THE GOAL OF GAMING: THE MOTIVATIONS BEHIND PLAYING DIFFERENT VIDEOGAME GENRES

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Abstract

Videogames are a massively popular form of media that offer a wide variety of experiences to a wide variety of people. However, a great deal of videogames research does not reflect this nuance, instead treating videogame exposure as a homogenous monolith. This dissertation aims to capture this nuance, contributing to our understanding of videogames through the lenses of genres, types of gamers, and needs. We first identify a list of videogame genres for use in research and the factor structure underlying those genres (Study 1). Using those factors, we then identify a gamer typology that largely replicates across multiple samples (Studies 2–4). We then examine whether different genres and different gamer profiles are uniquely associated with different forms of videogame need satisfaction (Study 4). Our predicted associations between genres and needs are mostly supported by the data, but the predicted associations between profiles and needs are only partially supported by the data. Finally, across two waves of data, we examine how the need frustration caused by the COVID-19 pandemic may have affected the use of games to satisfy needs, and how that affected well-being (Study 5). We hypothesized that people would change their gaming habits to satisfy the most frustrated needs, which would in turn lead to better well-being. Broadly speaking, we find this effect only for autonomy, and not for relatedness or competence. We also find that, in some cases, gaming to satisfy needs is associated with worse well-being. This latter finding could be due to people relying too heavily on videogames to try to address their malaise, without success. Overall, we provide a novel and nuanced look into the relations among videogame genres, the people who play them, and the needs that they satisfy.

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Chapter 1: Introduction

Recommended Listening: Anxious Heart – Nobuo Uematsu (*Final Fantasy VII*)

Videogames are a massively popular pastime. With over 3 billion players worldwide, it is a more lucrative industry than music and movies combined (BBC, 2019; Newzoo, 2022). No longer a niche interest, videogames are played by a wide variety of people, in a wide variety of contexts, and for a wide variety of purposes. Games have also become a central component of the cultural landscape: they are aggressively advertised in media and in public spaces; major media outlets hire staff explicitly to cover videogames; and, with growing frequency, they are adapted into massive film and television productions. Alongside this rise in cultural relevance has been a rise in academic research on the role that videogames play in our lives. Scholars are investigating a range of questions surrounding videogames, such as whether games can increase cognitive skills, contribute to well-being, or increase aggression (Przybylski & Weinstein, 2019; Ryan, Rigby, & Przybylski, 2006; Unsworth et al., 2015). There is a pervasive problem, however, at the heart of much of this research: the treatment of videogames as a single homogenous monolith, rather than an enormous variety of differing experiences. Much of the published research has conceptualized games as a singular experience, measured unidimensionally as "videogame exposure," played by a singular type of person, with a singular motivation for playing them. This ignores crucial nuance, however, in who plays games, what they're playing, and why they play them; all of these aspects are crucial for understanding how humans relate to videogames. Research that ignores this nuance, treating all videogame experiences as interchangeable, may obscure interesting and important relationships. The following program of research aims to identify and capture this nuance, examining how genre can be used to better understand the people who play games and their motivations for doing so.

The Phenomenology of Videogames

In 1996, *The New York Times* published an article discussing the Japanese videogame *Tokimeki Memorial*, a "dating simulator" that put players in the role of a high school student whose goal was to meet and date girls at his school (Pollack, 1996). The author speculates that the immense popularity of the game is due to players wanting to re-experience high school, but with more dating success and without the risk of painful rejection (Pollack, 1996). Some two decades later, the videogame developer and critic Tim Rogers countered that if that author had actually endeavoured to play *Tokimeki Memorial*, he would have learned that "rejection is by no means easier to take from a machine" (Action Button, 2021). Instead, it is the potential to feel the sting of rejection—along with the warmth of intimacy—that makes a game like *Tokimeki Memorial* a worthwhile experience.

This anecdote illustrates three important precepts for the present program of research. First, it demonstrates that games offer immersive and meaningful simulations of an array of important social, cognitive, and emotional phenomena: intimacy and heartbreak, triumph and loss, power and frustration. Like fiction more broadly, videogames provide an abstraction and simulation of the social world, providing audiences the opportunity for experiences that can enrich them, helping them to learn more about themselves, the world, and others (Mar & Oatley, 2008; Oliver et al., 2016). Second, the anecdote highlights the variety of experiences that games contain, and how this nuance is often lost. Popular perceptions of games have often seen them as a simple pastime whose only merit is entertainment. The reason the *Times* published a story on *Tokimeki Memorial* is that they thought it was surprising and unusual for a game to offer this sort of experience—something other than action or puzzles—which illustrates the mainstream ignorance of gaming experiences. Finally, this anecdote highlights the ease with which

videogames can be misunderstood. As with any complex human behaviour, it turns out that capturing the deeper elements of a phenomenon requires more than a passing familiarity with the domain. Although that sort of misunderstanding is relatively unimportant for a newspaper article, the stakes are considerably higher when conducting research on videogames and the people who play them.

The most prominent example of research failing to capture the phenomenology of videogames comes from work on the causal link between videogames and aggression (e.g., Anderson et al., 2010; Anderson & Dill, 2000; Bartholow & Anderson, 2002). The possibility that videogames make players more aggressive has remained a bugbear in the field for over two decades, despite this research suffering from numerous methodological flaws (Drummond & Sauer, 2019; Hilgard et al., 2017), failing to replicate in high-powered pre-registered studies (Ferguson & Wang, 2019; Hilgard et al., 2019; Przybylski & Weinstein, 2019), and effects failing to emerge in meta-analyses (Drummond et al., 2020; Ferguson, 2007; Ferguson, 2015; Ferguson, 2007). Most germane to the current discussion, part of the problem likely stems from a failure to accurately capture the experience of playing videogames. Problematically, much of the work purporting to show a link between violent videogames and aggression does not actually measure exposure to videogame violence (Weber et al., 2020). More often, these studies used lab experiments that had little resemblance to actual videogames, and in fact these experiments appear designed to elicit the predicted effect (Markey, 2015). Work of this nature is unlikely to provide insights into the truth of how videogames affect players.

Although the most prominent examples of videogame research often suffer from an ignorance of videogames and their experiences, there are studies that succeed in accurately capturing the phenomenology of gaming. One way of doing so is by examining the unique

effects of particular genres, and not treating videogames as a singular type of experience. An example of such work are investigations into whether real-time strategy games can improve certain cognitive skills (Dobrowolski et al., 2021; Jakubowska et al., 2021). Other successful studies have employed methods that provide rich data, such as qualitative or experience-focused approaches with actual players (e.g., Ewell et al., 2020, Rogers et al., 2016). A promising development in games research is the use of in-game behavioural data provided by publishers (e.g., Johannes et al., 2022; Vuorre et al., 2022). These datasets are massive records of real-world play by gamers and are less susceptible to the errors in measurement and validity faced by traditional methodologies. With the present work, we pursue a more nuanced and experiential understanding of videogames by (1) developing an empirically-based list of current videogame genres (Study 1); (2) identifying how these genres cluster and relate to one another (Studies 1–3); (3) creating a typology of gamers based on the genres they play (Studies 2 and 3); (4) examining these different types of games and gamers in terms of need satisfaction (Study 4); and, (5) investigating how the use of games to satisfy needs might be based on need frustration (Study 5).

Overview of Present Research

Genres

Genres are one of the main ways in which games are categorized and described. Genres were first used as labels to inform the expectations of players who may not have yet been very familiar with different types of videogames. For example, some of the first games released for the Nintendo Entertainment System were labeled with genres like “Action” (e.g., *Super Mario Bros.*), “Adventure” (e.g., *The Legend of Zelda)*, or “Sport” (e.g., *Baseball*) (Doucet, 2020).

Given that there were limited resources for learning more about what a game was like, and many consumers did not yet have a broader familiarity with the medium, these genre labels helped to inform would-be buyers about what sort of experience each game offered. That said, these labels were only included on around 30 games and were omitted from later releases. Genres still do serve a marketing purpose of course—videogame platforms and marketplaces will often categorize games by genre, for example—but are used more as a taxonomic tool among gamers. Genres have also become considerably more complex as games have become more advanced due to developments in technology affording more intricate game design. Some genres are narrative descriptors (e.g., Horror), but the most common ones describe types of gameplay (e.g., First Person Shooter). Some games blend multiple genres (e.g., *Cyberpunk 2077* is both a Role-Playing Game and a Shooter) whereas other games are categorized using hyper-specific labels that themselves refer to other games (e.g., *Blasphemous* is a "Metroidvania", a portmanteau of the games *Metroid* and *Castlevania*). There is no agreed upon number of genres that exist and every few years a new one springs forth into the vernacular (e.g., Auto-Battler in 2019). For gamers, genres are shorthand for conveying what it is like to play a particular game. They serve this function, in part, because there is general consensus on the genre(s) to which each game belongs. In other words, gamers have organically developed a phenomenologically-driven taxonomy for videogames. As researchers, we can take advantage of this by selectively adopting aspects of the genre taxonomy into our studies. However, much of the extant videogame research does not take genre into account.

Thus, a primary goal of this dissertation is to improve the measurement of videogame exposure by establishing a validated list of genres. Past research has frequently measured "videogame exposure" in general (e.g., "How many hours a week do you play videogames?"),

which treats one hour of careful strategizing and puzzle-solving in *Into the Breach* as equivalent to experiencing one hour of emotional storytelling in *A Space for the Unbound*. In truth, videogames vary a great deal, and this variation is captured rather systematically by genres. Different videogame genres offer clearly demarcated experiences, from pensive puzzle-solving to high-intensity multiplayer combat (Faisal & Peltoniemi, 2018; Lee et al., 2014). Moreover, different people likely seek out varied game experiences, and for a wide range of reasons. If we wish to understand the reasons that people play videogames, the effects that videogames have on them in turn, and the diverse manifestations of those relations, genres are a productive place to begin. Moreover, when we collapse across these experiences, treating them all as interchangeable, we introduce additional noise into our research, potentially weakening or obscuring interesting phenomena and relationships. This is of particular concern for videogames research, as effects in this realm tend to be small in nature (see Chapter 5 for a deeper discussion on the size of effects in videogames research). In Chapter 2, we establish an empirically-based list of genres to efficiently represent the modern videogame landscape. We then examine how interest in these genres tends to cluster and identify the latent variables responsible for this clustering.

Players

In spite of deep scholarly interest in videogames, we have an incomplete understanding of who plays which genres of games and why. Anecdotally, there are different archetypes of gamers represented in the gaming community, although these are based more on subcultural stereotypes than any systematic empirical investigation. For example, “the COD player” who plays mostly online shooters like *Call of Duty* (COD) might (be expected to) embody some of the more distasteful traits in the gaming community, such as chauvinism or close-mindedness.

Archetypes such as these are not based on observed patterns of gaming behaviour or motivations. Instead, they are based on association with a single subculture and, like all stereotypes, lack nuance and accuracy.

In truth, there likely are robust patterns in who plays which games and why. Some people may only play one or two genres. Others may play a single game but devote thousands of hours to it over the course of years. But the majority of gamers probably play some broader set of genres, which are potentially complementary and driven by related or complementary motivations. For example, someone might play narrative games (e.g., *Gone Home*) to satisfy their interest in plot and character, but also skill-testing games (e.g., *Slay the Spire*) to satisfy a need for cognitive stimulation. However, the different types of gamers that exist and the constructs that govern that typology remain unknown. In Chapter 2 (Studies 1–3), we construct and replicate a typology of gamers based on their interest in different genres. Combined, the three studies presented in this chapter provide a genre-based understanding of videogames and the people who play them.

Motivation

Having developed an empirically-based taxonomy for both genres and gamers, we then turn to examining the motivations that might distinguish different genres and different types of gamers. Given the capacity for videogames to satisfy basic psychological needs (Przybylski, Rigby, & Ryan, 2010; Ryan, Rigby, & Przybylski, 2006), one possibility is that interest in different videogame genres is driven by an individual's needs. In Chapter 3 (Study 3), we assess whether gamers seek out games of different genres based on their own needs. Specifically, we examine whether specific types of games are uniquely associated with satisfying certain needs,

and whether different types of gamers differentially use these games to satisfy these needs. This adds crucial nuance to our genre-based understanding of games and gamers, allowing us to understand genres and gamer types as a reflection of need satisfaction.

Finally, in Chapter 4 (Study 5), we assess whether the use of games to satisfy needs changes in response to changes in need frustration. We do this by capitalizing upon an event that resulted in the advent of a global increase in need frustration: the restrictions introduced by the COVID-19 pandemic. Through this, we posit that videogame need satisfaction is not just a stable individual difference, but also a reflection of the dynamic state of one's needs.

Taken together, this work establishes a firmer phenomenological grasp on videogames, contributing to a better understanding of what it means to play a videogame, who is playing videogames, and why those people play them. With it, we hope to add much-needed nuance to the scholarly understanding of videogames, along with concrete recommendations for improving future games research.

Chapter 2: Understanding Gaming Through Genre.

Recommended Listening: A Chorus of Tongues – Disasterpeace (*Hyper Light Drifter*)

Despite the fact that videogame research has grown to explore a large diversity of topics, much of this work ignores the existence of genres and treats videogame exposure as a singular entity, as if all types of gaming reflect a homogeneous experience (Faisal & Peltoniemi, 2018; Klevjer, 2006). This is best exemplified by the fact that the one of the predominant measures of videogame exposure is a single item: "How many hours a week do you play videogames?" (e.g., Bègue et al., 2017; Chaarani et al., 2022; Linebarger, 2015). This form of measurement effectively treats one hour of shooting enemy soldiers as the same experience as an hour of caring for a virtual farm. It is obvious, however, that a mobile puzzle game (e.g., *Candy Crush Saga*), a highly realistic hockey simulation (e.g., *NHL 22*), and a text-heavy roleplaying game (e.g., *Disco Elysium*) all offer completely distinct experiences. These distinct experiences are likely to have different effects on players. Just as importantly, these types of games will also attract completely different people. Those who are drawn to the puzzle game are not guaranteed to also find the hockey simulation to be appealing. This is because the different experiences provided by different genres of games are likely to fulfill different needs. A puzzle game is unlikely to fulfill a need for social interaction as effectively as an online multiplayer game where players collaborate to achieve a shared goal.

If our goal is to understand videogames, their effects, and their appeal, we cannot ignore this variability in videogame experiences. Indeed, different types of games have unique effects. Playing real-time strategy games, for example, is uniquely related to improved performance on cognitive tasks that require swift processing of visuospatial and temporal information (Gan et al., 2020). This is likely because these games require quick eye movements, swift processing of

visual information, and rapid mouse and keyboard movements in response. A reading-heavy roleplaying game—or even a turn-based strategy game with no time pressure—is unlikely to offer the same cognitive benefits; the experiences are completely different. Videogame research is thus best served by measuring and accounting for this variety in gaming experiences by considering genre.

What types of games are there?

The variety in videogames is well-represented by an existing classification system: genres (Faisal & Peltoniemi, 2018; Lee et al., 2014). Genres represent the structural or narrative elements that reliably differ between subsets of games, with similar games falling into the same genre. Genres are typically defined by either a narrative aspect (e.g., a horror-themed game), an aspect of gameplay (e.g., a role-playing game), or a combination of the two (e.g., a survival horror game) (Clearwater, 2011). Genres form an important area of research unto themselves, both for videogames and for other media like music and film (e.g., Chandler, 1997).

Although some studies do measure videogame exposure based on genre, how genres are measured varies from study to study and often fails to accurately represent the modern gaming landscape. For example, some studies aspire to measure genre but end up employing contrived categories based on researcher biases, such as “violent” and “non-violent” (e.g., Ferguson, 2011; Tortolero et al., 2014; Uhlmann & Swanson, 2004). Other studies do measure true videogame genres, but these genres often fail to reflect the current state of gaming (e.g., Boot et al., 2008; Green & Bavelier, 2004; Unsworth et al., 2015). For example, “Action” is sometimes used as a catch-all category for games from completely different genres, such as *Starcraft* (a contemplative real-time strategy game), *Halo* (a first-person shooter), and *Mario Kart* (a racing game). Constructing and measuring genres in this way is likely to render them useless because it equates

completely different experiences. Genre lists in the published literature also often include antiquated or unusual genres (e.g., *Flight Simulator*) and omit some of the currently most popular genres (e.g., Multiplayer Online Battle Arenas [MOBAs] like *League of Legends* and *DOTA 2*; Volk, 2016).[1]

This lack of standardization and accuracy in genre measurement is likely due to a dearth of empirical work identifying a representative yet manageable list of popular genres. That said, there have been two recent attempts to establish a standardized list of videogame genres, both using linguistic analyses of archival data (Faisal & Peltoniemi, 2018; Lee et al., 2014). Lee and colleagues (2014) collected hundreds of genre labels from game-related websites and online encyclopedias and used facet analysis to identify the 10 genre terms used most often (Table 1). This list has the benefit of being empirically-derived and has strong ecological validity, given the source of the data. However, it fails to include some genres that are currently popular (e.g., MOBAs; Volk, 2016). Faisal and Peltoniemi (2018) pursued a similar goal by conducting textual analyses of game synopses and genre data from two online game databases. This study benefits from a very large, rich, and ecologically-valid dataset. It also offers a particularly important contribution to this discussion: empirically demonstrating that genre categorization is seldom simple, as many games blend different genres. That said, their use of textual analysis to assign genre also appears to have resulted in somewhat capricious results. For example, it assigned *Command & Conquer: Red Alert*, which is perhaps *the* prototypical Strategy game, the genre of "Action." Their method also found that the game *X-Men Legends*, an Action RPG, was equally likely to be Action, Strategy, Sports-Racing, or a Space game. These difficulties indicate that automated assignment of genre using text from game synopses may not be a fruitful path forward

[1] Flight simulators were a niche, if well-recognized, genre in the 1990s. However, they declined steeply in popularity throughout the ensuing decades, up until the August 2020 release of Microsoft Flight Simulator.

for determining videogame genres. Although this past work has made several important contributions to our understanding of game genres, the aforementioned concerns limit the precision and utility of these genre lists in measuring videogame exposure.

Table 1
Videogame Genres Identified Across Different Studies

Faisal & Peltoniemi, 2018	Lee et al., 2014	Present Research
Action	Action	Action-Adventure
Strategy	Action/Adventure	Strategy (Single-player)
Sport-Racing	Strategy	Strategy (Multiplayer)
	Sports	Sports (Single-Player)
	Driving/Racing	Sports (Multiplayer)
	RPG	Racing
	Shooter	Role-Playing Games (RPGs)
	Simulation	Single-Player Shooter
	Fighting	Online Competitive Shooter
	Puzzle	Simulation
		Fighter (Single-Player)
		Fighter (Multiplayer)
		Puzzle (Mobile)
		Puzzle (Console/PC)
		Platformers
		MOBAs
		MMOs
		Horror
		Narrative
		Rhythm

In order to address this gap in the literature, we also undertook the task of empirically deriving a manageable and representative list of currently-relevant genres. This process involved several steps. We first identified a large number of possible genres using online databases, digital storefronts and platforms, internet forums, and our collective expertise and experience. This large number of genres was then reduced based on input from a group of videogame researchers and gamers. This reduced list was then presented to several hundred gamers who rated their familiarity with each genre and were given the opportunity to suggest any important genres that were missing. Genres that were rated less familiar were dropped, resulting in a final list of 20

genres that we use to represent the modern gaming landscape. This process is discussed in detail in the section Study 1 below.

Empirically identifying a list of videogame genres helps to answer an important question in games research: what types of games are there? And once we have that list, and familiarity data on those genres, we can then begin to answer another important question: what types of gamers are there? Once we've established a typology for the different genres of games, can we similarly establish a typology for the different types of people who play these different games?

What types of gamers are there?

Although gamers are unlikely to play every genre, many of them likely play some subset of videogame genres. Those who play the new *FIFA* game each year might also be more likely to play multiplayer competitive shooters like *Call of Duty*. Or gamers who enjoy social simulations (e.g., *The Sims* and *Animal Crossing*) might also like rhythm games (e.g., *Guitar Hero* or *Just Dance*). Interest in subsets of genres is unlikely to be random, but rather reflective of some individual motivation behind playing videogames. People might tend to play genres that all serve the same need. For example, sports games and competitive shooters likely both fulfill a need for competence, for example. Another possibility is that the genre interests might be complementary, each serving a different unique need. In this case, social simulations might satisfy a need for autonomy and social intimacy, with rhythm games providing a sense of competency. Investigating potential patterns in playing behaviour for different genres will help us to understand what drives interest in different games, allowing us to build a typology for different types of gamers. This typology would also help us to better understand what drives people to play games and why.

The first attempt to develop a typology for gamers was developed by Richard Bartle (1996) in the 1990's. He focused solely on online multiplayer games and proposed that players fall into one of four categories: Achievers, Explorers, Socializers, and Killers. The Bartle model attempted a top-down classification based on what players want from a game and how they behave as a result. Although it was only designed for one very specific type of game (i.e., online multiplayer games called "multi-user dungeons," or MUDs), this model was an important first step in establishing a typology of gamers. However, its top-down nature and its specificity make it of limited use today. Many subsequent efforts have been similarly focused on single genres or even single games, which unfortunately limits their applicability (e.g., Tseng, 2010; Yee, 2006a; Yee, 2006b; Zackariasson et al., 2010). Perhaps the most expansive attempt to establish a typology is by the consulting company Quantic Foundry, which used self-report data from over 450,000 participants to categorize players based on their motivations, in-game behaviour, and favourite games (Quantic Foundry, n.d.). Unfortunately, these data and the analyses supporting the model are proprietary and not available to researchers, and so the model cannot be used to benefit research. Another player typology is the 'BrainHex Model', developed to distinguish the unique neurobiological patterns of different types of gamers (Nacke et al., 2013). The BrainHex model was also developed in a top-down manner and identifies seven types of players, including "Daredevil," "Socialiser," and "Achiever." Although this model tells us something about *how* players are playing games, it does not tell us *which* games people are playing and *why.*

In order to better understand what genres people are playing and why, we adopted a bottom-up data-driven strategy for uncovering player typologies. Specifically, stable patterns in genre interest among gamers were identified using latent profile analysis. Developing a typology of gamers will allow us to better understand what sorts of gamers exist, which is a necessary

starting point for further exploring what differentiates these different types of gamers. A typology would allow us to identify which demographics and personality types are associated with what types of gamers, for example. This method can also be applied to different populations in order to identify group differences in gameplaying behaviour. Gameplaying behaviours differ between cultures (Polygon, 2017; Gematsu, 2019), and so different cultures may very well contain different typologies of gamers.

In this chapter, we present three studies that empirically derive both a set of main videogame genres and also a typology for gamers based on these genres. We do this using a series of multivariate analyses, conducted on genre familiarity and exposure data collected from large samples of videogame players. We first empirically identify a set of videogame genres that can be used to thoroughly and efficiently represent the modern gaming landscape (Study 1). Next, using exploratory factor analysis, we identify the latent variables underlying patterns of interest in videogame genres (Study 1). Using another sample and a slightly different measure, we then replicate that factor structure and, with those factors, use latent profile analysis to identify a typology of different videogame players (Study 2). Finally, we use confirmatory factor analysis to again replicate the videogame genre factor structure in a third sample, and attempt to replicate the player typologies (Study 3).

Study 1

Our first study examined the patterns in familiarity with videogames using a list of genres representing the most common videogame experiences. Factor analysis was then employed to identify the latent variables guiding interest in subsets of these genres.

Method

Participants. Participants were recruited from a metropolitan Canadian university with a diverse student population. In order to qualify for the study, participants had to self-report playing at least five hours of videogames per week (on either console, PC, or mobile). One participant was removed for being disruptive and inattentive while completing the study in the lab. Another participant was removed for having over 10% data missing from the crucial measures. All cleaning was conducted before data analysis and, after cleaning, our sample comprised 580 participants (44% Men, 56% Women, < .1% Other; M_{age} = 19.19, SD = 2.37).[2] The sample had a diverse cultural background, with 115 participants from a North American background, 132 from a South Asian background, and the rest spread among other cultures. The majority of the sample spoke English as their first language (n = 328), with the remainder of the sample speaking a variety of languages, such as Punjabi, Persian, Arabic, and Chinese.

Materials. In order to develop our list of videogame genres, we first generated a list of as many videogame genres as possible. We did this by thoroughly browsing digital platforms and storefronts (e.g., the *Steam* marketplace), reading online forums (e.g., Reddit), and using our extensive collective videogame knowledge. This resulted in a list of 68 genres, which we further divided into smaller and more specific categories, resulting in an additional 61 genres. We then whittled this list down to the following 22 main genres using our own expertise and by consulting with other experienced videogame enthusiasts: Online Competitive Shooter; Single-Player Shooter; Co-operative Shooter; Action-Adventure; Role-Playing Games; Puzzle (Mobile); Puzzle (Console/PC); Fighter (Single-Player); Fighter (Multiplayer); Platformers; Racing;

[2] The role of gender in videogame playing behaviour is a broad and important topic but is also outside the direct purview of this research program. Thus, the topic is discussed with regards to this research program in some detail in Appendix C.

Massive Multiplayer Online (MMOs); Multiplayer Online Battle Arena (MOBAs); Rhythm; Horror; Simulation; Narrative; Strategy (Single-Player); Strategy (Multiplayer); Sports (Single-Player); Sports (Multiplayer); and Flight Simulator.

One unique feature of our list is that, for some genres, it maintains unique entries for different modes and platforms of play. A game's mode of play, such as playing in a competitive multiplayer format or in a single-player format, is likely to drastically change the experience and its downstream effects. Playing an online competitive shooter, for example, tends to be extremely high-pressure, fast, and continuous. There is also a social element to online competitive games. Single-player games, on the other hand, tend to be far less tense, with lower stakes and no social rewards or repercussions based on performance. Platform can also sometimes have a substantial impact on the experience of playing a game. Although *The Witness* and *Candy Crush Saga* are both Puzzle games, they are unique to different platforms (consoles/PC and mobile devices respectively) and offer very different experiences. Puzzle games developed primarily for traditional videogame platforms tend to be very effortful experiences and, as a result, are something of a niche genre. In contrast, Puzzle games developed for mobile platforms are usually designed to provide shorter, lower-effort, and more approachable experiences. They are also one of the most popular genres of mobile game.

Videogame Genre Exposure Measure. Participants were asked to self-report their familiarity with each of the 22 genres. Each genre was presented individually, after the prompt "Please rate your familiarity with the following genre", with responses ranging from 1 (*Not at all familiar; I do not know what games in this genre are like*) to 5 (*Extremely familiar; very confident I know what games in this genre are like*). Each genre was also presented alongside

three exemplar games (e.g., "Sports (Multiplayer)" was presented alongside *NHL*, *FIFA*, and *Madden*).

Procedure. Participants completed the study on a computer in our lab. They first completed the genre exposure measure, presented in a randomized order. Next, they completed measures of various attitudes and beliefs unrelated to the present study,[3] and finally a battery of demographic questions.

Results

Mean familiarity for all genres appears in Table 2. Most games had a moderate mean familiarity rating, with means ranging from 1.39 to 3.20 on a five-point scale. The genre that participants found the most familiar was mobile puzzle games (M = 3.20), followed by online shooters (M = 3.03) and sports games, both single-player (M = 2.93) and multiplayer (M = 2.90). The least familiar genre was flight simulators (M = 1.39), with about 73% of the sample giving it the lowest possible rating on familiarity (*Not at all familiar; I do not know what games in this genre are like*). For this reason, this genre was dropped from the list for all analyses and was omitted in later studies. The co-operative shooter genre was rated as fairly familiar (M = 2.27) but this genre was also dropped from the list before any analyses, as we determined that this genre was difficult to define, measure, and distinguish from the other two shooter genres (Online Competitive Shooter and Single-Player Shooter). This resulted in a final list of 20 genres.

[3] These included belief in a just world, attitudes towards technology, and degree of social trust.

