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" Understanding Online Gaming:
The Interplay of Gaming Motivations, Genre Preferences and Internet Gaming Disorder "

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## Abstract

Research focusing on the complex system surrounding online gaming is still relatively rare. The aim of this study was therefore to explore connections between individual characteristics (age and gender), gaming motivations (Yee, 2006b), genre preferences (*MMORPG, MOBA, FPS*), gaming time and Internet Gaming Disorder (*IGD*; APA, 2013) using an online survey. Data from 3768 online gamers ranging from 18-52 years ($M = 25.72$; $SD = 6.83$) were analysed. The three gaming motivations *Achievement*, *Immersion* and *Social* were measured with an adapted version of Yee's (2006b) motivation scale. *IGD* was measured with a short scale (*IGDS9-SF*; Pontes & Griffiths, 2015) based on the nine diagnostic criteria proposed in the DSM-5 (APA, 2013). Genre preferences were operationalised in form of three items asking for the enjoyment of *MMORPG*s, *MOBA*s and *FPS* games. Results showed that genre preferences were significantly predicted by age, gender and motivations. *MOBAs* and *FPS* games were preferred by younger, *Achievement*-motivated gamers and men, whereas *MMORPGs* were preferred by *Immersion*-motivated gamers and women. Motivations, age and gaming time further significantly predicted *IGD*. Younger, highly time investing and *Achievement*- or escapism-motivated gamers reported higher *IGD* scores. Age and gender effects were also observed. Older gamers spent less time gaming and were motivated to a lesser degree by *Achievement* and *Social* motivations than younger gamers. Women reported lower *Achievement*, but higher *Social* and *Immersion* motivations than men. Neither effects of genre preference on *IGD* nor clustering of gamers according to their motivations were observed. Theoretical and practical implications are discussed.



*Keywords:* gaming motivations, Achievement, Immersion, Social, escapism, online game, game genre, Massively Multiplayer Online Role-Playing-Game (*MMORPG*), First Person Shooter (*FPS*), Multiplayer Online Battle Arena (*MOBA*), Internet Gaming Disorder (*IGD*), problematic gaming, pathological gaming, *IGDS9-SF*

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# 1. Theoretical Background

## 1. 1. Introduction

After more than 35 years since the early onsets of the industry in the 1970's, the global game[1] market share reached $35 billion in 2007 (Newzoo, 2018). Within the past 10 years it has further increased by 247.71% ($86.7 billion) reaching $121.7 billion in 2017 and it is predicted to exceed $180 billion by 2021. About 52% of the revenues produced by games in 2018 (137.9 billion) were generated in Asian and Oceanic regions closely followed by 23% in North America and 15% in Western Europe. Together, these regions account for roughly 90% of the global game market share, while all other regions generate only 10% of the revenues (Newzoo, 2018). Second to China which has the largest online population of 850 million are the United States (US) with 265 million gamers (Newzoo, 2018). 60% of Americans play games on a daily basis and every US household is home to an average of two gamers. 64% of US households own a device on which to play video games; 41% play on a personal computer (PC), 36% on a dedicated gaming console, another 36% on a smartphone and 24% on other wireless devices such as tablets. Dedicated handheld systems and virtual reality devices are the least popular platforms with 14% and 8% respectively (ESA, 2018). These numbers suggest that many households own not only one, but multiple gaming devices. Looking at the contribution of each platform towards the global video gaming market share, smartphones are by far the most "productive" platform generating $56.4 billion (41%) in revenues. PC games and console games generate about a quarter of the total revenues each with $32.9 billion (24%) and $34.6 billion (25%) respectively. The remaining 10% are being contributed by tablet games (Newzoo, 2018).

With games spreading to a multitude of platforms and thereby becoming more accessible to a bigger portion of the population, the stereotype of the "teenage-boy gamer" (ESA, 2018; Lenhart et al., 2008, cited in Cade & Gates, 2017) does not hold true anymore. Only 28% of gamers in the US are under 18 years old, whereas 29% are 18-30 years old and 23% are over 50 years old. The least represented age group are the 29-36-year olds which only make up a fifth of the whole gaming population (Statista, 2018a). Apart from gamers not conforming to the stereotypical age ascribed to them, they are also not predominantly male anymore. Within the last 10 years the percentage of female gamers in the US has been continuously varying between 40% and 48% and represents an almost equally big portion of the online population as men (Statista, 2018b).

[1] The term "games" will exclusively refer to video games in this paper unless specified otherwise.

Video games are thus becoming increasingly relevant for a multitude of demographic groups all over the world, and the need to understand their popularity and possible effects has simultaneously been growing stronger. While early research was often exclusively concerned with possible negative outcomes such as increased aggression and anti-social behaviour (for a critical review and meta-analysis see Anderson & Bushman, 2001; Griffiths, 1999; Sherry, 2001), the focus has shifted towards a more comprehensive understanding of gaming in recent years. Some of the suggested benefits of playing games have been improved visuospatial attention (Ferguson, 2007; Green & Bavelier, 2006), reduced reaction times (Dye, Green & Bavellier, 2009), improved multi-tasking abilities (Chiappe, Conger, Liao, Caldwell & Vu, 2013), increased prosocial behaviour (Gentile et al., 2009), more effective learning (Aguilera & Mendiz, 2003; Gee, 2005; Kato, 2010), improved mood and decreased stress (Russoniello, O'Brien & Parks, 2009), a heightened mental health and self-concept (Durkin & Barber, 2002) and even reduced symptoms of clinical depression (Russoniello, Fish & O'Brien, 2013).

Utilising this potential and drawing such benefits from gaming, however, is only possible, if the gaming behaviour itself is not problematic or unhealthy. It is therefore necessary to establish a framework which differentiates between healthy and unhealthy[2] gaming behaviour. The task of identifying valid criteria for determining whether gaming is healthy or unhealthy is a difficult one. The two behaviours are not mutually exclusive, but rather two opposite ends of a continuum (Kuss & Griffiths, 2012a). The lack of a consensus in this regard becomes clear when looking at estimated prevalence rates of problematic gaming. Estimations vary drastically (Griffiths, Kuss & King, 2012) and range from 0.3-3% (Ferguson, Coulson, & Barnett, 2011; King, Delfabbro & Griffiths, 2013a; Van Rooij, Schoenmakers, Vermulst, Van Den Eijden & Van De Mheen, 2011), over 8-9% (Gentile, 2009; Gentile et al., 2011), up to 44.5% (Hussain, Griffiths & Baguley, 2012). Apart from causes related to sample composition, age and culture (King, Haagsma, Delfabbro, Gradisar & Griffiths, 2013b), a big reason for the observed discrepancies are the different conceptualisations used to define and measure problematic gaming behaviours (Lopez-Fernandez, Honrubia-Serrano, Baguley & Griffiths, 2014).

### 1. 2. Internet Gaming Disorder

An attempt of a standardised distinction between healthy and unhealthy gaming behaviour was made with the publication of the 5th edition of the Diagnostic and Statistical Manual of Mental Health Disorders (DSM-5; American Psychiatric Association [APA], 2013). It

[2] The terms unhealthy gaming and problematic gaming are being used interchangeably in the current study.

defines a problematic, even pathological, gaming behaviour called Internet Gaming Disorder (*IGD*) as the "*persistent and recurrent use of the Internet to engage in games, often with other players, leading to impairment or clinically significant distress*" (APA, 2013, p. 795). Drawing from other disorder frameworks like the ones for pathological gambling and substance dependence, the American Psychiatric Association (APA) conceptualises *IGD* as a behavioural addiction. The proposed nine diagnostic criteria are: (1) preoccupation with games, (2) withdrawal symptoms when not gaming, (3) development of tolerance and a need to spend an increasing amount of time gaming, (4) loss of control and/or failed attempts to stop gaming, (5) loss of interest in other activities, (6) continued gaming despite negative consequences, (7) lying about the time spent gaming, (8) use of gaming as a coping mechanism and escape from problems and (9) risking or losing important relationships, jobs or opportunities in career or education due to gaming (APA, 2013). According to the APA, five out of those nine symptoms must have been present within a 12-month time frame for an *IGD* diagnosis. However, due to the concept still being in its beginning stages, *IGD* is only placed in section III of the DSM-5 which lists all disorders that require further research (APA, 2013) and should be interpreted cautiously.

The lacking consensus on the subject is reflected in the amount of controversy that *IGD* has been subjected to since the publication of the manual (e.g., Griffiths et al. 2016; Király, Griffiths & Demetrovics, 2015a; Petry et al., 2014, 2016). One major point of criticism is the addiction disorder framework which has been applied to problematic gaming behaviour. On the one hand, there is research suggesting that technology-based addictions can indeed result in symptoms commonly seen in substance-related addictions such as salience, withdrawal, tolerance and conflict (Kuss, Griffiths, Karila & Billieux, 2014; Kuss, Shorter, Van Rooij, Griffiths, & Schoenmakers, 2014). On the other hand, some studies scrutinise the comparability of traditional problem-behaviour and problematic online-behaviour and question the applicability of classical disorder and addiction frameworks (De Leo & Wulfert, 2013). Some criteria have been specifically criticised for a lack of validity in identifying *IGD* like the criterion of deception (King et al., 2013b; Ko et al., 2014) or for not being able to distinguish between healthy and unhealthy gaming behaviours like the criterion of escape (Ko et al., 2014; Lemmens, Valkenburg, & Gentile, 2015; Pontes, Király, Demetrovics, & Griffiths, 2014). Furthermore, an understanding of how withdrawal manifests itself in *IGD* is still underdeveloped and clinical descriptions of the symptoms are lacking (e.g., Kaptsis, King, Delfabbro & Gradisar, 2016).

Another area of controversy is the absence of a differentiation between gaming addiction and high engagement (Charlton & Danforth, 2010). It has been argued that the first criterion in its current form would pathologise highly engaged behaviours too easily (Kardefelt-

Winther, 2014a). A preoccupation with topics of interest is not particularly uncommon and does not necessarily indicate unhealthy behaviour (Griffiths et al., 2016). Comparably problematic is the missing distinction between primary and secondary diagnostic criteria since the nine proposed indicators of unhealthy gaming behaviour may not be equally relevant for *IGD* (Király et al., 2015a; Rehbein, Kliem Baier, Mößle & Petry, 2015). This raises serious concerns regarding their diagnostic reliability.

The most disputed aspect of *IGD* has been the notion that a gaming disorder is specific to online games (Griffiths & Pontes, 2014). In the DSM-5 it is stated that *IGD* is "*also commonly referred to as Internet use disorder* [or] *Internet addiction*" (APA, 2013, p.796.) which strongly indicates the Internet as crucial part of the disorder. Yet, at the same time its importance is being put up for debate with the statement that *IGD* "*could involve non-Internet computerized games as well, although these have been less researched*" (APA, 2013, p.796). Those inconsistencies beg the question whether the platform Internet is indeed the crucial part of *IGD*, whether it is the activity of gaming itself which can be problematic or if it is a combination of both which potentially leads to the development of a disorder. In case of the Internet being responsible for unhealthy gaming behaviour, the issue of differentiating it from other Internet related disorders arises. In contrast, if aspects of the gaming activity itself lead to problem-behaviour, it becomes necessary to establish which characteristics of gaming are putting gamers at risk of developing a disorder. Should these two aspects be equally relevant, an integration of both approaches is essential (Griffiths, King, Demetrovics, 2014). These considerations are centre to the ongoing controversy of whether *IGD* should be treated as a part of Internet addiction[3] (*IA*) in general, as a part of problematic video gaming or as an independent construct altogether (Király, Nagygyörgy, Griffiths & Demetrovics, 2014b).

When investigating *IGD*, the first approach is to assume that the Internet is the starting point for the development of a gaming disorder (Young, 1998, 2009). The idea is that *IA* constitutes an underlying construct which can manifest itself in different forms of online behaviour without changing its core characteristics (Cash, Rae, Steel & Winkler, 2012; Dalal & Basu, 2016). This "unitary position" sees the activity of using the Internet as the cause of problem-behaviours, while its specific purpose is secondary (Starcevic & Billieux, 2017). Under those assumptions, problematic use of online social networking sites (Baek, Bae & Jang, 2013; De Cock et al., 2014; Kuss & Griffiths, 2011; Tsitsika et al., 2014), "cyber-shopping" addiction (Duroy, Gorse & Lejoyeux, 2014), online gambling addiction (Griffiths, 2003; Griffiths &

[3] Internet addiction and problematic Internet use are being used interchangeably in the literature.

Barnes, 2008) and online pornography addiction (Grubbs, Volk, Exline & Pargament, 2015; Love, Laier, Brand, Hatch & Hajela, 2015) as well as *IGD* merely constitute subtypes of *IA*.

Despite the appealing idea that one underlying disorder can explain an array of problem-behaviours, this position has been criticised for artificially homogenising unhealthy online activities. It is argued that *IA* is a very heterogenous construct and should therefore not be treated as a single entity but rather as a spectrum of distinct disorders (Andreassen et al., 2016). Contrary to the unidimensional concept, the "spectrum position" treats *IA* as a multidimensional construct consisting of various individual disorders with a common platform (Starcevic & Billieux, 2017). It acknowledges the existence of a generalised *IA* next to the specific problem-behaviours. In distinction to the "unitary position", generalised *IA* is not seen as the singular construct underlying all other problematic online behaviours, but as one amongst many (Laconi, Tricard & Chabrol, 2015; Montag et al., 2015).

Based on this line of argumentation, studies have sought to investigate whether *IA* and *IGD* are indeed the same construct as suggested in the DSM-5 (APA, 2013) or not. Various significant differences between them were uncovered. People affected by *IA* were predominantly female and spent most of their time on the Internet chatting, networking and gaming. In contrast, people with signs of *IGD* were predominantly male and passed their time online almost exclusively with gaming (Király et al., 2014a). Males affected by *IGD* reported more sleeping problems and females reported more suicidal thoughts than men or women affected by *IA*. Both genders reported more subjective suffering when showing signs of *IGD* (Rehbein & Mößle, 2013). More people were affected by *IA* than by *IGD* (Király et al., 2014a) and their numbers showed a trend to grow larger towards the end of adolescence while the opposite was true for the group of people affected by *IGD* (Rehbein & Mößle, 2013). Furthermore, *IA* and *IGD* seemed to be independent from one another since only few people reported signs of both disorders simultaneously (Király et al., 2014a; Rehbein & Mößle, 2013). These demographic, behavioural and symptomatic differences strongly indicate that *IA* and *IGD* are, in fact, separate nosological entities and should be treated as such (Griffiths & Pontes, 2014).

The second approach taken in studies investigating *IGD* focuses on the games themselves rather than on the platform Internet. Instead of referring to unhealthy gaming behaviour as *IGD* or even *IA,* terms like *Problematic/Pathological Video Gaming* or *Video Gaming Disorder/Addiction* are used (e.g., King et al., 2013a; Mentzoni et al., 2011; Wölfling, Thalemann, & Grüsser, 2008). They refer "*to a persistent and maladaptive pattern of video game playing behaviour*" (King et al., 2013a, p.819). In contrast to the definition in the DSM-5 (APA, 2013), they do not specify the type of platform used for gaming. Accordingly, a categorisation into

online and offline games is often deemed unnecessary by researchers following this approach (King & Delfabbro, 2013; Porter, Starcevic, Berle & Fenech, 2010). Still, this lack of differentiation may be inadequate since it ignores findings which indicate that there are significant differences between online and offline gaming (Griffiths & Meredith, 2009; Lemmens & Hendriks, 2016; Thorens et al., 2014; Van Rooij et al., 2014). Studies have for example found that problem-gaming was most common amongst gamers who played online games (Van Rooij et al., 2014), that the patients who consulted an addiction outpatient clinic regarding problematic Internet use were mainly online gamers (Thorens et al., 2014) and that online games showed stronger correlations with *IGD* (Lemmens & Hendriks, 2016) and other negative outcomes (Smyth, 2007) in comparison to offline games. It thus seems important to make a distinction between games which are Internet-based and those which are not.

The third approach tries to integrate both aforementioned perspectives (Demetrovics et al., 2012; Kim & Kim, 2010). It states that problematic gaming behaviour can be more common in online gamers than in offline gamers while still being distinct from other Internet-based problem-behaviours. The reasoning behind this idea is that the Internet has unique properties which foster the development of an addiction. It is readily available, easily accessible and allows for rapid communication, anonymity, disinhibition and riskless interactions (e.g., Kuss & Griffiths, 2012b; Thorens, 2012; Wéry & Billieux, 2017), all of which facilitates potentially addictive behaviours (Nothrup, Lapierre, Kirk & Rae, 2015; Starcevic & Aboujaoude, 2017). Regarding *IGD* this implies that playing games can lead to problematic behaviour by itself but playing them online can foster the development of a disorder or addiction even more.

