused 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

Displacement

In this last section, we discuss negative hypothesized effects, beginning with the *displacement hypothesis*—that hypothesis that time spent on a media activity zero-sum displaces other, more psychosocially beneficial activities. The displacement hypothesis is long-standing in media research, dating back to television research in the 1950s (Mutz et al., 1993), but re-emerging with new media, including video games (Fisher, 2012). The literature contains numerous examples of gaming problematically displacing other life domains, with the most extreme examples involving player death after multiple days of uninterrupted gaming (i.e., all-encompassing displacement) (Kuperczko et al., 2022). More typical examples involve time spent gaming leading to lost sleep (Guo et al., 2022), lower performance at work or school performance (Drummond and Sauer, 2020), or the inability to maintain social relationships (Kowert et al., 2014). Displacement can be considered a higher-level category encompassing 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).

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 'hobby' level of analysis: it is not concerned with particular aspects of the game or player experience, but rather the activity of gaming as compared to other non-gaming activities. It

Table 3. Theoretical mechanisms connecting video gaming to negative effects on mental health

Theoretical Mechanism	Level of Analysis	Key Features/Experiences	Proximal Outcome	Example Causal Contrast	Abstracted Causal Model
Displacement	Hobby	(N/A)	Decreased time spent attending to other life domains	Spending time playing a game vs spending time doing any alternative activity of the person's choice	Playtime → Time spent maintaining other health-relevant life domains (Work/school performance; Social relationships; Physical health and sleep) → Functioning in other domains (Guilt; Loneliness; Fitness) → Life Satisfaction; C
Financial Harms	Business model	Loot boxes; Predatory monetization	Problem gambling; Dysregulated gaming; Overspending; Social comparison; Need frustration (FOMO?)	Playing a game with predatory monetization model vs playing the same game with no predatory monetization	Gaming-gambling Convergence Exposure (Loot Boxes; Social Casinos; Skin Betting); Predatory Monetization Exposure (Pay to win/play; Currency opacity; Misleading ads) → Problem Gambling; Disordered Gaming; Overspending (Financial Stress; Spending Regret) → Depression symptoms; C
Dysregulation	Purpose (why); Environmental context (where and how); Game Genre; Business Model	Loss of control; Continuous despite problems; Behavioral salience	Depression; Anxiety; Externalizing problems	Playing games in a dysregulated manner vs playing games with no symptoms of dysregulation	Dysregulated gaming (Loss of control; Continuation despite problems; Behavioral Salience) → Functional impairment; Anxiety; C; C
Sexualization	Content	Sexual content	Misogynistic attitudes; Gender stereotyping; Body dissatisfaction	Playing a game with sexualized content vs playing the same game with no sexualized content	Sexualized content → Body dissatisfaction → Self-esteem; Misogynistic Attitudes; Gender Female; C

Note: Causal models are illustrative examples of a model 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 both the exposure (some aspect of one's engagement with games, in blue) and 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.

is, therefore, one of the few mechanisms that is directly concerned with playtime; the causal contrast is playing a video game vs doing any other activity. Putting it in these terms highlights the importance of knowing what the other activity would have been—in other words, what other life domains is playtime (at this moment, for this person) actively detracting from (Magnusson et al., 2023)? Answers to this remain highly elusive in the current literature; further research using e.g., time-use diaries, interviews, and ecological analyses can help shed light on this.

Our example causal model Table 3 reflects this imprecision. Here, the model indicates that greater playtime directly reduces the time spent maintaining one or more other health-relevant life domains, including at minimum work or school performance, physical health and sleep, and social relationships. Spending less time in these areas results in diminished functioning in those other domains, 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, at least without better knowledge of what activities gaming tends to displace and what confounds this relationship—evidence indicates that the vast majority of players do not seem to suffer as a result of high playtime. 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. Until we as a field have comprehensively identified and controlled for these, trying to estimate a causal effect of playtime on wellbeing is fruitless.