Table 2
Genre familiarity and exposure rating means and standard deviations

Genre	Study 1	Study 2	Study 3
Online Competitive Shooter	3.03 (1.42)	4.08 (1.53)	3.43 (1.65)
Single-Player Shooter	2.37 (1.40)	3.06 (1.52)	2.57 (1.44)
Action-Adventure	2.89 (1.34)	3.64 (1.37)	2.57 (1.44)
Role-Playing Games	2.70 (1.43)	3.13 (1.61)	2.85 (1.56)
Puzzle (Mobile)	3.20 (1.34)	3.07 (1.17)	3.74 (1.69)
Puzzle (Console/PC)	1.74 (1.01)	2.12 (1.35)	2.30 (1.44)
Fighters (Single-Player)	2.60 (1.30)	2.97 (1.40)	3.08 (1.41)
Fighters (Multiplayer)	2.64 (1.32)	3.02 (1.39)	3.12 (1.42)
Platformers	2.74 (1.29)	2.83 (1.34)	3.19 (1.33)
Racing	2.64 (1.25)	2.63 (1.35)	2.86 (1.40)
MMOs	2.18 (1.34)	2.47 (1.57)	2.21 (1.46)
MOBAs	2.12 (1.31)	2.91 (1.88)	2.41 (1.73)
Rhythm	2.57 (1.27)	2.14 (1.32)	2.39 (1.30)
Horror	2.13 (1.30)	1.99 (1.24)	2.07 (1.29)
Simulation	2.47 (1.25)	2.25 (1.43)	2.64 (1.50)
Narrative	2.03 (1.19)	2.46 (1.44)	2.38 (1.42)
Strategy (Single-Player)	1.93 (1.17)	2.46 (1.47)	2.51 (1.51)
Strategy (Multiplayer)	2.05 (1.18)	2.42 (1.48)	2.40 (1.52)
Sports (Single-Player)	2.93 (1.48)	2.94 (1.76)	2.78 (1.63)
Sports (Multiplayer)	2.90 (1.46)	2.97 (1.79)	2.88 (1.64)
Flight Simulator	1.39 (0.79)	N/A	N/A
Co-operative Shooter	2.27 (1.40)	N/A	N/A

Note. Study 1 asked participants to rate their familiarity with each genre on a five-point scale. Studies 2 and 3 asked participants to rate the frequency of playing each genre on a six-point scale. Flight Simulators and Co-operative Shooters were not included in Studies 2 or 3. Means are presented with standard deviations in parentheses.

Exploratory Factor Analysis. An exploratory factor analysis using a principal axis factor solution with oblimin rotation was conducted on the familiarity ratings for the 20 videogame genres. A parallel analysis and scree plot recommended a five-factor solution. We generated a four-factor and five-factor model solution, comparing the fit and interpretation of both models. Both models had similarly good fit (Four-factor model: *SRMR* = .03, *RMSEA* = .05, *TLI* = .93; Five-factor model: *SRMR* = 0.02, *RMSEA* = .04, *TLI* = 0.96), though the five-factor model's fit was slightly better. After interpreting and comparing the factor loadings of both models, the five-factor solution was deemed more theoretically meaningful and so was adopted. However, this solution did have genres that did not load clearly onto a single factor and only served to hamper our interpretation. We thus removed one of these genres at a time and re-

assessed our four- and five-factor solutions until we obtained a solution with acceptable simple structure. We first dropped the Platformer genre, and then the Puzzle (Console/PC) genre. Each time that we did this, the five-factor solution was superior to the four-factor solution. After dropping those two genres, we obtained a factor solution with both good fit and acceptable simple structure (*SRMR* = 0.02, *RMSEA* = .03, *TLI* = 0.97). The factor loadings for this model are presented in Table 3.

Table 3
Factor loadings for the five-factor solution (Study 1)

Genre	Factor 1 Hardcore	Factor 2 Sports Genres	Factor 3 Fighters	Factor 4 Blockbuster	Factor 5 Approachable
Online Competitive Shooter	0.22	0.35		0.28	
Single-Player Shooter	0.22		0.23	0.36	
Action-Adventure			0.31	0.51	
Role-Playing Games	0.39			0.31	
Puzzle (Mobile)					0.50
Fighters (Single-Player)			0.76		
Fighters (Multiplayer)			0.69		
Racing		0.36			0.27
MMOs	0.61				
MOBAs	0.59				
Rhythm					0.52
Horror				0.52	
Simulation					0.52
Narrative	0.21			0.51	
Strategy (Single-Player)	0.55				
Strategy (Multiplayer)	0.72				
Sports (Single-Player)		0.80			
Sports (Multiplayer)		0.85			

Note. Factor loadings lower than .20 have been removed for ease of interpretation.

Factor 1 had the strongest loadings from high-investment games that often have steep learning curves, such as Strategy games and RPGs. It also had strong loadings from online competitive games that take months or years to master, such as MOBAs and MMOs. We therefore labeled it the "Hardcore" factor, as it appears to represent genres that require high investment and dedication. This factor would include games like *World of Warcraft*, *League of Legends*, *Civilization VI*, and *Final Fantasy XIV*.

Factor 2 has its strongest loadings from Sports games, Racing games, and Online Competitive Shooters. That said, Online Competitive Shooters load nearly equally-well on two other factors, and so it does not appear to be a defining characteristic of this factor. Its loadings from the Sports genres are the highest loadings in the entire solution, and so the factor seems to represent Sports and Sports-related genres, such as Racing. This factor was labelled the "Sports Genres" factor, and would likely include games like the annual releases of *NHL* and *NBA 2K*, and *Forza Horizon 5*.

Factor 3 has its strongest loadings from the two Fighter genres. It also has a moderate loading from Action-Adventure, but this genre loads more strongly elsewhere, and so it does not define this factor. Rather, this factor seems to represent interest in fighting games, and so we labelled it the "Fighters" factor. This would include games like *Street Fighter V*, *Dragon Ball FighterZ*, and *Super Smash Bros. Ultimate*.

Factor 4 has the greatest number of genres loading on it, though these include the aforementioned cross-loadings. Its strongest loadings are from Action-Adventure, RPGs, Narrative, and Horror. Single-Player Shooters also loads most strongly onto this factor than any other factor. These loadings seem to represent the high novelty of popular blockbuster videogames. These are games that offer exciting, polished, finite experiences and are often designed to be enjoyable by those who are moderately or highly invested in gaming. They also tend to be widely-marketed and very high-budget games. We thus labelled it the "Blockbuster" factor. This would include games like *The Last of Us*, *Bioshock*, and *Grand Theft Auto V*.

Factor 5 has its strongest loadings from Mobile Puzzle, Rhythm, and Simulation.[4] Games within these genres tend to have fairly intuitive and accessible controls and offer rewarding experiences without long-term investment or high learning curves. These games prioritize novelty and approachability, rather than the long-term dedication required by genres in the Hardcore factor, for example. We labelled this as the "Approachable" factor. This factor includes games such as *The Sims 4*, *Animal Crossing: New Horizons*, *Rock Band*, and *Candy Crush Saga*.

Our model also allowed the factors to inter-correlate with one another, and we observed correlations ranging from null to reasonably strong. The Hardcore factor correlated strongly with Fighters (r = .48) and Blockbuster games (r = .56), and more weakly with Sports Genre (r = .18) and Approachable games (r = .20). The Sports Genres games had no correlation with Approachable games (r = .02), but had a positive relationship with Fighters (r = .44) and Blockbuster games (r = .18). Fighters correlated with Blockbuster games rather strongly (r = .52) and had a weaker correlation with Approachable games (r = .23). Finally, Approachable games correlated weakly with Blockbuster games (r = .18). It is notable that all inter-factor correlations were positive and non-zero, save one: that between Sports Genre and Approachable games. This indicates that interest in one set of genres does not preclude interest in another. Rather, people are interested in some subset of these factors (with each factor representing several genres), to varying degrees. In other words, gamers as a whole exhibit a broad interest in different genres.

[4] One interesting quirk of the term "Simulation" is that it can refer to very different experiences. The most popular form of Simulation games are social simulators, such as *Animal Crossing* and *The Sims*. These tend to be popular, appealing, and approachable regardless of previous experience with videogames. Based on our results, our participants understood that this genre has this connotation. However, "Simulation" can also be used to refer to high-investment, and niche types of games. *Football Manager* is a very detailed and complex sports management sim, for example. These sorts of games are much less popular and so, for our purposes, "Simulation" will be used to primarily refer social simulators.

Discussion

We have empirically identified a set of genres that represent the modern gaming landscape, improving on past attempts in several ways. First, our list of genres includes important modern genres that have been previously omitted (e.g., MOBAs). Second, our list represents different modes of play, distinguishing between single-player and online multiplayer, and between mobile and console/PC, where appropriate. These distinctions help to ensure that our list is effective in capturing a variety of gaming experiences, providing a nuanced and precise depiction of gaming.

Although our adopted factor solution offers insight into the constructs underlying patterns of familiarity with different genres, it does have a mild cross-loading issue, as some genres do not load cleanly onto a single factor. Though this is not a fatal flaw of the model, it does cloud interpretations somewhat. Furthermore, these cross-loadings could not be eliminated even after several rotation attempts. Study 2 will attempt to rectify this issue, aiming to replicate the overall factor structure, without the cross-loadings. This will also serve to bolster our confidence in this factor structure, its interpretation, and the use of this genre list in future research.

Study 2

Study 1 established a genre list and an underlying factor structure for familiarity with these genres. Study 2 builds on this by replicating the factor structure in a novel sample, using a slightly different measure. Study 1 measured participants' familiarity with genres (to establish the current relevance of each genre), but most researchers are interested in exposure to these genres. Thus, Study 2 measures self-reported frequency of exposure. Finally, we also use these data to identify a typology of gamers.

Method

Participants. Participants were recruited from a metropolitan Canadian university with a diverse student population. In order to qualify for the study, participants had to self-report playing at least five hours of videogames per week (on either console, PC, or mobile). Over the course of the study, participants completed three items used to detect inattentive responding (e.g., "Please select agree and proceed to the next question"; Marjanovic et al., 2014). Twenty-three participants were removed for having answered one or more of these questions incorrectly. Another six were removed for having more than five missing responses from the crucial measures. All cleaning was conducted before data analysis and, after cleaning, our sample comprised 394 participants (71% Men, 29% Women; M_{age} = 19.4, SD = 2.5). The sample had a diverse cultural background, with 83 participants from a North American background, 64 from an East Asian background, 48 from a South Asian background, and the rest spread among other cultures. The majority of the sample spoke English as their first language (n = 233), with the remainder of the sample speaking a variety of languages, such as Chinese and Arabic.

Materials. Participants were presented with the list of 20 videogame genres established in Study 1. Each genre was presented in a randomized order, one at a time, alongside the prompt "How often do you play the following genre of videogame?" Response options ranged from 1 to 6, with the responses labeled as "Never", "Once every couple of years", "A few times a year", "Every month", "Every week", and "Everyday."[5] Each genre was also presented alongside three exemplars (e.g., "Online Competitive Shooter" was presented alongside *Call of Duty*, *Overwatch,* and *Battlefield*).

[5] This change in item wording results in an item that is ordinal, in contrast to the interval item used in Study 1. That said, under most circumstances, exploratory factor analysis is capable of handling ordinal data (Robitzsch, 2020). This issue is discussed in more detail in Appendix B.

Procedure. Participants completed the study online through Qualtrics. They first completed a series of videogame exposure measures, including the genre exposure measure, presented in a randomized order. This included measures such as average hours of videogame playtime per week over the past year and participants' favourite three videogames. These other exposure measures are not examined or analyzed further here as they lie outside of the goals of this dissertation. Next, they completed measures of various attitudes and beliefs unrelated to the present study, and finally a battery of demographic questions.

Results

A list of all genres and mean exposure ratings can be found in Table 2. The lowest mean exposure was for Horror games (M = 1.99; only a couple of times per year), whereas the highest was for Online Competitive Shooter (M = 4.08; every month). This pattern of responses is similar to that of Study 1, in which Online Competitive Shooter was the most familiar genre, but also has some notable differences. For example, whereas the two Sports genres were some of the most familiar to participants in Study 1, they are ranked somewhat lower on exposure for participants in Study 2. These differences may be due to sample variance, but are also likely attributable to the difference in question proffered: most players are likely familiar with sports games, but many of them may not play them.

Exploratory Factor Analysis. As in Study 1, an exploratory factor analysis using a principal axis factor solution with oblimin rotation was conducted on the exposure ratings for the 20 videogame genres. A parallel analysis and scree plot recommended a five-factor solution. We generated a four-factor and five-factor model solution, and compared the fit and interpretation of both models. In this case, the fit of the five-factor model (*SRMR* = 0.03, *RMSEA* = .06, *TLI* = 0.90) was a substantial improvement on the four-factor model (*SRMR* = .05, *RMSEA* = .09, *TLI*

= .81), and so the five-factor model was adopted. However, as in Study 1, this solution did have genres that did not load clearly onto a single factor and thus hampered interpretations. We thus removed one of these genres at a time and re-assessed the five-factor solution until we obtained a solution with acceptable simple structure. In this way, we first dropped the Racing genre, followed by Horror, Strategy (Single-Player), Narrative,[6] and Platformer. After dropping these five genres, we obtained a factor solution with good fit (SRMR = 0.03, RMSEA = .05, TLI = 0.94) and acceptable simple structure. The factor loadings for this model are presented in Table 4.

Table 4
Factor loadings for the five-factor solution (Study 2)

Genre	Factor 1 Hardcore	Factor 2 Sports Genres	Factor 3 Fighters	Factor 4 Blockbuster	Factor 5 Approachable
Online Competitive Shooter				0.40	-0.22
Single-Player Shooter				0.91	
Action-Adventure				0.38	
Role-Playing Games	0.41	-0.20			
Puzzle (Console/PC)					0.62
Puzzle (Mobile)					0.63
Fighters (Single-Player)			0.99		
Fighters (Multiplayer)			0.77		
MMOs	0.80				
MOBAs	0.60				
Rhythm					0.48
Simulation					0.68
Strategy (Multiplayer)	0.56				
Sports (Single-Player)		0.87			
Sports (Multiplayer)		1.01			

Note. Factor loadings lower than .20 have been removed for ease of interpretation.

The obtained factor solution for these data is very close to that observed in Study 1. We find the same five factors that are, broadly-speaking, defined by the same genres. This is notable given that we measured exposure rather than familiarity in this study; the latent variables underlying both familiarity and exposure appear to be similar. There are a handful of notable

[6]At this point, the principal axis estimation resulted in an ultra-Heywood case (i.e., a communality > 1), rendering the results uninterpretable. We then used maximum likelihood estimation instead, which resolved the issue.

differences between these two solutions, however. First, the genres that performed poorly in this factor analysis are different from those in Study 1. In Study 1, Platformer and Puzzle (Console/PC) were dropped for failing to load clearly onto a single factor. In the present study, we also drop Platformer, but we do not drop Puzzle (Console/PC). Instead, we drop a small handful of other genres that performed poorly. These differences are likely attributable to a combination of sample variance and measuring exposure instead of familiarity.

Another notable difference from Study 1 is the reduction of cross-loading. Although there are some genres still showing mild cross-loading (e.g., RPGs load positively onto Hardcore and negatively onto Sports Genres), it is less present in this factor solution and does not have a substantial negative impact on our interpretation of the factor structure. One genre also switched its primarily loading to a different factor: Online Competitive Shooter. Whereas this genre had comparable loadings onto multiple factors in Study 1 (Sports and Blockbuster, and to a lesser extent, Hardcore), its only positive loading in the present solution is onto Blockbuster. It also loads negatively onto Approachable, which was also not observed in Study 1.

The inter-factor correlations were weaker than those observed in Study 1, though the same relations emerged. The Hardcore factor had the strongest association with Blockbuster (r = .26) and the Fighter factor (r = .25), followed by Approachable (r = .19). Interestingly, Hardcore had a negative association with the Sports Genre factor (r = -.22). This Sports Genres factor was also negatively correlated with the Approachable factor (r = -.12) and showed weak positive relations to the Blockbuster (r = .11) and Fighter factor (r = .04). The Fighter factor was positively associated with both the Blockbuster (r = .33) and Approachable factor (r = .36). Finally, the Approachable factor had a weak positive correlation with the Blockbuster factor (r = .11).

As in Study 1, it seems that interest in one set of genres does not preclude interest in other sets of genres, but that there is a consistent pattern observed. For example, those playing Sports Genre games tend to be less interested in either Hardcore or Approachable genres. This is interesting since Approachable and Hardcore seem to describe opposing types of games. Approachable games stress novelty, intuitive controls, and immediate gratification, whereas Hardcore games offer steep learning curves and require long-term dedication. That interest in Sports Genres is negatively associated with both of these experiences means that it is truly unique and different motivations likely separate it from the other two. All the other factors tend to be positively-associated, however, with interest in one set of genres predicting a greater interest in other sets, if only weakly. These associations indicate that many gamers have a flexible interest in their hobbies. Someone might *usually* stick to playing *World of Warcraft* and *Final Fantasy*, but would make an exception for a big Blockbuster game like *Uncharted 4*.

Having replicated the factor structure underlying interest in different genres, we then used these factors to construct a typology of players.

Latent Profile Analysis. In order to construct our gamer typology, we conducted a latent profile analysis (LPA) on exposure ratings for the five genre categories identified by the factor analysis. Scores on each category for each participant were generated by calculating the mean exposure for each genre in a category. For example, Hardcore was based on exposure to RPGs, MMOs, MOBAs, and Strategy (Multiplayer). Descriptive statistics for each category are presented in Table 5. The Blockbuster genres had the highest mean exposure (M = 3.59), by a considerable margin, whereas Approachable genres had the lowest mean exposure (M = 2.40). The other three genre categories had similar mean exposure scores.

Table 5
Means, standard deviations, and correlations of exposure scores

Variable	*M*	*SD*	1	2	3	4
1. Hardcore	2.74	1.20				
2. Sports	2.96	1.72	-.27 [-.36, -.18]			
3. Fighters	2.99	1.32	.29 [.20, .38]	.05 [-.05, .15]		
4. Blockbuster	3.59	1.11	.28 [.19, .37]	.16 [.06, .25]	.36 [.27, .44]	
5. Approachable	2.40	1.06	.21 [.12, .31]	-.08 [-.17, .02]	.34 [.25, .43]	.08 [-.02, .18]

Note. *M* and *SD* are used to represent mean and standard deviation, respectively. Values in square brackets indicate the 95% confidence interval for each correlation. Means were calculated based on the genres that loaded most strongly onto each factor.

The LPA uses these five genre category scores to identify common profiles based on response patterns, and then classifies each participant into one of those profiles. In order to determine what number of profiles was appropriate for our data, we compared the fit statistics for 10 different models: a one-profile model, a two-profile model, and so on up to 10 profiles. Fit indices indicated that model fit worsens from six profiles onward, and so the fit indices for the one- to five-profile models are provided in Table 6. The fit statistics all indicated that a four-profile model was the optimal solution. However, given that the fit does not seem to worsen substantially for the five-profile model, we opted to estimate both models to see if either made more sense conceptually.

Table 6
Latent profile analysis fit indices (Study 2)

Fit Indices	Number of Profiles				
	1	2	3	4	5
AIC	6525.885	6385.364	6361.974	6236.025	6236.352
BIC	6565.649	6448.986	6449.453	6347.363	6371.548
Bootstrapped LRT (*p*-value)	-	$p = .009$	$p = .009$	$p = .009$	$p = .149$
Entropy	-	0.623	0.650	0.750	0.715
Group sizes				114, 112, 101, 67	100, 74, 45, 65, 110

Note. AIC = Akaike's Information Criterion; BIC = Bayesian Information Criterion; LRT=Likelihood Ratio Test.

Profiles are often interpreted in terms of elevation (whether the profile is generally higher or lower than the others), shape (the qualitative difference in patterns between the profiles), and scatter (the variability of scores within a profile) (Meyer & Morin, 2016). After considering both models, we preferred the five-profile model, which added a qualitatively distinct and theoretically meaningful new profile. Figures 1 and 2 show both the four- and five-profile models with standardized mean scores on the five genre categories.

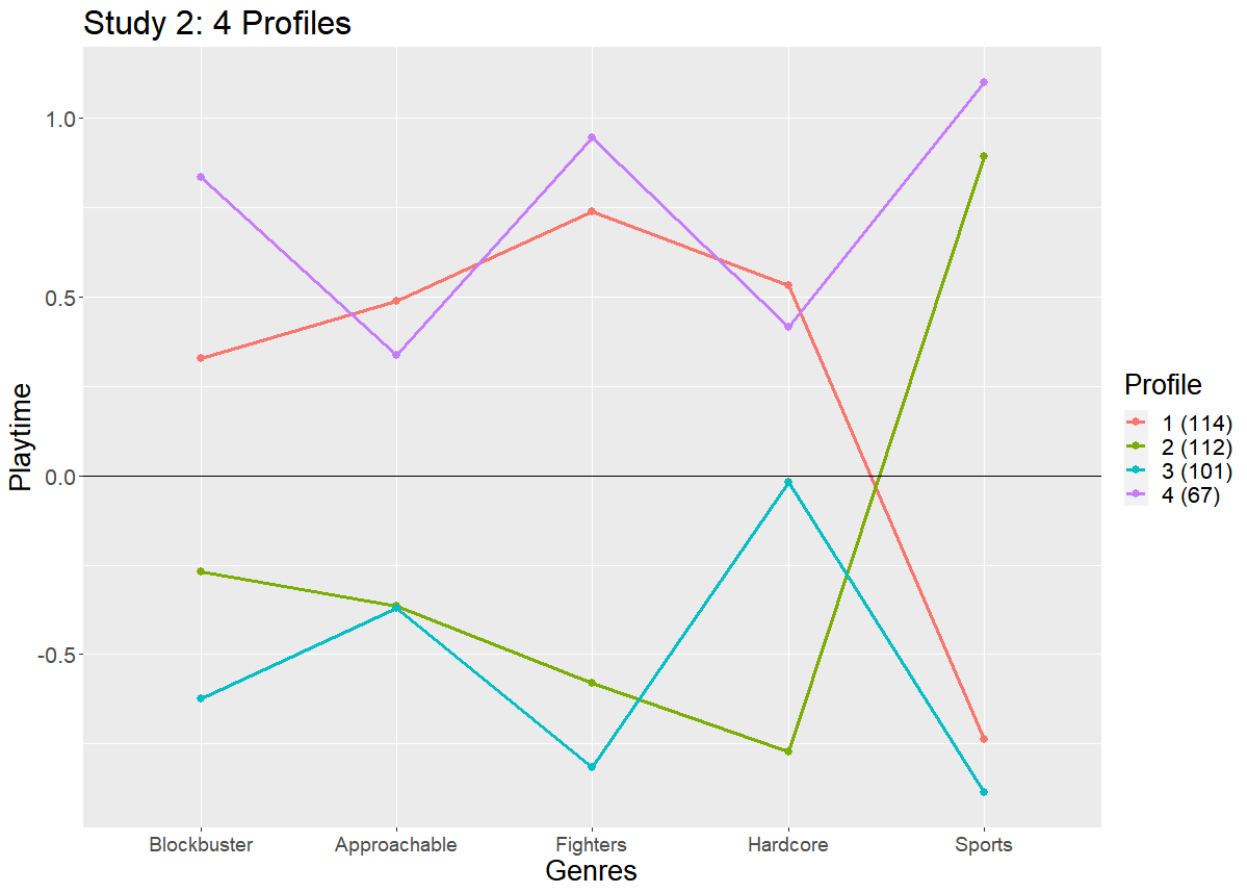

Figure 1. Four profile latent profile analysis (Study 2).

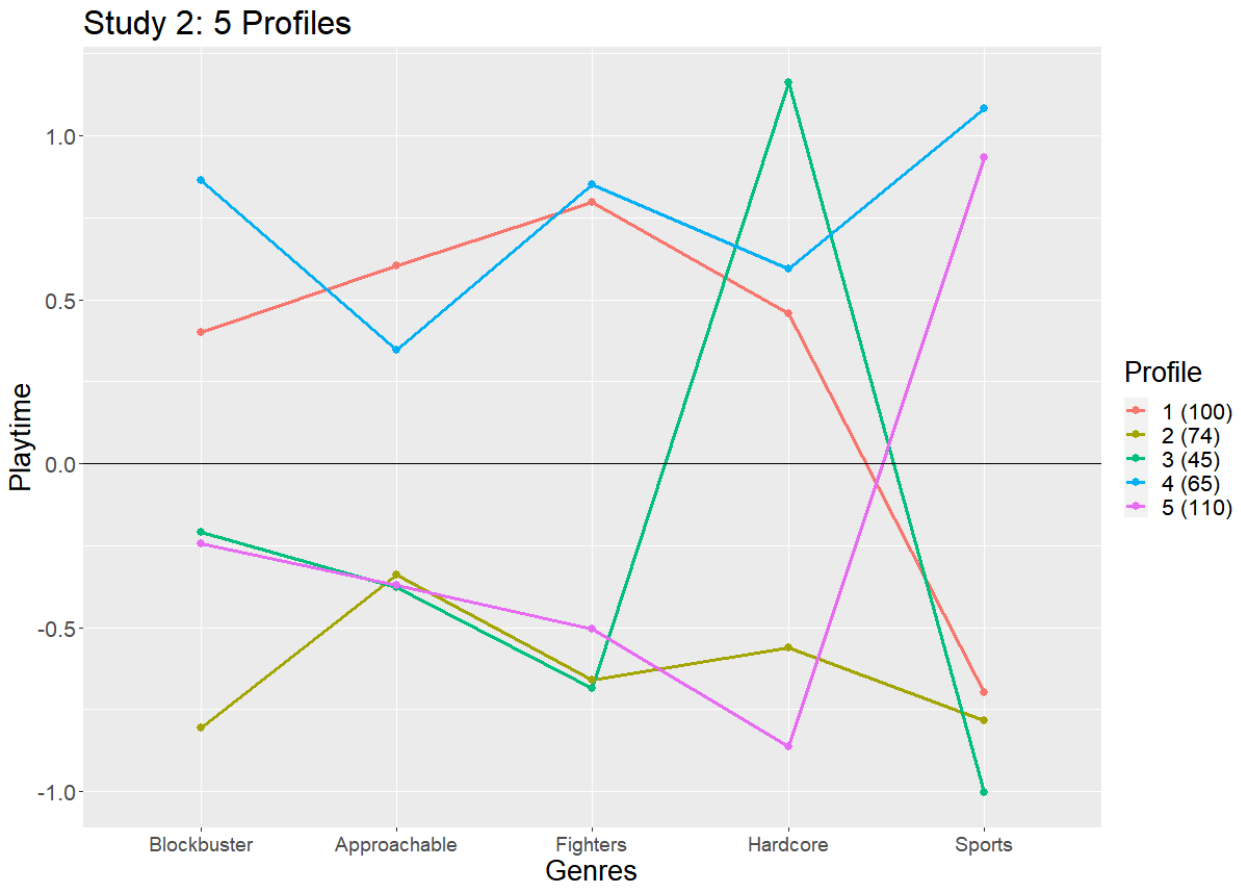

Figure 2. Five profile latent profile analysis (Study 2).

For both the four- and five-profile model, three of the profiles are quite similar in shape, elevation, and scatter. In the four-profile model, Profile 1 (n = 114/100) represents videogame players who engage with all genre categories except for Sports, scoring above the mean in a fairly consistent pattern on all other categories. Profile 2 (n = 112/110) is essentially the inverse of Profile 1, representing gamers that have relatively low exposure on all categories but are very high on Sports (nearly a standard deviation above the mean). Notably, they are also particularly low on the Hardcore category (almost a standard deviation below the mean). Profile 3 (n = 67/65) gamers score above the mean on every genre category, though not uniformly. They are especially high on Popular, Fighter, and Sports, seeming to form a group of all-around gamers who play a bit of everything.

In the four-profile model, Profile 4 (n = 101) is the inverse of Profile 3, with the group scoring below the mean on every category, but particularly low on Sports and Fighter and is just below the mean for Hardcore genres. In contrast, the five-profile model splits this profile, with a group that is low on everything (n = 74) and a new profile (Profile 5; n = 45) to represent gamers who play almost exclusively Hardcore games. Given our conceptualization of the Hardcore category—complex games that require high investment of both time and energy—a profile that consists of players who engage almost exclusively in this genre seems intuitive.

Discussion

In this study, we replicated the factor structure underlying interest in the sets of genres found in Study 1. These sets of genres were used to identify different profiles of gamers.

Types of Games. Despite using exposure instead of familiarity, the results of our factor analysis are very close to those of Study 1. This helps to bolster our confidence in these results and our interpretation. Interest in genres appears based on a few latent variables that lead them to cluster. Some genres cluster together based on shared content, such as Sports and Fighters. Genres in these categories demand a level of dedication that other genres do not, which is likely why they are each associated with their own unique factors.

The other three genre categories are based more on what they offer to players and what they expect from players in return. Blockbuster games, for example, offer novel, exciting, polished experiences. New, exciting, high-budget games typically fall into this category, and offer players a smooth and prestige experience, in exchange for a moderate amount of investment of time and energy. Blockbuster games are usually designed to have wide appeal, and have reasonably-finite playtimes (i.e., they can be completed in 5–25 hours). These games also

often have difficulty settings, to ensure that players will be able to play the game comfortably regardless of ability.