The current study adopts this integrative approach and treats *IGD* as a specific behavioural disorder which is neither fully part of *IA* nor of general problem-gaming. In contrast to the statements in the DSM-5 which imply that *IGD* may be the same construct as *IA* and that it might also include offline gaming (APA, 2013), the employed definition makes a clear distinction. When using the term *IGD*, the current study exclusively refers to problematic online gaming and not to other problematic Internet-based behaviours or offline gaming. Yet, in its essential form this view still conforms to the DSM-5 definition of *IGD* as a behavioural addiction which is expressed by excessive online gaming-behaviour with negative outcomes for the affected person (APA, 2013). Like in the DSM-5 (APA, 2013), *IGD* is being treated as behavioural addiction and the proposed nine diagnostic criteria are therefore employed as indicators of problematic online gaming behaviour. Despite the ongoing controversy regarding the adaption of an addiction disorder framework for problem-behaviour such as *IGD*, this approach seems warranted. Various researchers have pointed out that substance-related and behavioural

addictions share more commonalities than differences (Grant, Potenza, Weinstein & Gorelick, 2010; Griffiths, 2005) making the established disorder criteria a good starting point to further explore this relatively new disorder.

Having established the meaning of *IGD* in the current study, the question about possible causes and risk-factors remains. Despite its effects not being uncontroversial, gaming time (the amount of time spent playing video games) is a variable which has been frequently connected with *IGD* (e.g., Hellström, Nilsson, Leppert & Åslund, 2012; Lemmens & Hendriks, 2016; Király et al., 2014a). It has also been used as an indicator of video game engagement and involvement (Kowert, Festl & Quandt, 2014; Lo, Wang & Fang, 2005; Shen & Williams, 2011). Nevertheless, an exclusive use of gaming time as predictor of *IGD* has been criticised and some researchers emphasise that other potential risk-factors must be considered as well (Hellström et al., 2012). A multifactorial aetiological model has been proposed (see Figure 1) which includes the games, the gamer and the environment of the gamer (Ferchow, Franke, Jagla & Nowki, 2015; Rehbein & Mößle, 2012).

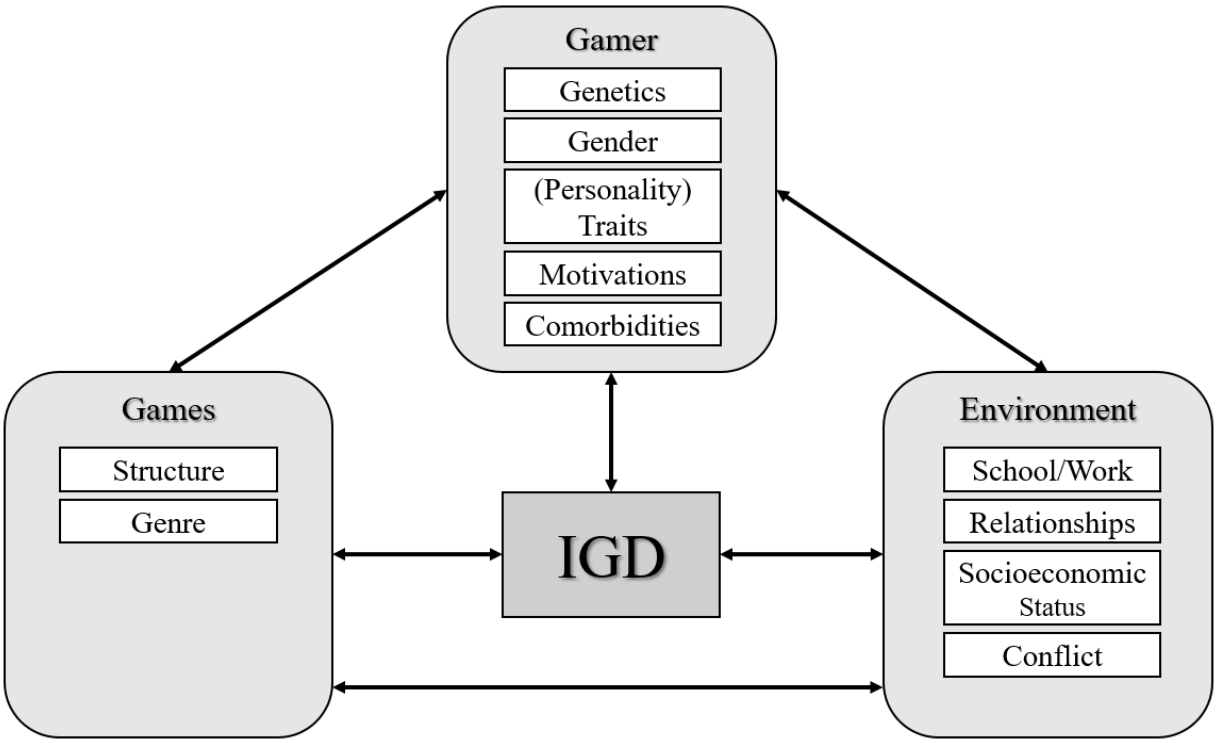


*Figure 1.* Causes and risk-factors of *IGD* (adapted from Ferchow et al., 2015 and Rehbein & Mößle, 2012)

Out of the listed factors, gamer-focused aspects like personality-traits, other individual characteristics and comorbidities have gotten a lot of attention from researchers. Studies investigating the Big Five personality traits have for example found that people showing signs of

unhealthy gaming behaviours reported decreased extraversion (Charlton & Danforth, 2010), heightened neuroticism (Mehroof & Griffiths, 2010; Peters & Malesky, 2008), decreased emotional stability (Charlton & Danforth, 2010) and decreased agreeableness (Charlton & Danforth, 2010; Collins, Freeman & Chamarro-Premuzic, 2012; Peters & Malesky, 2008). Furthermore, *IGD* also eems to be connected to other characteristics such as aggression (Mehroof & Griffiths, 2010; Kim, Namkoong, Ku & Kim, 2008), self-control (Collins et al., 2012; Kim et al., 2008) and self-regulation (Seay & Kraut, 2007), self-esteem (Ko, Yen, Chen, Chen & Yen, 2005), loneliness (Caplan, Williams & Yee, 2009; Kök Eren & Örsal, 2018), life satisfaction (Wang, Chen, Lin, Wang, 2008), attachment styles (Greschner et al., 2017), emotional intelligence (Herodotou, Kambouri & Winters, 2011) and narcissistic personality traits (Kim et al., 2008). Most of these studies are purely correlational and no conclusions regarding the direction of causality can be drawn. There are some longitudinal studies, which have found an increased risk of problematic gaming behaviour for people reporting high impulsivity and low empathy (Gentile et al., 2011), low self-esteem (Lemmens, Valkenburg & Peter, 2011) and low social competences (Gentile et al., 2011; Lemmens et al., 2011), suggesting a causative nature of these traits. A feeling of loneliness has further been shown to act both as antecedent and consequence of problematic gaming (Lemmens et al., 2011).

Regarding comorbidities various studies have found connections between problem-gaming and ADD/ADHD (Bioulac, Arfi & Bouvard, 2008; Tolchinsky & Jefferson, 2011; Yen et al., 2016), depression (Li, Liau & Khoo, 2011; Mentzoni et al., 2011; Peng & Liu, 2010) and anxiety (Mehroof & Griffiths, 2010; Mentzoni et al., 2011; Peng & Liu, 2010). Due to the study designs it is yet again unclear whether these psychiatric symptoms are a consequence or a cause of *IGD*, although there have been indications that depression, anxiety and social phobia are results of problem-gaming rather than risk-factors (Gentile et al., 2011).

In comparison, findings regarding potential environmental influences are a lot scarcer. Most of the time they are addressed in a diagnostic context concerning environmental outcomes as indicators of an already existing *IGD*. Nevertheless, there are studies suggesting connections between *IGD* and socioeconomic aspects like education level and unemployment (Cypra, 2005; Elliott, Golub, Ream & Dunlap, 2012a) as well as school- and family-related issues in adolescents (e.g., Baier & Rehbein, 2009; Batthyány, Müller, Benker & Wölfling, 2009; Skoric, Teo & Neo, 2009). Psychological research focusing on the characteristics of games themselves is also rare. A theoretical model with five structural components of games has been proposed, containing social features, manipulation and control features, narrative and identity features, reward and punishment features and presentation features (King, Delfabbro & Griffiths, 2010).

The control and management features like managing resources or mastering the game and especially the reward and punishment features such as levelling up, earning points, earning meta rewards and completing the game were rated more highly by gamers with unhealthy gaming behaviours (King et al., 2011). It has been suggested that an activation of reward networks could play a similar role in problematic gaming as it does in substance abuse (Hoeft, Watson, Kesler, Bettinger & Reiss, 2008; Koepp et al., 1998) linking the structural aspects of games to neurobiological reward processes.

Despite being most consistently associated with *IGD*, the direct effects of psychological variables such as anxiety and loneliness have been drawn into question. Studies have found that these aspects sometimes do not directly lead to negative outcomes, but that they are instead mediated by certain motivations which facilitate the development of problem-behaviours (Kardefelt-Winther, 2014b; Király et al., 2015b). A potential reason for these findings is that, in accordance with the *Self-Medication-Theory* (Khantzian, 1985), gaming could serve as a type of coping mechanism similar to substance abuse in other addictive disorders (Király et al., 2015b). A less pathological approach is taken by the *Mood Management Theory* (Zillmann, 1988, cited in Reinecke, 2017) which states that people use media to optimise their affective state. On that account, a person might not only game for recreational purposes but to fulfil specific needs and to alleviate negative emotions caused by real-life problems (Kardefelt-Winther 2014b; Király et al., 2015b). As a result, negative outcomes could be more common for these "compensatory gamers" because they are highly invested and spend more time gaming than people driven by other motivations (Kardefelt-Winther, 2014b). Furthermore, it is possible that motivations do not only pose as risk factors but that they sometimes also function as protective mechanisms which decrease the likelihood of negative consequences (e.g., Hellström et al., 2012). Overall, these findings emphasise the significance of understanding the motivations behind gaming when differences between healthy and unhealthy behaviours are being explored.

There have been some studies exploring these gaming motivations, most of which have exclusively focused on one type of game (e.g., Fuster, Carbonell, Chamarro & Oberst, 2013; Hussain, Williams & Griffiths, 2015; Zanetta-Dauriat et al., 2011). However, other researchers have pointed out the importance of distinguishing between different types of games (Demetrovics et al., 2011; Hilgard, Engelhardt & Bartholow, 2013; Kahn et al., 2015). Genres differ in structural aspects (King et al., 2010) as well as the activities and challenges which they offer (Adams, 2014) and, for that reason, also have different potentials to satisfy the individual needs of gamers (Hilgard et al., 2013). For example, if a person is seeking out social interactions they

are more likely to choose games which allow them to chat with other players in a relaxed environment. In contrast, people which are more interested in competition will value games providing competitive challenges more highly. As mentioned before, the different structural aspects of games also have varying potentials to elicit negative outcomes (King et al., 2011). Consequently, problematic behaviours could arise from the games themselves and not only from the motivations which are driving gamers to play.

Taken together these considerations suggest that gaming motivations, game genres and *IGD* interact in a complex manner. People are motivated to play games by individually different needs, some of which may be more likely to lead to problematic behaviours than others. People may also choose certain games because they manage to satisfy these individual needs. Additionally, the chosen games themselves have specific characteristics which, again, have the potential to elicit unhealthy behaviours. It becomes clear that it is a challenging task to determine whether the motivations, the genres or both are responsible for unhealthy gaming habits and in which type of relationship they stand to each other. Yet, only few studies have attempted to explore the aspects involved in this complex system (Floros & Siomos, 2012; Laconi, Pirés & Chabrol, 2017; Männikö, Billieux, Nordström, Koivisto & Kääriäninen, 2017). Hence, the aim of the current study is to shed light on the exact nature of the connections between these variables. The main questions asked in this paper are "W*hat* is being played?", "W*hy* is it being played?" and "How do those two interact with each other and with *IGD?*" The "*What*" refers to game genres and the "*Why*" to gaming motivations. Both terms will be further elaborated in the following two subchapters and specific definitions will be sought out in order to differentiate them from similar constructs.

### 1. 3. Game Genres

Games can be categorised based on different classification criteria. Some of the most common criteria the gaming platforms (ESA, 2018; Newzoo, 2018), the genres (Adams, 2014; Steffano, 2018) and the utilisation of the Internet (Griffiths & Meredith, 2009; Lemmens & Hendriks, 2016; Thorens et al., 2014; Van Rooij et al., 2014). The first criterion distinguishes games according to the platforms which they are played on: PC's, consoles, smartphones and other wireless devices or handheld systems (ESA, 2018; Newzoo, 2018). PC's and consoles are the most established gaming devices with the first computer game *Spacewar* being developed in the early 1960's (Russel, 1962) and the first gaming console *Magnavox Odyssey* becoming commercially available in the early 1970's (Baer, 1972). Mobile phones did not enter the video game market until more than 20 years later when Hagenuk released *Tetris* (Hagenuk,

1994) and Nokia released *Snake* (Nokia, 1997). Today PC's are still the preferred gaming platform in US households followed by consoles and smartphones who are equally popular (ESA, 2018). Furthermore, despite smartphones individually holding the biggest global game market share, PC and console games make up nearly half of the worldwide game revenues (Newzoo, 2018) when taken together. While a categorisation according to the employed gaming devices is widely used and makes sense from a game developer's and consumer's perspective, it only holds limited value when attempting to organise games into mutually exclusive groups. Nowadays many games can be played on multiple platforms and fall into more than one category. For example, *Fortnite: Battle Royal* (Epicgames, 2017) - a currently popular game - is available on PC, various gaming consoles, smartphones and other handheld devices such as tablets and covers nearly the whole range of available devices (www.epicgames.com/fortnite/en-US/faq). As a result, grouping games according to their platforms does not achieve clearly defined categories and further comes with a great loss of information.

Out of the three mentioned criteria, genres are the ones which retain the most information about a game after it has been categorised. They are defined as "*categories of games characterized by particular kinds of challenge, regardless of setting or game world content*" (Adams, 2014, p.67) and thereby state something about the games themselves rather than their surrounding aspects. Following this definition challenges are the distinguishing characteristics of genres and by claiming membership to one, the specific attributes of the corresponding challenges are ascribed to a game (Adams, 2014). While these challenges were once limited by their hardware, advances in technology have steadily broadened the range of possibilities. Some of the current, broad game genres are: Shooter, Action, Adventure Role-Playing, Strategy, Fighting, Sports, Racing, Arcade, Platform, Simulation and Puzzle games (Adams, 2014; ESA, 2018; Lemmens & Hendriks, 2016). These main genres are then further divided into subgenres or hybrid genres since games within one of these bigger categorisations can be quite heterogeneous (Adams, 2014; Nuyens et al., 2016). However, there is no consensus on what exactly qualifies as a main genre, a sub-genre or a hybrid genre (e.g., Donati, Chiesi, Ammannato & Primi, 2015; Elliott, Ream, McGinsky & Dunlap, 2012b; Rehbein, Psych, Kleimann, Mediasci & Mößle, 2010; Rehbein, Staudt, Hanslmaier & Kliem, 2016). For example, some categorise Action-Adventure games as distinct genre despite them combining aspects of both Action and Adventure games but treat Shooter, Fighting and Platform games as subgenres of Action games (Steffano, 2018). These conceptual inconsistencies are also a result of the expanding repertoire of games. With their growing number the initially strict boundaries between genres have become more fluid and an unambiguous classification of games has become more

difficult (Adams, 2014). Nowadays many games fall into multiple genres and new genres keep appearing as technology advances (Adams, 2014; Kuss & Griffiths, 2012a).

The third classification criterion is based on the implementation of the Internet. While games have been utilising this platform since the late 1970s (Bartle, 1996), its growing popularity has made a distinction between offline and online games necessary. Their differences are primarily expressed by varying game-design and playstyle. Offline games are mainly played alone and are rarely ever subject to change after their release, whereas online games usually evolve over time and are mostly played with other people (Király et al., 2014b). This combination of an ongoing game-play without a predetermined end and a naturally social environment makes online games inherently different from offline games even when they belong to the same genre. Consequently, when trying to organise games into distinct groups, both the genre and the context (offline versus online game) must be taken into account. Considering that the focus of this study does not lie on the game genres themselves but on their possible connection to *IGD* and that the employed definition of *IGD* exclusively refers to problematic *online* gaming behaviour, merely the online game genres are deemed relevant in this study.

The five most popular online game genres of 2017 were Multiplayer Online Battle Arena (*MOBA*) games, Massively Multiplayer Online Role-Playing games (*MMORPG*), Shooters, Strategy games and online gambling (Plarium, 2017). Despite representing a popular online activity, online gambling will be disregarded in the current study since it is viewed as a type of online problem-behaviour distinct to problem-gaming (e.g., Starcevic & Billieux, 2017) and accordingly does not qualify as a type of video game genre. The remaining four genres demonstrate that even after a division into online and offline games the issue of identifying distinct and mutually exclusive genres remains.