Financial Harms

A frequent topic of policy, media, and research debates is the potential for financial harms resulting from video game play. This area encompasses several related topics and labels—loot boxes, dark patterns, and predatory monetization, alongside others. Widespread research concern about potential financial harms began to pick up 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 players harm.

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).

Despite its prominence, research on financial harms remains very effects-driven and theory-light, making it challenging to distill into an illustrative model. We have nonetheless attempted to create one possible causal model in Table 3, based on an exposure (i.e., causal contrast) at the levels of game features and business models. The model depicts a world in which 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 are more likely to spend beyond their means, and both the financial strain as well as potential guilt are expected to negatively impact on mental health (cf. Petrovskaya and Zendle, 2023), here in the form of greater depressive symptoms. Exposure may also increase their likelihood of developing a pattern of disordered play, which in turn would also affect depression symptoms (Raneri et al., 2022). Lastly, exposure to gambling-like mechanics (but not non-gambling predatory monetization) is expected to increase the likelihood of developing problem gambling symptoms, which in turn is another path to various negative mental health impacts (Zendle and Cairns, 2019). A related model might estimate the effect of 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.

Dysregulation

Dysregulated gaming describes the phenomenon in which some players lose the ability to control—that is, regulate—their gaming in a healthy way, such that gaming becomes excessive and eventually is accompanied by significant psychological distress and/or functional impairment. For decades, both the public and scientists have been concerned about people developing pathological relationships with gaming (King and Delfabbro, 2019). There is widespread agreement that a small fraction of players experience negative life consequences in relation to their gaming, but substantial disagreement about how best to conceive of that phenomenon—as a mental health condition, a coping mechanism for other mental health conditions, a sub-clinical problematic behavior, or something else entirely (Aarseth et al., 2017; Ferguson and Colwell, 2020).

One nexus of research on dysregulated play uses the lenses of Gaming Disorder and Internet Gaming Disorder. In response to the growing concern, the American Psychiatric Association defined 'internet gaming disorder' (IGD) in the DSM-5 as a condition for future study. Shortly thereafter, the World Health Organisation included 'Gaming Disorder' (GD) in the ICD-11 (World Health Organization, 2018), with the two conditions sharing significant conceptual overlap but key differences in diagnostic criteria. Gaming associated with both versions of these disorder criteria is associated with various forms of psychiatric distress and impairment. For example, [I]GD 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), and obesity (Ko et al., 2020).

However, the preponderance of evidence showing that IGD symptoms are negatively related to wellbeing does not necessarily mean that it constitutes a genuine mental health disorder. The causal direction of the relationship between

mental health and dysregulated play has been heavily debated, with some evidence suggesting that dysregulated gaming may be better understood as a symptom of an underlying disorder or disorders (Van Rooij et al., 2018). Testing the direction(s) of causality between IGD symptoms and mental health requires us to understand the confounds that might be at play—factors that might be influencing both functional impairment and gaming disorder simultaneously (cf. Andreetta et al., 2020; Wang et al., 2017). Theory can help us enumerate and systematically test potential confounds (rather than them being proposed and tested ad hoc in disconnected papers), and thereby falsify them more effectively.

Differentiating highly-engaged, non-problematic players from dysregulated ones is a further challenge. 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). For example, a recent interview study comparing treatment-seekers with highly-engaged, healthy players found that 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 playing certain games for a certain amount of time characterized by dysregulation symptoms vs playing games for the same amount of time without such dysregulation symptoms—a contrast at the purpose and environmental context 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 foster dysregulated play.

With dysregulated gaming frequently considered a mental health condition, the direction of causality is implicitly drawn from gaming disorder to mental health—though it is near certain that the relationship is ultimately bidirectional. 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 other life domains and results in increased anxiety symptoms stemming from those areas of life as well.

Sexualization

Earlier in the paper, we reviewed some 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) (among women players) and more misogynistic attitudes (among male players). 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.

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

Above, we gave a brief overview of 13 distinct mechanisms that, based on previous research, might connect certain game features or gaming patterns to mental health. In line with the goals stated in the introduction, we believe this points to several important takeaways.