Hardcore genres usually offer less novelty and polish, opting instead to give players the opportunity to develop a deep competence in a mechanically-complex game. They also often offer an opportunity for competition and socializing along the way. In the massively popular and highly competitive MOBA *Dota 2*, for example, you are often considered a "noob" until you exceed at least 1000 hours of playtime. In MMOs like *World of Warcraft* or *Final Fantasy XIV*, players will often play for years, racking up hundreds or thousands of hours of combined playtime, providing a consistent sense of development for the player and their character.

Finally, Approachable genres focus on providing intuitive controls and an immediate sense of reward. These games can be played and enjoyed by newcomers to the particular game or even to videogames as a whole. *Rock Band*, for example, has players play along with familiar pop and rock music using plastic instruments and a microphone. Rhythm games of this nature are often beloved even by people who do not play videogames regularly, as they encourage cooperative and accessible fun. Approachable genres also require less investment of time and energy than either Blockbuster or Hardcore games. Some Approachable games do offer increased benefits for long-term investment, such as *The Sims 4*, which encourages players to design characters and families, following them for their entire lifespans.

Types of Gamers. Given these interpretations of the genre categories, we can now better elucidate the different profiles observed in our LPA. Profile 1 represents all-around gamers who are interested in a variety of gaming experiences, other than Sports. They enjoy novelty in addition to longer-term familiar gaming experiences, likely across a wide array of content domains. Profile 2 captures very casual players. These people are likely not deeply interested in

videogames or seldom have the opportunity to play them. Profile 3 contains our most dedicated players who play the Hardcore genres to the exclusion of all others. These are the people who have thousands of hours in their game(s) of choice and are less interested in videogames so much as they are interested in these particular games and their concomitant investment in competence, skill, and socialization. Profile 4 resembles Profile 1, but with an additional interest in Sports. These are all-around gamers who do not discriminate against Sports, and who have a particular interest in Blockbuster genres. And, finally, Profile 5 captures a group who are interested in Sports games and practically nothing else. These are the players who buy *NHL* or *NBA 2K* each year and play few other videogames. Some of these players will play it primarily in the single-player mode and be finished with it after a few weeks. Others will play the game throughout the entire year, honing their skills in competitive multiplayer or playing on the couch with friends. In this way, Profile 5 captures a swath of gamers with potentially different interests and needs, but who are playing the same genre of games.

Having established this factor structure and begun to develop our gamer typology, we then conducted a direct replication of Study 2, using the same genre list and the same measure of genre exposure. We also use confirmatory factor analysis, in order to obtain stronger evidence to support our factor structure.

Study 3

Study 3 is a direct replication of Study 2, with the only difference being the absence of any measures unrelated to the present study. The analytic approach was also similar to that of Study 2, but deviated in one way: instead of conducting an exploratory analysis on the genre exposure data, we conducted a confirmatory factor analysis (CFA).

Method

Participants. Participants were recruited from the same pool as Study 2 and with the same inclusion criteria. One participant was removed for reporting their age as below 16. Another three were removed for having more than five missing responses from the crucial measures. All cleaning was conducted before data analysis and, after cleaning, our sample comprised 322 participants (47% Men, 52% Women; < .1% Other, and 2 failed to report; M_{age} = 19.6, *SD* = 2.5). The sample had a diverse cultural background, with 70 participants from a North American background, 67 from a South Asian background, and the rest spread among other cultures. The majority of the sample spoke English as their first language (*n* = 194), with the remainder of the sample speaking a variety of languages, such as Chinese, Arabic, Punjabi, and Persian.

Materials. All materials were the same as those presented in Study 2.

Procedure. All procedures were identical to those used in Study 2.

Results

A list of all genres and mean exposure ratings appears in Table 2. As in Study 2, the lowest mean exposure was to Horror (M = 2.07; only a couple of times per year). However, unlike in Study 2, the highest mean exposure was to Puzzle (Mobile) (M = 3.74; close to every month). This is likely the result of having recruited more mobile gamers and fewer traditional gamers than in past samples. The next highest mean was for Online Competitive Shooter (M = 3.43; between a few times a year and every month), which was the highest mean exposure in Study 2. Whereas Online Competitive Shooter and Action-Adventure were both substantially higher than the other genres in Study 2, the genre means are all much closer together in Study 3. This is also likely the result of recruiting more mobile gamers. After means were calculated, but

before any substantial analyses were conducted, one participant was found to be an extreme multivariate outlier, based on Mahalanobis distance. This participant was removed from all analyses, resulting in a final sample of 321.

Confirmatory Factor Analysis. We used a confirmatory factor analysis to build a factor model based on the results of our exploratory factor analysis from Study 2. We specified five factors with paths to the genres as specified in Study 2: (1) Hardcore, defined by RPGs, MOBAs, MMOs, and Strategy (Multi-player); (2) Sports, defined by (Single-Player) and Sports (Multiplayer); (3) Fighters, defined by Fighters (Single-Player) and Fighters (Multiplayer); (4) Blockbuster, defined by Single-Player Shooter, Online Competitive Shooter, and Action-Adventure; and (5) Approachable, defined by Puzzle (Console/PC), Puzzle (Mobile), Rhythm, and Simulation. We used a maximum likelihood approach to estimate the model and allowed for error covariances between the following genre pairs due to their similarity: Single-Player Shooter and Online Competitive Shooter, MMOs and RPGs, and Puzzle (Console/PC) and Puzzle (Mobile). The fit for the model was adequate: *SRMR* = 0.71, *RMSEA* = .084, *CFI* = 0.89, *TLI* = 0.85. Although the model does not fit as well as the exploratory factor analyses from Studies 1 and 2, reduction in fit is expected when all cross-loadings are reduced to 0 (as in a CFA). As in Study 2, we observed some notable cross-loadings for a handful of genres here, and the restriction of those loadings is likely negatively impacting model fit. Although the fit indices hover around adequate, the factor loadings were very strong (Table 7). All genres loaded above .50 on their respective factors, except for Puzzle (Mobile), which had a loading of .40. This confirmatory factor analysis provides additional evidence to support the factor structure and interpretations in Studies 1 and 2.

Table 7
Factor loadings for the confirmatory factor analysis (Study 3)

Genre	Factor 1 Hardcore	Factor 2 Sports Genres	Factor 3 Fighters	Factor 4 Blockbuster	Factor 5 Approachable
Online Competitive Shooter				0.66	
Single-Player Shooter				0.62	
Action-Adventure				0.73	
Role-Playing Games	0.62				
Puzzle (Console/PC)					0.50
Puzzle (Mobile)					0.40
Fighters (Single-Player)			0.79		
Fighters (Multiplayer)			0.82		
MMOs	0.77				
MOBAs	0.63				
Rhythm					0.73
Simulation					0.53
Strategy (Multiplayer)	0.67				
Sports (Single-Player)		0.92			
Sports (Multiplayer)		0.91			

Latent Profile Analysis. As in Study 2, exposure scores for each genre category were generated by calculating the mean for the set of genres in a given category. Descriptive statistics are presented in Table 8. These genre category exposure scores differ somewhat from Study 2. In Study 2, the Blockbuster category had the highest mean exposure, the Approachable category had the lowest mean exposure, and the three other categories were closely gathered in between. In the present study, we found that the Fighters category had the highest mean exposure. This is surprising, as the Fighters genre tends to be somewhat niche, albeit with extremely popular mainstream entries (e.g., *Super Smash Bros.* and *Mortal Kombat*). The next highest mean exposure was the Blockbuster category, followed by Sports, Approachable, and then finally, Hardcore. It appears our sample comprises a different blend of gamers than our sample in Study 2. In particular, it would seem that we have fewer people interested in Hardcore genres and many more people interested in Approachable games.

Table 8
Means, standard deviations, and correlations with confidence intervals

Variable	*M*	*SD*	1	2	3	4
1. Hardcore	2.47	1.20				
2. Sports	2.84	1.58	.07 [-.04, .18]			
3. Fighters	3.10	1.29	.31 [.20, .40]	.22 [.12, .32]		
4. Blockbuster	3.06	1.23	.40 [.31, .49]	.30 [.20, .40]	.41 [.31, .49]	
5. Approachable	2.77	1.04	.28 [.18, .38]	-.01 [-.12, .10]	.24 [.13, .34]	.01 [-.10, .12]

Note. *M* and *SD* are used to represent mean and standard deviation, respectively. Values in square brackets indicate the 95% confidence interval for each correlation. Means were calculated based on the genres that loaded most strongly onto each factor.

As in Study 2, we compared the fit statistics for up to 10 profiles. Fit indices suggested that model fit improves up until the six-profile model and so the fit indices for one- to six-profile models are provided in Table 9. The fit statistics all indicated that a six-profile model was the optimal solution. However, given that the five-profile model fit was also good, and that we adopted a five-profile model in Study 2, we opted to estimate both models. Figures 3 and 4 present the five- and six-profile models with standardized mean scores on the five genre categories.

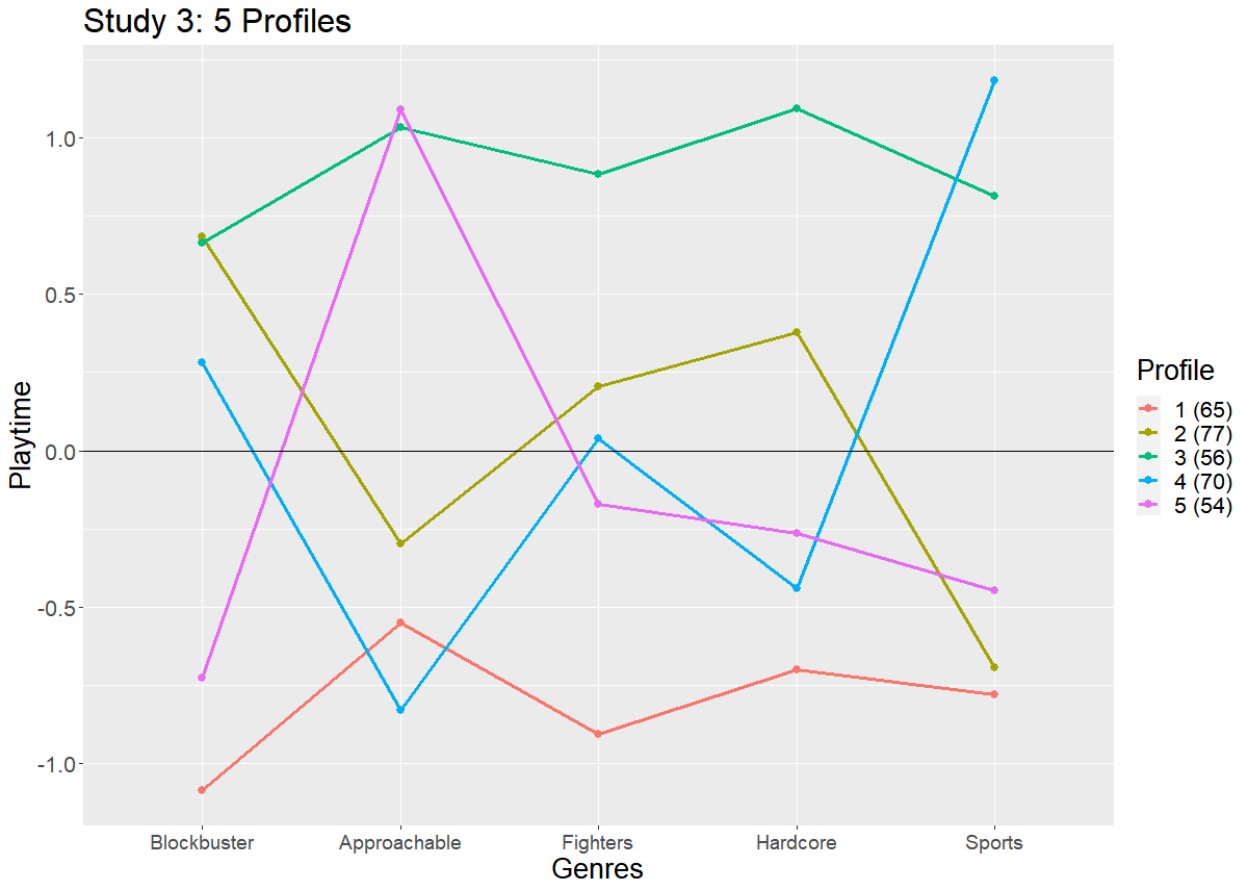

Figure 3. Five profile latent profile analysis (Study 3).

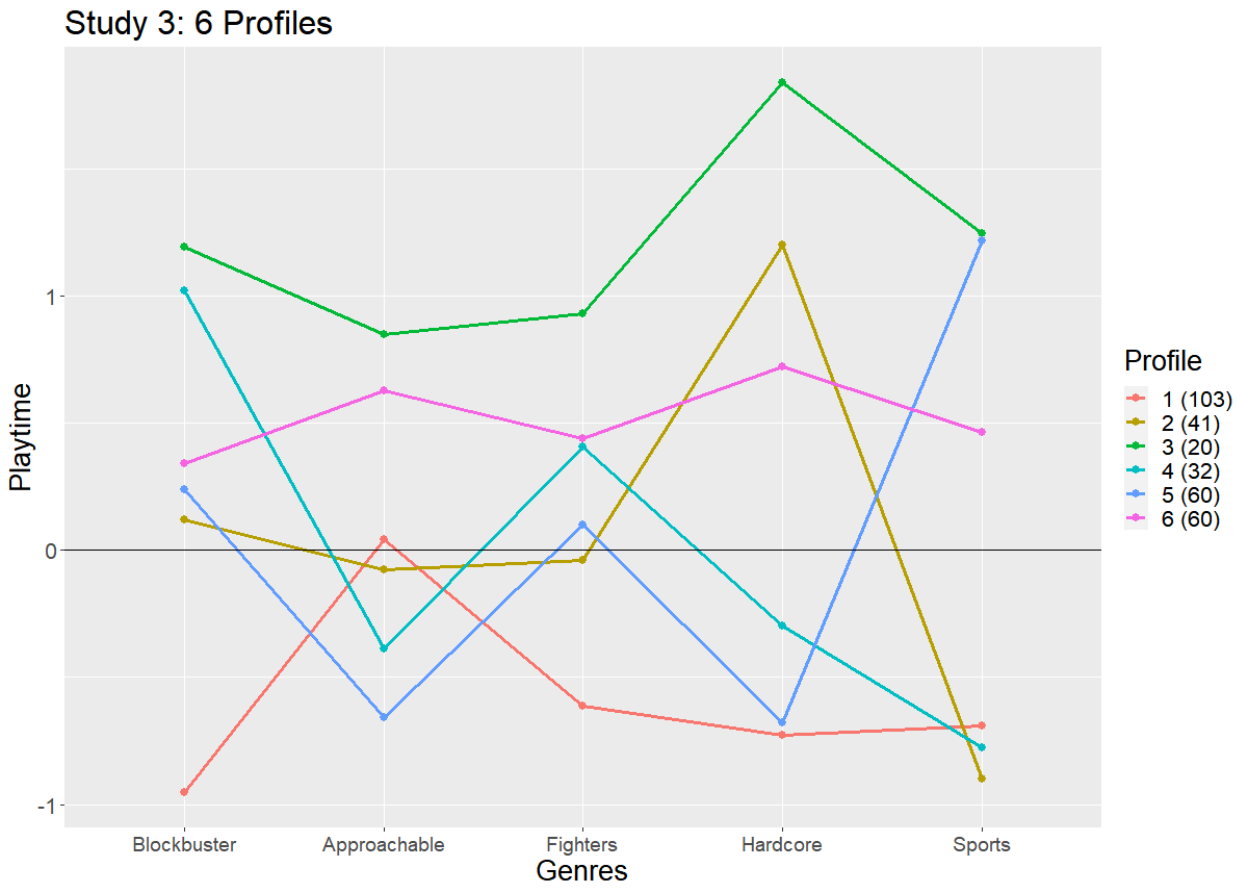

Figure 4. Six profile latent profile analysis (Study 3).

Although the fit indices favour the six-profile model, the five-profile model presents a more parsimonious and interpretable gamer typology. Notably, the profiles in the five-profile model are very evenly distributed (with group sizes ranging from 54–77), whereas the profile distributions for the six-profile model is quite uneven (with group sizes ranging from 20–103). This sort of uneven group distribution is generally considered to be unideal for an LPA. Further, the six-profile model introduces redundancy, producing profiles that are less qualitatively distinct. Thus, we focus our interpretation on the five-profile model.

Table 9
Latent profile analysis fit indices (Study 3)

Fit Indices	Number of Profiles					
	1	2	3	4	5	6
AIC	5318.011	5182.124	5127.397	5128.114	5064.885	5026.208
BIC	5355.756	5242.517	5210.437	5233.801	5193.220	5177.190
Bootstrapped LRT (*p*-value)	-	$p = 0.01$	$p = 0.01$	$p = 0.248$	$p = 0.01$	$p = 0.01$
Entropy	-	0.664	0.709	0.693	0.749	0.804
Group sizes					65, 77, 56, 70, 54	103, 41, 20, 32, 66, 60

Note. AIC = Akaike's Information Criterion; BIC = Bayesian Information Criterion; LRT=Likelihood Ratio Test.

The five-profile model obtained shares many similarities with the five-profile model adopted in Study 2. There is a profile that is uniformly high on all genre categories (Profile 3, $n = 56$) and a profile that is uniformly low for all categories (Profile 1, $n = 65$). One profile is primarily interested in Sports (Profile 4, $n = 70$), to the exclusion of most other categories. That said, this profile is slightly above the mean on both Blockbuster and Fighters, whereas they were below the mean on all genre categories (other than Sports) in Study 2. Another profile is relatively high on all categories *other* than Sports (Profile 2, $n = 77$), which was also observed in Study 2, though they do land just below the mean on Approachable. The one profile that is distinct here is Profile 5 ($n = 54$), which represents people who are below the mean on all categories except for Approachable. In Study 2, the equivalent of this profile was Profile 5, which was particularly high on Hardcore genres, instead of Approachable. This difference is likely due to a greater number of mobile gamers in this sample than in Study 2, an interpretation supported by the considerably higher mean exposure for the Approachable genres. We also observe a lower mean exposure for Hardcore genres here compared to Study 2. Overall,

however, this LPA closely resembles the one obtained in Study 2, providing additional support for this model and our interpretations.

Discussion

In this study, we again replicate the factor structure underlying interest in sets of videogame genres found in the previous two studies. We did so using confirmatory factor analysis, which is a more stringent test of our proposed factor structure. The model had acceptable fit and demonstrated very strong factor loadings that supported our proposed structure. Although the model had weaker fit than the exploratory factor analyses obtained in Studies 1 and 2, this was likely a result of the more conservative test provided by confirmatory factor analyses, the smaller sample size, and the removal of all cross-loadings from Study 2.

We then used these sets of genres to identify different profiles of gamers, based on their exposure to these different genres, largely replicating our Study 2 findings. The main distinction between our two LPA models is that Study 2 presents a profile that is dedicated to Hardcore genres, whereas Study 3 presents a profile that is dedicated to Approachable genres. In all likelihood, both of these profiles represent real groups of gamers in the world. Their distinct appearances in one of our two LPA models is likely an indication that (1) our samples differed in composition between our two studies, and (2) these groups may be somewhat smaller and more capricious than the other profiles that emerged.

If we want to better understand what genres people are playing and why, a player typology must be developed using a bottom-up data-driven analysis of what games people are actually playing. By identifying stable patterns in genre interest among gamers, we can better understand what sorts of gamers exist and what differentiates them. This method can also be applied to different populations in order to identify group differences in gameplaying behaviour.

For example, gameplaying behaviours differ between cultures (Polygon, 2017; Gematsu, 2019), and so different cultures may very well contain different typologies of gamers. Using these typologies, we can also make inferences about how these groups differ in terms of personality, demographics, and motivation to play games. For example, different types of gamers are likely to seek out different genres of games based on differences in the psychological needs satisfied by different games.

Chapter 3: Understanding Genre Through Need Satisfaction

Recommended Listening: Fallen Down (Reprise) – Toby Fox (*Undertale*)

A psychological need is a psychological "nutriment or condition that [is] essential to an entity's growth and integrity" (Ryan, 1995, p. 410). In order for a given desire to qualify as a need, its fulfilment must be essential to one's well-being, and its frustration must increase one's risk of ill-being (Ryan & Deci, 2000; Vansteenkiste & Ryan, 2013; Vansteenkiste et al., 2020). One popular theory of needs, Self-Determination Theory (SDT), posits that the three primary psychological needs are: (1) autonomy, the need to feel agentic and in control; (2) relatedness, the need for social interaction and connection; and (3) competence, the need to feel skilled and effective (Deci & Ryan, 2000; Ryan & Deci, 2000). According to this theory, satisfaction of these three needs is integral to individual well-being for humans across time, place, and culture (Vansteenkiste et al., 2020). Others have proposed additional candidates as basic psychological needs, such as security/safety and pleasure/stimulation (Sheldon et al., 2001). However, these other needs have not yet been employed in research nearly as often as the three identified by SDT. There has also been some debate as to whether the SDT needs are indeed culturally-universal (e.g., Markus & Kitayama, 2003), but some large-scale cross-cultural studies have found support for the idea that these three needs contribute to well-being across a variety of cultures (Church et al., 2012; Chen et al., 2015). According to SDT, everyone benefits from satisfaction of these needs and suffers from their frustration, even if the strength of this response does vary between contexts and people (Vansteenkiste et al., 2020). Germane to the current dissertation, SDT has also been used as a framework to explore whether videogames can satisfy core needs.

Can videogames satisfy basic psychological needs?

Self-determination theory has been used to explain the strong motivational pull of videogames, proposing that these games can help satisfy all three fundamental needs: autonomy, relatedness, and competence (Przybylski et al., 2010; Ryan et al., 2006; Tamborini et al., 2010; Tamborini et al., 2011). This theory has proven to be a good fit for videogame research, with the extent to which players enjoy a game influenced by how well a game meets those needs, boosting well-being (Ryan et al., 2006). The need satisfaction experienced by players is also associated with greater overall playtime (Johnson et al., 2016). These results make intuitive sense as the needs map well onto various aspects of games. Videogames provide players with a sense of autonomy by providing them with the freedom to act as they choose, and to make meaningful choices, within the context of the game world. This freedom could be as substantial as what is provided by open-world role-playing games, which allow players to behave in essentially any manner they choose. Or it could be as simple as the freedom to choose one's own goals and strategies, common to most games. Games also offer players a sense of competence by providing challenges carefully balanced against player skill: not so challenging as to be frustrating, but not so easy as to be boring. By gradually increasing difficulty, games scaffold challenges alongside player development, allowing them to further develop skill as they progress, without eliminating enjoyable challenge. Moreover, many games allow players to select a difficulty setting, individualizing this experience of challenge. Finally, videogames can satisfy a need for relatedness in one of two ways. First, games can offer multiplayer experiences: the opportunity to be cooperative or competitive with other players, be they friends or strangers. Online multiplayer games provide an opportunity to connect with others, collaborate on highly advanced and challenging tasks, and sometimes even meet a future spouse (Rosenbloom, 2011). The

second way that games satisfy relatedness needs is by providing opportunities to connect with fictional characters. Videogames can offer rich and complex interactive narratives, with dozens of characters and thousands of lines of dialogue.[7] Such games offer players the opportunity to form parasocial relationships (Klimmt et al., 2009; Song & Fox, 2016)—close bonds with a fictional character or celebrity (Horton & Wohl, 1956)—which can provide a sense of belonging and combat loneliness (Derrick et al., 2009). By providing opportunities to sate core needs, videogames become an attractive and intrinsically motivating pursuit (Przybylski et al., 2010).

In addition to the needs identified by SDT, there are also other needs that may be satisfied by playing videogames. One such need is the need for "varied, novel, and complex sensations and experiences, and the willingness to take physical and social risks for the sake of such experiences" (Zuckerman, 1979, as cited in Hoyle, 2002). This has been characterized as "sensation seeking", another potentially fundamental human need (Sheldon et al., 2001). Videogames are well-suited to satisfy this need, as many of them provide novel, thrilling, and widely-varied experiences. Any player of the competitive multiplayer shooter *Apex Legends*, for example, can regale you with thrilling stories of how their squad managed to eke out a death-defying victory against the 19 other teams. Single-player games can also provide these experiences. The critically-acclaimed action-adventure game, *The Legend of Zelda: Breath of the Wild*, offers players a massive open world to explore, filled to the brim with puzzles, secrets, and enemies. Games like these offer challenges, thrills, surprises, and novelty, and can often be played for dozens or even hundreds of hours. Thus, in addition to the needs specified by SDT, videogames may also satisfy our need for new sensations and experiences, and our interest in different genres may reflect individual differences in this need.

[7] The English-language script of *Final Fantasy VII*, for example, presents approximately 344,000 words.

Do different genres satisfy different needs?

Although the allure of videogames lies in their capacity to satisfy these basic needs, the extent to which a game satisfies each need for each person likely differs. Different genres are more successful at satisfying some needs than others. For example, a competitive multiplayer sports game is more likely to foster a feeling of competence than a narrative game with no skill requirement. Different players are also attracted to videogames for different reasons: one player might only play games that offer rich stories, whereas another might be interested in the feeling of freedom afforded by an open world. Some past work has examined this possibility. One study interviewed MOBA players and found that this genre provides them with a sense of satisfaction through teamwork and competition (Johnson et al., 2015). This suggests that online competitive multiplayer games may help fulfill our needs for interpersonal cooperation, in addition to skill development and mastery. A handful of other studies have also examined whether particular genres might satisfy certain needs, and whether certain types of gamers use games to satisfy particular needs. One such study found that genres are differentially related to the satisfaction of autonomy and relatedness needs (Johnson et al., 2015). For example, MMORPGs had stronger associations with autonomy and relatedness than MOBAs, and RPGs were more associated with relatedness than were first-person shooters. This stands as preliminary evidence that different genres can satisfy different needs. However, this study measured genre exposure in a unique and potentially problematic way. The researchers asked participants to list their current favourite game and its genre. Genres were only analyzed if it was listed 30 or more times, which resulted in a list of only seven genres. It is not clear whether this is a useful or accurate means of measuring genres, or why this particular threshold was chosen. Participants were then categorized based on their single reported genre, rather exposure measured on a continuum with

several other genres. This approach precludes some important analyses, such as assessing the relationships between different genres and need satisfaction or using that covariance in multivariate analyses.

Another relevant study attempted to establish a gamer typology and then assess its relationship to need satisfaction. They found that players in the "Strategy & Role-Playing" class used games to satisfy autonomy needs more than players in any of the other three classes ("Action-Adventure", "Sport and Simulation", or "Shooting"; Johnson & Gardner, 2010). This demonstrates that different types of gamers are using games to satisfy different needs. However, there are also some concerns with how this finding was achieved. Genre exposure was measured using a list of genres that is not reported. These data were then analyzed and reduced using a factor analysis, though this factor analysis was also not reported. Finally, participants were assigned one of the four classes based on their self-reported favourite game and its genre. Although the study does lack some of the information necessary to evaluate these methods, the information that they do provide suggests that this may not be an effective way of identifying a gamer typology. The crucial problem with this approach is that an individual's interest in multiple genres is ignored—even though these data were collected—in favour of categorization based on a single favourite game (and its genre). Furthermore, using this factor analysis to establish a typology makes a subtle but important error: it mistakes the set of continuous latent variables underlying patterns of genre interest for being a single nominal variable (i.e., gamer type). Finally, the authors do not attempt to interpret their gamer classes, despite these classes seeming somewhat unusual. For example, it is unclear why "Sport and Simulation" belong together, or whether there were other genres excluded from these analyses altogether.

Study 4

There currently remains important work to be done examining the role of need satisfaction for different genres and for different types of gamers. By applying the lens of SDT, we can better understand what distinguishes genres, what makes them uniquely appealing, and how the people attracted to them differ. In this pre-registered study, we do just that, assessing how the different genre categories and gamer types identified in Chapter 2 relate to need satisfaction in a community sample of gaming enthusiasts. We predict that the different genre categories will demonstrate unique associations with different types of need satisfaction, and that the different types of gamers will also show different levels of need satisfaction, based on their preferred genres. All hypotheses were pre-registered [https://aspredicted.org/62fy7.pdf]. For each need, we make different predictions:

Hypothesis 1a: Playing genres that are high in narrative and social content (e.g., RPGs, Narrative games, multiplayer games) will be positively associated with using videogames to satisfy relatedness needs.