On the one hand, *MMORPG*s and *MOBA*s are relatively narrow genre definitions. *MMORPG*s are a sub-genre of Role-Playing-Games and *MOBA*s are considered to be Action-Real-Time-Strategy games, a hybrid between the Action and the Strategy genre (Steffano, 2018). On the other hand, Shooters and Strategy games are very broad genres and encompass a wide variety of games (Adams, 2014; Steffano, 2018). The first two genres thus represent a homogeneous group of games, whereas the latter two are very heterogeneous. A second critical point is that *MOBAs* are referred to as an independent genre despite generally being classified as a sub-genre of Strategy games (Steffano, 2018). If Strategy games and *MOBA*s were listed as one category it would only be a matter of distinguishing sub-genre from main genre. However, since both genres are listed simultaneously (Plarium, 2017) some games may fall into both categories and an unambiguous classification is not possible. Given these conceptual

struggles it seems necessary to narrow the number of genres down to a few mutually exclusive, homogeneous groups when aiming to identify individual contributions of game genres to *IGD*.

*MMORPG*s fulfil the pursued genre characteristics. Games falling into this genre all share a specific set of characteristics and form a homogeneous group (Steffano, 2018). They are also distinct to the other listed genres (Plarium, 2017) and can easily be differentiated from them. The next genre, *MOBA*, also encompasses a very narrow field of games which are highly similar to each other. The issue with *MOBA*s is that they belong to the main genre Strategy and do not form a distinct category when listed together with it. The Strategy genre itself consists of many sub-genres such as Real-Time-Strategy, Wargames, Turn-Based-Tactics as well as *MOBA*s. These types of games share the challenge of strategic gameplay but are otherwise a very heterogeneous group (Steffano, 2018). Considering its heterogeneity, it seems sensible to drop the broad Strategy genre and retain the more homogeneous sub-genre of *MOBA* games. Shooter, the final genre, does not overlap with any other listed genre but has various subgenres such as First-Person-Shooters (*FPS*), Third-Person-Shooters as well as "Shoot 'em Up" games (Rehbein et al., 2016) and is just as heterogenous as the Strategy genre. Out of the Shooter sub-genres, *FPS* is often treated as the most popular one and has frequently been the topic of research (Elliott et al., 2012b; Metcalf & Pammer, 2014; Rehbein et al., 2016). The focus on the *FPS*[4] genre will also be adopted in the current study with the aim to extract a more homogeneous group of games from the broad Shooter genre.

After narrowing down the initial five online game genres (Plarium, 2017), three mutually exclusive and homogeneous genres remain:

1. *MMORPG*s are large online worlds populated by thousands of gamers who control customisable characters in the game. The aim is to become more powerful and to advance through the game by completing different types of tasks and challenges either alone or together with other players (Kneer & Rieger, 2015; Kuss, Louws & Wiers, 2012; www.techopedia.com/definition/1919/massively-multiplayer-online-role-playing-game-mmorpg).
2. *MOBA*s are online arenas in which two teams of players compete to defeat each other by controlling different pre-designed characters with unique skills and abilities (Bonny & Castaneda, 2017; Kokkinakis, Cowling, Drachen & Wade, 2017).
3. *FPS* are tactical shooter games experienced from a first-person perspective in which players use guns and similar weapons in order to achieve a variety of designated

[4] In the current study the *FPS* genre only refers to *online* First-Person-Shooter games.

goals alone, as a team or in competition with other players (Király et al., 2014b; Kuss et al., 2012; www.techopedia.com/definition/241/first-person-shooter-fps)

While being mutually exclusive in terms of game categorisation, these three genres share a couple of common aspects. For one, the big *MMORPG*, *MOBA* and *FPS* game titles are all primarily played on PC or console. For example, the *MOBA League of Legends* (Riot, 2009) had 100 million monthly active players in 2016 (Volk, 2016) and was the most played PC game in 2017 (Plarium, 2017). *World of Warcraft* (Blizzard Entertainment, 2004) is continually the most popular *MMORPG* (Plarium, 2017) and is exclusively playable on PC. Popular *FPS* games such as *Counter-Strike: Global Offensive* (Valve Corporation, 2012) and *Overwatch* (Blizzard Entertainment, 2018) are only available on PC and console. Out of the three genres, *MOBA* is the only one which has recently seen a boom of games on mobile devices, both through adaptions of originally PC-based games like *Mobile Legends* (Moonton, 2016) as well as independent mobile games like *Arena of Valor* (Timi Studio Group, 2016). Since handheld devices and PC's or consoles are quite different in nature, this one-sided increase of mobile game versions might affect the homogeneity of the *MOBA* genre more than the other two genres. Hence, only games using PC or console are included in the current study with the aim to minimise genre heterogeneity and maintain mutually distinct groups.

The second similarity is that all three categories of games are online multiplayer genres. They consist of games which are typically played online by multiple people who are participating in the same game at the same time (www.dictionary.com/browse/multiplayer). Social interactions are fostered and facilitated in those online environments, giving them their social nature (Király et al., 2014b; Nuyens et al., 2016). More than half of the most frequent gamers in the US play multiplayer games one or more times per week (EFA, 2017) which begs the question why people chose to play these online multiplayer games. Researchers argue that the opportunity for social interactions makes online multiplayer games particularly appealing (Kowert, Vogelgesang, Festl & Quandt, 2015; Kuss, Griffiths & Pontes, 2017; Lo et al., 2005; Shen & Williams, 2011). Consequently, it could be argued that these games are sought out by gamers who seek out these interactions and are therefore socially motivated. But are social motivations the only driving forces behind online gaming or are there other ones as well?

### 1. 4. Gaming Motivations

Motivation is "*an affectively charged state that energizes and directs action aimed at the attainment of a reward or avoidance of a punishment*" (Schultheiss, Strasser, Rösch, Kordik & Graham, 2012, p.650). More easily put, motivations are *"reasons for acting or behaving in*

*a particular way"* (en.oxforddictionaries.com/definition/motivation). They are defined by their content (needs) as well as the processes employed to fulfil those and originate at the crossroads between the needs of a person and the present environmental cues. Motivations can be divided into implicit (automated and subconscious) and explicit (voluntary and conscious) motivations which is not to be confused with being intrinsically (from within) or extrinsically (by the surroundings) motivated. They differ from one person to another and elicit varying behaviours aimed at either attaining or avoiding certain outcomes. Motivations further need to be differentiated from motives. Opposing to motivations which are very dynamic motives are stable dispositions. Three of the most researched motives are achievement, power and affiliation (Shultheiss et al., 2012). All these constructs and phenomena which are unified by the single term motivation are as manifold as they are complex and can only be understood via a multidimensional approach. Since its beginnings, however, the field of motivational research has been very heterogeneous with countless theories competing for their right of existence. Every discipline advocates their own perspective which results numerous separate theories that are still in use despite the existence of integrative motivational models (Murayama, 2018).

Research exploring gaming motivations has often drawn from a few specific frameworks. Four regularly employed theories are: *Maslow's Hierarchy of Human Needs* (Maslow, 1943; Maslow & Frager, 1987), *Self Determination Theory* (Deci & Ryan, 1985, cited in Ryan & Deci, 2000b; Ryan, Rigby & Przybylski, 2006), *Social Cognitive Theory* (Bandura, 1986, cited in Bandura, 1999; Bandura, 2001) and *Uses and Gratifications Theory* (Katz, Bulmer & Gureitch, 1974; Rosengren, 1974, cited in Sherry, Greenberg, Lucas & Lachlan, 2006).

*Maslow's Hierarchy of Human Needs* (*HHM*) initially proposed five needs driving and motivating human behaviour: physiological needs, safety needs, needs of belonging and love, self-esteem needs and the need for self-fulfilment (Maslow, 1943); a sixth need called self-transcendence was added later on and is seen as the ultimate goal a person can reach (Maslow, 1971). Taking this theory as a starting point, Wan and Chiu (2006) found that the needs of the gamers in their sample indicated a two-factor model rather than a six factor one. This resembled a division of needs into dissatisfactory and satisfactory needs first proposed by Herzberg (Herzberg, Mausner & Snyderman, 1959, in Bassett-Jones & Lloyd, 2005). The *HHN* aspects of physiological needs, safety needs, needs of belonging and love and self-esteem needs comprise the dissatisfactory needs, while self-fulfilment need and need of self-transcendence relate to the satisfactory needs (Király et al., 2014b). The results of the study suggested that people showing signs of unhealthy gaming behaviours tend to be driven by the need to relieve dissatisfaction, whereas people with healthy gaming behaviours mainly seek out a sense of

satisfaction (Wan & Chiu, 2006). Another study employed a similar two-factor approach by differentiating between harmonious and obsessive passions and found that only obsessive passions were linked to problematic online gaming (Wang & Chu, 2007). Contrary to harmonious passions where behaviour is being pursued willingly, obsessive passions describe behaviours that have become attached to certain feelings like self-esteem (compare to self-esteem need of *HHN*) and have become uncontrollable (Vallerand et al., 2003). There is also some evidence that passions are linked to game genres (Puerta-Cortés, Panova, Carbonell & Chamarro, 2017). Nevertheless, research employing *HHN* itself to distinguish between game genres is lacking.

*Self Determination Theory* (*SDT*) orders motivations along a continuum between non-self-determined and self-determined and groups them into three main sections: amotivation, extrinsic motivation, which is further split into four subcategories, and intrinsic motivation. While it is seen as ideal to be entirely self-determined, it is usually both internal and external motivations which elicit behaviours that serve to fulfil the three basic human needs of competence, autonomy and relatedness (Ryan & Deci, 2000b). *Basic Psychological Needs* theory, a sub-theory of *SDT*, specifies that experiencing a fulfilment of these needs will lead to an increase in subjective wellbeing (Ryan, 1995). A second sub-theory, *Cognitive Evaluation Theory*, proposes that intrinsic motivations can be enhanced or undermined depending on how well needs of competence and autonomy are being fulfilled in certain situations (Ryan & Deci, 2000a). Based on *SDT* it has been suggested that video games are a new type of environment which can satisfy the three basic human needs and consequently enhance subjective wellbeing as well as intrinsic motivations for future play (Ryan et al., 2006). Consistent with these assumptions, effects of need-satisfaction on wellbeing and motivations have been uncovered (Ryan et al., 2006). Some studies have also employed this concept when investigating video game enjoyment or engagement (Przybylski, Rigby & Ryan, 2010; Tamborini, Bowman, Eden, Grizzard & Organ, 2010) and have developed tools for assessing motivations based on *SDT* (Lafrenière, Verner-Filion & Vallerand, 2012). However, there is little research linking *SDT* to *IGD* with merely one study connecting needs-frustration (a lack of need fulfilment) to problematic gaming (Mills, Milyavskaya, Heath & Derevensky, 2017). Moreover, studies assessing motivational differences between genres based on *SDT* are also lacking.

*Social Cognitive Theory* (*SCT*) is an extension of Bandura's social learning theory (Bandura, 1977) and sees personal factors (cognitions, emotions, biological factors), behavioural patterns and environmental events as reciprocally connected (Bandura, 2001). Within that triadic system people do not only learn from their own experiences but also have the opportunity to learn by observing others. This is generally referred to as observational learning

and can be divided into four stages: attention, retention, production and motivation. The last stage, motivation, is regarded as the link between learning certain behaviours and performing them. By cognitively processing the consequences of behaviours, outcome-expectations are developed which serve as motivators of future behaviour (Bandura, 2004). In the context of video games, three types of outcome-expectations with individual subcategories have been theorised: normative (moral self-reaction), game-external (pastime, escapism) and game-internal (performance, agency, status, sociability, believability, involvement). Normative outcomes refer to the perceived moral status of gaming and whether it is positively or negatively connotated. Game-external outcomes address the effects of gaming activities outside of the game whereas game-internal outcomes are direct consequences within the game itself (De Grove, Cauberghe & Van Looy, 2014). On top of these conscious motivational processes, habit is also proposed as a driving factor of behaviour (De Grove, Cauberghe & Van Looy, 2016). Repetitive actions can become habitual (LaRose & Eastin, 2010) and this can change outcome-expectations and behaviour (De Grove & Van Looy, 2015). Opposed to *SDT*, the concept of *SCT* accounts for normative aspects and game content related motivations (DeGrove et al., 2016) making this approach more suitable for differentiating between game genres. It faces a similar issue as *SDT* though with a lack of research exploring its predictive value regarding problematic online gaming behaviours.

*Uses and Gratifications Theory* (*UGT*) assumes that people play an active role in media consumption rather than only being passive recipients. They purposefully choose certain types of media or media content to gratify their needs and desires. It is those perceived needs which give rise to the motivations that drive behaviour (Rubin, 2009). Studies of the *UGT* tradition generally share a set of common topics and goals.

> *They are concerned with: (1) the social and psychological origins of (2) needs, which generate (3) expectations of (4) the mass media or other sources, which lead to (5) differential patterns of media exposure (or engagement in other activities), resulting in (6) need gratifications and (7) other consequences, perhaps mostly unintended ones.* (Katz et al., 1974, p.20)

The explored aspects are generally based on empirical data collection (e.g., Ruggiero, 2000; Sherry et al., 2006), and the derived needs and motivations are therefore often unique to a specific group of researchers (Katz et al., 1974). While it has led to criticism regarding the resulting heterogeneity of concepts (Rubin, 2009), this characteristic makes *UGT* very malleable. It can easily be adapted for research of new forms of media such as video games. In line with the empirical approach of *UGT*, Sherry and colleagues (2006) analysed interview data of

gamers and identified six important motivational aspects of gaming: arousal, challenge, competition, diversion, fantasy and social interaction. Another study employed Weibull's (1985, cited in Wu, Wang & Tsai, 2010) structural model of media use in the tradition of *UGT* to investigate motivations of gaming. It proposed that three motivations (achievement, enjoyment, social interaction) were part of one higher-order gratification factor. Together with structural aspects of media (fairness, incentive, security), this factor influenced the intention to continue gaming (Wu et al., 2010).

Apart from these predominantly theoretical approaches (an exception being *UGT*), many researchers have chosen a purely empirical path of exploring gaming motivations. They attempt to understand the drives behind gaming activity by asking gamers about their motivations directly and thereby minimise the superimposition of information with predetermined constructs. Bartle's (1996) original gaming motivation model is based on thorough examination of Multi-User Dungeon (*MUD*)[5] players and comprises four motivational types of gamers: achievers, killers, explorers and socializers. Yee's (2006b) model follows in Bartle's (1996) footsteps and is one of the more widely established frameworks of gaming motivations. Principal component analysis of 40 items on a sample of 3000 *MMORPG* players revealed 10 lower-order and three higher-order motivational components. These three main motivations and their according subscales are: *Achievement* (advancement, mechanics, competition), *Social* (socializing, relationship, teamwork) and *Immersion* (discovery, role-playing, customization, escapism; Yee, 2006b). The approach shows great similarities to the empirical *UGT* research (Li, Liau, Gentile, Khoo & Cheong, 2013). Moreover, parallels to *SDT* have also been drawn with *Achievement* motivations resembling the need for competency and *Social* motivations resembling the need for relatedness (Hilgard et al., 2013). Another connection is the one to the classic motives of human behaviour: achievement, power and affiliation (Heckhausen & Heckhausen, 2018; Schultheiss et al., 2012). The *Social* factor is in line with affiliation, while the *Achievement* factor consists of achievement motives as well as power motives. The only motivation which cannot be compared to any of these classical motives is *Immersion* because it is entirely derived from game specific aspects. This deviation from already established motives depicts that empirical approaches are crucial when exploring novel concepts since important aspects would otherwise be disregarded.

[5] *MUD*s are Role-Playing games and the predecessor of MMORPGs (www.techopedia.com/definition/556/multi-user-dungeon-mud)

Some of the more recent empirical research approaches have found a varying number of relevant factors. For example, in the *Motivations for Online Gaming Questionnaire* (*MOGQ*) seven gaming motivations are proposed: social, escape, competition, coping, skill development, fantasy and recreation (Demetrovics et al., 2011). In comparison, the *Gaming Attitudes, Motives and Experiences Scale* (*GAMES*) found nine relevant factors: story, violent catharsis, violent reward, social interaction, escapism, loss-sensitivity, customization, grinding and autonomy (Hilgard et al., 2013). A third model, the *Trojan Player Typology* (*TPT*), lists only six distinct motivational types of gamers: socializer, completionist, competitor, escapist, story-driven and smarty-pants (Kahn et al., 2015). Despite the diverging number of factors and varying nomenclature, there are commonalities between these models. All three models include dimensions related to story or content, coping or escape, performance, competition or achievement as well as social interactions (Demetrovics et al., 2011; Hilgard et al., 2013; Kahn et al., 2015). Those shared factors resemble Yee's (2006b) main motivations of *Achievement, Social* and *Immersion* considering that the latter subsumes story and escape aspects.