Causality at the Forefront

Though severely limited by the fact that we are not experts in all of the above mechanisms, we have placed causality at the fore of this review by generating potential high-level causal models for each mechanism. In doing so, we hope to encourage other researchers to do the same and align their theoretical frameworks, study designs, and statistical methods with a causal interest, if causality is indeed what they hope to understand.

To achieve this, we echo previous work in calling for researchers to ensure that they can answer the following three questions in each of their projects (Lundberg et al., 2021).

1. **Do I have a causal hypothesis, and if so, what is my best guess at the underlying causal structure of the system?** A large portion of the studies conducted in this space specify particular hypotheses, which

are often causal in nature (e.g., does experiencing increased need satisfaction in games lead to improved subjective wellbeing?). If a given study does have a causal estimand, we believe generating a causal model to be an invaluable first step towards successfully gaining information about this. This need not be a perfect representation of the system—indeed, none of the ones we produced above are, and others' attempts may look very different—but it can offer a starting point for connecting theory to the data the study seeks to generate (2021). This is not to say that descriptive and qualitative research are not valuable; on the contrary, these can be invaluable tools for identifying new effects to be tested, developing a shared understanding of a particular phenomenon, honing terminology, fleshing out existing theory by establishing boundary conditions, and more. But for the large portion of research that is framed as confirmatory and causally-oriented, causal inference principles should be followed.

2. **What study designs best facilitate the study of a causal estimand?** For some questions we may be able to randomize groups to different levels of the exposure; for example, we may be able to modify a game such that the monetization features differ between two versions, and assign players to play one game or the other. In such a situation, we should push for randomized controlled trials, perhaps in conjunction with preregistration and registered reports, to give us the best chance at causal inference. If this is not possible (e.g., because the exposure is a player experience factor that cannot be directly manipulated), can I collect multiple data points so as to estimate a within-person relationship instead of a between-person one? Within-person effects are typically more closely related to a causal effect than between-person effects.

3. **Are my statistical tests aligned with the model I predicted at Step 1?** When one has a causal estimand, the underlying structure of the system directly informs the modelling approach. For example, if we believe that trait mindfulness affects both the likelihood of experiencing nostalgia during gameplay and one's mental health, this 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 we think that nostalgic experiences and mental health jointly cause players to feel less stressed during gameplay, this is a collider that should *not* be controlled for. We encourage readers to familiarize themselves with DAGs and other tools for aligning their statistical tests with their potentially causal inference goals (see e.g. Rohrer, 2018 for a gentle introduction, and Dablander, 2020 for a more technical one).

To this central challenge of developing internally consistent causal models, we want to add a further challenge: what other activities might result in similar or interchangeable exposure? So far, we have focused on gaming-related exposure in a narrow sense: what is the effect of playing a game with versus without certain content such as sexualized characters, or with versus without some player experience factor such as need satisfaction? However, to understand whether playing games has meaningful and unique effects on players' lives, this is only half the battle. To determine whether games are meaningfully affecting people, researchers need to establish two things: (1) Does (some aspect of gaming) causally contribute to the mental health outcome of interest? (2) If the causal contrast is 'not playing a game', would whatever the person did instead lead to the same outcome? For example, playing a simulation game such as *Stardew Valley* might causally contribute to feeling less stress via an emotion-focused approach to coping. However, if the person would have instead watched a relaxing TV show and that too would have contributed to feeling less stress, then the practical significance of gaming for that person is diminished—games have a causal effect on the outcome but are just one of several interchangeable activities for achieving the same outcome.

Our understanding of how people spend the time they might otherwise spend gaming is, at present, highly limited. However, we contend that establishing this is a crucial next step for the next generation of video game effects research (Magnusson et al., 2023). This may involve methods like time-use diaries (e.g., Orben and Przybylski, 2019), greater digital trace data logging of gaming behavior, interviews, and more. Likely, these methods will show that many of the benefits (or harms) of gaming would equally occur with other leisure activities. Any effects that remain, however, will point us toward the truly unique, 'active ingredients' of games compared to other pursuits—that is, to the things that make games so special to so many of us.