Hypothesis 1b: Gamer profiles that are high in frequency of exposure to these genres will exhibit a greater tendency to use videogames to satisfy relatedness needs, compared to other profiles.

Hypothesis 2a: Playing genres that are high in competition and skill (e.g., competitive multiplayer games, RPGs, Strategy) will be positively associated with using videogames to satisfy competence needs.

Hypothesis 2b: Gamer profiles that are involve high exposure to these genres will exhibit a greater tendency to use videogames to satisfy competence needs, relative to other profiles.

Hypothesis 3a: Playing genres that give the player considerable control and power (e.g., Simulation, Action-Adventure, RPG, Strategy) will be positively associated with using videogames to satisfy autonomy needs.

Hypothesis 3b: Profiles that have high exposure to these genres will exhibit a greater tendency to use videogames to satisfy autonomy needs, compared to other profiles.

Finally, we predict that sensation seeking will reliably associate with different genre categories and different gamer profiles:

Hypothesis 4a: Playing genres that are highly focused on novelty (e.g., Action-Adventure, Shooters, Sports) will be positively associated with sensation seeking.

Hypothesis 4b: Profiles that are high in these novelty-rich genres will also exhibit greater sensation seeking.

Method

Participants. Participants were recruited using online community sampling. The study was advertised on Twitter, various videogame boards on Reddit, gaming communities on Discord, and gaming groups on Facebook. Participants who participated in our lab's past online videogame studies were also contacted, if they had agreed to be on our email list. In order to qualify for the study, participants had to self-report playing at least five hours of videogames per week (on either console, PC, or mobile). By way of remuneration, participants had the option to enter into a raffle to win a 50 USD gift card, with odds of winning set at 1 in 100 or better. Our

sample initially consisted of 1930 participants who consented to take part.[8] Participants completed three items used to detect inattentive responding (e.g., "Please select agree and proceed to the next question"; Marjanovic et al., 2014). As was pre-registered, we removed any participant that answered one or more of these questions incorrectly (n = 389). We also pre-registered that we would drop any participants who had more than 5% missing data from the crucial measures, which resulted in a further eight participants being excluded. All cleaning was conducted before data analysis and, after cleaning, our final sample comprised 1533 participants (73.9% Men, 17.4% Women, 5.9% Non-binary, 1.4% whose gender was not listed, 1.2% who preferred not to specify, and 0.1% who did not respond; M_{age} = 27.04, SD = 6.34). The sample had a diverse cultural background, with 754 participants from a North American background, 205 from a Western-European background, 127 from an Eastern-European background, and the rest spread among other cultures. The majority of the sample spoke English as their first language (n = 985), with the remainder of the sample speaking a variety of languages, such as German, Spanish, and Chinese.

Materials. Participants completed the same measure of genre and general videogame exposure as in Studies 2 and 3.

Videogame Need Satisfaction. Videogame need satisfaction was measured using the Player Experience of Need Satisfaction (PENS) measure, which assesses the extent to which one experiences need satisfaction in videogames (Ryan et al., 2006). Participants completed the autonomy, competence, and relatedness subscales of the PENS, each of which comprises three

[8]At the beginning of the study, 2443 participants consented to take part. At the end, we asked again if they consent to us using their data: 1934 consented, 14 did not consent, and 495 failed to respond. Participants were required to answer this question to enter the raffle. The majority of participants who did not answer this question had left the study very shortly after the initial consent question. From those 1934, four participants were removed for appearing to be duplicates with other participants. This resulted in a sample of 1930, before additional cleaning.

items. The original study that developed this scale reported acceptable, if somewhat low, internal reliability for each subscale (Autonomy: Cronbach's α = .63; Competence: α = .71; Relatedness: α = .72). We obtained similar, if slightly improved, measures of internal reliability (Autonomy: ω = .72 [95% CIs: .69, .75]; Competence: ω = .74 [95% CIs: .72, .77]; Relatedness: ω = .76 [95% CIs: .74, .79]; all confidence intervals bootstrapped with 1000 resamples unless otherwise stated). Our items were also altered slightly from the original scale, which references a particular game. Instead, we formatted the questions to refer to videogames in general, as we were interested in need satisfaction across all of one's gaming experiences. Autonomy was measured using items such as "I experience a lot of freedom in videogames." Competence was measured using items such as "While playing videogames, I feel very capable and effective." Relatedness was measured using items such as "I find the relationships I form in videogames fulfilling." All items were responded to on a scale from 1 (*strongly disagree*) to 7 (*strongly agree*).

***Sensation Seeking*.** Sensation seeking was measured using the Brief Sensation Seeking Scale, which has been shown to have both good reliability and validity (Hoyle et al., 2002). However, we omitted the two items from the Disinhibition scale, as they were unrelated to the present research. Participants completed the remaining six items, which consisted of items such as "I get restless when I spend too much time at home." All items were responded to on a scale from 1 (*strongly disagree*) to 5 (*strongly agree*). We found the truncated measure to have acceptable, if weak, internal reliability (ω = .67 [95% CIs: .64, .70]).

Procedure. Participants completed the study online through Qualtrics. They completed all measures in a randomized order, followed by a battery of demographic questions.

Results

Mean ratings for all genres and needs appears in Table 10. The highest exposure was observed for RPGs (*M* = 4.12; every month), followed by Action-Adventure (*M* = 3.67; between a few times a year and every month). The lowest exposure was for both single-player and multiplayer Sports (*M* = 1.66; between never and once every couple of years). Most genres had moderate exposure means, falling between 2.50 and 3.00.

Table 10

Means and standard deviations for genre exposure and need satisfaction behaviours in Study 4

Genre	Mean	SD
Online Competitive Shooter	3.10	1.68
Single-Player Shooter	3.01	1.38
Action-Adventure	3.67	1.24
Role-Playing Games	4.12	1.37
Puzzle (Mobile)	2.59	1.71
Puzzle (Console/PC)	2.68	1.17
Fighters (Single-Player)	2.51	1.41
Fighters (Multiplayer)	2.59	1.47
Platformers	2.81	1.17
Racing	2.21	1.32
MMOs	3.22	1.87
MOBAs	2.78	1.89
Rhythm	2.28	1.31
Horror	2.21	1.22
Simulation	2.57	1.35
Narrative	2.66	1.24
Strategy (Single-Player)	3.08	1.41
Strategy (Multiplayer)	2.46	1.46
Sports (Single-Player)	1.66	1.22
Sports (Multiplayer)	1.66	1.28
PENS: Autonomy	6.04	0.79
PENS: Competence	5.59	0.90
PENS: Relatedness	4.82	1.29
Sensation Seeking	2.89	0.74

Note. Genre exposure was measured on a six-point scale. Autonomy, competence, and relatedness were all measured on a seven-point scale. Sensation seeking was measured on a five-point scale.

Exploratory Factor Analysis. We conducted an exploratory factor analysis on all 20 genres using a principal axis factor solution with oblimin rotation. Visual inspection of the scree plot indicated a six-factor solution, whereas the parallel analysis recommended a seven-factor solution. We generated five-, six-, and seven-factor model solutions and compared the fit of all models. The five-factor model had worse fit (*SRMR* = 0.03, *RMSEA* = .07, *TLI* = 0.86) than either the six-factor (*SRMR* = 0.02, *RMSEA* = .05, *TLI* = 0.90) or seven-factor model (*SRMR* = 0.02, *RMSEA* = .04, *TLI* = 0.94). We then interpreted the six-factor and seven-factor models and found that the six-factor model solution provided a clearer interpretation in line with our past findings, and so we adopted it as our model solution. The factor loadings for this model are presented in Table 11.

Table 11
Factor loadings for the six-factor solution (Study 4)

Genre	Factor 1 Hardcore	Factor 2 Sports Genres	Factor 3 Fighters	Factor 4 Blockbuster	Factor 5 Approachable	Factor 6 Role-playing
Online Competitive Shooter	0.31			**0.53**		
Single-Player Shooter				**0.79**		
Action-Adventure				**0.37**		0.25
Role-Playing Games						**0.89**
Puzzle (Mobile)					**0.40**	
Puzzle (Console/PC)					**0.71**	
Fighters (Single-Player)			**0.86**			
Fighters (Multiplayer)			**0.90**			
Platformers			0.28		**0.40**	
Racing		**0.38**		0.20		
MMOs	**0.40**					0.28
MOBAs	**0.59**					
Rhythm			0.24		**0.41**	
Horror				**0.37**	0.20	
Simulation					**0.47**	
Narrative					**0.52**	
Strategy (Single-Player)					**0.37**	
Strategy (Multiplayer)	**0.64**					
Sports (Single-Player)		**0.87**				
Sports (Multiplayer)		**0.91**				

Note. Factor loadings lower than .20 have been removed for ease of interpretation. Bolded values indicate the genre's highest factor loading.

The six-factor solution is very similar to the five-factor model obtained in Studies 1–3, but with an extra factor extracted to represent Role-playing. Whereas RPGs loaded most strongly on the Hardcore factor in previous models, the genre essentially forms its own factor in the present data (alongside loadings from MMOs and Action-Adventure). The appearance of this new factor is likely explained in two ways. First, this sample is very different from that of Studies 1–3. Whereas those studies used student samples, the present study uses an online gaming enthusiast sample, comprising people from all over the world and from a much wider age cohort. This sample likely has very different gaming habits from university students, and so the fact that there is this much similarity between this model and our previous models speaks to the robustness and generalizability of our characterization. Second, RPGs may also play a slightly different role for the present sample than for past samples. Whereas RPGs were in the middle of the range of means for students, the genre is very comfortably the highest on exposure for this community sample. Furthermore, RPGs represent a heterogenous collection of games, ranging from the Japanese text-heavy turn-based *Final Fantasy* to the Western shooter-style *Mass Effect* or the combat-focused action RPG *Elden Ring*. In this way, RPGs may be a 'supra-genre', representing a mix of many related-but-distinct sub-genres. Given its clear import to our sample, we allowed RPGs to remain as a distinct single-genre factor. Other factor interpretations are very similar to those discussed in Chapter 2.

Need Satisfaction and Genre. Having identified a set of genre categories, we then examined whether the different genre categories were associated with different forms of need satisfaction. As in our previous studies, scores on each category for each participant were generated by calculating the mean exposure for each genre in a category. For example, Hardcore

was based on exposure to MMOs, MOBAs, and Strategy (Multiplayer). Descriptive statistics and inter-correlations for each genre category are provided in Table 12.

We next examined the relationship between all genres and needs using Pearson correlations (Table 12). Our first prediction was that genre categories high in narrative and social content would be positively associated with relatedness. This was supported by our data: the Hardcore category, which primarily features multiplayer experiences, had a moderate relation with relatedness (r = .26). The Approachable (r = .11) and Role-playing (r = .10) categories were also associated with relatedness, albeit more weakly. The Role-playing genre is very high in narrative content and the Approachable category includes genres that can be high in narrative content, such as Narrative and Simulation. Thus, playing Hardcore, Approachable, and Role-playing genres is associated with using games to satisfy relatedness needs.

Next, we predicted that genre categories high in competition and skill would be positively associated with competence. This was mostly supported by our data. The genre category most strongly associated with competence was Blockbuster (r = .16), which includes genres that require skill (i.e., Action-Adventure and Single-Player Shooters) and encourage competition (i.e., Online Competitive Shooters). The next strongest association was with Hardcore (r = .12), a category defined by the skill and dedication its genres require. Fighters also showed an association of a similar strength (r = .11), which is not surprising, given that Fighters tend to focus on intense practice, learning difficult button combinations, and memorizing elaborate sets of moves for numerous characters. One surprising finding was that Sports genres were only very weakly associated with competence (r = .03), despite their focus on player skill and competition.

For autonomy, we predicted that it would be positively associated with genre categories that offer extensive control and power. Our evidence for this prediction was somewhat weaker

compared to the other predictions. We find the predicted association with the Role-playing category (r = .14), which offers players considerable freedom in how they behave and affect the story. We also find this association with the Blockbuster category (r = .09), although it is somewhat weaker. The Blockbuster category includes genres like Action-Adventure, which emphasizes player freedom and agency, and so it is surprising that this association is not stronger. However, other genres in this category, such as Horror and Online Competitive Shooter, emphasize this experience less, which may result in a dilution of predicted relationship. Interestingly, Sports actually demonstrates a considerable negative association with autonomy (r = -.12), demonstrating just how little these games emphasize player agency. These games represent closed systems in which the player is given limited freedom to influence the game outside of individual matches or superficial customizations. Thus, playing Role-playing and Blockbuster genres is associated with an increased use of games to satisfy autonomy needs, and playing more Sports genres is associated with decreased use of games to satisfy autonomy needs.

Finally, we predicted that genre categories focused on novelty would be positively related to sensation seeking. This prediction is supported by our data. The strongest association with sensation seeking was the Blockbuster category (r = .29), which is defined by its emphasis on novelty. The polished, high-budget genres in this category, such as Action-Adventure, Online Competitive Shooters, and Single-Player Shooters, provide novel and stimulating experiences. The next highest associations were with Sports (r = .26) and Hardcore (r = .21), both of which provide thrilling high-stakes competitive experiences. Fighters also exhibited a reasonably strong association (r = .18), likely because of the thrill of competition they provide, along with the novelty and variety of playing different characters, different franchises, and different matchups.

Thus, players higher in sensation seeking tend to play more Blockbuster, Sports, Hardcore, and Fighter genres.

Table 12

Means, standard deviations, and correlations of exposure scores and needs

Variable	*M*	*SD*	1	2	3	4	5	6	7	8	9
1. Hardcore	2.82	1.28									
2. Sports	1.84	1.08	.36 [.31, .40]								
3. Fighters	2.55	1.36	.14 [.09, .19]	.27 [.23, .32]							
4. Blockbuster	3.00	0.98	.29 [.25, .34]	.40 [.36, .44]	.28 [.24, .33]						
5. Approachable	2.67	0.79	.12 [.07, .17]	.25 [.20, .29]	.29 [.24, .34]	.32 [.28, .37]					
6. Role-playing	4.12	1.37	.03 [-.02, .08]	-.13 [-.18, -.08]	.05 [-.00, .10]	.12 [.07, .17]	.29 [.24, .33]				
7. Competence	5.59	0.90	.12 [.07, .17]	.03 [-.02, .08]	.11 [.06, .15]	.16 [.11, .21]	.01 [-.04, .06]	.08 [.03, .13]			
8. Autonomy	6.04	0.79	.03 [-.02, .08]	-.12 [-.17, -.07]	.05 [-.00, .10]	.09 [.04, .14]	.05 [-.00, .10]	.14 [.09, .19]	.43 [.39, .47]		
9. Relatedness	4.82	1.29	.26 [.21, .30]	.00 [-.05, .05]	.07 [.02, .12]	.08 [.03, .13]	.11 [.06, .16]	.10 [.05, .15]	.20 [.15, .25]	.33 [.29, .38]	
10. Sensation Seeking	2.89	0.74	.21 [.16, .25]	.26 [.21, .30]	.18 [.13, .22]	.29 [.24, .33]	.09 [.04, .14]	-.07 [-.12, -.02]	.06 [.01, .11]	.02 [-.03, .07]	.05 [-.00, .10]

Note. M and *SD* are used to represent mean and standard deviation, respectively. Values in square brackets indicate the 95% confidence interval for each correlation. Means were calculated based on the genres that loaded most strongly onto each factor.

Latent Profile Analysis. Next, we conducted a latent profile analysis on these genre category exposure scores. Following the same procedure as in Studies 2 and 3, we compared the fit statistics for up to 10 different profiles. Fit indices suggested that model fit improves up until the six-profile model (Table 13). These indices disagreed somewhat on which model was optimal. Although BIC and the likelihood ratio test both indicate that the sixth profile improves the model, entropy indicates that the assignment of classes is slightly more certain in the five-profile model. We thus opted to estimate both the five- and six-profile models and found the six-profile model to be clearer and more interpretable. Thus, we focus our interpretation and later analyses on the six-profile model.

Table 13
Latent profile analysis fit indices (Study 4)

Fit Indices	Number of Profiles					
	1	2	3	4	5	6
AIC	28227.077	26901.522	26736.232	26517.405	26072.187	25972.726
BIC	28291.097	27002.887	26874.942	26693.459	26285.587	26223.470
Bootstrapped LRT (*p*-value)	-	$p = .010$	$p = .010$	$p = .010$	$p = .010$	$p = .010$
Entropy	-	0.941	0.758	0.790	0.796	0.774
Group sizes					210, 72, 200, 207, 844	106, 206, 150, 204, 805, 62

Note. AIC = Akaike's Information Criterion; BIC = Bayesian Information Criterion; LRT=Likelihood Ratio Test.

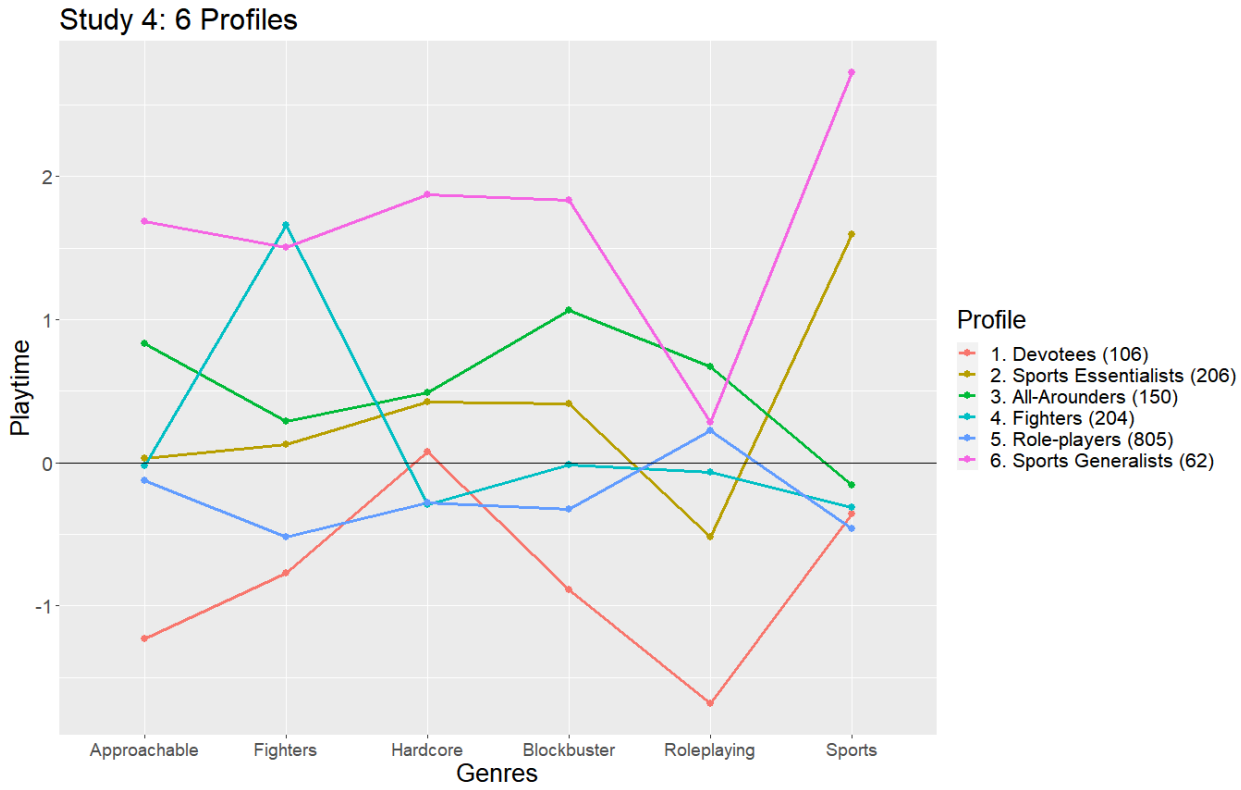

Figure 5. Six profile latent profile analysis (Study 4).

The six-profile LPA is provided in Figure 5. This model shares several profiles and themes with the LPAs presented in Chapter 2, but also differs in a handful of ways. Many of these differences are attributable to the presence of the Role-playing factor, which was not in the previous models. This change removes the RPG genre from the Hardcore factor and also adds a new dimension on which profiles can be defined, resulting in the creation of a new profile defined by its unique focus on Role-playing, to the general exclusion of other genre categories (Profile 5; *n* = 805). Although this profile does not have the highest exposure to Role-playing genres, it is unique in that all of its genre category scores are below the mean, other than Role-playing. We label this profile the 'Role-players.' It is also worth noting that all of the profiles, save one (Profile 1; *n* = 106), have scores on the Role-playing category hovering around the

mean. This is likely a reflection of the very high mean exposure to RPGs we observed; nearly all gamers seem to be playing some amount of Role-playing games.

Another thematic difference between this model and the previous ones is the relevance of Sports to defining the profiles. Whereas profiles presented extreme scores on Sports in our past models, the present model has four profiles with Sports scores just below the mean, and two profiles with Sports scores well-above the mean. This suggests that this sample is generally more interested in Sports genres, even if they are part of profiles that do not play them often. Profile 2 (n = 206) represents gamers who have a general interest in all genres but have a particular interest in Sports. We label this profile the 'Sports Essentialists.' Profile 6 (n = 62), our smallest class, are an even more extreme version of this, with very high exposure scores on all genre categories—especially Sports—other than Role-playing. We label this profile the 'Sports Generalists.'

A similar tempering can be observed with the profile defined by its interested in Hardcore genres (Profile 1; n = 106). This profile was present in our previous models, but with a much higher relative score on Hardcore. In the present model, its score on Hardcore is just above the mean, but its scores on all other categories are quite low. This is likely a reflection of an increased general interest in Hardcore genres across the entire sample, rather than an absolute reduction of interest in Hardcore genres in this profile. It is also likely the result of removing the RPG genre from this category. Because of their devotion to Hardcore genres, we label this profile the 'Devotees.'

Other profiles are present in this model in much the same way as observed previously. Profile 3 (n = 150) gamers are generally interested in all genres and are especially high on Blockbuster and Approachable genres, but are below the mean on Sports genres. We label this

profile the ‘All-Arounders.’ Profile 4 (n = 204) gamers are around the mean on all genres, but have the highest score on Fighters. We label this profile the ‘Fighters.’ Despite the very different sample used in this study, the present results have a strong resemblance to those observed in Studies 2 and 3.

Need Satisfaction and Gamer Type. Having identified a gamer typology, we then examined whether these different classes of gamer differed in their use of videogames to satisfy needs. We assessed this possibility using a one-way ANOVA, with a single six-level factor to represent profile. In each model we compared all profiles on a single need and then evaluated the marginal mean differences to determine which profiles differed from which (Table 14). All models satisfied the diagnostic requirements for ANOVA.

Table 14

Need satisfaction means for all profiles

Profile	*n*	Autonomy	Competence	Relatedness	Sensation Seeking
1. Devotees	106	5.87 (0.87)	5.55 (0.98)	4.69 (1.18)	2.93 (0.79)
2. Sports Essentialists	206	5.77 (0.84)	5.52 (0.96)	4.76 (1.11)	3.13 (0.67)
3. All-Arounders	150	6.22 (0.71)	5.84 (0.85)	5.16 (1.16)	2.97 (0.65)
4. Fighters	204	6.15 (0.70)	5.68 (0.83)	4.75 (1.34)	2.90 (0.74)
5. Role-players	805	6.08 (0.76)	5.52 (0.89)	4.76 (1.37)	2.74 (0.72)
6. Sports Generalists	62	6.03 (0.67)	5.92 (0.77)	5.27 (0.67)	3.70 (0.64)

Note. Means are presented with standard deviations in parentheses. Autonomy, Competence, and Relatedness were all measured on a seven-point scale. Sensation seeking was measured on a five-point scale.

Autonomy. There was a statistically-significant difference in the use of videogames to satisfy autonomy needs between gamer profiles (F = 8.69, p < .001, η^2 = .03), although this effect was small. Means were generally high across all groups (Figure 6), but we used pairwise comparisons of marginal means to determine where group differences lay. We generated 95% confidence intervals for the mean differences between each pair of profiles, corrected using the

Tukey method for comparing a set of six estimates (NB. This was used for all ANOVA models discussed henceforth).

We predicted that profiles that were high in frequency for genre categories that emphasized player control and agency (i.e., Role-playing, Blockbuster, Approachable) would show a greater use of games to satisfy autonomy needs. When plotting these profile means, they essentially form two groups: a higher group consisting of Sports Generalists, Role-players, Fighters, and All-Arounders; and a lower group consisting of Sports Essentialists and Devotees. According to our confidence intervals, Sports Essentialists and Devotees are both lower on autonomy than all other profiles, other than Sports Generalists (which had an especially wide confidence interval). There are no differences between the profiles in the lower cluster or differences between the profiles in the higher cluster. This indicates that most types of gamers use games to satisfy their need for autonomy, but some types do so to a lesser extent, specifically those gamers focused on Hardcore genres. This makes sense, given that these genres generally do not emphasize autonomy. Sports Essentialists are also using games less for a sense of control than some other gamer types. This is likely because Sports genres tend not to focus on providing agency. Similarly, we found that playing Sports genres was negatively associated with autonomy need satisfaction in our previous analyses. Sports Essentialists likely do use other genres to satisfy this particular need—their autonomy mean is still fairly high in absolute value—but do so less in general, given their overwhelming focus on Sports genres. Our prediction finds some support in these findings. The profiles that are high in the Role-playing, Blockbuster, and Approachable genre categories are indeed higher on autonomy than some other profiles—namely, the Sports Essentialist and Devotee profiles. However, they are not higher than the

Sports Generalist profile, nor the Fighter profile. The high autonomy need satisfaction in the Fighter profile is especially surprising. In sum, we find partial support for our prediction.

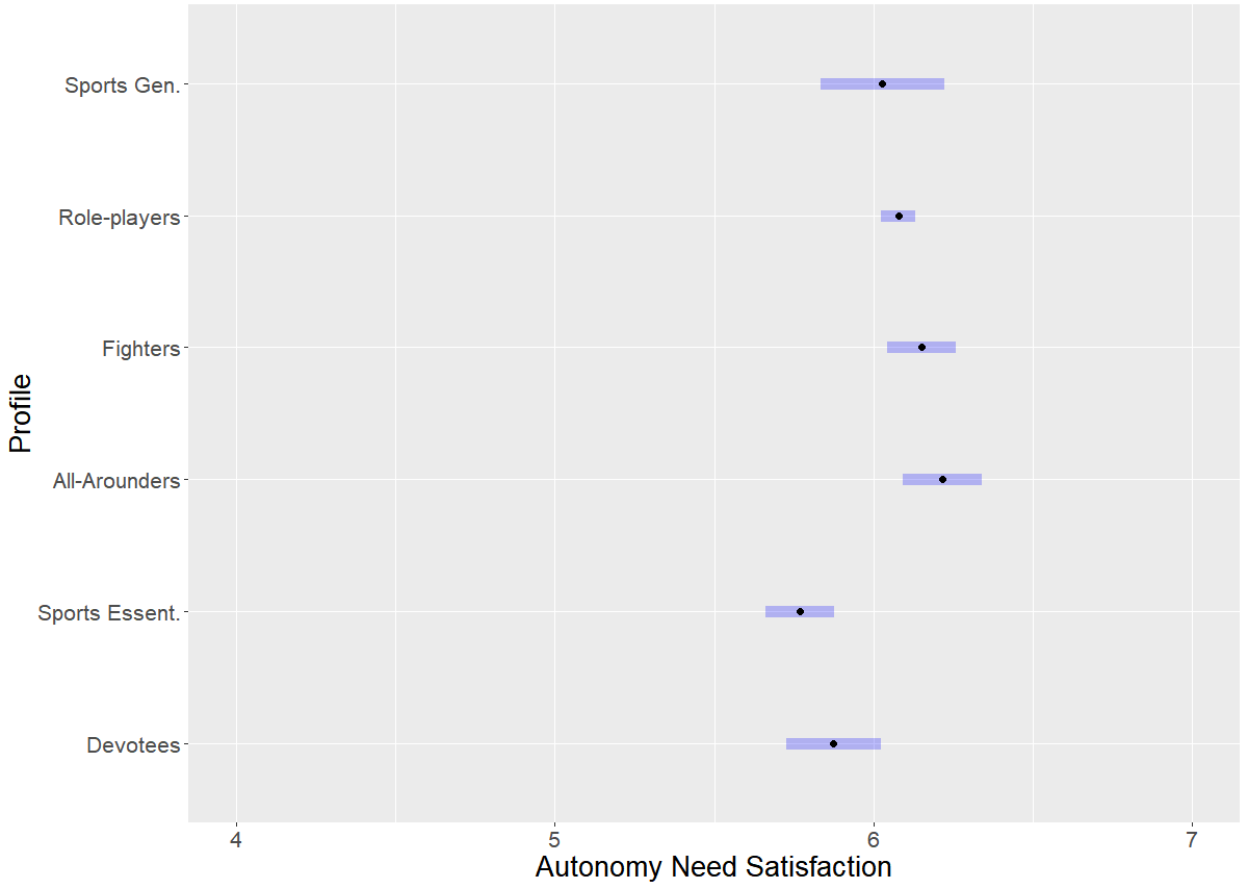

Figure 6. Mean use of videogames to satisfy autonomy needs for each gamer profile. Blue lines represent 95% confidence intervals, corrected for a set of six estimates. Note that the x-axis has been truncated for legibility.