The bottom-up processes underlying empirically developed instruments like the *MOGQ* (Demetrovics et al., 2011)*, GAMES* (Hilgard et al., 2013)*, TPT* (Kahn et al., 2015) or Yee's (2006b) own questionnaire cause the derived motivations to strongly resemble structural game characteristics (Király, 2014b). This facilitates a distinction between different game genres and an assessment of motivations standing behind specific genre preferences. Such empirically based instruments are further capable of uncovering hypothesised connections between *IGD* and gaming motivations. Yee's (2006b) framework in particular has regularly been employed in studies investigating *IGD* and has proven itself capable of detecting motivational effects (e.g., Billieux et al., 2011; Hussain et al., 2015; Kardefelt-Winther, 2014b). Since the model's development, its three proposed main factors have further been cross-culturally validated (Yee, Ducheneaut & Nelson, 2012) and have been able to predict long term habits and behaviours (Li et al., 2013). The 10 subscales have similarly been linked to in-game behaviours (Billieux et al., 2013). Moreover, despite the model being based on motivations reported by gamers primarily playing *MMORPG*s, it is reasonable to assume that it will be applicable to other genres as well. This assumption is made based on the stated similarities to the three other models which have been developed on gamers of different genres. On that account, it seems warranted to utilise Yee's (2006b) model of gaming motivations in the current study.

### 1. 5. Research Questions and Hypotheses

All of the critical elaborations regarding the distinction and definition of *IGD*, gaming motivations and game genres can be summarized in three statements. Firstly, the current study takes an integrative approach to the *IGD* framework proposed in the DSM-5 (APA, 2013) and focuses specifically on Internet-based gaming behaviours. Secondly, gaming motivations are based on Yee's (2006b) empirically derived model which comprises *Achievement, Social* and *Immersion* motivations as well as their subscales. Finally, game genres have been narrowed down from an ambiguous and inconsistent array of game types to three highly popular and distinct online genres called *MMORPG*s, *MOBA*s and *FPS* games. Based on these statements, the vague questions about "*Why*" people are gaming, "*What*" they are playing and how those aspects relate to each other and to problematic gaming, can be rephrased into more specific research questions (*RQ*). Do gaming motivations (*Achievement, Social, Immersion*) influence genre preferences (*MMORPG*, *MOBA*, *FPS*)? Do gaming motivations and genre preferences influence the expression of *IGD*? Are gaming motivations directly connected to *IGD* or is this relationship mediated by their connection to genre preferences?

These three aspects, however, do not exist in isolation but are instead embedded in a much bigger and more complex system. While it is impossible to include all potential sources of influence, some fundamental factors must be considered. Due to their importance in shaping people's lives, attitudes and behaviours, demographic aspects play a crucial role in psychological research. In particular, age and gender have frequently been considered in prior research about online gaming (e.g., Ferchow et al., 2015; Festl, Scharkow & Quandt, 2013; Lemmens & Hendriks, 2016; Rehbein et al., 2016) and will therefore be included in the current study as well. Furthermore, given the regularity with which studies have found connections between *IGD* and gaming time (e.g., Hellström et al., 2012; Lemmens & Hendriks, 2016; Király et al., 2014a), its effects will be estimated as well and, if necessary, controlled for. With the inclusion of these three additional variables, further *RQ*'s can be formulated. Does gaming time influence the expression of *IGD*? Do age and gender influence gaming time, gaming motivations, genre preferences and *IGD*?

Overall, the present paper takes a novel approach to investigating online gaming and differs from previous studies looking at connections between gaming motivations, game genres and problematic gaming (Floros & Siomos, 2012; Laconi et al., 2017; Männikö et al., 2017) in a few crucial aspects: (1) It makes a sharp distinction between problematic Internet-based gaming (*IGD*) and issues related to offline gaming or other Internet-based behaviours. (2) It puts the focus on three highly popular and distinct online game genres (*MMORPG, MOBA*, *FPS*).

(3) It looks at effects of age and gender on multiple crucial variables (gaming time, gaming motivations, genre preferences, *IGD*). (4) It proposes a unique model of genre preferences mediating the effect of gaming motivations on *IGD*.

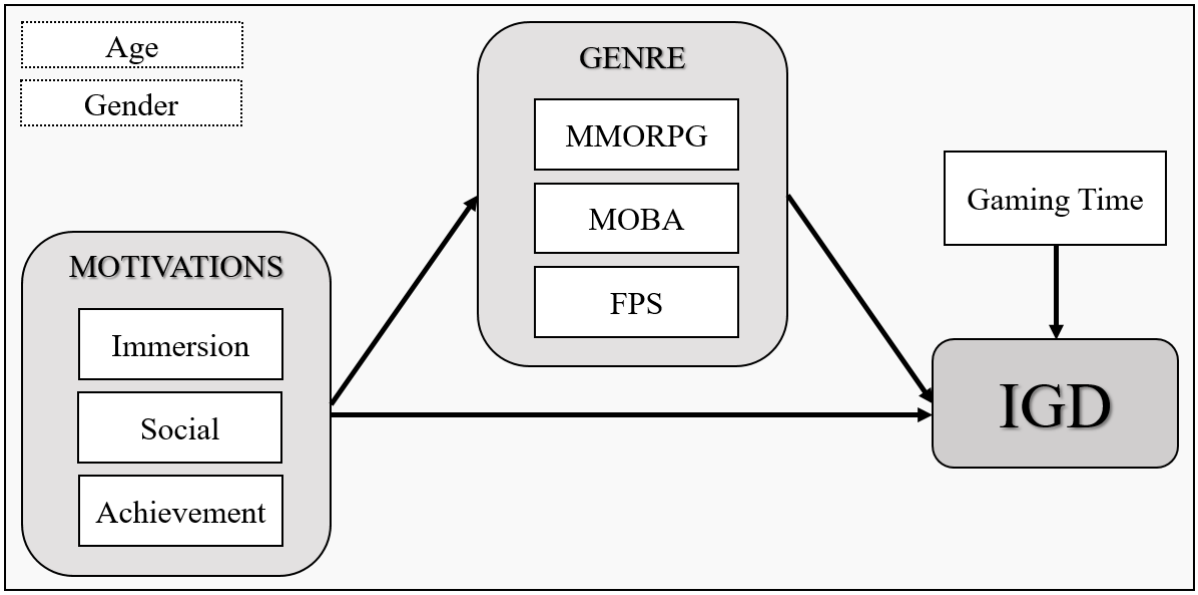


*Figure 2.* General model of assumed connections

Figure 2 visualises the variables and connections which the current study aims to explore. The specific hypothesis for each of the stated *RQ*'s are derived from findings of prior research and will now be elaborated in detail.

*RQ1: Does age influence the expression of motivations, genre preferences, gaming time and IGD scores?*

Studies have shown negative correlation between age and gaming time, indicating that older gamers tend to spend less time gaming than younger ones (Festl et al., 2013; Lemmens & Hendriks, 2016; Rehbein et al., 2016). Accordingly, it is predicted that gamers will spend less time gaming with increasing age in the currents study.

**Hypothesis 1a:** Gamers spend less time gaming the older they are.

Younger people have been more likely to show signs of problematic gaming behaviours across various studies (Caplan et al., 2009; Lemmens et al., 2015; Mentzoni et al., 2011; Wittek et al., 2015) and another study found that gaming addiction scores decreased towards the end of adolescence (Rehbein & Mößle, 2013). Gamers in the current study are therefore expected to report lower *IGD* scores with increasing age.

**Hypothesis 1b:** Gamers score lower on *IGD* the older they are.

There are only a few studies reporting motivational changes connected to age. Still, the effects that were found suggest decreasing *Achievement* motivations across all genders (Fuster et al., 2013; Yee, 2006a, 2006b) and decreasing *Immersion* motivations for female gamers (Yee, 2006a). Seeing as no such effects were found for *Social* motivations, it is merely hypothesised that motivations change across age without specifying the exact nature of that change.

**Hypothesis 1c:** There is a connection between age and gaming motivations.

There are indications of genre preferences differing across age groups, with younger gamers preferring Shooter, Action and Role-Playing-Games and older gamers preferring Strategy games (Elliott et al., 2012a, 2012b; Lemmens & Hendriks, 2016; Nagygyörgy et al., 2013; Rehbein et al., 2016; Scharkow, Festl, Vogelgesang & Quandt, 2015). The most consistent trends were those for Shooter games (found in all listed studies) and the least consistent ones were those for Strategy games (only found in one study). These findings suggest that younger participants prefer *FPS* games (Shooter sub-genre) and *MMORPGs* (Role-Playing-Game sub-genre) more than older gamers. Since *MOBA*s are part of both the Action and the Strategy genres, no clear hypothesis can be made for this specific genre. It is assumed that genre preferences of the current sample will vary with age but not in which way specifically.

**Hypothesis 1d:** There is a connection between age and genre preferences.

*RQ 2: Are there differences between men and women regarding motivations, genre preferences, gaming time and IGD scores?*

Across research men have consistently been found to spend more time gaming than women (Ferchow et al., 2015; Festl et al., 2013; Floros & Siomos, 2012; Gentile, 2009; Hellström et al., 2012; Laconi et al., 2017; Lemmens et al., 2015; Lucas & Sherry, 2004; Männikö et al., 2017; Rehbein et al., 2016). The same difference is expected in the current sample.

**Hypothesis 2a:** Men spend more time gaming than women.

Men have also reported more unhealthy gaming habits than women (Ko et al., 2005; Lemmens et al., 2015; Rehbein & Mößle, 2013; Zanetta-Dauriat et al., 2011) and were more likely to show symptoms of problem-gaming (Gentile, 2009; Hussain et al., 2015; Mentzoni et al., 2011; Wittek et al. 2015). Men are thus predicted to score higher on *IGD*.

**Hypothesis 2b:** Men have higher *IGD* scores than women.

Results indicating motivational gender differences have been inconsistent. On the one hand, some studies have found men to be highly motivated by *Achievement* (Ko et al., 2005; Williams, Consalvo, Caplan & Yee, 2009; Yee, 2006a, 2006b) while women were more likely

to report *Social* motivations, escapism motivations (subscale of *Immersion*) and fantasy motivations, a construct closely resembling *Immersion* (Király et al., 2015b; Yee, 2006a, 2006b). On the other hand, there are also findings indicating that men score higher on *Social* motivations and gratifications than women (Ko et al., 2005; Lucas & Sherry, 2004). Due to these discrepancies gender differences are only hypothesised on a general level.

**Hypothesis 2c:** Men and women differ in their motivations.

Another area of inconsistent findings are the differences regarding genre preference. Some studies found men preferring *FPS* games and women preferring Role-Playing-Games, the genre which *MMORPG*s belong to (Ghuman & Griffiths, 2012; Nagygyörgy et al., 2013). Other studies claim that men prefer *MMORPG*s to a higher degree than women (Hellström et al., 2012; Laconi et al., 2017). There are even findings which suggest that male gamers prefer most types of genres more than women do, namely Role-Playing-Games, Shooters (Lucas & Sherry, 2004), Strategy and Action games (Lucas & Sherry, 2004; Scharkow et al., 2015). Since *MOBA*s are part of both the Action and the Strategy genre, this would also imply a stronger *MOBA* preference in male gamers. Nevertheless, seeing as there is a lack of consensus regarding the precise nature of gender differences, diverging genre preferences are expected in the current study, but the exact nature of those differences remains to be seen.

**Hypothesis 2d:** Men and women differ in their genre preferences.

*RQ 3: Does gaming time influence the expression of IGD scores?*

As mentioned above, gaming time has often been used as one of the main indicators of *IGD*. Correspondingly extensive is the research linking increased gaming time to signs of problem-behaviour (Ferchow et al., 2015; Gentile, 2009; Gentile et al., 2011; Hellström et al., 2012; Király et al., 2014a; Kuss et al. 2012; Lemmens & Hendriks, 2016; Männikö et al., 2017; Pontes et al., 2014; Šporčić & Glavak-Tkalić, 2018; Yee, 2006b). It is predicted that gaming time will correlate positively with the reported *IGD* scores.

**Hypothesis 3:** Gamers who spend more time gaming have higher *IGD* scores.

*RQ 4: Do gaming motivations influence the expression of IGD scores?*

A lot of the research reporting connections between *Immersion* motivations and unhealthy gaming behaviours is specific to a few *Immersion* subscales. The strongest indicator amongst them has been escapism (also referred to as coping; Billieux et al., 2013; Hellström et al., 2012; Kardefelt-Winther, 2014b; Kuss et al., 2012; Laconi et al., 2017; Li et al., 2011; Männikö et al., 2017; Šporčić & Glavak-Tkalić, 2018; Xu, Turel & Yuan, 2012; Zanettta-

Dauriat et al., 2011). Fantasy and the main motivation *Immersion* have also shown connections to problem-gaming (Caplan et al., 2009; Kneer & Rieger, 2015; Laconi et al., 2017; Li et al., 2013; Šporčić & Glavak-Tkalić, 2018). Furthermore, a habitual form of *Immersion* was reported to be more highly activated in problematic gamers (Kneer & Glock, 2013). Higher *Immersion* motivations are thus expected to be connected with higher *IGD* scores.

**Hypothesis 4a:** Gamers with higher *Immersion* motivations have higher *IGD* scores.

Contrary to *Immersion* motivations, the research on *Social* motivations is not nearly as consistent. Some studies report negative outcomes for socially motivated gamers (Hussain et al., 2015; Kneer & Glock, 2013; Li et al., 2013; Männikö et al., 2017; Šporčić & Glavak-Tkalić, 2018; Zanetta-Dauriat et al., 2011) and addiction-like experiences of people playing games with social characteristics (Hull, Williams & Griffiths, 2013). Yet, many studies have not found any effects of *Social* motivations at all (Billieux et al., 2013; Kardefelt-Winther, 2014b; Knier & Rieger, 2015). One study has even suggested a beneficial effect of *Social* motivations and reported that they were associated with a reduced risk for *IGD* (Hellström et al., 2012). It seems possible for *Social* motivations to act as a protective factor instead of a risk-factor. Thus, a correlation between *Social* motivations and *IGD* is predicted, but no specific direction of the effect is assumed.

**Hypothesis 4b:** There is a connection between *Social* motivations and *IGD* scores.

Findings regarding *Achievement* motivations resemble those of *Immersion*. The following subscales of *Achievement* motivations and related concepts have shown connections to heightened *IGD* scores: mechanics (Kuss et al., 2012), advancement (Billeux et al., 2013) and competition (Hussain et al., 2015; Šporčić & Glavak-Tkalić, 2018). The main factor *Achievement* and an enjoyment of *Achievement* were also related to problem-gaming in prior studies (Kardefelt-Winther, 2014b; Kneer & Glock, 2013; Li et al., 2013; Männikö et al., 2017; Zanetta-Dauriat et al., 2011). *Achievement* motivations are therefore hypothesised to positively correlate with *IGD* scores in this study.

**Hypothesis 4c:** Gamers with higher *Achievement* motivations have higher *IGD* scores.

*RQ 5: Do genre preferences influence the expression of IGD scores?*

Out of the three genres investigated in this study, *MMORPGs* show the strongest connections to *IGD*. People indicating higher *MMORPG* preferences have consistently reported negative outcomes (Elliott et al., 2012a; Hellström et al., 2012; Kuss et al., 2012; Lee et al., 2007; Ng & Wiemer-Hastings, 2005; Rehbein et al., 2010). Furthermore, a higher interest and

involvement (Peter & Malesky, 2008; Smyth, 2007) as well as more time spent on Role-Playing-Games (Männikö et al., 2017) have been connected to more symptoms of unhealthy gaming. Accordingly, higher *MMORPG* preferences are expected to be connected to higher *IGD* scores.

**Hypothesis 5a:** Gamers with higher *MMORPG* preferences have higher *IGD* scores.

There are also a couple of studies connecting *FPS* preferences to *IGD*. A high interest for playing *FPS* games has been linked to problematic gaming (Festl et al., 2013; Männikö et al., 2017), and people playing *FPS* games have similarly shown stronger indications of problem-behaviour (Elliott et al., 2012a). Hence, higher *FPS* preferences should also be accompanied by higher *IGD* scores in the present sample.

**Hypothesis 5b:** Gamers with higher *FPS* preferences have higher *IGD* scores.

*MOBA* games have so far only been minimally researched and specific connections to *IGD* have yet to be made. Still, there are studies which have found that a preference for the Action and Adventure genre (Elliott et al., 2012a; Laconi et al., 2017) and a high involvement in Action and Strategy games (Männikö et al., 2017) are linked to problematic gaming. With the *MOBA* genre being partially Action and partially Strategy game this would suggest that it might also show correlations with *IGD*. The current study therefore assumes that there will be a connection between *MOBA* preferences and *IGD*.

**Hypothesis 5c:** There is a connection between *MOBA* preferences and *IGD* scores.

*RQ 6: Does genre preference mediate the connection between motivations and IGD scores?*

Online games are said to be mainly sought out for social reasons which have been called the driving force behind online gameplay (Choi & Kim, 2004; Griffiths, Davies & Chappell, 2004; Jansz & Martens, 2005). Especially *MMORPG*s are inherently social environments (Cole & Griffiths, 2007) and various studies have found connections between social motivations and a preference to play *MMORPG*s (Fuster et al., 2013; Laconi et al., 2017). Other motivations frequently linked to *MMORPG*s are *Immersion*, its subscale escapism and the related concepts fantasy and exploration (Fuster et al., 2012, 2013; Ghuman & Griffiths, 2012; Király et al., 2015b). A feeling of *Immersion* in *MMORPG*s also showed a relationship with the frequency of playing *MMORPG*s (Billieux et al., 2011). The factor of *Achievement* motivations and its subscale competition have often been linked to *FPS* gaming (Ghuman & Griffiths, 2012; Király et al., 2015b; Kneer & Rieger, 2015). Their role for *MMORPG* preferences is not so clear. Some researchers have linked concepts like power and prestige which resemble *Achievement*

motivations to higher *MMORPG* preferences (Fuster et al., 2012, 2013), whereas others claim that people with *MMORPG* preferences have low *Achievement* motivations (Ghuman & Griffiths, 2012). For *MOBA* games research is scarce with only one study suggesting higher *Social* motivations for female *MOBA* gamers (Laconi et al., 2017). In summary, connections between genre preferences and motivations can be expected in the current study. Due to the wide range of concepts used in the existing studies as well as a lack of research regarding *MOBA*s, the exact nature of these connections will not be specified.