Levels of Analysis

The mechanisms here span several distinct levels of analysis: sexualization is focused on in-game content, displacement is focused on the hobby at large, exergames are focused on a feature, and so on. Connecting back to our ultimate goal of understanding causal systems and being able to intervene on a system, each of these levels of analysis implicates a very different set of interventions. As a starting point, we can view potential intervention targets through our levels of analysis, differentiating hobby-centered, game-centered, and player-centered approaches.

A theoretical mechanism that predicts effects of playing **any and all games** (i.e., the hobby-centered approach) would require governmental intervention and regulation—as seen, for example, in China's restriction of gaming to only three hours a week for under-18s (Goh, 2021). A mechanism that predicts the effects of a particular **feature**, **business model**, or **game** would require intervention in game design, such that developers are empowered, encouraged or required to change their product to safeguard users' wellbeing. A mechanism that predicts effects of a particular player experience construct may require intervention at both the design level—identifying which game aspects contribute to the likelihood of that player experience occurring—as well as the player-centered level, providing players with tools or guidance to help them most

reliably achieve certain experiences and avoid others. This might include mindfulness exercises, dashboards where players can track their play and/or mood (or game diaries where they can do this by hand), reflective questionnaires, and so on.

It is worth noting that in nearly all of the above mechanisms, playtime is at best a moderator; almost never is it the primary predictor. This makes sense; following Orben's 2021 digital diet metaphor, looking at playtime is akin to looking at raw calories: it may be able to tell you about extreme overuse but has limited information about the healthiness of the diet. In the absence of a theory that predicts the direct effects of time, 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.

The Übermodel

Looking forward, we hope this review can help chart a course towards an even more ambitious goal: integration of the above mechanisms into a so-called 'grand theory' (Turner and Boyns, 2001). Several of these models have obvious points of overlap, and could—eventually—be combined to form a set of even more comprehensive and predictive models. For example, social benefits and harms are closely related to relatedness satisfaction and frustration; the potential harmful effects of over-reliance on games for emotion regulation may be well-explained by dysregulation; and so on. We caution that this remains, for the moment, a distant possibility—we must first go through the process of generating several well-specified theories for specific effects of interest, iteratively falsifying and improving upon these, until we have a set of empirically well-validated theories.

As highlighted in the introduction, integration can only proceed effectively if we adhere to scientific first principles: allowing theories to adapt or be discarded in light of (new) evidence, seeking to falsify rather than prove theories, and treating theories as owned by the research collective rather than any individuals. Theories are communal resources that require researchers to coordinate their research efforts, not isolated explanations whose direction is dominated by a single researcher or group. At present, we often behave otherwise: as Watkins (1984) put it, using someone else's theory 'is a bit like someone else's toothbrush—it is fine for that individual's use, but for the rest of us...well, we would just rather not, thank you' (p. 86)—a phenomenon also observed in the use of psychological measures (Elson et al., 2023). Rather than maintaining dozens of competing theories for any single phenomenon, an alternative approach seeks to take the empirical successes of one theory and combine them with the successes of others while modifying or discarding their failed predictions (Gigerenzer, 2010).

Conclusion

In conclusion, the wide variety of hypothesized mechanisms through which gaming can impact mental health mental health, accompanied by the lack of robust and generalizable evidence, necessitates more focused exploration of causal relations. Addressing the concerns of various stakeholders, including parents, players, game developers, policymakers, and clinicians, requires explicit attention to causality, in the design and communication of our research. We argue that a shift towards a more formalized approach to causal contrasts, emphasizing visibility, explicitness, and shared theoretical frameworks, can pave the way for incremental progress in the field. By providing an overview of the diverse ways in which gaming affects mental health, we hope to provide a map of the gaming research landscape, encouraging more collaborative and iterative theory development in the research community, and ultimately point us towards ways to best support players' digital well-being.

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Conflicts of Interest

We perceive no conflicts of interest related to this work.

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