Competence. There was a statistically-significant difference in the use of videogames to satisfy competence needs between profiles ($F = 5.67$, $p < .001$, $\eta^2 = .02$), although this effect was small (Figure 7). We predicted that profiles that were high in frequency on genre categories that emphasized player skill and challenge (i.e., Hardcore, Sports, Role-playing, Blockbuster) would show a greater use of videogames to satisfy competence needs.

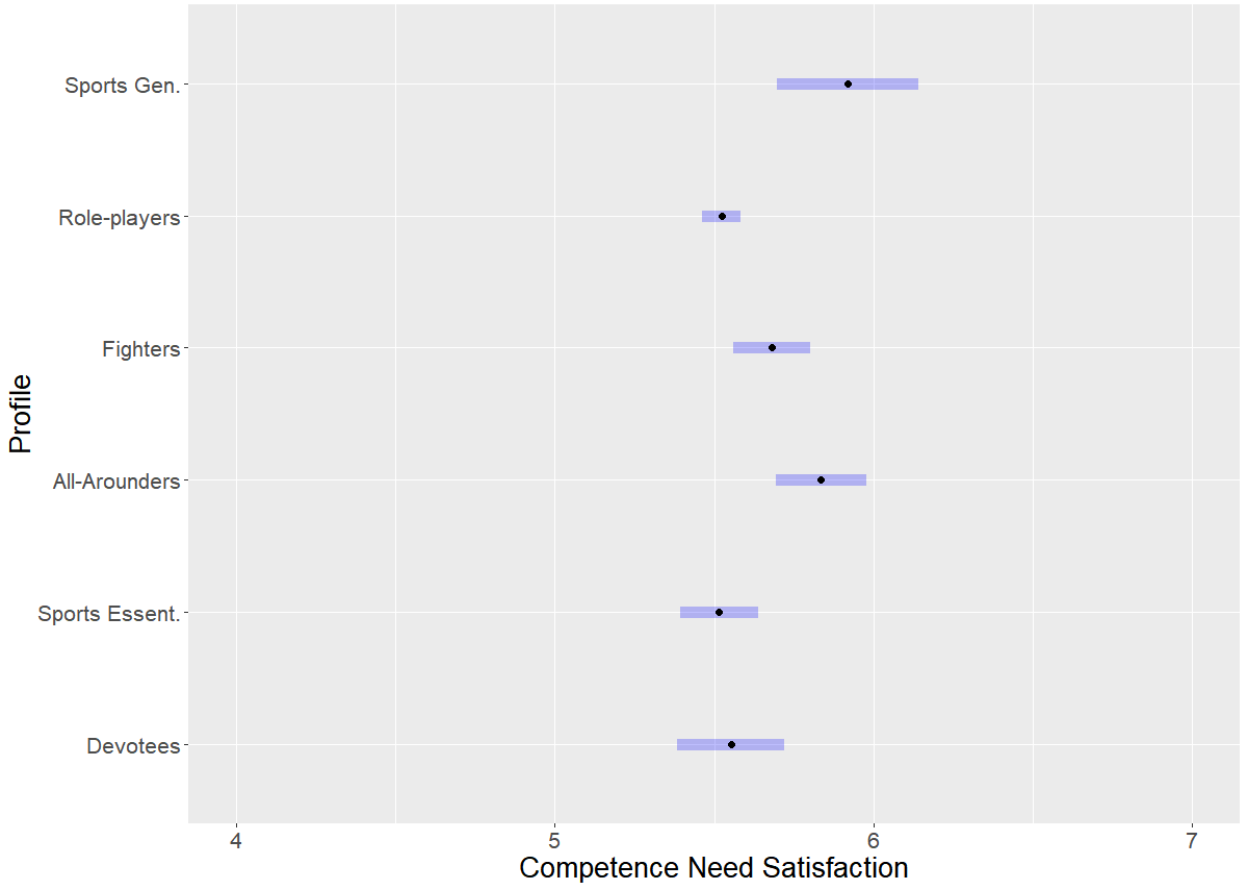

Figure 7. Mean use of videogames to satisfy competence needs for each gamer profile. Blue lines represent 95% confidence intervals, corrected for a set of six estimates. Note that the x-axis has been truncated for legibility.

Pairwise comparisons provided only weak evidence to support our predictions. The profile that used games to satisfy competence needs the most was the Sports Generalist class, which had a higher mean than both Sports Essentialists and the Devotees. The next highest mean was the All-Arounder profile, which had a higher mean than both Sports Essentialists and the Devotees. We found no other mean differences. Given their focus on Blockbuster genres, we would predict that the All-Arounder profile would have a high competence mean. We would make the same prediction about the Sports Generalist profile, because of a focus on Sports genres, which often emphasize skill development. However, the other profiles align with our predictions less clearly. The finding most contradictory to our prediction is that of the Devotees

profile, which presents one of the lowest means, but which we would predict to present one of the highest means. This is especially surprising given that we found that competence need satisfaction is associated with exposure to the Hardcore genres.

One potential reason for finding little support for this prediction is that our predictions seem a poor fit for the LPA model solution. Nearly every profile in this model is high on one of the genre categories that we would associate with increased satisfaction of competence needs. This naturally makes for a prediction that is unclear and difficult to evaluate.

Relatedness. The ANOVA model found a statistically-significant difference in the use of videogames to satisfy relatedness needs ($F = 4.34$, $p < .001$, $\eta^2 = .01$), although this effect was small (Figure 8). We predicted that profiles high in frequency for genre categories that emphasized narrative and social content (i.e., Hardcore, Role-playing, Blockbuster) would show a greater use of videogames to satisfy relatedness needs.

Pairwise comparisons do not support our predictions. The profiles essentially fall into two groups: a higher group comprising the Sports Generalist and All-Arounder profiles, and a lower group comprising the other four profiles. What's unique about the two highest profiles is that they have a high interest in every genre category, including the ones most associated with relatedness need satisfaction. However, the other profiles that have high exposure to these genre categories (e.g., Devotees and Role-players) feature much lower means. Thus, it is not the profiles that we expected that are using games to satisfy relatedness needs the most. Rather, it appears to be the most well-rounded profiles, who have high exposure to nearly ever genre category, that engage the most in this form of need satisfaction.

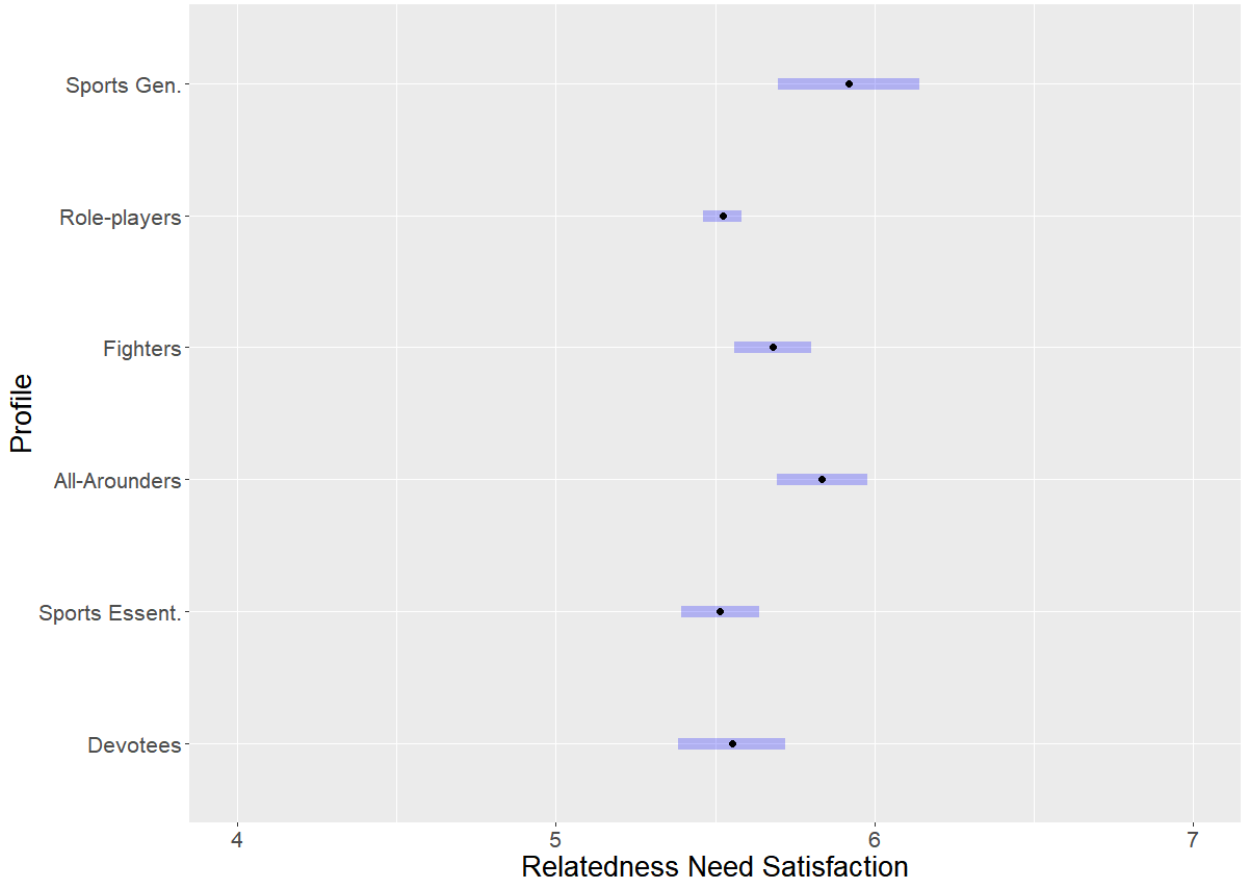

Figure 8. Mean use of videogames to satisfy relatedness needs for each gamer profile. Blue lines represent 95% confidence intervals, corrected for a set of six estimates. Note that the x-axis has been truncated for legibility.

Sensation Seeking. There was a statistically-significant difference in the need for novel, varied, and complex stimuli between gamer profiles ($F = 28.87$, $p < .001$, $\eta^2 = .09$) (Figure 9). The effect size here was much larger than the ones obtained in the previous models. This larger effect size is also reflected in the profile mean differences, which are more dramatic than those observed for the SDT needs.

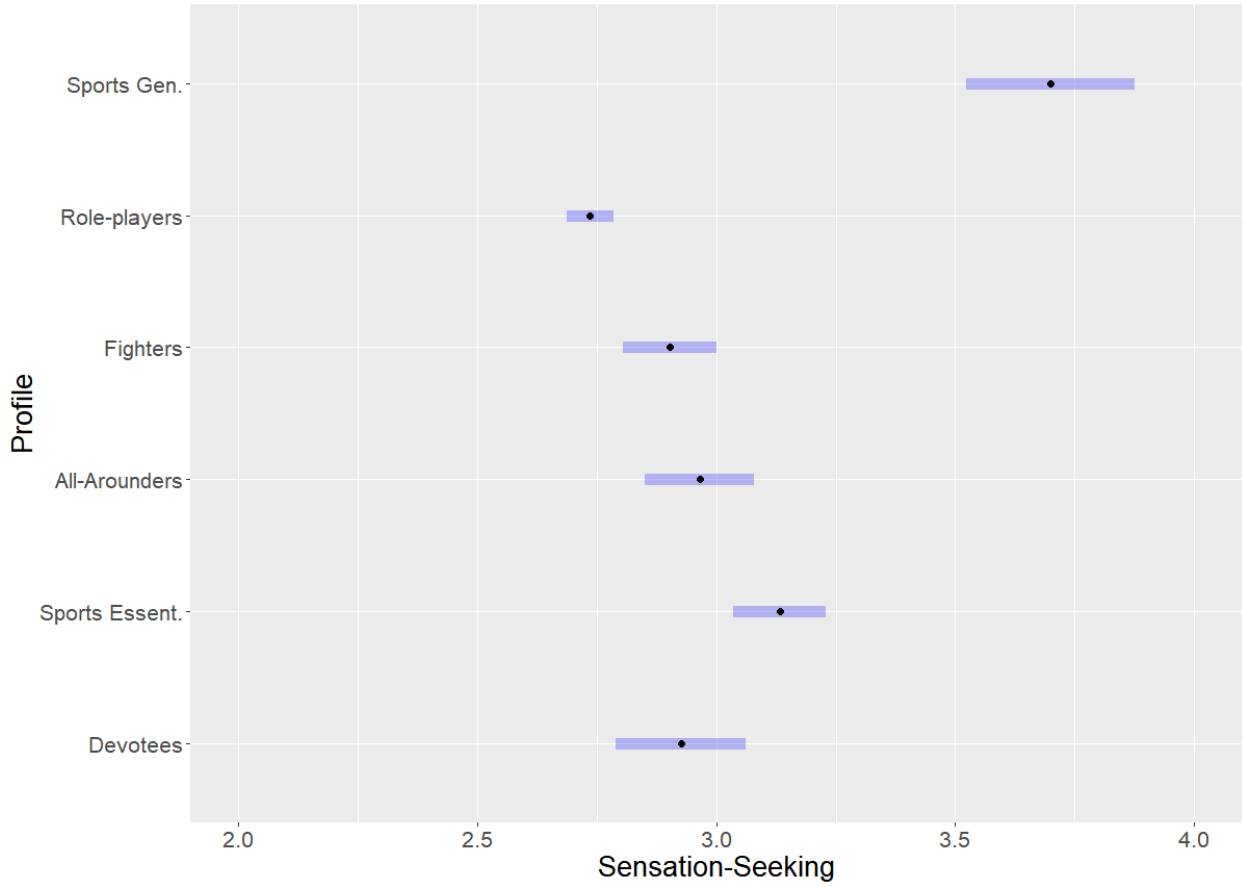

Figure 9. Mean sensation seeking for each gamer profile. Blue lines represent 95% confidence intervals, corrected for a set of six estimates. Note that the x-axis has been truncated for legibility.

We predicted that profiles that were high in frequency on genre categories that emphasized novelty and stimulation (i.e., Blockbuster, Sports) would show greater sensation seeking. There was some evidence to support this claim. The Sports Generalist profile was comfortably higher on sensation seeking than any other profile. Given that this profile has the highest means on both Blockbuster and Sports, this is in line with our predictions. The Sports Essentialist profile were also higher on sensation seeking than the Fighter and Role-player profiles, which also supports this prediction. However, the other profile defined by interest in Blockbuster genres, the All-Arounder profile, was not meaningfully higher on sensation seeking than any other profile (other than Role-player, which has the lowest mean). Overall, we find

partial support for the hypothesis that gamer types that favour genres high in novelty and arousal show higher sensation seeking. This effect appears to be more strongly predicated on Sports genres than on Blockbuster genres.

Discussion

In this study, we examined the roles that need satisfaction plays in genre and gamer type. Building on our previous work, we investigated whether exposure to different types of genres was associated with different types of need satisfaction. We also investigated whether different types of gamers differ in their use of videogame need satisfaction. Based on our conceptualization of these genre categories and gamer types, we also made several predictions about how they would associate with different needs.

Our predictions for the relations between genre category and needs were mostly supported by the data, though to different extents for each need. Some of the need-genre category associations conformed very closely to our predictions. For example, the multiplayer experiences of Hardcore genres and the narratively-rich experiences of Role-playing genres and (some) Approachable genres, were all positively associated with satisfying relatedness needs. Similarly, playing Blockbuster and Hardcore genres, which encourage skill and competition, was associated with satisfying competence needs. Interest in genres is clearly a reflection of individual differences in videogame need satisfaction.

Other relations proved more difficult to predict, however. For example, we predicted that playing Sports genres would be associated with satisfying competence needs, but did not find this association. This lack of association may be explained by our later results, however. When we compare profiles on competence, we find that Sports Generalists have one of the highest

means and that Sports Essentialists have one of the lowest. We find a similar pattern when comparing profiles on sensation seeking: Sports Essentialists are much higher on sensation seeking than are Sports Generalists. This indicates that some people are using the same genres to achieve different purposes: some types of gamers are using Sports games to satisfy competence more than other types of gamers playing Sports games. Thus, even within the same genre, there are individual differences in what drives us to play a game and what we take away from it.

One noteworthy aspect of this study that has not yet been discussed is that our outcomes include three need satisfaction behaviours and one individual difference in need: sensation seeking. These are related concepts, of course—presumably individual differences in trait needs correlate to their respective need satisfaction behaviours—but it is a distinction worth noting nonetheless. These two different types of outcomes also lead to two different effect interpretations. When we examine the relation between a need satisfaction behaviour, such as the use of games to satisfy relatedness needs, and a gameplaying behaviour, such as frequency of playing Role-playing games, we infer that the association represents the extent to which participants use Role-playing games to satisfy relatedness needs. However, the association between a trait need, such as sensation seeking, and a gameplaying behaviour, instead likely represents the extent to which that individual difference drives interest in that particular genre. It does not necessarily mean that the genre itself satisfies that need (though we might also infer that it does). This is likely why sensation seeking generally demonstrated stronger bivariate associations with genre exposure than did the need satisfaction outcomes (Table 12). Had we examined the use of games to satisfy sensation seeking, presumably the effects would have been similar in magnitude to those of the other need satisfaction behaviours.

Whereas our predictions of genre category–need associations were largely supported, our predictions for differences in need between gamer types were less supported. Some profiles behaved as expected for some needs and not others. For example, the Role-player profile presents one of the higher means on Autonomy, as was predicted, but presents one of the lowest means on Relatedness, which was the opposite of what we predicted. Another curious pattern was that of the Sports Generalist profile, which contains the fewest number of participants and presents the highest mean for every need save one. This leads the profile to sometimes support our predictions (e.g., competence) and other times confound them (e.g., relatedness). This is likely the result of the profile presenting the highest exposure means for nearly every genre category. Although the profile is defined by its interest in Sports, its high interest in nearly every other category is results in associations with various needs. Another way of conceptualizing this profile is one that is interested in all genres to a great extent, but is not more interested in Role-playing genres than the rest of the sample. This would also explain why the group is so small, since most gamers are unlikely to take this maximalist approach to an interest in genres.

These findings demonstrate that making predictions about the nature of latent profiles before they are identified can be a tricky endeavour. However, the findings do provide a rich and nuanced insight into the nature of these profiles. For example, this constellation of results reveals the Sports Essentialists as a group who are using games to satisfy needs less than the rest of the sample, but still have a need for complex and varied stimuli. The All-Arounders emerge in juxtaposition to the Sports Essentialists, demonstrating a willingness to use games to satisfy any of the needs examined here, recognizing games for their varied and fluid potential. Depictions such as these would not be possible without thorough measurement of genre exposure and the use of advanced multivariate analyses.

One profile still remains undifferentiated, however. The Role-players, defined by their chief interest in Role-playing games, do not reliably demonstrate the needs we would expect of such a class. For example, they are not especially high in relatedness, despite the narrative and character-driven nature of RPGs, and despite the association we find between exposure to Role-playing genres and the satisfaction of relatedness needs. This undifferentiation is likely for two reasons. First, the RPG genre is likely more heterogenous than other genres. Whereas challenging and skill-intensive RPGs like *Dark Souls* serve competence needs, open-world sandbox RPGs like *The Elder Scrolls V: Skyrim* serve autonomy needs, and plot-heavy narrative-rich RPGs like *Persona 5* serve relatedness needs. This profile likely contains players who focus on one, some, or all of these types of RPGs. This heterogeneity may have prevented the profile from reliably distinguishing itself. Second, and relatedly, this profile represents more participants than any other, and so likely has inherited more difficult-to-classify 'misfit' participants than any other profile. This too would hamper our efforts to describe and distinguish the class.

This study represents one of the first attempts to integrate need satisfaction into our understanding of genre and gamer type. With this work, we have established that genres are differentially associated with need satisfaction, and that interest in sets of these genres is associated with different levels of need satisfaction. There is yet more to explore in this area, however. One important line of research would be differentiating the use of the same genre for different needs. One way to do this would be to integrate need satisfaction into the latent profile analysis, which would allow different profiles to emerge that show similar levels of interest in the same genre but show different levels of need satisfaction. Another important line of inquiry would be examining how videogame need satisfaction might be the result of state changes in need frustration. Although this study conceptualizes videogame need satisfaction as something

like a trait—reflecting relatively-stable preferences for game genre—it is also possible that our gaming behaviours change over time as a result of changes in need frustration. We examine this possibility in Chapter 4.

Chapter 4: Understanding Need Satisfaction Through Need Frustration

Recommended Listening: The House, Part 1 – Chris Remo (*Gone Home*)

The pandemic threatened our basic needs and psychological well-being, in addition to our health and livelihood. There were widespread increases in depression (Wanberg, 2020), as many were deprived of access to friends and family and felt a loss of control and agency. If different games can be used to satisfy different needs, perhaps we are more attracted to those games that cater to our least-satisfied needs? In this chapter, we examine this possibility, using the unique context of the pandemic, which provided a quasi-experimental manipulation of need dissatisfaction on a level completely unattainable in any research lab.

What distinguishes need dissatisfaction from need frustration?

One unique aspect of the pandemic has been its active frustration of our needs. Need frustration is not just low need satisfaction, but is instead the active thwarting of our needs, leading to need dissatisfaction and subsequent blows to well-being (Vansteenkiste & Ryan, 2013). Whereas low need satisfaction does not necessarily imply the presence of need frustration, need frustration always involves low need satisfaction and is more threatening (Vansteenkiste et al., 2020). Relatedness frustration, for example, can be characterized by alienation or loneliness; autonomy frustration as a pressure to behave in a particular way; and competence frustration as a sense of ineffectiveness and helplessness. The pandemic has led many people to experience these frustrations, thanks to active obstructions to opportunities for need satisfaction, resulting in mood disorders and depression (Levine et al., 2022).

Need frustration can also lead us to change our behaviour, seeking out need substitutes or engaging in compensatory behaviours (Vansteenkiste & Ryan, 2013). Need substitutes are extrinsic sources of need satisfaction that hold the promise of restoring a need, but they are often

superficial and offer only fleeting satisfaction (Sheldon et al., 2010). These include things like popularity, attractiveness, or consumer goods (Kasser & Ryan, 1996; Unanue et al., 2014; Selvi & Bozo, 2020). Compensatory behaviours can include disengagement with the relevant activity or the inverse: ramping up attempts to engage in that activity (Vansteenkiste et al., 2020). Thus, pandemic-induced need frustration may have resulted in more active engagement with videogames, which provide an avenue for need satisfaction.

Is gaming behaviour based on need frustration?

Justin McElroy, on the videogame podcast *The Besties*, proposed that *Animal Crossing: New Horizons* may be the most important game ever released (McElroy, 2020). This was not because of the game's content, but rather because of when it was released: March 20, 2020, right at the start of the pandemic. *Animal Crossing* is a social simulation game, in which players help to establish an island town by developing relationships with other villagers, constructing buildings, and visiting the islands established by their real-world friends. For a world that had just gone into lockdown, isolating many from their friends and family, *Animal Crossing* turned out to be an incredible boon. The game was hugely successful and some attribute this success to its accidentally impeccable timing. Many people who might otherwise never play a game like *Animal Crossing* were very attracted to its soothing atmosphere and its promise of simple, pleasant socializing (Bundel, 2020). It offered the chance to connect with friends, family, and the game's community. It also permitted complete control over their island, its inhabitants, and its landscape, giving players the freedom to design their perfect island town. Many players set personal goals for their island and played *Animal Crossing* everyday, slowly working towards achieving those goals. To put it another way: for a world that had just had its basic psychological needs threatened, *Animal Crossing* offered a novel way to sate these needs.

This example illustrates how gaming behaviours may reflect state changes in need dissatisfaction, as supported by research on this topic. For example, real-world need frustration is associated with increased need satisfaction in videogames (Allen & Anderson, 2018, Suppl.).[9] Real-world need frustration is also associated with maladaptive relationships to gaming (Mills et al., 2018; Allen & Anderson, 2018). The example of *Animal Crossing* suggests that using videogames to satisfy needs can contribute to our well-being. This too has been supported by research. Satisfying the need for relatedness in videogames, for example, is associated with better overall well-being (Allen & Anderson, 2018, Suppl.). However, no research has examined whether the use of games to satisfy needs changes in response to need frustration, and whether this change is associated with improved well-being. We examine these two possibilities directly, using the advent of the pandemic as a real-world manipulation of need frustration. In this way, we can examine how need satisfaction through gaming varies based on level of need frustration: before, during, and after the most restrictive periods of the pandemic.

Is this relation a reflection of individual differences in need strength?

It is also worth examining whether these effects are moderated by individual differences in need strength. Although the needs identified by SDT are thought to be universal (Vansteenkiste et al., 2020), it is possible that different people experience them to different degrees, requiring more or less succor to sate them, and experiencing different blows to well-being in response to their (dis)satisfaction. For example, someone who experiences the need for relatedness more acutely may respond more dramatically to relatedness frustration (i.e., greater changes in videogame need satisfaction) and experience greater benefits from that need's satisfaction (i.e., greater improvements to well-being). Although some studies have failed to find

[9] It is worth noting, however, that this relation is inverted for relatedness: increased real-world relatedness frustration is associated with decreased relatedness satisfaction in videogames.

evidence for a moderating role of trait need strength on the effects of need satisfaction (e.g., Chen et al., 2015; Wörtler et al., 2020), the argument to conceptualize needs as 'universal, not uniform' remains compelling (Soenens et al., 2015).

Study 5 – Wave 1

The present study uses the pandemic as a naturally-occurring manipulation of need frustration by assessing participants before, during, and after the most restrictive periods of the pandemic. Although this does not allow us to make causal judgements about the relations between need frustration, videogame need satisfaction, and well-being, it does provide a more intense and ecologically-valid manipulation of need frustration than could ever be achieved in a lab setting. Participants were first recruited and assessed in July 2020. In addition to reporting on their behaviour and experiences at that time, they also made retrospective judgements about their behaviour before the onset of the pandemic (i.e., November 2019 to January 2020). Participants were subsequently contacted for a follow-up study in February 2022, after pandemic restrictions had loosened considerably in North America (where many of our participants resided). We pre-registered the hypotheses [https://aspredicted.org/w8vh6.pdf]:

Hypothesis 1: Greater need frustration for a given need will be associated with increased use of videogames to satisfy that need.

Hypothesis 2: Increased use of videogames to satisfy needs will be associated with improvements in well-being.

Hypothesis 3: The relations specified in Hypotheses 1 and 2 will be moderated by trait need strength, such that those higher in a given trait need will exhibit stronger relations.

The first wave of data will be analyzed and discussed first, followed by the follow-up data.

Method

Participants. Participants were recruited using the same community sampling techniques described in Chapter 3. In order to qualify for the study, participants had to self-report playing at least five hours of videogames per week (on either console, PC, or mobile). By way of remuneration, participants had the option to enter into a raffle to win a 50 USD gift card, with odds of winning set at 1 in 100 or better. Our sample initially consisted of 1333 participants who consented to take part.[10] Participants completed three items used to detect inattentive responding (e.g., "Please select agree and proceed to the next question"; Marjanovic et al., 2014). As was pre-registered, we removed any participant that answered one or more of these questions incorrectly (n = 74). We also pre-registered that we would drop any participants who had more than 5% missing data from the crucial measures, which resulted in one participant being excluded. Finally, 19 participants were excluded for reporting that they hadn't played any of the games they listed in the specified time periods. All cleaning was conducted before data analysis and, after cleaning, our final sample comprised 1239 participants (68.1% Men, 26.7% Women, 5.1% Other, and one participant who did not respond; M_{age} = 26.60, SD = 7.26). The sample had a diverse cultural background, with 707 participants from a North American background, 162 from a Western-European background, and the rest spread among other cultures. The majority of the sample spoke English as their first language (n = 898), with the remainder of the sample speaking a variety of languages, such as German and Spanish.