**Hypothesis 6a:** There is a connection between gaming motivations and genre preferences.

The in previous studies observed effects and connections make the previously mentioned mediation hypothesis likely. If motivations are indeed predictive of *IGD* and the same is true for genre preferences, the connection between these two variables has the potential to mediate the effect of motivations on *IGD*. This would imply that specific motivations are not directly "responsible" for *IGD* but instead influence which types of genres a person prefers to play. These genres and their specific structural characteristics in turn lead to negative outcomes. To investigate this theory a mediation hypothesis is proposed.

**Hypothesis 6b:** The effect of motivations on *IGD* scores is mediated by genre preferences.

*RQ 7: Can gamers be grouped into meaningful gamer-types according to their gaming motivations?*

A last interesting aspect when investigating gaming, which has not been mentioned so far, is the potential existence of distinct "types" of gamers. The idea is that, although different motivations drive different people to a different extent resulting in different choices and behaviours, there might be underlying groups of gamers whose members share similarities which could be used to categorise them. A categorisation of that kind has the advantage that a person's behaviours and needs are more easily comprehensible if they can be associated with a known and understood pattern. Being able to identify such gamer types would therefore add practical value to the current investigation of gaming.

Some researchers have attempted the development of gamer typologies using various starting points. One study clustered gamers according to their specific motivations (advancement, socializing, role-playing, escapism) and certain psychological factors (urgency, premeditation, perseverance, sensation seeking, self-esteem; Billieux et al., 2015). Five groups emerged, three of which were classified as problematic: unregulated achievers, unregulated

escapers, hard-core gamers, regulated social role-players and regulated recreational gamers. The study depicted the necessity of looking at combinations of variables rather than just single ones since, contrary to expectations, the reported self-esteem was high in a problematic cluster and low in a nonproblematic one. A second study clustered gamers into four distinct groups according to their genre preferences: hardcore gamers, "full" gamers, casual gamers and non-gamers (Manero, Torrente, Freire & Frenández-Manjón, 2016). Large gender differences were uncovered between them. Female gamers were primarily part of the last two, low involvement groups, whereas men were overrepresented in the first two, high involvement groups. A last study clustered gamers only on the basis of gaming motivations and found three groups: social gamers, aggressive gamers and inactive gamers (Tseng, 2011). The employed motivations, however, were not the ones proposed by Yee (2006b) but instead consisted of exploration motivations and the need for aggression. Based on this research, it would be interesting to see whether gamers can be grouped into distinct gamer types according to *Achievement, Social* and *Immersion* motivations as well.

**Hypothesis 7a:** Gamers can be grouped into distinct types according to their gaming motivations.

Considering that motivations have been shown to correlate to *IGD* and other factors like gender, age and genre, clusters with different motivational profiles should also differ in these aspects. Similarly, the resulting clusters should show differences in gaming time since it has been shown to be closely associated with the same aspects as motivations (*age, gender, genre, IGD*). The following hypotheses are formulated based on these connections.

**Hypothesis 7b:** The gamer-types differ in the time spent gaming.

**Hypothesis 7c:** The gamer-types differ in their *IGD* scores.

**Hypothesis 7d:** The gamer-types differ in their genre preferences.

**Hypothesis 7e:** The gamer-types differ in age and gender.

# 2. Methods

## 2.1. Study Design and Implementation

The website Reddit (Huffman & Ohanian, 2005, www.reddit.com) is an American website that serves as a global platform for people to actively discuss any given topic with others. It is organised into smaller forums, so called "Subreddits", which are designated for specific topics. Members can subscribe to any forum they are interested in and will be kept up-to-date about its current content. There are countless Subreddits about gaming, different gaming genres and specific games. They vary drastically in size depending on the popularity of the specific forum-topic as well as their purpose – be it to discuss things with a few close friends only (as little as two members) or to share things on a much larger scale (millions of members).

The larger Subreddits about gaming offered themselves as a gateway to reach an audience which was not only suitable for this study but also likely to be interested in participating. This was advantageous because it held the potential for a large number of participants. Since the current study sought to investigate effects that were present at one point in time rather than their change over time, a cross-sectional design was employed. Each person only had to participate in the survey once and no follow-up assessment was needed.

The survey itself was composed using SoSci Survey (Leiner, 2016a), an online survey toolkit. It allows for technical testing to ensure that everything is displayed and recorded properly and further offers the possibility of pre-testing before the data-collection period starts. The present survey was pre-tested by 20 gamers who gave written and verbal feedback. Apart from minor annotations regarding typing and formatting errors, the main point of criticism was the level of detail of the items measuring the average gaming time. They were adjusted accordingly to ask for an estimation of hours rather than minutes and a distinction of weekday/weekend rather than weekday/Saturday/Sunday.

After all necessary adjustments were made, the moderators of 101 Subreddits on the topic of relevant gaming topics were contacted to get permission for posting the survey on their forums. 37 of them did not reply at all while 22 of the other 65 declined the request. The link to the survey was then posted on the remaining 42 Subreddits with a short message to all readers explaining the topic of the survey and the requirements to take part. For any questions that arose before starting the survey a contact e-mail address was posted at the end of the message together with an encouragement to share the link with other gamers.

Once a participant clicked the link they got redirected to the SoSci Survey page hosting the online survey. It started off with a page of information (see Appendix B) including the

estimated length of the survey (10 minutes) and the requirements for participation. In order to fill out the survey participants had to (1) be 18 years or older so that no parental consent was needed, (2) speak English fluently since the survey was being conducted in English and (3) play online multiplayer games at least once a week so they were familiar with the topic. The following page informed about the survey being entirely anonymous and voluntary and asked to only continue if the conditions and requirements were understood and agreed to. Once consent was given, participants received another short briefing about the general topic of the study and about the sort of topics they were going to be asked about. Then the survey started with questions regarding demographic and gaming habits, followed by the adapted motivations scale and finally the *IGD* scale. After the last questions were answered, participants reached the final page which thanked them for their participation and debriefed them completely about the exact aims of the present research (see Appendix B). Again, the participants were given a contact e-mail address in case they had any questions about the survey or wanted to be informed when the results of the study were available.

The survey was kept online for roughly three weeks (19 days) in April 2018 until the daily participation rate dropped to near zero. During that period all comments, replies and emails that were posted on the forums or sent to the contact email-address were answered. A lot of the remarks were questioning whether the current study's focus would exclusively lie on the negative, possibly addictive side of gaming. Their concerns were addressed by communicating that it was not the aim of this study to focus on the negatives, but rather to gain a differentiated insight into which motivations might increase or decrease the risk of addictive behaviours in gamers and what role genre preferences play in that context.

### 2.2. Sample

A total of 5716 people started the survey of which 4006 (70.08%) completed it. After data cleaning, the final sample consisted of 3768 (94.06% of all completed surveys) participants (238, 5.94% were excluded). Cases showing any of the following criteria were excluded from statistical analysis: (1) extremely fast or slow completion time of the survey (relative speed index (*RSI*) values above 2 (Leiner, 2016b) or time values outside of the outer fences of the boxplot[6]) as it seemed unlikely that the given answers were genuine, (2) improbable or impossible combinations of age and educational degree (completed upper tertiary level under 22 years old), (3) improbable or impossible combinations of average time spent gaming and

[6] These values are marked with an asterisk in SPSS (IBM Corp., 2017) and are called extreme values.

weekly time spent on main occupation (less than 5 hours remaining per day besides these two activities), (4) extreme values of time spent on main occupation or gaming time (values outside the outer fences of the boxplot) and (5) invalid or extreme values for age (below 18 or values outside the outer fences of the boxplot). It was decided to keep outliers (within the outer fences but outside the inner fences of the boxplot) since, due to their large count, excluding them would have resulted in an artificially homogenous sample.

### 2.3. Measures

All items from the current survey can be found in their adapted as well as their original from in Appendix B. Cronbach's alpha was used to measure the reliability of the employed scales. Using the RStudio (2018) package "lavaan" (Rosseel, 2012), the model fit was assessed with confirmatory factor analyses (*CFA*) employing mean- and variance adjusted weighted least squares (*WLSMV)* estimators [7] for the Likert-scaled items.

*Demographic Items.*

These items collected relevant demographic data consisting of gender (male/female, a third option was omitted to avoid provoking facetious answers), age (18 – 100 years), country of origin (free input with suggestions to ensure consistent spelling), educational level (five options adapted from the International Standard Classification of Education (*ISCED*), UNESCO Institute for Statistics, 2011) and hours per week spent on the main occupation such as work or education.

*Gaming Habits Items.*

These items addressed the preferred gaming platform (PC/console) and time spent gaming (split into hours per weekday/weekend and amount of days during the week/weekend) of the participants. Information about genre preferences was collected individually for each of the three selected main genres by indicating agreement or disagreement to the question: "*What types of games do you enjoy playing? I enjoy playing…* [*MMORPG, MOBA, FPS*]". Answer options ranged from "*completely disagree*" (1) to "*completely agree*" (7) on a 7-point Likert-scale. The choice of a 7-point Likert-scale over a 5-point one was made to allow for more finely grained answers (Krosnick & Presser, 2010) since the preference for each genre was being measured by one item only.

[7] *WLSMV* estimators were used for *CFA* as this is recommended for ordinal (Likert-scaled), not normally distributed data (Finney & DiStefano, 2006; Li, 2016).

*Motivations to Play Online Games Questionnaire (MPOGQ*; Yee, 2006b).

Since the current study employs Yee's (2006b) motivational model, his originally developed scales were used to assess gaming motivations. The *MPOGQ* consists of 39 items addressing the different gaming motivations. For their use in this study the items were split into three categories asking for importance, enjoyment and frequency of gaming aspects. If necessary, the items were rephrased to fit into one of these three categories. Their wording was further adjusted either in order to avoid comprehension problems or to include *MOBA* and *FPS* aspects in the items which originally only addressed *MMORPG* games. For example, the item "*How important is it for you to become powerful*?" was changed to "*Becoming powerful/ranking up…* [is important to me]." Due to this rephrasing process, a 5-point Likert-scale ranging from "*completely disagree*" (1) to "*completely agree*" (5) could be used for the first two categories and a scale ranging from "*never*" (1) to "*always*" (5) could be used for the third one. Additionally, the option "does not apply" was given in case the participants did not feel like the question applied to any of the games they played[8].

The 39 items were grouped into the original 10 first order and three second order factors and model fit indices[9] were calculated for this higher order model. It failed to reach an acceptable fit ($\chi^2(689) = 32081.55$; $p < .001$[10]; CFI = .89; TLI = .88; RMSEA = .11; SRMR = .10) and neither the 10-factor structure ($\chi^2(657) = 26715.03$; $p < .001$; CFI = .91; TLI = .90; RMSEA = .10; SRMR = .09), nor the three-factor structure ($\chi^2(699) = 48403.277$; $p < .001$; CFI = .84; TLI = .83; RMSEA = .14; SRMR = .12) reached acceptable fit indices individually. A revision of the gaming motivation model for its use in the current study was therefore necessary. To explore the underlying factor structure in the current dataset, exploratory factor analysis (*EFA*) with weighted least squares (*WLS*) estimators of polychoric correlations[11] was conducted using the RStudio (2018) package "psych" (Revelle, 2018). Varimax rotation was used in order to gain distinct, easily interpretable factors. Bartlett's Test of Sphericity ($\chi^2(741) = 56219.20$; $p < .001$) and the Kaiser-Meyer-Olkin measure of sampling adequacy (*KMO* = .83) both indicated suitable data for factor analysis. There were no missing data.

[8] "Does not apply" answers were treated like answers of the lowest agreement category under the assumption that high importance or enjoyment would lead gamers to play games which provide them with these aspects.
[9] The cut-off values were: CFI ≥ .95, TLI ≥ .95, RMSEA ≤ .08, SRMR ≤ .07 (Hooper, Coughlan & Mullen, 2008)
[10] $\chi^2$ p-values tend to be influenced by sample size, becoming significant in large samples (Bentler & Bonett, 1980) and therefore need to be interpreted together with other available fit indices.
[11] The use of *WLS* of polychoric correlations in *EFA* is recommended for discrete variables (Barendse, Oort, Timmerman, 2015) and polychoric correlations are moreover recommended for ordinal items such as Likert-scale ones (Holgado-Tello, Chacón-Moscoso, Barbero-García & Vila-Abad, 2010).

Multiple decision criteria were used simultaneously to determine the appropriate number of factors: (1) the Guttman-Kaiser rule (Bortz & Schuster, 2010; Guttman, 1954), (2) the Scree Test (Cattell, 1966) and (3) Horn's Parallel Analysis (Dinno, 2009; Horn, 1965). According to the Guttman-Kaiser rule, 11 factors with eigenvalues[12] greater than one could be extracted. Following Horn (1965), only factors with eigenvalues bigger than the corresponding (mean) eigenvalues of simulated data should be retained when running *PCA*. The same concept can be applied to principal axis factoring (*PAF*) where the extracted sums of squared loadings are used instead of the initial eigenvalues of *PCA*. Using *PAF* instead of *PCA* has the advantage that the extracted values represent a portion of the *common* variance amongst all variables rather than a portion of the total variance. It thereby allows for unique variance within the variables (Bortz & Schuster, 2010). In the current dataset the first 11 factors had higher observed than simulated values. At factor 12 this relation was reversed which suggested an 11-factor solution and resembled the results of the Guttman-Kaiser rule. Table 1 shows the eigenvalues and the comparison of the extracted sums of squared loadings with the simulated ones.

Table 1

*Eigenvalues and extracted sums of squared loadings of Parallel Analysis (N = 3768)*

| | **Number of Factors** | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | *1* | *2* | *3* | *4* | *5* | *6* | *7* | *8* | *9* | *10* | *11* | *12* |
| **Eigenvalue** | 5.65 | 5.08 | 3.03 | 1.99 | 1.65 | 1.59 | 1.33 | 1.29 | 1.23 | 1.08 | 1.04 | 0.91 |
| **Observed** | 4.85 | 4.20 | 2.15 | 1.08 | 0.78 | 0.71 | 0.46 | 0.42 | 0.33 | 0.16 | 0.12 | 0.01 |
| **Simulated** | 0.21 | 0.18 | 0.16 | 0.15 | 0.14 | 0.13 | 0.12 | 0.11 | 0.10 | 0.09 | 0.08 | 0.07 |

The interpretation of the Scree plot (see Figure 3) was more ambiguous. Various elbows could be identified lying either at the fourth, fifth, seventh or 10$^{th}$ factor. This indicated either a three-, four-, six- or nine-factor solution. Neither the four-, nor the six-factor solution resembled the original scales, or the factor numbers indicated by the Guttman-Kaiser rule and the Parallel Analysis. The three-factor solution, on the other hand, reflected Yee's (2006b) second order factors and the nine-factor solution resembled the original 10 first order factors as well as the 11 factors suggested by the other criteria. Overall, the models with more factors (9 – 11) received stronger support from the employed criteria and were therefore further investigated. In a first step the initial model fit indices were calculated for the suggested solutions of nine factors ($\chi^2(558) = 18418.77$; $p < .001$; CFI = .94; TLI = .93; RMSEA = .09; SRMR = .08), 10 factors ($\chi^2(549) = 15292.45$; $p < .001$; CFI = .95; TLI = .94; RMSEA = .08; SRMR = .08) and

[12] These eigenvalues correspond to the initially extracted eigenvalues of principal component analysis (*PCA*).

11 factors ($\chi^2(539) = 13020.34$; $p < .001$; CFI = .96; TLI = .95; RMSEA = .08; SRMR = .07). The 11-factor model showed the best initial fit and was consequently explored further.