[10]At the beginning of the study, 2640 participants consented to take part. At the end, we asked again if they consent to us using their data: 1364 consented, 20 did not consent, and 184 failed to respond. Participants were required to answer this question to enter the raffle. The majority of participants who did not answer this question had left the study very shortly after the initial consent question. From those 1364, four participants were removed for appearing to be duplicates of other participants. An additional 27 were removed for reporting an age below 16.

Materials. For our measure of gameplaying habits, participants completed both a retrospective measure, which asked them to think of "November 2019 (last year) to January 2020 (start of this year)", and a quarantine measure, which asked them to "think back to the time during the quarantine when measures were most restrictive (i.e., your movements and behaviours were most limited)." Trait measures of need strength were not measured retrospectively, as they should be relatively stable across time. Need frustration and well-being were only measured for the quarantine period, as we were not confident that participants would be able to accurately self-report on these constructs for the pre-pandemic period.

Gameplaying Habits and Need Satisfaction. To assess the use of games to satisfy needs during particular periods, we used a different measure from previous studies. For the quarantine measure, participants listed the games they played most during the height of the quarantine (maximum of 3). For each game listed, they reported how often they played that game. Response options ranged from 1 to 7, with the responses labeled as "Never", "Once a month", "Several times a month", "Once a week", "Several times a week", "Once a day", and "Several times a day." For each game, they also completed a nine-item measure of how much they enjoyed various aspects of that game. We designed these nine items to correspond to the three SDT needs (three items per need). Each item was presented with the prompt, "How much did you enjoy the following aspect of [game title]?" Autonomy was measured using items such as "Being able to influence the game world in the way that I want." Competence was measured using items such as "Improving my playing skills." Relatedness was measured using items such as "Interacting with story characters in the game." Responses were provided on a scale from 1 (*Not at all*) to 5 (*Totally loved it*), with a "Not Applicable," option provided (treated as missing). Participants also completed a retrospective version of this measure referring to the games they played during the

pre-pandemic period (otherwise identical). Generally speaking, we found that these items had decent internal reliability, with omegas ranging from 0.72 to 0.83. All items are presented in Appendix A.

Quarantine Need Frustration. Participants reported the extent to which they felt that their needs for autonomy, relatedness, and competence were frustrated during quarantine. Each need was measured using three items, with responses ranging from 1 (*Strongly disagree*) to 5 (*Strongly agree*). Autonomy was measured using items such as "During the pandemic, I have felt forced to do many things I wouldn't choose to do." Relatedness was measured using items such as "During the pandemic, I have felt lonely." Competence was measured using items such as "During the pandemic, I have felt serious doubts about whether I can do things well." All three need frustration measures showed acceptable internal reliability ($\omega_{Relatedness} = .71$; $\omega_{Competence} = .89$; $\omega_{Autonomy} = .75$). All items are presented in Appendix A.

Need to Belong. To measure the strength of trait need for relatedness, we employed the Need to Belong scale, which assesses personal desires for social affiliation and group acceptance (Leary et al., 2013). Higher scores on this scale relate to personality traits associated with seeking social contact (i.e., extraversion, agreeableness) as well as emotional reactivity in response to social rejection (Leary et al., 2013). The scale consists of 10 items (e.g., "I try hard not to do things that will make other people avoid or reject me,") with responses ranging from 1 (*Strongly disagree*) to 5 (*Strongly Agree*). It exhibited good construct validity across nine studies, and good internal reliability, with Cronbach's alpha ranging from 0.78 to 0.87 across 15 samples (Leary et al., 2013). We also found that the measure had good internal reliability ($\omega = .83$).

Need for Autonomy. We developed a scale to measure the strength of trait need for autonomy, assessing individual desire for control and discomfort with lack of control. It consisted of 10 items, such as "I need to feel a sense of choice and freedom in the things I do" (Appendix A) with responses ranging from 1 (*Strongly disagree*) to 5 (*Strongly Agree*). Unfortunately, we found that the measure had somewhat poor internal reliability ($\omega = .58$). However, dropping any single item did not improve this reliability. This should be kept in mind when interpreting scores for this measure.

Need for Competence. A scale to measure trait need for competence was developed, assessing an individual's desire to feel effective in a domain and discomfort with feeling unskilled. It consisted of 10 items, such as "I don't try new things unless I know I'll be good at them" (Appendix A), with with responses ranging from 1 (*Strongly disagree*) to 5 (*Strongly Agree*). We found that the measure had decent internal reliability ($\omega = .75$).

Quarantine Well-Being. We used two different measures as indices of well-being: mood and negative symptomatology. For each measure, participants were instructed to think back to the time when quarantine measures were most restrictive. First, they reported on their mood, reporting the extent to which they experienced four negative emotions (i.e., "To what extent did you feel tense/worried/anxious/sad during the pandemic?") and four positive emotions (i.e., happy, hopeful, calm). Participants responded on a scale from 1 (*Not at all*) to 4 (*A lot*). Next, they reported on the extent to which they experienced each of eight negative physiological symptoms, such as "low energy/exhaustion" or "headaches", with responses ranging from 1 (*Not at all*) to 4 (*A lot*) (Emmons, 1991; Appendix A).

Procedure. Participants completed the study online through Qualtrics. They first completed the measure of their quarantine gaming habits, followed by their pre-pandemic

gaming habits. Next, they completed the trait need measures and well-being measures in a randomized order. Finally, they completed a measure of quarantine need frustration and a battery of demographic questions.

Results

Because we were interested in how need satisfaction changed in response to the need frustration brought on by the pandemic, we calculated a new variable to represent this change by subtracting pre-pandemic need satisfaction from pandemic need satisfaction, for each need. This variable is represented using Δ (e.g., Δrelatedness), with negative scores indicating a decrease in satisfaction. Descriptive statistics for all three variables are presented in Table 15. All three needs at both time points had means above the midpoint of the scale, indicating that our sample generally did use games to satisfy these three needs. That said, broadly speaking, the differences for each need between the two time points were small. Relatedness and competence both showed essentially no change, whereas autonomy showed some change in means (about .18 of a standard deviation). In addition, using games to satisfy one need was associated with using games to satisfy the other two needs, even across time points.

Table 15

Means, standard deviations, and correlations of videogame need satisfaction for pre-pandemic and quarantine periods

Variable	*M*	*SD*	1	2	3	4	5	6	7	8
1. Relatedness (Pre.)	3.56	0.91								
2. Relatedness (Quar.)	3.57	0.82	.52 [.48, .56]							
3. ΔRelatedness	0.01	0.85	-.58 [-.61, -.54]	.40 [.35, .45]						
4. Competence (Pre.)	3.88	0.69	.29 [.23, .34]	.23 [.18, .28]	-.09 [-.15, -.03]					
5. Competence (Quar.)	3.88	0.64	.24 [.19, .30]	.31 [.26, .36]	.03 [-.02, .09]	.56 [.52, .60]				
6. ΔCompetence	0.00	0.63	-.07 [-.12, -.01]	.07 [.01, .12]	.13 [.08, .19]	-.53 [-.57, -.48]	.41 [.36, .46]			
7. Autonomy (Pre.)	3.64	0.85	.44 [.40, .49]	.30 [.25, .35]	-.18 [-.23, -.12]	.39 [.34, .43]	.32 [.27, .37]	-.10 [-.15, -.04]		
8. Autonomy (Quar.)	3.77	0.76	.30 [.25, .35]	.44 [.40, .49]	.10 [.04, .16]	.29 [.24, .34]	.39 [.34, .43]	.08 [.02, .14]	.50 [.46, .54]	
9. ΔAutonomy	0.14	0.80	-.21 [-.26, -.15]	.09 [.03, .14]	.30 [.25, .35]	-.14 [-.19, -.08]	.02 [-.03, .08]	.17 [.12, .23]	-.60 [-.63, -.56]	.40 [.35, .44]

Note. M and *SD* are used to represent mean and standard deviation, respectively. Values in square brackets indicate the 95% confidence interval for each correlation. “Quar.” refers to the quarantine period. “Pre.” refers to the pre-pandemic period. All ratings made on a five-point scale.

Descriptive statistics for trait need strength and quarantine need frustration are presented in Table 16. All three need frustrations were strongly related to one another (*r*s ranging from .48 to .63). The three trait needs were also associated with their respective need frustrations, though these associations varied in strength (*r*s ranging from .20 to .39). Furthermore, Need to Belong predicted all three need frustrations at a similar magnitude (*r*s ranging from .39 to .40), which was also stronger than the associations observed for either Competence ($r = .26$) or Autonomy ($r = .20$) with their respective frustrations. This may reflect the fact that Need to Belong had less measurement error (as a published and validated measure), whereas the other two measures were self-created, were not thoroughly validated, and had worse internal reliability.

Table 16

Means, standard deviations, and correlations of trait need strength and quarantine need frustration

Variable	*M*	*SD*	1	2	3	4	5
1. Need to Belong	3.27	0.72					
2. Need for Competence	2.56	0.57	.28 [.22, .33]				
3. Need for Autonomy	3.23	0.46	.12 [.06, .17]	.37 [.32, .41]			
4. NF: Relatedness	2.84	1.00	.39 [.34, .44]	.15 [.09, .20]	.11 [.06, .17]		
5. NF: Competence	2.90	1.18	.40 [.35, .45]	.26 [.21, .31]	.12 [.07, .18]	.52 [.48, .56]	
6. NF: Autonomy	3.04	1.02	.39 [.34, .44]	.20 [.15, .26]	.20 [.14, .25]	.48 [.44, .53]	.63 [.59, .66]

Note. *M* and *SD* are used to represent mean and standard deviation, respectively. Values in square brackets indicate the 95% confidence interval for each correlation. NF = Need Frustration. All ratings made on a five-point scale.

Structural Equation Models. In our pre-registration, we outlined a structural equation model that evaluates all of our hypotheses simultaneously. This model uses need frustration to predict Δneed satisfaction, which is in turn used to predict all three quarantine well-being outcomes (positive affect, negative affect, and negative symptomatology). Trait need strength was also specified as a moderator for each of these relationships. A separate model was specified for each of the three SDT needs. However, none of these models had acceptable model fit (Appendix B), and so we interpret them no further here. Given that these models were our pre-registered analyses, we now move into exploratory analyses to evaluate our hypotheses in other ways.

Need Frustration and Need Satisfaction. Our first hypothesis was that greater quarantine need frustration would be associated with more use of games to satisfy that need. However, we found only limited evidence to support this hypothesis. Relatedness frustration was not meaningfully associated with either Δrelatedness (r = .01) or quarantine relatedness satisfaction (r = .04). Competence frustration was also not meaningfully associated with either Δcompetence (r = .01) or quarantine competence satisfaction (r =.06). Autonomy frustration did show the predicted relationship, however. People whose autonomy was more frustrated showed greater Δautonomy (r = .10) and quarantine autonomy satisfaction (r = .12). Using games to satisfy relatedness and competence does not appear to be a function of need frustration, although we do find evidence of this relation for autonomy.

Need Satisfaction and Well-Being. We predicted that using games to satisfy needs would be associated with improvements in well-being. Contrary to this prediction, we found that videogame need satisfaction during quarantine was either unassociated with well-being, or was associated with worse well-being. Negative affect (r = .09) and symptomatology (r = .07) were

both associated with increases in using videogames to satisfy relatedness needs. Positive affect had a similar association, though weaker in magnitude (r = -.05). Autonomy also showed this pattern, such that positive affect (r = -.07), negative affect (r = .11), and symptomatology (r = .14) were all associated with Δautonomy. Change in competence satisfaction had no notable associations with any well-being measure.

These effects contradict our predicted effect. Notably, they appear to be driven by the associations with quarantine need satisfaction. Relatedness satisfaction during quarantine, for example, is associated with both negative affect (r = .11) and symptomatology (r = .12), whereas pre-pandemic relatedness satisfaction has no substantial association with any of our well-being outcomes. Autonomy has a similar pattern: whereas quarantine autonomy satisfaction is associated with worse well-being (positive affect: r = .02; negative affect: r = .14; symptomatology: r = .13), pre-pandemic autonomy satisfaction is associated with improved well-being during quarantine (positive affect: r = .09; negative affect: r = .00; symptomatology: r = -.03). Competence presents a unique pattern of associations: both pre-pandemic competence satisfaction (r = .11) and quarantine competence satisfaction (r = .14) are associated with more positive affect during quarantine, but its associations with the other well-being outcomes are not distinct from zero.

Need Strength. Our third hypothesis was that any effects would be moderated by need strength, such that people with greater needs would show stronger effects. Broadly speaking, we did not find evidence for this hypothesis. Moderation for Hypothesis 1 was examined by regressing a quarantine need satisfaction on its corresponding need frustration, need strength, and their product. This resulted in three models, one for each need. Only the relatedness model showed the predicted effect, with those higher in the Need to Belong exhibiting a positive

relationship between relatedness satisfaction and relatedness frustration (and those lower in Need to Belong having a negative relationship; interaction b = .11, 95% CI [0.05, 0.17]; Figure 10). This model explained only a small amount of variance in quarantine relatedness satisfaction, however (R^2 = .02). Moreover, the relationship between need satisfaction and need frustration was weak, even for those high in the Need to Belong. The models examining this moderation for competence and autonomy were both null and do not support our hypothesis.

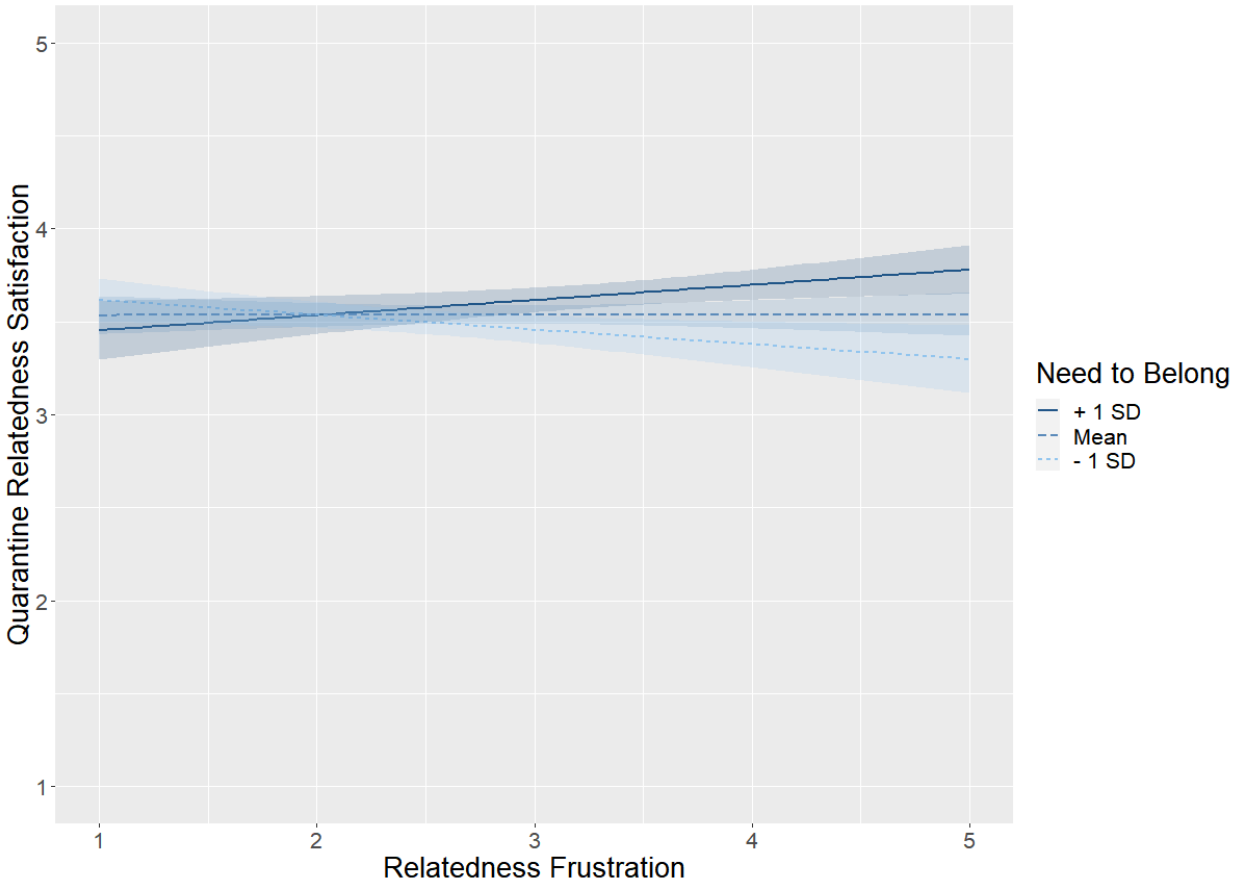

Figure 10. Interaction between Need to Belong and relatedness frustration when predicting quarantine relatedness satisfaction.

We next examined moderation for Hypothesis 2 by regressing each well-being measure onto quarantine need satisfaction, the corresponding need strength, and their product. This resulted in three models—one for each well-being measure—for each of the three needs, for a total of nine models. None of these models show the predicted moderation.

Need Satisfaction, Need Frustration, and Well-Being. Having examined all of our pre-registered hypotheses with mixed success, we then moved on to exploratory analyses. We first evaluated the moderating role of need frustration on the relationship between need satisfaction and well-being by regressing each well-being measure onto quarantine need satisfaction, the corresponding need frustration, and their product (for a total of nine models; Figure 11).

We found that for some needs, need satisfaction was associated with *worse* well-being, for those experiencing higher levels of frustration. Quarantine relatedness satisfaction, for example, was associated with less positive affect, more negative affect, and increased symptomatology, for those experiencing a great deal of frustration in their need for relatedness. However, these associations were effectively null for those experiencing mean levels (or below) of relatedness frustration.

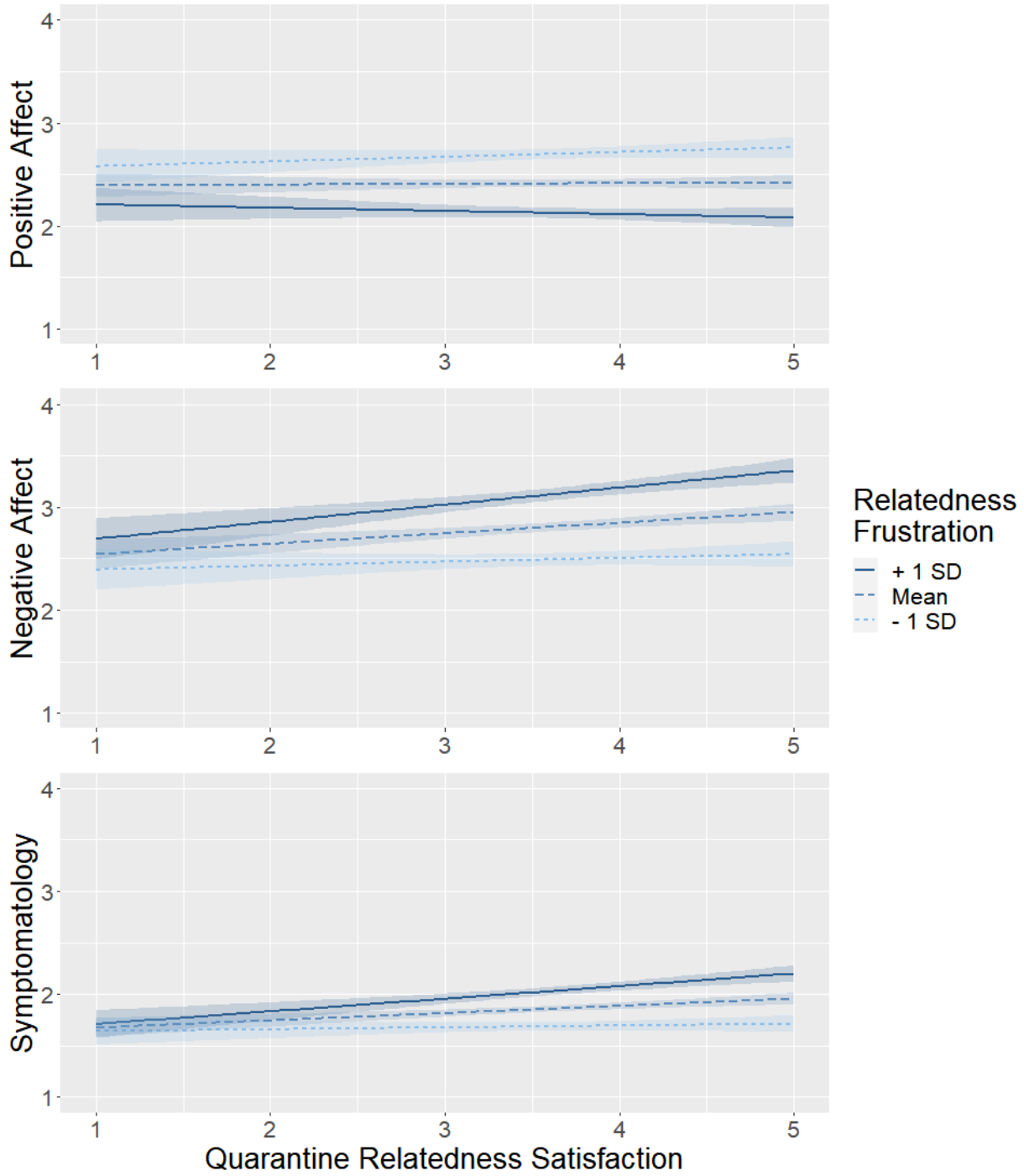

Figure 11. Interactions between quarantine relatedness satisfaction and relatedness frustration when predicting well-being.

The other two needs do not show this pattern to the same extent. Competence shows the same interaction as described above for positive affect. For those low in competence frustration,

competence satisfaction predicts greater positive affect. But for those high in competence frustration, competence satisfaction has a null relationship with positive affect. However, this interaction does not appear for the other two well-being outcomes. Lastly, autonomy does not exhibit this interaction for any of the well-being outcomes. Thus, this interaction appears to be fairly unique to relatedness.

Discussion

In this study, we examined the relationship between need frustration and videogame need satisfaction. Specifically, we investigated whether need frustration resulting from the pandemic and quarantines is associated with concomitant changes in using videogame to satisfy needs. We also examined whether these changes in need satisfaction are associated with changes in well-being, and whether individual differences in need strength moderate these relations.

Broadly speaking, we did not find strong evidence for our hypotheses. Before taking each of these hypotheses in turn, we must first discuss our pre-registered analysis. We used structural equation models to evaluate all of our hypotheses simultaneously. However, these models had very poor fit. This model failure does not provide evidence against our hypotheses, however, but rather suggests that the combination and direction of effects specified are not sufficiently accurate. These models may have suffered for a variety of reasons. One major potential cause is the specification of two types of moderation: (1) the relationship between need frustration and Δneed satisfaction and (2) the relationship between Δneed satisfaction and the three well-being outcomes. This number of potential moderations was likely too complex and considerably worsened the fit for our model. Another potential issue was the prediction that all needs would show the same patterns of associations. As we have demonstrated, the three SDT needs have different associations with frustration and well-being, and these needs played distinct roles

during quarantine. This is immediately clear when considering the three Δneed satisfaction variables, of which only autonomy illustrated a mean difference between pre-pandemic and the quarantine. Given these issues with our SEMs, we turned to unregistered analyses to evaluate our hypotheses.

Satisfaction and Frustration. We predicted that quarantine need frustration would be associated with changes to gaming behaviour in order to better satisfy the frustrated need. In other words, someone who was particularly lonely during quarantine should change their gaming behaviours in order to sate that need. However, we found that this satisfaction-frustration relation only for autonomy and not for the other needs. There are a couple of possible interpretations for this. One is that our prediction is indeed only correct for autonomy. Those who felt lonely or unskilled during the pandemic may not have turned to games to better sate those needs. Instead, it may have only been those who felt restricted, incapable of engaging or influencing the world around them, who turned to videogames. This interpretation has a certain intuitive appeal. During quarantine, people had much more time to play videogames than they otherwise would have. This may have allowed them the time to play big open-world games that would have normally required too high a time investment. These are the sorts of games that emphasize player freedom and grant us a sense of agency and control. Those who felt especially confined by the quarantine may have been especially prone to this change in behaviour.

Another possible interpretation lies in the measurement of these constructs and the order in which they affect one another. If indeed players do change their gaming in order to address their need frustration, and they are successful in doing so, then it may not be possible to evaluate this relation using cross-sectional measurement. If a person feels lonely and then uses games to feel less lonely, then they likely do show a reduced frustration of relatedness needs. Thus,

players who began to use games to satisfy their relatedness needs more often would *not* show increased need frustration. Instead, this would essentially erase our predicted association. To evaluate this possibility, it would be necessary to use a cross-lagged panel design with several waves of data in quick succession. Although it is too late to use the advent of the pandemic as the context for such a design, it would still be valuable as the relation between need frustration and videogame need satisfaction should still hold.

The Many Faces of Need Satisfaction. One surprising result was the variety of associations between need satisfaction and well-being, depending on the need, time period, and outcome. Pre-pandemic autonomy satisfaction, for example, was associated with improved well-being during quarantine, but both Δautonomy satisfaction and quarantine autonomy satisfaction were associated with worse well-being. The other needs each had unique patterns of association with well-being. What becomes clear is that these different needs show complex and varied relations to well-being, when it comes to the use of videogames to satisfy them.

It is also clear that our prediction that changes in videogame need satisfaction would be associated with improved well-being was incorrect. If anything, quarantine need satisfaction was associated with worsened well-being. One possible explanation for these findings is that those who were feeling worse unsuccessfully used videogames to try to address that malaise. We explored this possibility by examining need frustration as a moderator and found some evidence to support this interpretation. For those who experienced less relatedness frustration, quarantine relatedness satisfaction had little association with well-being (or showed improved well-being, in the case of positive affect). However, for those who experienced a great deal of frustration for relatedness needs, relatedness satisfaction predicted worse well-being.

That said, this pattern is relatively unique to relatedness. Competence has the same

interaction for positive affect, but not the other outcomes, and autonomy does not exhibit this interaction at all. This may be because videogames are simply not capable of being our sole (or perhaps even primary) means of sating relatedness needs. For those who were especially lonely, increased reliance on games to satisfy social needs was associated with worse well-being, because videogames are likely not as effective a replacement for real-world socialization. As much as we hated them, Zoom "parties" were probably better than videogames in this regard. This does not mean that games cannot satisfy relatedness needs *at all*, but rather that they should be a supplement to other means.

It should also be noted that the order of these effects cannot be determined with our design. Using videogame to satisfy needs during quarantine may have led to worse well-being, or those with worse well-being were driven to rely on videogames more (or some third variable explains their association). Each of these interpretations are reasonably defensible and would have to be examined using experimental or cross-lagged panel designs.

One final takeaway from these findings is that a difference score may not be the most appropriate way of measuring need satisfaction. Although we had hoped that this would capture the change in gaming behaviour between the two periods, the newly-calculated variables seemed to eliminate some of the meaningful variability in need satisfaction. This is illustrated by the associations between need satisfaction and our other variables. The Δneed satisfaction tended to have weaker (or null) associations when compared with either quarantine need satisfaction or pre-pandemic need satisfaction. This may be the result of a statistical artefact that reduces the reliability of difference scores, especially when scores are near zero, as we observed (Cronbach & Furby, 1970; Jennings & Cribbie, 2016). Thus, although the difference scores remain of some interest, they should not be the focus of our analyses either here or in Wave 2.

Individual Differences in Need Strength. Our final hypothesis was that the other effects would be moderated by individual differences in need strength. Although we did find variability in these traits and many of the expected associations (e.g., those who felt needs more strongly also showed increased frustration of those needs during quarantine), they were not consistent moderators of the effects observed. The one moderation of note that we did find was for the frustration and satisfaction of relatedness, which was moderated by Need to Belong. Those who were higher in Need to Belong had a stronger positive association between relatedness frustration and satisfaction, with those weak in a Need to Belong exhibiting a negative association between the two constructs. This finding is in line with our predictions: feeling a more acute need for warmth and intimacy strengthens the predicted relationship between frustration and gaming to satisfy needs. However, this finding was not found for the other needs, or when examining the association between need satisfaction and well-being. This suggests that need strength is not especially important for these effects, and that the needs are fairly "universal" (as argued by the original SDT authors; Ryan, 1995; Vansteenkiste et al., 2020).

In order to further investigate the associations between videogame need satisfaction, need frustration, and well-being, we collected a follow-up wave of data using the same participants, approximately 19 months after the initial data collection. Our goal was to examine whether these findings would change after the initial shock of the pandemic had subsided, and after quarantine restrictions had loosened. We also made new predictions for these associations, based on the findings of our first wave of data.