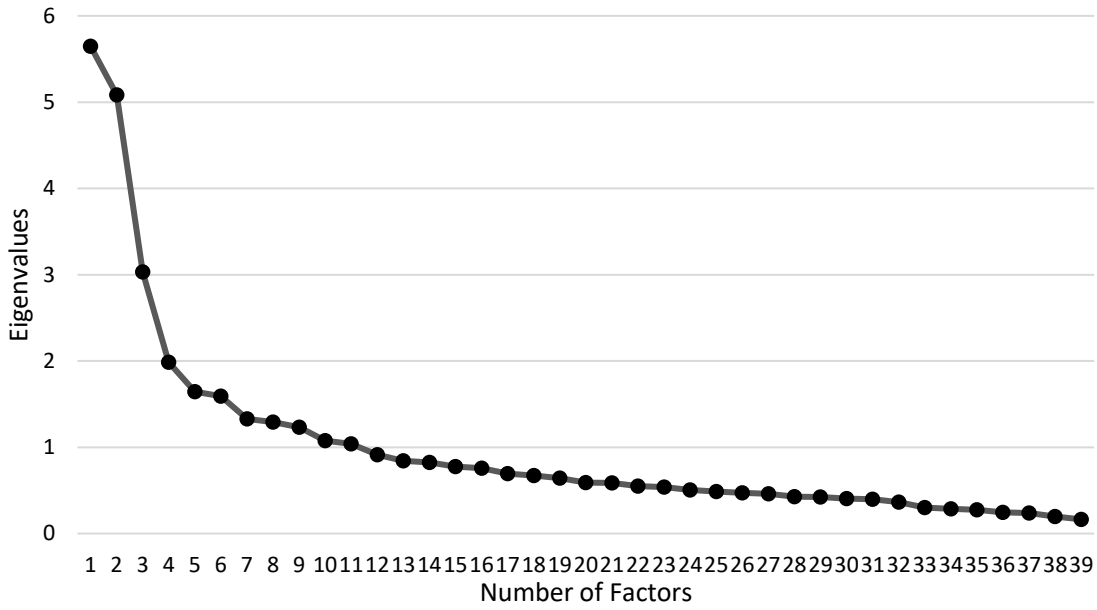


*Figure 3.* Scree plot of eigenvalues from 11-factor model

Three of the 39 items (*10.13, 11.1, 11.8*) failed to load higher than $\lambda = .30$[13] on any of the 11 factors, while the primary factor loadings of the remaining 36 items ranged from $\lambda = .33$ to $\lambda = .88$. Five of those items were cross-loading (*9.3, 9.12, 10.12, 11.2, 11.3*), meaning that they showed significant loadings on more than just one factor (Hair et al., 2014). Internal consistency values for the factors lay between $\alpha = .58$ (poor reliability) and $\alpha = .89$ (good reliability) with four of the factors only containing two items. The complete table of varimax rotated factor loadings, communalities and factor properties of the 11-factor model can be found in Appendix C (Table A1).

Despite acceptable fit indices, several problems were identified which spoke against retaining the 11-factor solution. Firstly, factors should ideally consist of at least three items (Yong & Pierce, 2013) and more than a third of the identified factors fell short of that criterion. Secondly, the factor structure of the original 10 subscales (Yee, 2006b) notably differed from the proposed model (see Figure 4). Not only were items grouped inconsistently and loaded on different factors, but three items failed to load on any of the factors entirely. Also notable was the poor reliability of the last factor with an internal consistency of just $\alpha = .58$ which made it unsuitable for further analysis. Due to these shortcomings a more parsimonious model consisting of only three factors was applied. This factor-solution not only allowed for a higher number

[13] For large samples ($n > 350$) $\lambda \geq .30$ can be regarded as significant (Hair, Black, Babin & Anderson, 2014).

of items per factor and lowered the risk of them falling short of the abovementioned three-item minimum (Yong & Pierce, 2013) but was also supported by the previously conducted Scree Test and resembled Yee's (2006) three main motivations.

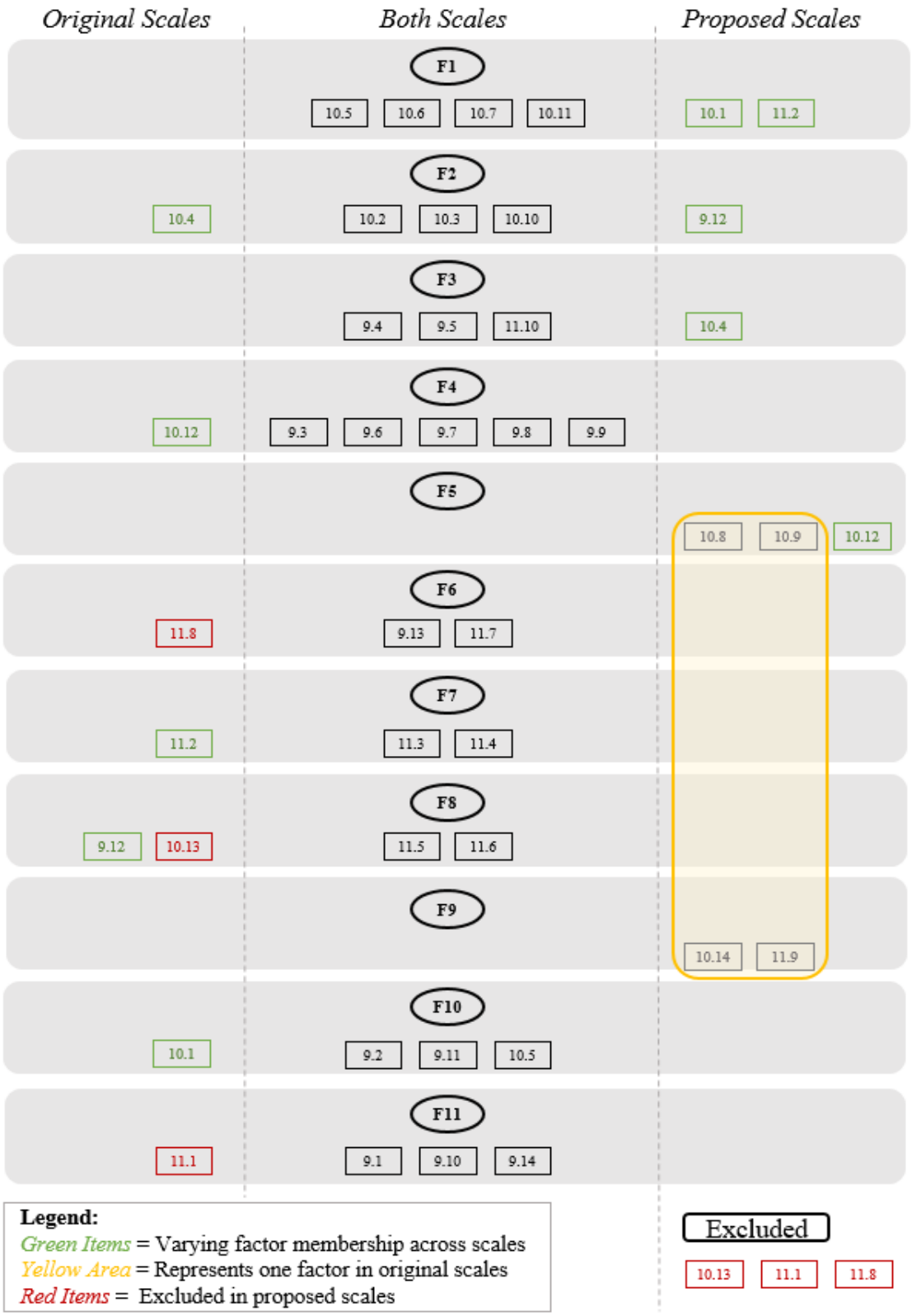


*Figure 4.* Comparison of item factor membership between original 10 and proposed 11 factors

The three-factor model achieved a nearly identical factor structure to the original second order factors (see Figure 5) with only one item failing to load (*11.1*) entirely and merely two items loading on a different factor (*9.2, 9.11*). Since all other items loaded on the originally assigned factors, the original factor nomenclature was adopted. Factor 1 (F1) consisted of *Immersion* motivation items, Factor 2 (F2) consisted of *Social* motivation items and Factor 3 (F3) consisted of *Achievement* motivation items. All factors consisted of a sufficient, albeit varying number of items (9-16) and achieved good internal consistency values ($\alpha = .80$ to $\alpha = .83$). Factor loadings ranged widely from $\lambda = .31$ to $\lambda = .83$ and three items showed cross-loadings (*10.8*, *10.12*, *10.15*). The complete table of varimax rotated factor loadings, communalities and factor properties of the initial three-factor model can be found in Appendix C (Table A2).

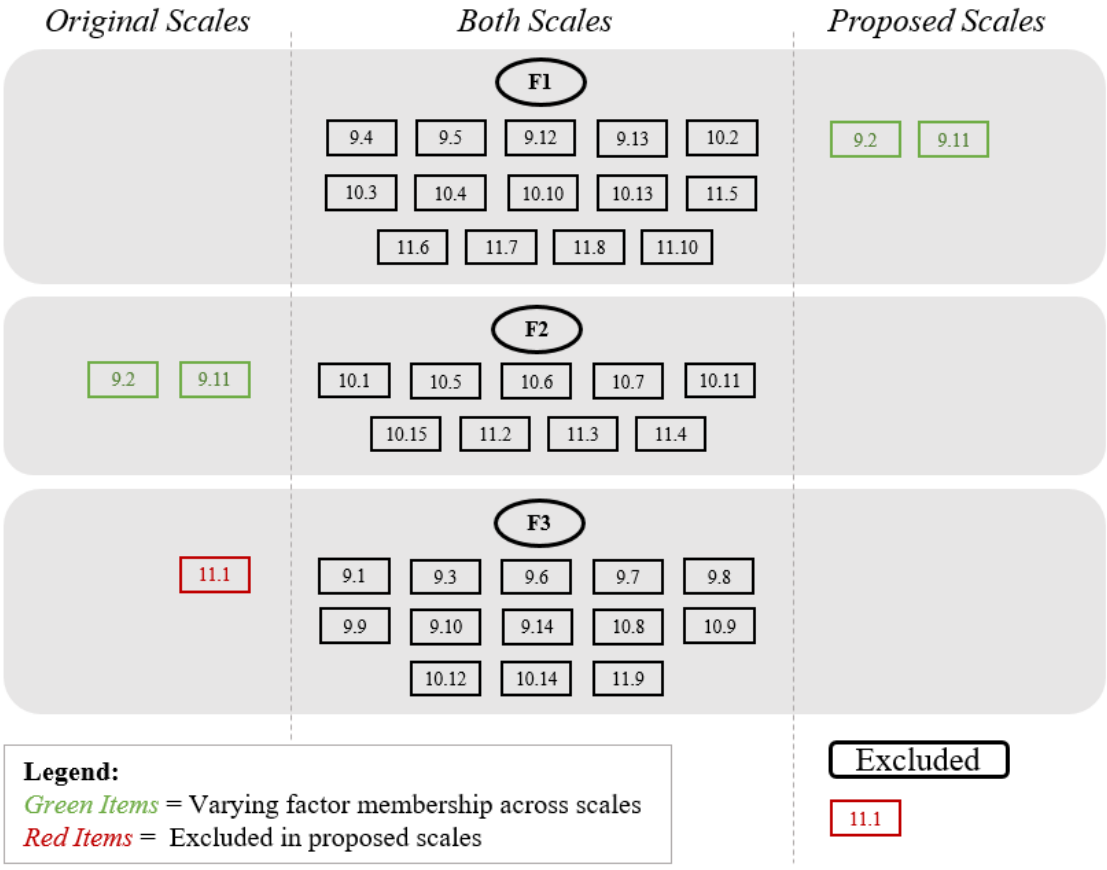


*Figure 5.* Comparison of item factor membership between original 3 and proposed 3 factors

Despite being more consistent with the original model and being overall more parsimonious, the overall model fit of the three-factor model was not acceptable ($\chi^2(662) = 45271.94$; $p < .001$; CFI = .85; TLI = .84; RMSEA = .13; SRMR = .12). In order to obtain a motivational model with acceptable fit indices, the varimax rotated loading matrix of the polychoric *EFA*

was closely analysed. All items that either had a primary loading below $\lambda = .40$[14] or showed cross loadings were removed (*9.1, 9.2, 9.9, 9.13, 10.12, 10.13, 10.14, 10.15, 11.7, 11.8, 11.9*). Item *10.8* was retained despite cross-loading since the difference between primary and secondary loading was sufficiently large[15] and the latter barely reached significance. After running *EFA* again with the reduced itemset, one more item was removed (*9.11*) due to a factor loading below $\lambda = .40$ leaving 26 of the initial 39 items. Many communalities of the remaining items were below the desired minimum value of .40 (Costello & Osborne, 2005), with the average communality of the items being .37. This is usually an indicator either for the lack of a relation to the other items or for the existence of additionally extractable factors. In light of prior analyses, these low values are likely reflective of the underlying 11-factor structure. All 26 items were therefore retained.

Running an *EFA* with a random sample drawn from the whole dataset ($N_{random} = 1884$) showed the same factor structure and almost identical factor loadings, as did a comparison of factor structures between male and female gamers. Consequently, the proposed factor structure was deemed appropriate for the current dataset. The three final factors explained 37.3% of the total variance: F1 (*Immersion*) with 10 items, F2 (*Social*) with eight and F3 (*Achievement*) with eight as well. The internal consistencies of the scales were $\alpha = .83$ for *Immersion*, $\alpha = .85$ for *Social* and $\alpha = .77$ for *Achievement* motivations, ranging from acceptable to good values. Table 2 shows the correlations of the *Immersion*, *Social* and *Achievement* with each other. The complete matrix of varimax rotated factor loadings for the final model is shown in Table 3, and key descriptive statistics of each scale are depicted in Table 4.

Table 2

*Pearson correlations among factors and descriptive statistics for scales (N = 3768)*

| | **Immersion** | **Social** | **Achievement** |
|---|---|---|---|
| *Immersion* | 1 | - | - |
| *Social* | **.22**** | 1 | - |
| *Achievement* | **-.14**** | **.23**** | 1 |

*Note.* **p < .01. The reported p-values are two-tailed. Significant values appear in bold.

[14] Items loading between $\lambda = .30$ and $\lambda = .40$ are helpful for structure exploration but only contribute minimally to further interpretation (Hair et al., 2014).

[15] A difference of $\lambda = .20$ between the primary and the secondary loading is commonly considered sufficiently large for retaining an item, based on initial research by Cliff and Hamburger (1967).

Table 3

*Final varimax rotated 3-factor model factor matrix (N = 3768)*

| | Factors | | | |
|---|---|---|---|---|
| **Items** | *Immersion* | *Social* | *Achievement* | **Communalities** |
| *10.2* | **.62** | .10 | -.20 | .46 |
| *10.3* | **.62** | .09 | -.04 | .42 |
| *10.10* | **.62** | .05 | -.10 | .41 |
| *11.10* | **.62** | .02 | -.02 | .36 |
| *10.4* | **.60** | .08 | .05 | .35 |
| *9.12* | **.58** | .08 | -.14 | .36 |
| *9.4* | **.56** | .03 | .10 | .30 |
| *11.5* | **.54** | .18 | -.20 | .34 |
| *9.5* | **.51** | .06 | .23 | .29 |
| *11.6* | **.48** | .15 | -.15 | .26 |
| *10.6* | .06 | **.86** | .12 | .81 |
| *10.7* | .05 | **.85** | .14 | .80 |
| *11.2* | .07 | **.68** | .11 | .44 |
| *10.11* | .17 | **.56** | -.03 | .34 |
| *10.1* | -.04 | **.54** | .18 | .31 |
| *10.5* | .23 | **.53** | -.00 | .35 |
| *11.3* | .08 | **.52** | .08 | .21 |
| *11.4* | .10 | **.46** | .08 | .17 |
| *9.8* | .00 | .03 | **.61** | .36 |
| *9.7* | .19 | -.00 | **.60** | .37 |
| *10.8* | -.29 | **.31** | **.57** | .53 |
| *10.9* | -.26 | .13 | **.57** | .45 |
| *9.3* | -.02 | .17 | **.57** | .36 |
| *9.14* | -.09 | .07 | **.44** | .20 |
| *9.10* | .01 | .12 | **.42** | .18 |
| *9.6* | -.06 | -.02 | **.41** | .17 |
| **% of** | *Immersion* | *Social* | *Achievement* | **total** |
| **Var** | 13.9% | 13.6% | 9.8% | 37.3% |
| **EV** [a] | 3.62 | 3.53 | 2.55 | |

*Note.* [a] EV = eigenvalue. Factor loadings over 0.3 appear in bold.

Table 4

*Descriptive statistics of motivation scales (N = 3768)*

| | No. of Items | Mean | SD | Skewness | Kurtosis | α [a] |
|---|---|---|---|---|---|---|
| *Immersion* | 10 | 3.29 | .73 | -.42 | -.40 | .83 |
| *Social* | 8 | 3.25 | .79 | -.20 | -.26 | .85 |
| *Achievement* | 8 | 3.09 | .77 | -.15 | -.25 | .77 |

*Note.* [a] α = Cronbach's Alpha.

The item fit of the three-factor model for the reduced number of items was still not satisfactory[16] ($\chi^2(296) = 18782.46$; $p < .001$; CFI = .92; TLI = .91; RMSEA = .13; SRMR = .11). The modification indices of the conducted *CFA* suggested relationships between some variables within the same scales which were not accounted for by factor affiliation alone and were likely to cause the observed poor model fit (*9.4 & 9.5, 9.4 & 11.10, 9.7 & 9.8, 9.10 & 9.14, 10.2 & 10.3 & 10.10, 10.6 & 10.7, 11.3 & 11.4, 11.5 & 11.6*). Closer inspection of these items suggested that the reason for the unaccounted effects may have been a result of the previously explored underlying subscales. All items that showed significant connections were part of the same factors in the previously explored 11-factor model. In addition, the wording of some items was very similar. This could have also led to the indicated connections. For example, items *11.3*: "*Talking to online friends about personal issues*" and *11.4*: "*Asking your online friends for support when you have real-life problems*" as well as items *9.10*: "*Knowing as much about the game mechanics and rules as possible*" and *9.14*: "*Knowing the precise numbers and percentages underlying the game mechanics*" resemble each other strikingly. Accounting for the indicated connections improved the model fit significantly ($\chi^2(286) = 18782.46$; $p < .001$; CFI = .97; TLI = .96; RMSEA = .08; SRMR = .07). This did not disturb the overall factor structure since all item-pairs belonged to the same factor and were not formed across factors (for a similar approach see Billieux et al., 2013).

To explore whether the proposed scales and the original scales (Yee, 2006b) were still comparable, Pearson correlation coefficients were calculated (see Table 5). All proposed scales were highly correlated with their equivalent original scale. Since the proposed scales drew from the same, albeit reduced item set as the original ones, these correlations indicated that the more parsimonious scales still measured similar latent factors.

[16] While not being directly comparable to the initial three-factor model due to different item sets, it can still be judged whether the employed model is a good fit for the current dataset.

Table 5

*Pearson correlation coefficients for proposed and original scales (N = 3768)*

| | **Original Scales** | | |
|---|---|---|---|
| **Proposed Scales** | *Immersion* | *Social* | *Achievement* |
| *Immersion* | **.95**** | .09** | -.09** |
| *Social* | .25** | **.94**** | .27** |
| *Achievement* | -.12** | .21** | **.94**** |

*Note.* The reported p-values are two-tailed; **p < .01. The main axis appears in bold.

Despite its exploratory nature, it was decided to employ the proposed gaming motivation model because it achieved higher parsimony and simultaneously retained better scale properties and model qualities than the original one. The final model is depicted in Figure 6.

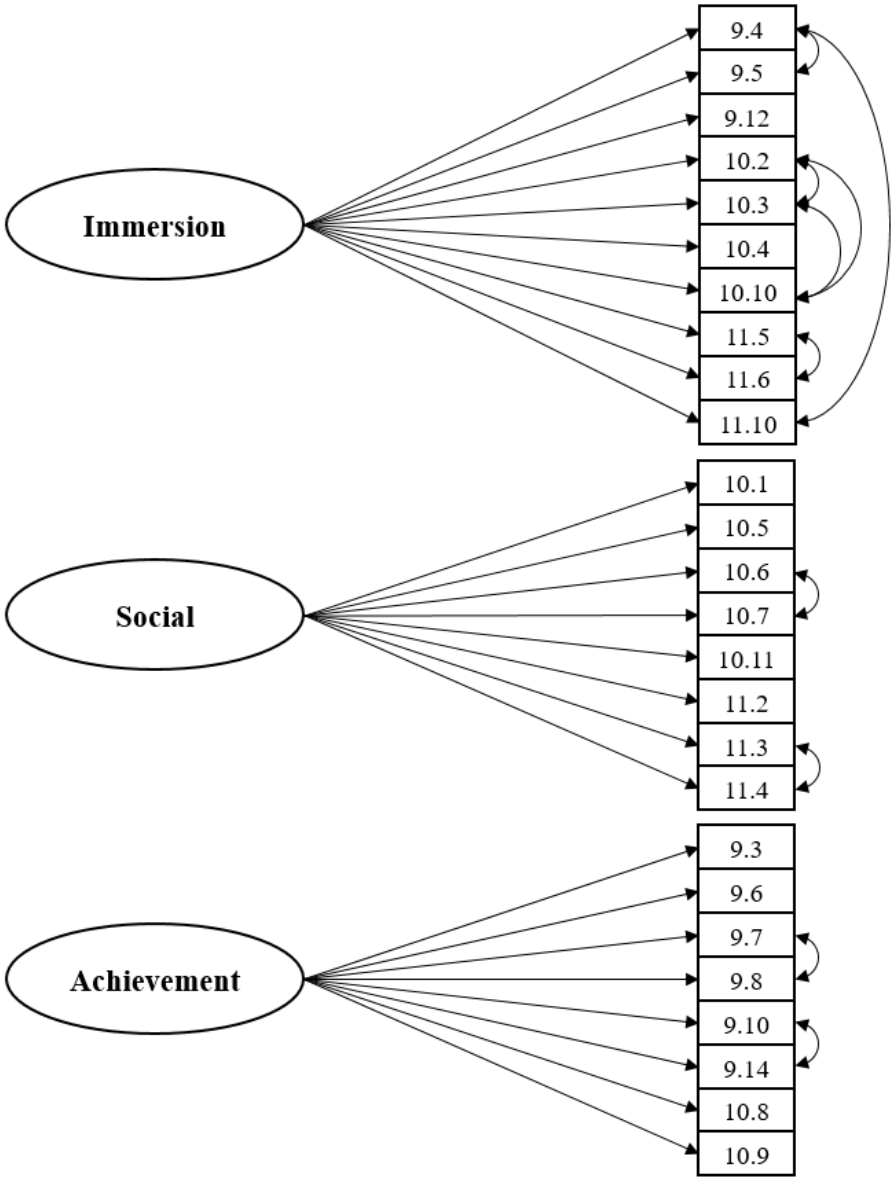


*Figure 6.* Final three-factor structure of motivational model

*Internet Gaming Disorder Short Scale (IGDS9-SF*; Pontes & Griffiths, 2015).

There are a multitude of instruments measuring *IGD* and similar constructs (e.g., King et al., 2013; Petry et al., 2014; Pontes, 2016). The *IGDS9-SF* was chosen over other available instruments for the following reasons: (1) A longer survey time could be avoided due the small number of contained items (9 items). (2) While relying on fewer items it still showed acceptable psychometric qualities in other studies (Monacis, Palo, Griffiths & Sinatra, 2016; Schivinski, Brzozowska-Woś, Buchanan, Griffiths, & Pontes, 2018). (3) It is based on the discussed DSM-5 criteria which are theoretically anchored in symptoms of well researched addictions (APA, 2013). (4) The one-factor structure has been cross-culturally validated (Monacis et al., 2016; Palo et al., 2018; Pontes & Griffiths, 2016; Stavropoulos et al., 2017) which was important for the present international sample. (5) It specifically targets *IGD* rather than related constructs such as *IA* or online gambling.

The *IGDS9-SF* was therefore employed to assess possible negative effects of gaming habits on a person's everyday life within a 12-month timespan. It consists of nine questions each of which targets one of the proposed nine DSM-5 (APA, 2013) diagnostic criteria for *IGD*. All items load on one latent factor representing *IGD*. This one-factor model had an acceptable fit for the current sample ($\chi^2(27) = 623.39$; $p < .001$; CFI = .99; TLI = .98; RMSEA = .08; SRMR = .06) supporting the originally proposed factor structure. The scale ($M = 20.88$, $SD = 7.28$) showed a good internal consistency with $\alpha = .86$.

All items were shortened and rephrased for their use in this study to avoid comprehension problems. For example, the item "*Do you feel the need to spend increasing amount of time engaged gaming in order to achieve satisfaction or pleasure*?" was changed to "[Have you]*...felt the need to spend more time gaming to feel satisfied or pleased?*" A full list of original and adapted items can be found in Appendix B. Answers were given on a 5-point Likert-scale ranging from "*never*" (1) to "*very often*" (5). Total scores could lie between 9 and 45 points with higher scores indicating more negative effects than lower ones. A cut-off score of 36 was originally suggested as diagnostic criterion for *IGD*. Still, it was not used in this study since the aim was not to diagnose *IGD*, but rather to explore trends in behaviour across a continuum of problem-gaming. A distinction between disordered and healthy was not made. *IGD* scores were instead interpreted as the degree to which a person is experiencing negative effects caused by their gaming activity.

# 3. Results

## 3.1. Demographic Characteristics

Table 6 gives an overview of the collected demographic data and gaming habits. The gender ratio was unbalanced with males strongly outweighing females (88,7%). The reported age of participants ranged from 18 to 52 years and had a relatively low mean value of 25.72 years (*SD* = 6.83). Most gamers were either from Europe (45.5%) or North America (40.8%), while only 33 were from Africa (0.9%).

Table 6

*Summary of demographic sample characteristics and gaming habits*

| Variables | n | % | Mean | SD |
|---|---|---|---|---|
| **Age** | | | 25.72 | 6.83 |
| **Gender** | | | | |
| Male | 3343 | 88.7 | | |
| Female | 425 | 11.3 | | |
| **Continent** | | | | |
| Australia & Oceania | 140 | 3.7 | | |
| Africa | 33 | 0.9 | | |
| Asia | 188 | 5.0 | | |
| Europe | 1715 | 45.5 | | |
| North America | 1538 | 40.8 | | |
| Central & South America | 100 | 2.7 | | |
| N/A | 54 | 1.4 | | |
| **Education** | | | | |
| Primary or less | 36 | 1.0 | | |
| Lower secondary | 157 | 4.2 | | |
| Upper secondary | 1731 | 45.9 | | |
| Lower tertiary | 1448 | 38.4 | | |
| Upper tertiary | 395 | 10.5 | | |
| N/A | 1 | 0.0 | | |
| **Time spent on main occupation (per week)** | | | 33.58 | 14.89 |
| **Platform** | | | | |
| PC | 3211 | 85.2 | | |
| Console | 557 | 14.8 | | |
| N/A | 1 | 0.0 | | |
| **Time spent on gaming (per day)** | | | 3.90 | 2.34 |
| **IGD Score** | | | 20.88 | 7.28 |

Nearly everyone stated to have an education level of upper secondary or above (94.8%) with nearly half having either a lower or upper tertiary education (48.9%). Only 5.2% of participants indicated an education level of lower secondary or below. The average time spent on the main occupation (e.g., school, university, work) was 33.58 hours (*SD* = 14.89), with a minimum of 0 and a maximum of 84. The median was 40 hours (28.8%) and frequencies further spiked at 30 (9.9%), 50 (7.1%), 45 (6.3%) and 20 (6.0%). 185 people (4.9%) answered that they did not spend any time on a main occupation at all, indicating that they were not currently working or in education. Participants spent an average of 3.90 hours (*SD* = 2.34) gaming per day ranging from 0.14 to 13.14 hours. The uneven distribution of platform preference was comparable to the one of gender, with 85.2% of participants indicating a preference for gaming on a PC over gaming on a console. On average participants scored 22.88 points (*SD* = 7.28) on the *IGD* scale. 3.7% percent scored above 36 points indicating pathological levels of gaming.

### 3.2. Effects of Age

Five simple regressions were conducted to explore possible effects of age on gaming time, *IGD* and gaming motivations (see Table 7). No highly influential cases were present in the data (Cook's Distances[17] ≤ 0.01). Corrections for heteroscedasticity were made with bootstrapping where necessary.

Table 7

*Summarised and shortened simple regressions of the predictor age (N = 3768)*

| | | | | | 95% CI B | |
|---|---|---|---|---|---|---|
| **Predictor** | **Dependent Variable** | **B** | **SE B** | **β** | *lower* | *upper* |
| **Age** | *Gaming Time* | -0.06 | 0.01 | **-.17**** | -0.07[a] | -0.05[a] |
| | *IGD* | -0.19 | 0.02 | **-.18***** | -0.22[a] | -0.15[a] |
| | *Immersion* | 0.00 | 0.00 | -.02 | -0.01 | 0.00 |
| | *Social* | -0.01 | 0.00 | **-.12***** | -0.02 | -0.01 |
| | *Achievement* | -0.02 | 0.00 | **-.21***** | -0.02 | -0.02 |

*Note.* [a] CI and p-values were calculated using bootstrapping of 1000 samples. **p < .01, ***p < .001. The reported p-values are two-tailed. Significant values appear in bold.

Hypothesis 1a is supported since time spent gaming significantly decreased with increasing age. The effect was small with age only explaining around 3% of variance in gaming time ($R^2$ = .03, $F$(1,3766) = 105.37, $p$ < .001). Gaming time decreased by around 3 ½ minutes

[17] Values > 1 are seen as problematic (Field, Miles & Field, 2012).

for every year which adds up to a decrease of an hour every 16-17 years. Older gamers also showed a significant decrease in *IGD* scores which supports hypothesis 1b. The found effect was small with age explaining 3% of variance in *IGD* scores ($R^2 = .03$, $F(1,3766) = 118.80$, $p < .001$). *IGD* scores decreased by approximately one point for every extra five years.

*Social* as well as *Achievement* motivations both decreased with age, which explained 2% ($R^2 = .02$, $F(1,3766) = 56.64$, $p < .001$) and 4% ($R^2 = .04$, $F(1,3766) = 167.46$, $p < .001$) of their variance respectively. *Social* motivations fell by a tenth of a point for every extra 10 years, while *Achievement* motivations fell by the same amount in five years. No significant effects were found for *Immersion* motivations. Hypothesis 1c is thus only partially supported.

The potential effects of age on genre preferences could not be tested with simple regressions due to the ordinal nature of the genre preference variables. An ordinal regression was attempted but the proportional odds assumption was violated. This can be the result of large sample sizes and a high percentage of zero frequency cells when using continuous predictors. Additional analysis of this assumption was performed using binary logistic regressions of the dichotomised outcome variables. The obtained individual location estimators differed significantly as well, and the proportional odds assumption had to be rejected. Multinomial logistic regression was used instead. The three regression tables, one for each genre, can be found in Appendix C (Tables A3-A5).

The inclusion of age increased the model fit for *MMORPG* preferences significantly ($R^2_{Nagelkerke} = .02$, $\chi^2(6) = 64.91$, $p < .001$). However, it was not possible to identify a coherent trend with increasing age for them. The model fit for *MOBA* preferences also increased significantly after the inclusion of age ($R^2_{Nagelkerke} = .06$, $\chi^2(6) = 220.43$, $p < .001$). With increasing age, the odds of indicating *MOBA* preferences exceeding the lowest category decreased for all preferences with exception of the neutral category. Finally, the model fit for *FPS* preferences also increased significantly when age was included ($R^2_{Nagelkerke} = .04$, $\chi^2(6) = 140.36$, $p < .001$). With increasing age, the odds of indicating *FPS* preferences exceeding the lowest category decreased for all categories. Consequently, hypothesis 1d is partially supported by the results.

### 3.3. Effects of Gender

Two-sample t-tests were employed to find possible differences between men and women regarding gaming time, *IGD* scores and gaming motivations. All three variables were approximately normally distributed. The results showed significant differences for gaming time ($t(3766) = -2.29$, $p = .01$) with women ($M = 4.14$, $SD = 2.47$) spending more time gaming than men ($M = 3.86$, $SD = 2.32$). Nevertheless, the effect size was irrelevant ($d = 0.12$) and did

not support hypothesis 2a. There were no significant differences ($t(3766) = 0.32$, $p = .37$) between women ($M = 20.77$, $SD = 7.10$) and men ($M = 20.90$, $SD = 7.30$) regarding *IGD* scores. Accordingly, hypothesis 2b is not supported either.

Women ($M = 3.83$, $SD = 0.71$) scored significantly higher on *Immersion* motivations ($t(574)$[18] $= -13.24$, $p < .001$) than men ($M = 3.34$, $SD = 0.80$). This effect was medium sized ($d = 0.65$), with women reporting nearly ½ point higher scores than men. Women ($M = 3.40$, $SD = 0.84$) also reported higher *Social* motivations ($t(523$[19]$) = -4.12$, $p < .001$) than men ($M = 3.23$, $SD = 0.78$). This effect was small ($d = 0.22$), with women reporting and average of ¼ point higher *Social* motivations than men. Contrary to the effects for *Immersion* and *Social* motivations, men ($M = 3.35$, $SD = 0.75$) reported higher *Achievement* motivations ($t(3766) = 13.66$, $p < .001$) than women ($M = 2.82$, $SD = 0.79$). The effect size was medium ($d = 0.69$), with men reporting an average of ½ point higher *Achievement* motivations than women. These results support hypothesis 2c.

Gender differences for genre preferences could not be calculated using two-sample t-test since the genre preference variables were not normally distributed. Levene's test further indicated unequal variances for all three variables (*MMORPG* ($F = 127.40$, $p < .001$), *MOBA* ($F = 22.06$, $p < .001$), *FPS* ($F = 28.90$, $p < .001$)), which also ruled out the use of a Mann-Whitney U-test. Instead Mood's Median test was employed to draw basic conclusions about potential gender differences. The results indicated significant differences in *MMORPG* preferences ($\chi^2_{Yates}(1, N=3768) = 122.49$, $p < .001$) with more women (65.18%, m = 7) scoring above the median than men (37.09%, m = 6). Significant differences were also found for *MOBA* preferences ($\chi^2_{Yates}(1, N=3768) = 21.92$, $p < .001$) with more men (42.84%, m = 3) scoring above the median than women (30.82%, m = 2). *FPS* preferences differed significantly as well ($\chi^2_{Yates}(1, N=3768) = 61.72$, $p < .001$) with more men (43.58%, m = 5) scoring above the median than women (23.53%, m = 4). These results support hypothesis 1d.