Study 5 – Wave 2

Wave 2 was collected in February 2022. Although the pandemic was far from over (in spite of what we predicted in the Spring of 2020), many countries had loosened their restrictions,

and many people were likely experiencing less need frustration than 18 months prior. Using the same sample, we re-examined the relations among need satisfaction, frustration, and well-being, in a less dire context. Given the unexpected results of our first wave of data, we approached this second wave with an exploratory mindset. That said, we still pre-registered new hypotheses based on our previous findings [https://aspredicted.org/jv7qc.pdf]. They are as follows:

Hypothesis 1a: Recent use of videogames to satisfy autonomy and relatedness needs will be associated with worse well-being.

Hypothesis 1b: Recent use of videogames to satisfy competence needs will be associated with improved well-being.

Hypothesis 2: The effects specified in Hypotheses 1a and 1b will be moderated by their respective need frustrations, such that those who are more frustrated will experience stronger deleterious effects (relatedness and autonomy) and weaker beneficial effects (competence).

Method

Participants. We reached out to all participants in the cleaned sample from Wave 1. By way of remuneration, participants had the option to enter into a raffle to win a gift card for $50 (USD), with odds of winning set at 1 in 50 or better. Of those 1239 participants, 564 consented to participate.[11] Participants completed three items used to detect inattentive responding (Marjanovic et al., 2014) and, as was pre-registered, we removed any participant that answered one or more of these questions incorrectly (n = 15). We also pre-registered that we would drop any participants who had more than 5% missing data from the crucial measures, though no participant met this criterion. Two participants were removed, however, for failing to list any videogames that they had played recently. All cleaning was conducted before data analysis and,

[11] At the beginning of the study, 599 participants consented. At the end, we asked again if they consent to us using their data: 564 consented, one did not consent, and 34 failed to respond.

after cleaning, our final sample had 547 participants (62.1% Men, 30.8% Women, 6.7% Other; M_{age} = 27.20, SD = 6.64).

Materials. Participants completed a subset of the measures administered in Wave 1. However, participants were asked instead to think about the past three months ("until around December, 2021"). Participants completed the gameplaying habits and need satisfaction measure, the need frustration measures, and the well-being measures.

Procedure. Participants completed the study online through Qualtrics. They first completed a measure of their recent gaming habits, followed by the measures of their recent well-being measures, presented in a randomized order. Finally, they completed a measure of recent need frustration.

Results

In order to examine how need satisfaction differed from the quarantine period, we again calculated Δneed satisfaction variables for all three needs (subtracting quarantine need satisfaction from recent need satisfaction; Table 17). As observed in Wave 1, all three needs at both time points had means above the midpoint of the scale, indicating that our sample generally did use games to satisfy these three needs. The differences for each need between the two time points were generally small (as observed in Wave 1). The only notable mean change was that of autonomy (about .25 of a standard deviation). On average, participants used games to satisfy autonomy needs less in the recent period than during quarantine. Given that we saw a commensurate increase of autonomy need satisfaction from the pre-pandemic period to quarantine, this reduction may represent a return to baseline.

Table 17

Means, standard deviations, and correlations of videogame need satisfaction for quarantine and recent periods

Variable	*M*	*SD*	1	2	3	4	5	6	7	8
1. Relatedness (Quar.)	3.60	0.78								
2. Relatedness (Rec.)	3.58	0.76	.32 [.24, .40]							
3. ΔRelatedness	-0.03	0.90	-.60 [-.65, -.54]	.57 [.51, .62]						
4. Competence (Quar.)	3.82	0.66	.26 [.18, .34]	.17 [.09, .25]	-.09 [-.17, -.01]					
5. Competence (Rec.)	3.83	0.62	.15 [.07, .23]	.32 [.24, .39]	.14 [.06, .23]	.44 [.37, .51]				
6. ΔCompetence	0.01	0.67	-.11 [-.20, -.03]	.13 [.04, .21]	.22 [.14, .30]	-.57 [-.62, -.51]	.49 [.42, .55]			
7. Autonomy (Quar.)	3.77	0.74	.46 [.39, .52]	.20 [.11, .28]	-.24 [-.31, -.15]	.34 [.27, .42]	.18 [.10, .26]	-.17 [-.25, -.09]		
8. Autonomy (Rec.)	3.58	0.79	.15 [.06, .23]	.42 [.35, .49]	.23 [.15, .31]	.20 [.12, .28]	.35 [.27, .42]	.12 [.04, .20]	.36 [.29, .43]	
9. ΔAutonomy	-0.19	0.87	-.26 [-.34, -.18]	.22 [.13, .30]	.42 [.35, .49]	-.11 [-.19, -.03]	.16 [.07, .24]	.25 [.17, .33]	-.53 [-.59, -.47]	.60 [.54, .65]

Note. *M* and *SD* are used to represent mean and standard deviation, respectively. Values in square brackets indicate the 95% confidence interval for each correlation. "Quar." refers to the quarantine period. "Rec." refers to the recent period. The change (Δ) variables were calculated by subtracting quarantine need satisfaction from recent need satisfaction. All ratings made on a five-point scale. The means for the quarantine period were different from those presented in Wave 1, as the current sample includes only those who participated in Wave 2.

Table 18

Means, standard deviations, and correlations of recent need frustration and recent well-being

Variable	*M*	*SD*	1	2	3	4	5
1. NF: Relatedness	2.85	0.96					
2. NF: Competence	3.07	1.15	.51 [.45, .57]				
3. NF: Autonomy	2.95	0.98	.57 [.51, .62]	.65 [.60, .70]			
4. Positive Affect	2.58	0.65	-.45 [-.51, -.38]	-.47 [-.54, -.41]	-.60 [-.65, -.54]		
5. Negative Affect	2.89	0.78	.46 [.39, .52]	.60 [.55, .65]	.65 [.60, .70]	-.60 [-.65, -.54]	
6. Symptomatology	1.93	0.50	.35 [.27, .42]	.45 [.38, .52]	.48 [.41, .54]	-.42 [-.48, -.34]	.56 [.50, .62]

Note. *M* and *SD* are used to represent mean and standard deviation, respectively. Values in square brackets indicate the 95% confidence interval for each correlation. NF = Need Frustration. All ratings made on a five-point scale.

Descriptive statistics for recent need frustration and well-being appear in Table 18. All three need frustration means were near the midpoint. All three need frustrations were strongly related to one another (*r*s ranging from .51 to .65) and predicted worse well-being (*r*s ranging from |.35| to |.60|).

Need Frustration and Need Satisfaction. For the most part, as in Wave 1, need frustration and need satisfaction were not strongly related. Neither relatedness nor autonomy frustration showed a notable association (i.e., distinct from zero) with either recent need satisfaction or Δneed satisfaction. Competence need frustration did, however, predict both recent competence satisfaction (r = -.11) and Δcompetence (r =-.08). These competence effects support the idea that the successful use of games to satisfy competence needs is associated with reduced competence frustration. That said, the effects are relatively small, were not predicted, and seem unique to this need.

Need Satisfaction and Well-Being. To assess the relationship between need satisfaction and well-being, we estimated the bivariate relations among both sets of variables (Table 19). No Δneed satisfaction variable had an association with any well-being measure and so we focus our interpretation on the recent need satisfaction measures.

We predicted that recent use of games to satisfy relatedness and autonomy needs would be associated with worse well-being but found only weak evidence in support of this prediction. Recent relatedness need satisfaction was associated with recent symptomatology (r = .10), but such an association was not observed for negative affect (r = .04). Relatedness satisfaction also had a positive association with positive affect (r = .10; but the confidence intervals include zero).[12] Recent autonomy satisfaction had only weak associations with negative affect (r = .05)

[12] The confidence intervals observed in Wave 2 are, generally speaking, much wider than those observed in Wave 1, due to the substantially reduced sample size.

and symptomatology (r = .08). Thus, there is only weak evidence that using games to satisfy relatedness and autonomy needs is associated with worse well-being.

We also predicted that recent use of games to satisfy competence needs would be associated with better well-being and found some evidence for this. Recent competence satisfaction was associated with positive affect (r = .23), less negative affect (r = -.09), and less symptomatology (r = -.10), though the latter two associations have confidence intervals that include zero.

Need Satisfaction, Need Frustration, and Well-Being. Our final hypothesis was that the effects predicted would be moderated by need frustration, such that those who are more frustrated will experience stronger deleterious effects (in the case of relatedness and autonomy) and weaker beneficial effects (in the case of competence). To examine this possibility, we regressed each well-being measure onto recent need satisfaction, the corresponding need frustration, and their product (for a total of nine models).

We found mixed evidence for our hypothesis. The effect of recent competence satisfaction on positive affect is indeed stronger for those who are less frustrated, and effectively null for those highly frustrated. However, this moderation was not observed for either negative affect or symptomatology (Figure 12).

Table 19

Correlations between videogame need satisfaction and recent well-being

Variable	Relatedness (Rec.)	ΔRelatedness	Competence (Rec.)	ΔCompetence	Autonomy (Rec.)	ΔAutonomy
Positive Affect	.09 [.00, .17]	.00 [-.08, .09]	.23 [.15, .31]	.05 [-.03, .13]	.03 [-.05, .12]	.02 [-.07, .10]
Negative Affect	.04 [-.05, .12]	.01 [-.08, .09]	-.09 [-.17, -.00]	-.03 [-.11, .06]	.05 [-.03, .13]	.02 [-.07, .10]
Symptomatology	.10 [.02, .19]	.02 [-.06, .11]	-.10 [-.18, -.02]	-.02 [-.11, .06]	.08 [-.01, .16]	.03 [-.06, .11]

Note. Values in square brackets indicate the 95% confidence interval for each correlation. “Rec.” refers to the recent period. The change (Δ) variables were calculated by subtracting quarantine need satisfaction from recent need satisfaction.

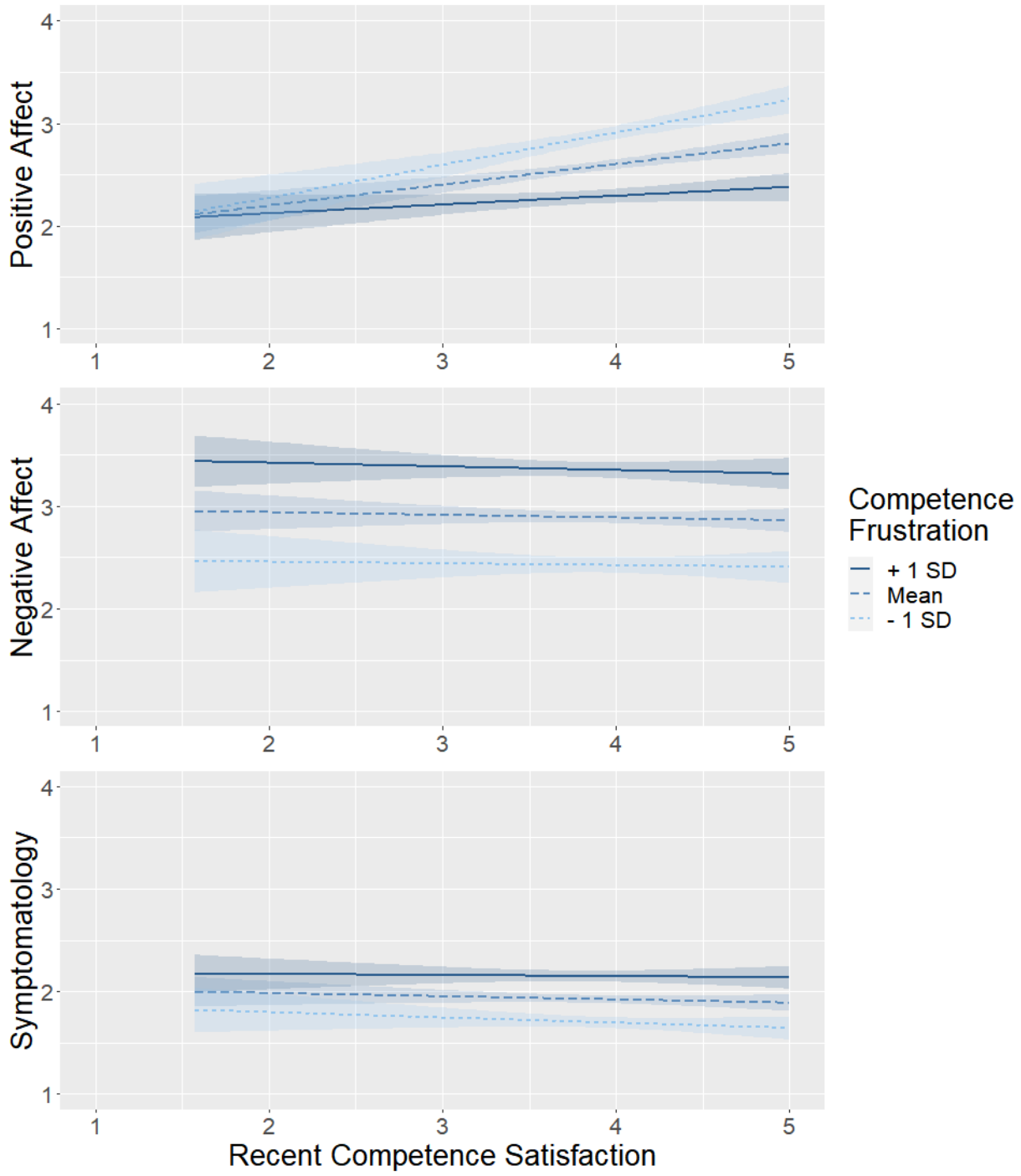

Figure 12. Interactions between recent competence satisfaction and competence frustration when predicting well-being.

Relatedness does exhibit a satisfaction-frustration interaction, though not exactly the one predicted. We expected that the deleterious effects of relatedness satisfaction would be stronger for those who were more frustrated. However, the strongest interaction we observed was for positive affect: recent relatedness satisfaction was associated with increased positive affect, but only for those low in frustration. This interaction is in keeping with the spirit of our hypotheses—using games to satisfy needs is more beneficial and less detrimental for those who are less frustrated—but is surprising because this interaction is only weakly present in the Wave 1 data. Visual inspection of the model predicting symptomatology also indicates the potential presence of the predicted interaction, but the confidence intervals for the interaction term narrowly include zero and should be interpreted cautiously (Figure 13).

Autonomy had no satisfaction-frustration interactions for any well-being outcome, nor any main effect of autonomy satisfaction. The only noteworthy effect in all three models was that of autonomy frustration, which predicted less positive affect, more negative affect, and more symptomatology.

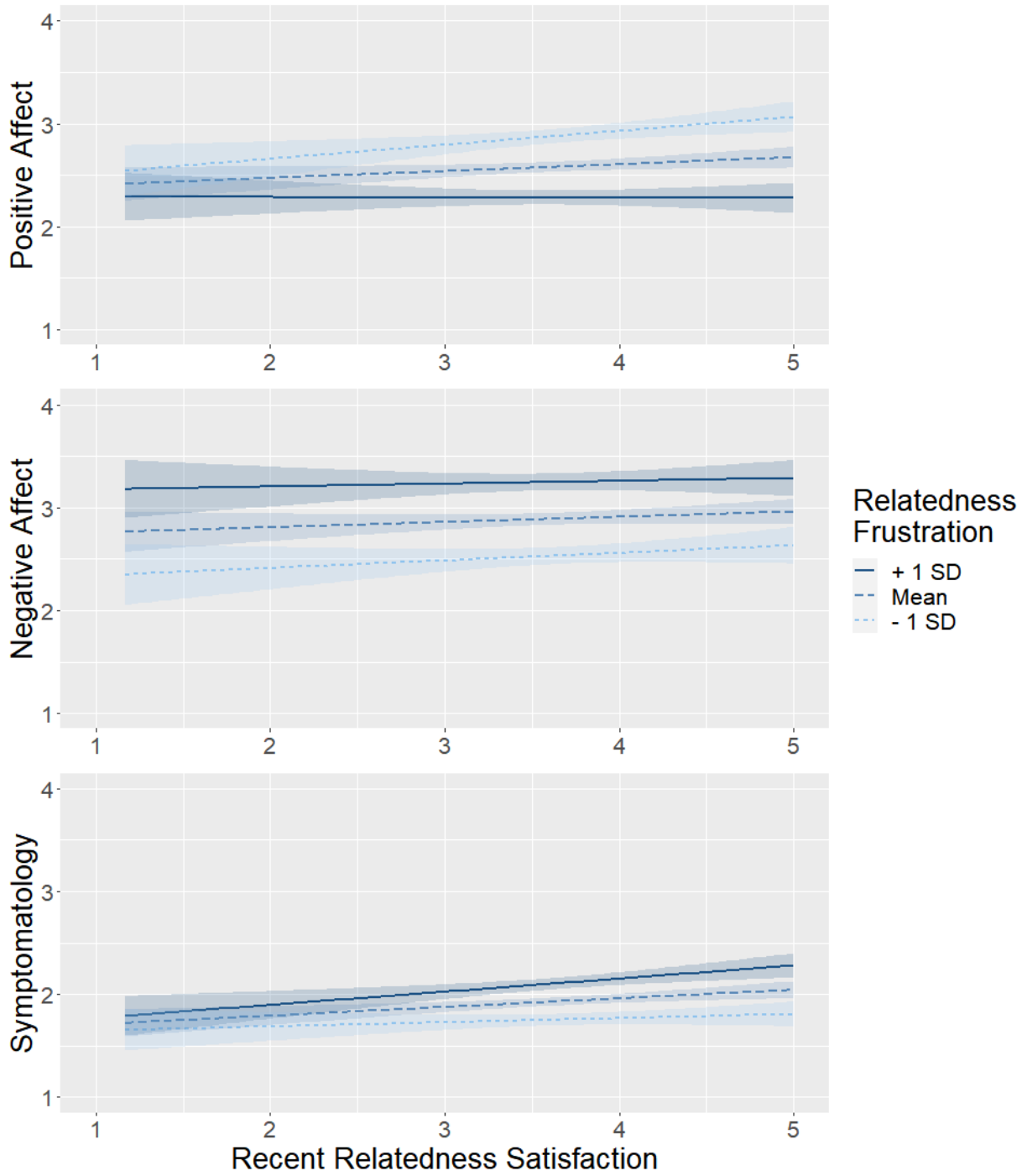

Figure 13. Interactions between recent relatedness satisfaction and relatedness frustration when predicting well-being.

Discussion

These follow-up data allow us to determine whether the relations observed during the

quarantine period were unique to that context or would replicate under a more ‘normal’ context.

The Many More Faces of Need Satisfaction. One of the main findings of Wave 1 was that need satisfaction has different relations to need frustration and well-being, depending on the need and context. Some forms of need satisfaction are associated with improved well-being, whereas others are not. Some of these effects are moderated by need frustration, whereas others are not. Our Wave 2 hypotheses reflect this nuance, with different predictions for each of the three needs. Only some of these hypotheses were supported, however.

In Wave 1, we found that using games to satisfy relatedness and autonomy needs during quarantine was associated with worse well-being. However, these relationships appear only tenuously in Wave 2, when restrictions were mostly lifted. Furthermore, in Wave 2, we found that satisfying relatedness needs predicts more positive affect (with confidence interval narrowly including zero). Thus, gaming to satisfy relatedness and autonomy needs predicts worse well-being much more robustly during the quarantine period. But the reasons for this difference are not clear. It could be a function of the isolation and stress of quarantine, or perhaps something about the frequency, means, and motivations of quarantine gaming.

That said, the relation between gaming to satisfy competence needs and well-being observed in Wave 1 does hold. In Wave 2, we find that competence satisfaction predicts more positive affect, less negative affect, and fewer health symptoms. Thus, this phenomenon doesn’t appear to be completely unique to the quarantine context, even if the two aforementioned associations are stronger under those conditions.

Regardless, the correct interpretation of these effects remains somewhat unclear. We attempted to elucidate things by examining need frustration as a potential moderator, but again found mixed support for our hypotheses. We predicted that those high in need frustration would

show weakened benefits and stronger detriments of need satisfaction. The predicted interaction was observed for competence, though only for positive affect, not negative affect nor symptomatology. This is in line with our findings from Wave 1, in which only competence had this interaction with positive affect. Somewhat unexpectedly, relatedness satisfaction was associated with positive affect for those who were less frustrated, but not for those who were more frustrated. This interaction is not present when predicting negative affect, and only weakly present when predicting symptomatology. These two examples of moderation are thematically consistent with our predictions and our earlier findings. In contrast, our autonomy models uncovered no interactions, nor any notable effects of autonomy satisfaction on well-being. The only consistent effect among these three models was that autonomy frustration reliably predicted worse well-being.

Given these findings, we cannot conclusively determine the order and direction of effects between need satisfaction, need frustration, and well-being. However, it does seem as though the effects were not unique to the quarantine context, even if they were emphasized or altered in some way at that time. The interpretation of these models that we favour is that using games to satisfy needs can improve some aspects of well-being, but only for some people—perhaps only if one's needs are not being actively thwarted. In this way, videogames can proffer benefits, but they cannot overcome active frustration. There may also be individual differences governing these relations that we have not measured. Although need strength was not relevant in Wave 1, some other aspect of personality could determine whether using games to satisfy needs improves to well-being.

One other possible interpretation is that using games to satisfy needs reduces need frustration, which in turn improves well-being. This would mean that need frustration mediates

associations between satisfaction and well-being, rather than moderates it. To explore this possibility, for the cases where moderation was found, we conducted mediation analyses, specifying satisfaction as the predictor, the well-being measure as the outcome, and the respective need frustration as the mediator.[13] However, these models revealed mixed results (Appendix B). The relatedness model predicting positive affect showed no association between need satisfaction and frustration, thereby precluding the possibility of mediation. The competence model predicting positive affect did, however, show a mediated effect of satisfaction through frustration. However, it is not clear that mediation is a superior interpretation to moderation, especially given that it only appeared for one of our models. Without additional evidence, we favour the moderation interpretation.

Frustrating Times. This study was initially conceived in the early days of the pandemic. We felt that the global quarantine presented an unprecedented (and hopefully singular) opportunity to examine how videogames could help us in especially difficult times, functioning differently compared to normal circumstances. Data were collected as quickly as possible, as soon as ethics had cleared, and we planned to follow up in a few months after 'the pandemic was over' to examine how things had changed. Eventually, it became clear that there was no true end to the pandemic in sight, and so we would have to settle for collecting data at a time that seemed less restrictive than during Wave 1. It is not totally clear, however, that we have fully captured the changes from pre-pandemic to quarantine, and then from quarantine to 'post-quarantine.' The major change that we find between these three time points is an increase in the use of games to satisfy autonomy needs from pre-pandemic to quarantine, and then a return to pre-pandemic levels of autonomy need satisfaction in Wave 2. This may reflect the unique context of the

[13] These mediation analyses were exploratory and not pre-registered.

quarantine, when circumstances encouraged people to use games to satisfy autonomy needs. However, as time went on, this became either less necessary or less effective.

It is not clear, however, to what extent Wave 2 represents a ‘more normal’ context. Many still lived under heavy restrictions in February 2022, when Wave 2 was collected. Many still struggled with precarious health and work, fewer opportunities for socialization and intimacy, and the additional effects of having struggled with these things for nearly two years. Indeed, the mean levels of need frustration are nearly identical between the two waves of data, with small increases in the frustration of competence and autonomy needs. Thus, it remains unclear whether we have extended our quarantine findings to a ‘more normal’ context or whether our Wave 2 data represents a comparable, if noisier context to that of Wave 1, along with a smaller sample. This may explain why we find evidence for many of the effects observed in Wave 1, which still provides a comforting replication of our findings, speaking to the robustness of what we have uncovered.

Chapter 5: Discussion

Recommended Listening: Where is My Heart? – Alessandro Coronas (*Where is My Heart?*)

Videogames research has often suffered from a lack of nuance, reflected in poor measurement and a failure to capture the actual experience of playing videogames. This dissertation aimed to address these issues in several ways. In our first three studies, we created an empirically-derived list of the most popular genres and the latent structure underlying them, demonstrating that it is both robust and comprehensive. A detailed taxonomy for videogames is a fundamental first step for meaningful research in this area, and one that has previously been ignored by researchers who treat all videogames as the same. Using this list, we then identified a typology for gamers based on their interest in these genres. This typology was also found to be robust and replicable. Next, in Study 4, we identified how these different genres are uniquely associated with different types of need satisfaction, and how different types of gamers use games to satisfy their needs. Finally, in Study 5, we examined how changes in frustration might predict changes in the use of games to satisfy needs, and whether this need satisfaction predicts well-being. This was examined across two waves of data: one near the beginning of the pandemic and one nearly 18 months later. As a result, we discovered different satisfaction-frustration relations and different satisfaction-well-being relations for the three needs we examined, with some variation also observed based on the time period.

General Discussion

Is Any of This Even Science?: How to Approach Videogame Research

What unites these studies is a drive towards a more accurate understanding of the phenomenology of videogames. That is, with this work, we developed a nuanced and

experientially-grounded conceptualization of videogames and the people who play them. With each chapter, we attempted to drill down deeper, adding further detail and distinction to our characterizations of games and gamers with each layer. We began with a focused effort to describe these phenomena using careful and detailed measurement. Advanced multivariate statistics were also key in capturing the interrelations among the many variables considered, which is not possible using traditional univariate approaches. An additional strength of our research is that we examined enthusiast samples of real-world gamers—individuals who actually play games regularly—including two global samples from online gaming communities. As a result, we feel confident that our results should generalize to the real-world, for people who actually play games, rather than the general population or a convenience sample of university undergraduates.

There is much more descriptive work to be done in videogames research. As with many areas of psychological research, videogames research has largely focused on hypothesis testing, to the neglect of the descriptive research that forms the foundation of the scientific method (Rozin, 2009). This problem is not intrinsic to games research, although it may be exacerbated by the types of questions that have typically surrounded this topic. Historically, researchers have focused on testing hypotheses such as, “Videogames make people more aggressive,” as opposed to understanding the experiences of gaming and gamers. This issue can be illustrated using a personal anecdote. Once, after presenting Studies 1–3 to a group of psychology researchers, an audience member eagerly raised their hand, and asked, “Why should psychologists care about this?”, and “Is any of this even science?”. Rather than being surprised that this sort of foundational work hadn’t yet been done in the previous decades of videogames research, they questioned whether it should be bothered with at all. Although some may always regard

videogames as little more than a frivolity, they are a massively popular form of novel interactive media and an utterly unique cybernetic technology. The fact that a great many millions of people engage with games on a daily basis means that it is imperative that we fully understand these experiences and their effects. To this end, we first endeavoured to understand videogames through the lens of genres.

A Blue Window with Text in It: What makes a game part of a genre?

Final Fantasy is a beloved franchise of Japanese RPGs that has spanned over three decades with over 15 entries in its main series. When its creator, Hironobu Sakaguchi, was asked to define this massive and varied series of games, he replied "*Final Fantasy* is *Final Fantasy* if it has a blue window with text in it" (Nakamura, 2014). This tongue-in-cheek response nonetheless illustrates an important point: genres can be difficult to define in clear and concrete terms. It is not always clear what genre a game is, what distinguishes that genre from others, and at what point a category 'becomes' a genre.

This difficulty is present throughout our early studies. For example, the initial list of genres presented in Chapter 2 included, "Co-operative Multiplayer Shooters". Does the cooperative aspect make this type of game distinct enough from other multiplayer shooters to be its own genre? And is it sufficiently popular enough to justify a place on our list? Although we ultimately decided that it should not be on our list, depending on the context and research purpose including it can easily be justified. Lists of genres must reflect both the current moment in gaming in terms of popularity and representation, and the research goals. If a researcher is interested in the cooperative aspect of gaming, then she should certainly make this distinction. A great deal of past research has chosen to measure videogame exposure rather unthinkingly, and we hope our studies convey the importance of taking into account a wider range of factors when

measuring videogame exposure, including present popularity. Although this approach entails effort and thought each time a study is designed, it cannot be avoided. It would be a mistake, for example, to avoid the issue of maintaining genre lists by shoehorning all genres into a small list of broader categories (e.g., using "Action" to represent both *Grand Theft Auto V* and *Elden Ring*). Although this approach has the apparent benefits of being both streamlined and timeless, it also eliminates much of the meaningful variance that makes measuring genre exposure worthwhile. When we treat highly divergent gameplay experiences as being interchangeable, we introduce additional noise into our measurement, thereby obscuring the effects that we are most interested in capturing. As to what level of granularity is required, that is ultimately up to individual researchers. We feel that the list of 20 genres we developed effectively captures the most popular videogame experiences without being so long that it fatigues participants. This set of genres also covary in relatively stable ways across diverse samples, which suggests that they are likely valid, insofar as they measure what we think they are measuring. However, future researchers may choose to expand, truncate, or alter the list of genres measured here. What is important is that it is done carefully and thoughtfully, with input from people who play videogames, and with an eye towards capturing the actual experience of doing so.

It should also be noted that some researchers have argued against the utility of genres in videogames research. For these thinkers, genre labels, as they have been used in gaming culture and in research, fail to capture the novelty and complexity that videogames offer (Clarke et al., 2017). This is in part because some genre labels are aesthetic descriptors inherited from prior media forms, rather than being organically developed to describe the novel experience of playing a game (e.g., "Action"; Apperley, 2006). This critique is also based on the dynamic nature of genres. New genres emerge as old ones fade, old genres re-emerge in popularity or are

transmuted into something new, and sometimes a genre will simply have its name changed. This dynamic nature can frustrate and inhibit communication between scholars, developers, and videogame players (Clarke et al., 2017). For these reasons, some have argued that genres fail to serve their primary purpose: allowing interested users to identify, collocate, and retrieve subsets of games. Although we maintain in this dissertation that genres are a uniquely useful unit of measurement (for a variety of reasons already discussed), the concerns raised do have merit. It may be fruitful to consider some of the alternatives to studying genres that have been proposed, such as focusing on specific features (e.g., exploration) or on prototypical examples of types of games (Clarke et al., 2017).

Anatomy of a Gamer: What genres make a type of gamer?

We used our newly-developed list of genres to identify different types of gamers based on their interest in these genres. Although basing a gamer typology on genre interest is probably an uncontroversial decision, it is not the only option. One of the simplest ways to identify different types of gamers would be to categorize them based on average hours played per week; this sort of typology would primarily distinguish between lower-investment "casual" gamers and highly-dedicated "hardcore" gamers. One could also categorize gamers based on platforms (e.g., console vs. PC) or eras of interest (e.g., retro vs. contemporary). Knowing whether someone primarily plays on a computer, a console, or their mobile device likely does give you some insight into what type of gamer they are. Indeed, gamers themselves often characterize themselves along these lines. There are also many who play primarily old games, and barely ever bother with modern ones. Identifying whether someone interested primarily in the classics (i.e., a "retro" gamer), playing games that have finally gone on sale three or four years after release (i.e., a "patient" gamer), or chasing the newest release zeitgeist, could tell you a lot about their needs

and motivations. Thus, our decision to produce a typology based on genres should not be viewed as the only possible option.

Importantly, none of these typology options are mutually exclusive and one could easily pursue two or more in tandem. These options can be combined to develop an even more nuanced understanding of different types of gamers. We opted to focus exclusively on genres because of the unique nuance they offer: genres are an organically-developed but highly-complex taxonomy that is easily recognized by gamers. This familiarity allows us to access and measure that complexity and nuance with relative ease. Genres also match motivations and needs rather closely, which further suits our goals. Broadly speaking, genres serve the same needs for most players, even if there are deviations, based on the type of content and gameplay. Unsurprisingly, games that emphasize social interactions and forming connections (e.g., *Stardew Valley*) are likely to help fulfill a need for connection. Although some players may use a game for something other than its 'intended' purpose (e.g., never shooting a gun in a shooter game, thereby turning it into a puzzle game; Burch, 2013), this is rather rare. For our purposes, genres represent a systematic and reasonably consistent way of capturing different types of gaming experiences, and therefore assist us with identifying different types of gamers. Given the success we observed with this approach, we would recommend it to future researchers.

Our typology of gamers largely replicated across our various samples, even when sampling different populations (i.e., undergraduates in Chapter 2 vs. online communities in Chapter 3). These samples differed in terms of age, location, and stage of life, and yet the typology we observed remained rather stable. As a result, we are relatively confident in the robustness of our typology. That said, it may be that a sample collected solely in another culture, such as Japan, would reveal a different typology. This is to be expected, as the gaming habits and

market differ between these two cultures (e.g., Polygon, 2017).[14] Future research should attempt to replicate both our genre exposure measure and gamer typology in different cultures. Even keeping culture constant, this gamer typology may change with time. As games change, with genres growing and shrinking in popularity, our genre exposure measure will also need to change. However, it is unclear whether the typology will also change with it. It may be that future typologies will produce approximately the same profiles, even if some of the genres they comprise change. This is because, as we have argued, gamer profiles reflect individual differences in needs, which should remain relatively stable even if the popular game genres shift somewhat.

The Nature of Needs: How do different genres sate different needs?

Videogames can satisfy basic psychological needs and also improve our well-being (Ryan et al., 2006; Przybylski et al., 2010; Allen & Anderson, 2018, Suppl.). In the present research, we demonstrated that both genres and gamer types can be understood through their association to different needs. That said, some aspects of the relation between needs, genres, and gamer still require illumination. The precise reasons why gamers play a particular set of genres has not yet been fully explained. Genres that cluster together may do so because they all serve the same need, or because they serve a complementary set of needs. The factors identified in Chapters 2 and 3 indicate that genres cluster based on a shared style of play. The Hardcore factor, for example, comprises genres that all require long-term investment and dedication (MMOs, MOBAs, and Multi-player Strategy games). When these clusters are used to identify

[14] Other demographic variables may also affect which genres people play and for what purpose. For example, teenagers may use games primarily as a means of contact with their friends, whereas their parents may use games chiefly as a way to relax and decompress. Although our samples capture the heterogeneity of the gaming population, we did not explicitly parse and compare these different sub-populations. Just as future work should examine the potential moderating role of culture, so too should it investigate the role of other demographic variables, such as age.

gamer types, however, the nature of this clustering is less clear. Some profiles appear dedicated to a single type of gaming experience, whereas other profiles were characterized by a varied taste in genre. Thus, both approaches to gaming appear present. Some people use gaming to satisfy a single need and their taste in genres reflects that. Others use games to satisfy a wider set of needs and are thus attracted to a wider variety of gaming experiences. This result stands as a reminder that individual differences remain important for explaining human phenomena: different people will do the same thing, but for different reasons.

One surprising finding is that genres seem to differ in their capacity to satisfy needs, and this also differs between individuals. These two findings are best illustrated by the Sports genre, as discussed in Chapter 3. We anticipated that Sports games would help to satisfy a need for competence, due to their focus on skill and competition. Although Sports was often a unique and important component of the different gamer profiles (both at high and low levels of exposure), it seldom showed the predicted association with need satisfaction. This seems to imply that the genre itself simply does less to satisfy needs than do other genres. However, this result also differed between individuals. We identified two different profiles based on their high exposure to Sports games: one that played nearly every genre of game in addition to Sports, and another that played only Sports games almost exclusively. Whereas the latter group (Sports Essentialists) had the lowest level of competence satisfaction, the former (Sports Generalists) had the highest. Thus, even at similar levels of exposure to a particular genre, there are individual differences in how people use the same genre to satisfy the same need.

This finding also implies that gaming to satisfy needs is trait-like in nature: relatively stable across time and contexts. However, our data provide mixed evidence for this claim. In Chapter 4, we proposed that experiencing need frustration would cause people to change their

gaming habits to better satisfy the frustrated need. This prediction posits that videogame need satisfaction is state-like in nature, fluidly changing across time and context. But the evidence to support this hypothesis was unclear. Between pre-pandemic and early pandemic periods, the only change we saw was an increase in the use of games to satisfy autonomy needs. Later on, between the early pandemic and late pandemic periods, we also saw a decrease in the use of games to satisfy autonomy needs. This suggests that some gaming behaviors did change in response to the need frustration caused by the pandemic. As to whether gaming to satisfy needs is more trait-like or state-like, we are unable make a definitive conclusion. It may be that it is more trait-like, but the extreme conditions of a burgeoning pandemic were able to shake its typical stability. In a more normal context, it may be that these behaviours fluctuate with time, or are consistent in all but extreme cases. Future research should continue to examine this issue by examining videogame need satisfaction across time and situations.

Limitations

There are several limitations of the work presented here. One issue is that actual gaming behaviors were not measured. Although we are confident in the self-report data used, directly measuring gaming behaviour would mitigate some of the problems associated with self-report. At present, however, this sort of data is difficult to access. However, console manufacturers have recently begun collaborating with researchers to provide measures of gaming behaviour (e.g., Johannes et al., 2022; Vuorre et al., 2022), and so this approach is becoming increasingly feasible.

Relatedly, many of the effects we report in this program of research were small in magnitude, according to the popularly-cited effect size guidelines of Cohen (1988). Thus, one potential limitation of this work is the absence of large effects, as they have been traditionally

defined. These guidelines have come under considerable scrutiny in the ensuing decades however and recent recommendations have instead suggested that researchers instead compare their effects with other effects commonly reported in their research area (Schäfer & Schwarz, 2019).[15] To this end, we compared the effects obtained in this program of research to recently published meta-analyses in videogames research and, in short, the effects we report here tend to be either comparable or smaller to the average effect size reported in related areas of videogames research. A meta-analysis examining the effect of videogames on attitude change, for example, found an average effect size of $g = 0.36$ for implicit attitudes and $g = 0.24$ for explicit attitudes (Kolek, 2022). Another meta-analysis on the effects of videogames on cognitive skills found an average effect size of $g = 0.55$ for cross-sectional studies and $g = 0.34$ for long-term intervention studies, though they also caution that publication bias has inflated these published effect sizes by about 30% (Bediou et al., 2018). Thus, average effect sizes in videogames research seem to account for between 24% and 55% of a standard deviation of variance, though are also likely artificially inflated. The effect sizes we report tended to range between about $r = .10$ and $r = .30$, though with a strong concentration at the lower end of that range. This means that our effects tended to account for between 20% and 60% of a standard deviation of variance. Thus, many of our effects were smaller than the average effect sizes reported in these meta-analyses, though others were comparable or occasionally larger. Given the exploratory nature of this work, we should be careful in our interpretation of any small effect reported herein that was not replicated in a follow-up study.

[15] Notably, Cohen (1988) himself also made this recommendation, though it was his attempt to establish effect size guidelines that entered the collective academic memory, instead of the nuanced advice that accompanied it.

Another limitation in this work is the use of cross-sectional methodologies. Although much of the research discussed herein deals with longer timescales, additional waves measured in closer chronological proximity would be necessary to answer many research questions. This limitation is one of the major hurdles in effectively disentangling the relations among need frustration, need satisfaction, and well-being. Daily diary studies could also be used to assess the associations among these variables on a smaller timescale, providing an insight into the day-to-day experience of using games to satisfy (frustrated) needs. Future research should use these repeated measure designs to investigate these relations with greater sensitivity.

One final limitation of this work is the difficulty of making predictions when our results were rooted in descriptive multivariate analyses. Although we made hypotheses for each study, it is difficult to make predictions about the performance of variables that have not yet been calculated (i.e., factors, profiles). To do so, the nature of these variables must first be predicted, and then their relations with other variables must also be predicted. This results in each prediction requiring multiple conditions in order to be supported by the data, making them much less likely to find support. This sort of descriptive work is therefore somewhat at odds with traditional hypothesis-testing frameworks. That said, careful measurement can inform predictions for follow-up replication studies, which are then likely to be robust and well-suited to hypothesis testing. By replicating our results across several samples, including one that was measured at two different points, we hoped to mitigate this particular weakness.

Conclusion

This dissertation contributed to our understanding of videogames through the lens of genres, types of gamers, and needs. We identified a list of genres for use in games research and identified and validated the factor structure underlying these genres. Using those factors, we then

identified a gamer typology that largely replicated across multiple samples. We hypothesized that these factors and gamer profiles would show reliable associations with different forms of need satisfaction. Our predicted associations between genres and needs were mostly supported by the data. However, the predicted associations between profiles and needs were only partially supported by the data, highlighting the difficulty in making predictions about latent profiles before they have been identified. That said, the profiles themselves, and their differences in need satisfaction, contribute to a better understanding of who plays videogames and why. Finally, across two waves of data, we examined how the need frustration caused by the pandemic may have affected the use of games to satisfy needs, and how that affected well-being. We hypothesized that people would change their gaming habits to satisfy the most frustrated needs, which would in turn lead to better well-being. Broadly speaking, we found this effect only for autonomy, and not relatedness or competence. However, we also found that, in some cases, gaming to satisfy needs was associated with worse well-being. This latter finding could be due to people relying too heavily on videogames to try to address their malaise, without success. Overall, we provide a novel and nuanced look into the relations among videogame genres, the people who play them, and the needs that they satisfy.

As videogames become increasingly popular and prevalent in the media landscape, it becomes all the more crucial for videogames research to develop deep and nuanced understandings of videogames: who plays them, why they play them, and their effects on players. The present research contributes to these goals and provides useful new tools for future games research.

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Appendix A

Unpublished Measures

Videogame Need Satisfaction Measure

The following questions will ask you about your experiences with [GAME] during the quarantine. If a given question is not applicable to that game, please choose "Not Applicable" as your response.

How much did you enjoy the following aspect of [GAME]?

1 (Not at all); 2 (A little bit); 3 (A moderate amount); 4 (A great deal); 5 (Totally loved it)

Autonomy

1. Being able to influence the game world in the way that I want

2. Having a lot of control over a character or world

3. Being able to affect the outcome of the story, the world, or the characters

Competence

1. Overcoming challenges

2. Improving my playing skills

3. Making my character (team, base, etc.) as powerful as possible

Relatedness

1. Interacting with story characters in the game

2. Playing with friends

3. Meeting new people in the game (NPCs or other players)

Quarantine Need Frustration

With regards to the recent COVID-19 pandemic, please indicate the extent to which you agree with the following statements. As with previous questions, when responding, please think back to the time during which the quarantine measures were most restrictive (i.e., your movements and behaviours were most limited).

1 (Strongly disagree); 2 (Disagree); 3 (Neither agree nor disagree); 4 (Agree); 5 (Strongly agree)

Autonomy

1. During the pandemic, I have felt like I've lost control.

2. During the pandemic, I have felt powerless.

3. During the pandemic, I have felt forced to do many things I wouldn't choose to do.

Competence

1. During the pandemic, I have felt incompetent.

2. During the pandemic, I have felt like I can't do anything very well.

3. During the pandemic, I have felt serious doubts about whether I can do things well.

Relatedness

1. During the pandemic, I have felt lonely.

2. During the pandemic, I haven't felt connected with people who care for me.

3. During the pandemic, I have felt that the relationships I have are just superficial.

Need for Autonomy

For each of the following statements, please indicate the degree to which you agree or disagree with the statement.

1 (Strongly disagree); 2 (Disagree); 3 (Neither agree nor disagree); 4 (Agree); 5 (Strongly agree)

1. I prefer a job where I have a lot of say in what I do and when I do it.

2. I try to avoid situations where someone else tells me what to do.

3. I need to feel a sense of choice and freedom in the things I do.

4. It's important that I get to do what really interests me.

5. It stresses me out to think about others influencing my life.

6. It's important that I am in complete control of my own destiny.

7. I enjoy the unexpected and random parts of life. (R)

8. I'm not worried about things being outside of my control. (R)

9. I don't mind letting others take the lead. (R)

10. Luck and chance are the spice of life. (R)

Need for Competence

For each of the following statements, please indicate the degree to which you agree or disagree with the statement.

1 (Strongly disagree); 2 (Disagree); 3 (Neither agree nor disagree); 4 (Agree); 5 (Strongly agree)

1. It's important for me to feel like I know what I'm doing.

2. I don't try new things unless I know I'll be good at them.

3. Sports are only fun for me when I'm winning.

4. I'm not interested in games that I know I won't be good at.

5. I would never start a puzzle that I didn't think I could solve.

6. I don't need to be the best in the room at what I'm doing. (R)

7. I enjoy doing things even when I'm not great at them. (R)

8. I don't mind reading things that I find difficult to understand. (R)

9. Sports are fun for me, even when I'm not great at it. (R)

10. I don't mind making mistakes here and there. (R)

Physical Symptoms

The following questions are about the COVID-19 pandemic. As with previous questions, when responding, please think back to the time during which the quarantine measures were most restrictive (i.e., your movements and behaviours were most limited). Please rate the extent to which you experienced each of the following during the pandemic.

Please rate the extent to which you experienced the following during the pandemic.

1 (Not at all); 2 (A little); 3 (Moderately); 4 (A lot)

1. Headaches

2. Stomach-upset/pain

3. Chest/heart pain

4. Faintness/dizziness

5. Shortness of breath

6. Acne/pimples

7. Insomnia/trouble sleeping

8. Low energy/exhaustion

Appendix B

Supplemental Analyses

Wave 1 Structural Equation Models

We pre-registered structural equation models to assess all of our hypotheses simultaneously. The model used need frustration to predict Δneed satisfaction, which was in turn used to predict all three quarantine well-being outcomes (positive affect, negative affect, and negative symptomatology). Trait need strength was also specified as a moderator for each of these relationships. A separate model was specified for each of the three SDT needs. These models had poor fit and so were not discussed at length in the main text but their fit statistics are presented here (Table B1).

Table B1

Fit indices for the Wave 1 structural equation models

Model	CFI	TLI	RMSEA	SRMR
Relatedness	0.268	-1.300	0.662	0.169
Competence	0.219	-1.453	0.701	0.235
Autonomy	0.188	-1.552	0.785	0.271

Note. CFI = Comparative Fit Index; TLI = Tucker-Lewis Index; RMSEA = Root Mean Square Error of Approximation; SRMR = Standardized Root Mean Square Residual.

Wave 2 Mediation Analyses

Relatedness

We used bootstrapped mediation (N = 5000 resamples) to examine whether need frustration mediates the effect of need satisfaction on well-being, in cases where we found evidence of moderation. Our first model examined the effect of relatedness satisfaction and frustration on positive affect. Need satisfaction showed no effect on need frustration, however, precluding the possibility of mediation (b = -0.04, 95% CI [-0.14, 0.07]). Need frustration did

show the anticipated negative effect on positive affect (b = -0.30, 95% CI [-0.35, -0.25]). Need satisfaction showed a positive direct effect on positive affect, but the effect was very small and the confidence intervals narrowly including zero (b = 0.06, 95% CI [-0.001, 0.13]). The indirect was also small and its confidence intervals also included zero (b = 0.01, 95% CI [-0.02, 0.04]).

Competence

Our second model examined the effect of competence satisfaction and frustration on positive affect. Here we found evidence of mediation, with satisfaction showing a negative effect on frustration (b = -0.20, 95% CI [-0.36, 0.05]), which in turn showed a negative effect on positive affect (b = -0.26, 95% CI [-0.30, -0.22]). Need satisfaction also showed a positive direct effect on positive affect (b = 0.19, 95% CI [0.11, 0.26]) and a small indirect effect through need frustration (b = 0.05, 95% CI [0.01, 0.09]).

The Use of Ordinal Items in Measuring Genre Exposure

In Studies 2–4, we use an ordinal item to measure frequency of exposure to different genres of videogames. In practical terms, one of the concerns of using ordinal items is that the difference between two values (e.g., 1 and 2) might be psychometrically different from the values between two other values (e.g., 2 and 3). Although exploratory factor analysis is capable of handling ordinal data, there may still be concern about these differences in values when measuring genre exposure frequency. In particular, the difference between responding “Never” (i.e., 1) and responding “Once every couple of years” (i.e., 2) may be meaningfully different from the difference between responding “Once every couple of years” and “A few times a year” (i.e., 3). It is difficult to conclusively diagnose whether this is true and, more importantly, whether this is problematic for our results and their interpretation. In order to mitigate concerns about this issue, we re-conducted one of our major analyses after dropping participants who

responded “Never” to a particular genre category, and then compared those results to the original results.

In Study 4, we examined the associations between six genre categories and several outcomes (Table 12). In order to determine whether these results were affected by the inclusion of people who responded “Never” to all genres within a particular category, we removed anyone with a value of 1 on a particular genre category from the associations between that genre and our need outcomes. So, for example, 131 participants responded with “Never” to all Hardcore genres, and so they were removed from the correlations between Hardcore genre exposure and the four need outcomes. After applying this correction, we re-ran all correlations, but found that there were few substantial or consistent changes in the results of interest (Table B2). Some associations increased in strength, whereas others decreased. Broadly speaking, however, the results remained similar in magnitude and direction, and the small changes that were observed do not appear to be consistent or indicative of any systemic underlying problems with the data.

Table B2

Means, standard deviations, and correlations of exposure scores and needs

Variable	1	2	3	4	5	6	7	8	9
1. Hardcore									
2. Sports	.43 [.38, .49]								
3. Fighters	.19 [.13, .25]	.23 [.16, .29]							
4. Blockbuster	.31 [.26, .36]	.39 [.34, .45]	.22 [.16, .27]						
5. Approachable	.15 [.10, .20]	.28 [.22, .33]	.19 [.14, .24]	.31 [.26, .35]					
6. Role-playing	.08 [.03, .14]	-.08 [-.14, -.01]	.03 [-.03, .09]	.11 [.06, .17]	.20 [.15, .25]				
7. Competence	.10 [.05, .16]	.04 [-.03, .10]	.09 [.03, .15]	.15 [.10, .20]	.02 [-.03, .07]	.08 [.03, .13]			
8. Autonomy	.00 [-.05, .06]	-.08 [-.14, -.02]	.04 [-.01, .10]	.08 [.03, .13]	.04 [-.01, .09]	.13 [.08, .18]	.43 [.39, .47]		
9. Relatedness	.19 [.14, .24]	.08 [.01, .14]	.02 [-.04, .08]	.07 [.02, .12]	.11 [.06, .16]	.12 [.07, .17]	.20 [.15, .25]	.33 [.29, .38]	
10. Sensation Seeking	.22 [.17, .27]	.27 [.21, .32]	.17 [.11, .22]	.30 [.25, .34]	.12 [.07, .17]	-.02 [-.07, .03]	.06 [.01, .11]	.02 [-.03, .07]	.05 [-.00, .10]

Note. Values in square brackets indicate the 95% confidence interval for each correlation. Means were calculated based on the genres that loaded most strongly onto each factor.

Appendix C

Gender

One of the major vectors by which we might examine videogame playing is gender. Videogames are stereotypically more associated with men than with women, though anecdotally, this does appear to be changing. Furthermore, recent estimates in both Canada and the USA suggest that gamers are actually about equally split between men and women (Entertainment Software Association, 2022; Entertainment Software Association of Canada, 2020). That said, the gender breakdown in our samples varied widely based on sampling method and location. Broadly speaking, men were overrepresented in our samples, though samples collected using undergraduate convenience samples (i.e., Studies 1–3) tended to be closer to closer to an even split between men and women. Our two online community samples, however, clearly overrepresented men (i.e., Studies 4 and 5). This discrepancy, between the gender of our sample and the gender of gamers in the general population, is likely due to the aforementioned stereotypic association of videogames with men. Women may spend less time in online videogames communities, for example, where the majority of our community sampling was done. Even the ones who do spend time there may be less likely to identify themselves as a 'gamer,' or as an enthusiast of a particular videogame (despite evidence to the contrary). Thus, they may be less likely to participate in studies targeting gamers and enthusiasts. This discrepancy is also likely due in part to differences in how the sample was defined. The Entertainment Software Association (ESA), who regularly collects demographic information on people who play videogames, defines a gamer as someone who plays games at least one hour per week on average (Entertainment Software Association, 2022). We limited our sample to those who play games for at least five hours per week on average. It may be the case that women play

videogames for less time per week, on average, and so some of the women who qualified as ‘gamers’ in the ESA’s data would not have qualified for our studies.

Genre

Across our samples, men and women demonstrated different patterns of gameplay (Table C1). In all samples, for example, women demonstrated a greater interest in Approachable genres than did men, and men demonstrated a greater interest in Sports genres than did women. Broadly speaking, men demonstrated greater levels of interest in most genre categories than did women, though with some additional exceptions: women were slightly more interested in Role-playing games than were men, for example. Men and women also showed similar levels of interest in Hardcore genres in all studies other than Study 1. Men and women also showed reasonably similar levels of variance across our samples. Although there were cases where the variance was notably different between the two groups (e.g., Approachable genres in Study 2), most genre categories show similar levels of variance between the two groups and the differences that are present do not appear to reflect a deeper pattern.

Given that these differences are not particularly extreme or robust, there do not appear to be many especially prominent differences in genre interest between men and women, other than Sports and Approachable genres. This too contradicts some long-held if slowly-changing stereotypes about women being only interested in a handful of “simple” genres, such as family-friendly Nintendo games.

Table C1

Genre category exposure by gender

	Study 1		Study 2		Study 3		Study 4		
Genre Category	Men (255)	Women (322)	Men (280)	Women (114)	Men (151)	Women (168)	Men (1134)	Women (267)	Non-binary (91)
Hardcore	0.42 (1.09)	-0.34 (0.78)	2.71 (1.20)	2.81 (1.21)	2.74 (1.27)	2.22 (1.08)	2.87 (1.32)	2.64 (1.23)	2.74 (0.99)
Sports	0.53 (0.96)	-0.39 (0.81)	3.21 (1.73)	2.35 (1.54)	3.27 (1.67)	2.45 (1.39)	1.94 (1.10)	1.67 (1.07)	1.30 (0.52)
Fighters	0.48 (0.95)	-0.36 (0.88)	2.90 (1.27)	3.21 (1.43)	3.19 (1.23)	3.02 (1.35)	2.62 (1.38)	2.29 (1.26)	2.38 (1.09)
Blockbuster	0.41 (1.01)	-0.32 (0.87)	3.70 (1.05)	3.33 (1.23)	3.60 (1.11)	2.58 (1.14)	3.10 (0.96)	2.68 (1.00)	2.73 (0.87)
Approachable	-0.25 (1.03)	0.21 (0.92)	2.07 (0.83)	3.20 (1.13)	2.24 (0.88)	3.22 (0.95)	2.60 (0.78)	2.84 (0.85)	3.00 (0.68)
Role-playing							4.02 (1.35)	4.28 (1.46)	4.73 (1.25)

Note. Mean scores are presented with standard deviations in parentheses. In Study 1, standardized factor scores are presented (i.e., grand mean centered on 0, with a standard deviation of 1). All other studies present means calculated using the genres for each category on a six-point scale. Only Study 4 had a substantial number of participants that reported a gender other than Man or Woman and thus we only present the means for those two groups for Studies 1–3. Number of participants of each gender identity is presented in parentheses next to each gender label. Finally, only Study 4 extracted the Role-playing factor, and so Studies 1–3 do not report it as its own mean.

Table C2

Videogame need satisfaction by gender

	Study 4			Study 5 (Wave 1)		Study 5 (Wave 2)	
Need	Men (1134)	Women (267)	Non-binary (91)	Men (844)	Women (331)	Men (341)	Women (169)
Autonomy	6.01 (0.80)	6.08 (0.78)	6.23 (0.65)	3.68 (0.77)	3.96 (0.69)	3.52 (0.76)	3.66 (0.84)
Competence	5.62 (0.89)	5.41 (0.91)	5.69 (0.87)	3.92 (0.62)	3.78 (0.67)	3.89 (0.59)	3.70 (0.67)
Relatedness	4.69 (1.28)	5.14 (1.17)	5.41 (1.27)	3.50 (0.82)	3.71 (0.76)	3.49 (0.75)	3.70 (0.75)

Note. Mean scores are presented with standard deviations in parentheses. In Study 4, need satisfaction was measured using the seven-point Player Experience of Need Satisfaction scale. In Study 5, need satisfaction was measured using the five-point items of our design (see: Chapter 4 and Appendix A). Only Study 4 had a substantial number of participants that reported a gender category other than Man or Woman and thus we only present the means for those two groups for Study 5. Number of participants of each gender identity is presented in parentheses next to each gender label.

Need Satisfaction

As to the use of games to satisfy needs, men and women tended to use them in similar manners, though with some notable exceptions (Table C2). In Study 4, women showed a higher usage of games to satisfy relatedness needs than did men, and even less variance. This pattern is also presented in both waves of Study 5, though the differences are weaker than in Study 4. Men showed a greater tendency to use games to satisfy competence needs in Study 4 than did women. This pattern was also present in both waves of Study 5, though the differences were fairly small. Both men and women showed similar means and variances of autonomy need satisfaction in Study 4. In Wave 1 of Study 5, women used games to satisfy autonomy needs more than did men, though this difference was attenuated in Wave 2. Generally, both groups showed similar variances, except where noted.

Taken together, these results do not seem to suggest that men and women use games to satisfy needs in radically different ways, though there do appear to be some robust patterns. In particular, men seem to favour using games to satisfy competence needs, and women seem to favour using games to satisfy relatedness needs. Crucially, both groups are high on both needs, in absolute values—both men and women use games to satisfy both of these needs—but there do appear to be measurable, if slight, differences between the two groups.