Since male and female sample sizes were very unequal and many areas of significant differences in gaming behaviour and gaming motivations were indicated, all further analyses were conducted separately for male and female gamers.

[18] The degrees of freedom were adjusted from 3766 to 574 since Levene's test indicated unequal variances ($F = 16.61$, $p < .001$).
[19] The degrees of freedom were adjusted from 3766 to 523 since Levene's test indicated unequal variances ($F = 6.21$, $p = .01$).

### 3.4. Effects of Gaming Time

Simple regressions were employed to investigate the hypothesised effects of gaming time on *IGD* scores (see Table 8). No highly influential cases were present in the data (Cook's Distances ≤ 0.07). Corrections for heteroscedasticity were made with bootstrapping.

Table 8

*Shortened simple regression output for Gaming Time predicting IGD split into males (N = 3343) and females (N = 425)*

| | | | | | 95% CI B | |
|---|---|---|---|---|---|---|
| **Predictor** | **Gender** | **B** | **SE B** | **β** | *lower* | *upper* |
| *Gaming Time* | *male* | 0.77 | 0.06 | **.24*** ** | 0.66 | 0.88 |
| | *female* | 1.21 | 0.16 | **.42*** ** | 0.89 | 1.54 |

*Note.* ***p < .001. The reported p-values are two-tailed. Significant values appear in bold. All CI and p-values were calculated using bootstrapping of 1000 samples.

The *IGD* scores of male gamers increased significantly with increasing time spent gaming. This effect was small with gaming time explaining 6% of the variance in *IGD* scores ($R^2$ = .06, $F(1,3341) = 211.04$, $p < .001$). Female gamers who spent more time gaming also reported significantly higher *IGD* scores. The effect was small with gaming time explaining 18% of the variance in *IGD* scores ($R^2$ = .18, $F(1,423) = 90.77$, $p < .001$). For every extra hour spent gaming per day, *IGD* scores increased by about ¾ point for men and by nearly 1 ¼ points for women. Additionally, the results showed that gaming time had a significantly bigger impact on *IGD* scores of women (CI men [0.66;0.88], CI women [0.89;1.54]). Hypothesis 3 is supported by the results, suggesting that gaming time is an important predictor of *IGD*. Due to its observed impact, gaming time was controlled for in all further analyses including *IGD*.

### 3.5. Effects of Gaming Motivations

Multiple hierarchical regressions were calculated to find potential influences of gaming motivations on *IGD* scores. No highly influential cases were present in the data (Cook's Distances ≤ 0.08) and no problematic multicollinearity was found (VIF[20] ≤ 1.15). Corrections for heteroscedasticity were made with bootstrapping. In a first step, the relative influences of the gaming motivations were estimated with stepwise regressions. According to that sequence,

[20] Values > 10 are seen as problematic (Field et al., 2012).

they were then hierarchically added to a basic multiple regression while controlling for gaming time. This approach was taken since the stepwise regression function in SPSS (IBM Corp., 2017) does not allow for a correction of heteroscedasticity with bootstrapping. The regression tables for the male sample are shown in Table 9 and for the female sample in Table 10.

Table 9

*Hierarchical multiple regression models for motivations predicting IGD in males (N = 3343)*

| | **Model 1** | | | | | **Model 2** | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | **95% CI B** | | | | | **95% CI B** | |
| **Predictor** | **B** | **SE** | **β** | *lower* | *upper* | **B** | **SE** | **β** | *lower* | *upper* |
| *Gaming Time* | 0.77 | 0.06 | **.24*****| 0.65 | 0.88 | 0.69 | 0.06 | **.22***** | 0.57 | 0.80 |
| *Achievement* | | | | | | 1.59 | 0.18 | **.16***** | 1.24 | 1.93 |
| *Immersion* | | | | | | | | | | |
| *Social* | | | | | | | | | | |
| $R^2_{adj}$ | | | .06 | | | | | .09 | | |
| *F for* $\Delta R^2_{adj}$ [a] | | | **211.04*****| | | | | **96.09***** | | |

| | **Model 3** | | | | | **Model 4** | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | **95% CI B** | | | | | **95% CI B** | |
| **Predictor** | **B** | **SE** | **β** | *lower* | *upper* | **B** | **SE** | **β** | *lower* | *upper* |
| *Gaming Time* | 0.67 | 0.06 | **.21***** | 0.55 | 0.78 | 0.67 | 0.06 | **.21***** | 0.54 | 0.78 |
| *Achievement* | 1.67 | 0.18 | **.17***** | 1.30 | 2.02 | 1.63 | 0.18 | **.17***** | 1.25 | 1.98 |
| *Immersion* | 0.70 | 0.17 | **.07***** | 0.36 | 1.04 | 0.66 | 0.18 | **.07***** | 0.32 | 1.03 |
| *Social* | | | | | | 0.15 | 0.17 | .02 | -0.19 | 0.49 |
| $R^2_{adj}$ | | | .09 | | | | | .09 | | |
| *F for* $\Delta R^2_{adj}$ [a] | | | **17.82***** | | | | | 0.83 | | |

*Note.* [a] $\Delta R^2$ = Change in R compared to previous model. ***p < .001. The reported p-values are two-tailed. Significant values appear in bold. All CI and p-values were calculated using bootstrapping of 1000 samples.

In the male sample *IGD* scores increased significantly with rising *Achievement* ($\beta$ = .17, p < .001) and *Immersion* ($\beta$ = .07, p < .001) motivations. *Achievement* motivations explained an additional 3% of variance in *IGD* when taking gaming time into account (model 1: $R^2_{adj}$ = .06, $F(1,3341) = 211.04$, $p < .001$; model 2: $R^2_{adj}$ = .09, $F(2,3340) = 156.57$, $p < .001$; $\Delta R^2$ = .03). This posed a small effect. However, adding *Immersion* motivations to the model only explained an irrelevant amount of additional variance (model 2: $R^2_{adj}$ = .09, $F(2,3340) = 156.57$,

$p < .001$; $\Delta R^2 = .03$; model 3: $R^2_{adj} = .09$, $F(3,3339) = 110.84$, $p < .001$; $\Delta R^2 = .00$). Model 2 was therefore deemed sufficient. No significant effect was observed for *Social* motivations.

Table 10

*Hierarchical multiple regression models for motivations predicting IGD in females (N = 425)*

| | **Model 1** | | | | | **Model 2** | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | **95% CI B** | | | | | **95% CI B** | |
| **Predictor** | **B** | **SE** | **β** | *lower* | *upper* | **B** | **SE** | **β** | *lower* | *upper* |
| *Gaming Time* | 1.21 | 0.17 | **.42*****| 0.91 | 1.55 | 1.11 | 0.17 | **.39***** | 0.79 | 1.45 |
| *Achievement* | | | | | | 1.38 | 0.42 | **.15***** | 0.57 | 2.26 |
| *Social* | | | | | | | | | | |
| *Immersion* | | | | | | | | | | |
| $R^2_{adj}$ | | | .18 | | | | | .20 | | |
| *F for* $\Delta R^2_{adj}$ [a] | | | **90.77**** | | | | | **11.60***** | | |

| | **Model 3** | | | | | **Model 4** | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | **95% CI B** | | | | | **95% CI B** | |
| **Predictor** | **B** | **SE** | **β** | *lower* | *upper* | **B** | **SE** | **β** | *lower* | *upper* |
| *Gaming Time* | 1.10 | 0.17 | **.38***** | 0.77 | 1.44 | 1.10 | 0.17 | **.38***** | 0.77 | 1.44 |
| *Achievement* | 1.21 | 0.44 | **.13**** | 0.36 | 2.10 | 1.24 | 0.44 | **.14**** | 0.35 | 2.13 |
| *Social* | 0.62 | 0.40 | .07 | -0.17 | 1.40 | 0.58 | 0.42 | .07 | -0.25 | 1.39 |
| *Immersion* | | | | | | 0.25 | 0.51 | .02 | -0.71 | 1.29 |
| $R^2_{adj}$ | | | .20 | | | | | .20 | | |
| *F for* $\Delta R^2_{adj}$ [a] | | | 2.56 | | | | | 0.26 | | |

*Note.* [a] $\Delta R^2$ = Change in R compared to previous model. **p < .01, ***p < .001. The reported p-values are two-tailed. Significant values appear in bold. All CI and p-values were calculated using bootstrapping of 1000 samples.

In the female sample *IGD* scores only increased significantly with rising *Achievement* motivations ($\beta = .15$, $p < .001$). They explained an additional 2% of the variance in *IGD* when accounting for gaming time (model 1: $R^2_{adj} = .18$, $F(1,423) = 90.77$, $p < .001$; model 2: $R^2_{adj} = .20$, $F(2,422) = 52.32$, $p < .001$; $\Delta R^2 = .02$). This posed a small effect. No significant effects were observed for *Immersion* and *Social* motivations.

Hypothesis 4a is not supported since *Immersion* motivations showed no significant effect in the female sample, and the found effect in the male sample was only of irrelevant size. Hypothesis 4b is not supported due to the lack of any significant effects of *Social* motivations

on *IGD* scores in either sample. Hypothesis 4c, on the contrary, is fully supported with *IGD* scores increasing by more than 1 ½ points for men and 1 ¼ points for women with every extra point in *Achievement* motivations.

Considering the strong connections between escapism and *IGD* found in previous studies and the failed effect of *Immersion* as a whole, the individual effect of the subscale escapism (as proposed by Yee, 2006b) was analysed as well. In the male sample the reported *IGD* scores rose significantly with increasing escapism ($\beta = .41$, $p < .001$) which explained an extra 15% of the variance in *IGD* after accounting for gaming time (model 1: $R^2_{adj} = .02$, $F(1,3341) = 62.92$, $p < .001$; model 2: $R^2_{adj} = .17$, $F(2,3340) = 349.61$, $p < .001$; $\Delta R^2 = .15$). In the female sample the reported *IGD* scores also rose significantly with increasing escapism ($\beta = .37$, $p < .001$) which explained an extra 10% of the variance in *IGD* after accounting for gaming time (model 1: $R^2_{adj} = .02$, $F(1,423) = 7.40$, $p < .01$; model 2: $R^2_{adj} = .12$, $F(2,422) = 30.66$, $p < .001$; $\Delta R^2 = .10$). Both effects were small but showed that escapism, as a subscale of *Immersion*, has a significant effect on the expression of *IGD* scores in men and women.

### 3.6. Effects of Genre Preferences

Multiple regressions were employed to check for possible connections between genre preferences and *IGD* scores. No highly influential cases were present in the data (Cook's Distances ≤ 0.13) and no problematic multicollinearity was found (VIF ≤ 1.23). Due to the ordinal character of the genre preference variables and a lack of normally distributed residuals when treating genre preference as metric, genre preferences were dummy coded. The regression tables of the final models including gaming time and all three genre preference variables can be found in Appendix C (Tables A6 & A7).

*IGD* scores were significantly higher for men who indicated *MOBA* preferences higher than the lowest category, an exception being the neutral one. *MOBA* preferences merely explained 1% more variance than a model including only gaming time (model 1: $R^2_{adj} = .06$, $F(1,3341) = 211.04$, $p < .001$; model 2: $R^2_{adj} = .07$, $F(7,3335) = 35.77$, $p < .001$; $\Delta R^2 = .01$). This made the found effect irrelevant in size. No trends were found for *FPS* or *MMORPG* preferences. In the female sample *IGD* scores were significantly higher for women who indicated *FPS* preferences higher than the lowest category, an exception being category 3 (*slightly disagree*) and category 5 (*moderately agree*). The significant connections between *FPS* preferences and *IGD*, however, did not present any clear trend or pattern. Moreover, *FPS* preferences barely explained any additional variance in *IGD* when accounting for gaming time (model 1: $R^2_{adj} = .18$, $F(1,423) = 90.77$, $p < .001$; model 2: $R^2_{adj} = .18$, $F(7,417) = 14.19$, $p <$

.001; $\Delta R^2 = .00$). This made any potential effects irrelevant in size. *MMORPG* and *MOBA* preferences showed no meaningful connection to *IGD*. Consequently, the current data does not support any of the three hypotheses 5a, 5b or 5c.

### 3.7. Mediation Model

Due to the ordinal character of the genre preference variables, multiple ordinal regressions were employed to answer the question of possible connections between gaming motivations and genre preferences. The proportional odds assumption was initially rejected, likely because of the large sample size and the high percentage of zero cells. As before, the assumption was checked with binary logistic regressions of the dichotomised outcome variables. The individual location estimators did not differ significantly, and the proportional odds assumption was therefore accepted as fulfilled. No highly influential cases were present in the data (Cook's Distances $\leq 0.07$) and no problematic multicollinearity was found (VIF $\leq 1.14$). All six regression tables can be found in Appendix C (Tables A8 – A13).

In the male sample *MMORPG* preferences increased significantly with rising *Immersion* motivations ($B = 0.73$, $p < .001$). They enhanced the model fit[21] significantly ($R^2_{Nakelkerke} = .08$, $\chi^2(1) = 274.12$, $p < .001$). The odds of men preferring *MMORPG* games increased by 2.08 for every extra point in *Immersion* motivations. *Social* motivations only accounted for a minor increase in model fit ($\Delta R^2_{Nakelkerke} = .01$), and *Achievement* motivations failed to reach significance altogether. *MOBA* preferences increased significantly with rising *Achievement* motivations ($B = 0.52$, $p < .001$) and enhanced model fit significantly ($R^2_{Nakelkerke} = .05$, $\chi^2(1) = 154.38$, $p < .001$). The odds of men preferring *MOBA* games increased by 1.68 for every extra point in *Achievement* motivations. *Immersion* and *Social* motivations failed to show notable connections with *MOBA* preferences. *FPS* preferences of men increased significantly with rising *Achievement* motivations ($B = 0.66$, $p < .001$) and enhanced model fit significantly ($R^2_{Nakelkerke} = .07$, $\chi^2(1) = 246.97$, $p < .001$). The odds of men preferring *FPS* games increased by 1.77 for every extra point in *Achievement* motivations. *Social* and *Immersion* motivations were both significant but only accounted for a minor increase in model fit ($\Delta R^2_{Nakelkerke} = .01$).

In the female sample *MMORPG* preferences increased significantly with rising *Immersion* motivations ($B = 0.57$, $p < .001$) and enhanced model fit significantly ($R^2_{Nakelkerke} = .03$, $\chi^2(1) = 12.56$, $p < .001$). The odds of women preferring *MMORPG* games increased by 1.76 for every extra point in *Immersion* motivations. No effects were found for *Achievement* or

[21] Amount of proportional reduction in the Log-Likelihood measure.

*Social* motivations. *MOBA* preferences increased significantly with rising *Achievement* motivations ($B$ = 0.56, p < .001) and enhanced model fit significantly ($R^2_{Nakelkerke}$ = .06, $\chi^2(1)$ = 23.06, p < .001). The odds of women preferring *MOBA* games increased by 1.76 For every extra point in *Achievement* motivations. *Immersion* and *Social* motivations failed to show notable connections with *MOBA* preferences. *FPS* preferences of women increased significantly with rising *Achievement* motivations ($B$ = 0.56, p < .001) and enhanced model fit significantly ($R^2_{Nakelkerke}$ = .10, $\chi^2(1)$ = 44.23, p < .001). The odds of women preferring *FPS* games increased by 2.17 for every extra point in *Achievement* motivations. Again, *Immersion* and *Social* motivations failed to reach significance.

Hypothesis 6a is mostly supported by these results since *Immersion* motivations positively predicted *MMORPG* preferences and *Achievement* motivations positively predicted *MOBA* and *FPS* preferences in both genders. *Social* motivations failed to show any relevant effects on genre preference in the current sample.

In order to test whether genre preferences mediate the effect of gaming motivations on *IGD* scores, three assumptions must be met: (1) Gaming motivations must predict *IGD* scores. (2) Gaming motivations must predict genre preferences. (3) Genre preferences must predict *IGD* scores. Assumptions (1) and (2) are met for some of the gaming motivations and genre preferences. The third assumption is not met since all three genre preferences failed to predict *IGD* scores in either gender. Hence, a mediation analysis could not be calculated and hypothesis 6b is not supported by the data.

### 3.8. Clustering and Gamer Types

A hierarchical cluster analysis using the Ward method (Ward, 1963) with squared Euclidean distances was conducted to answer the question whether gamers can be grouped into meaningful groups of gamers (gamer types) according to their gaming motivations. The dataset was suitable for clustering since there were no missing values, all variables were measured on the same scale and no variables correlated too highly with each other (see Table 11).

Table 11

*Pearson correlation coefficients between motivations (N = 3768)*

| Variables | Achievement | Immersion | Social |
|---|---|---|---|
| *Achievement* | 1 | | |
| *Immersion* | -.14** | 1 | |
| *Social* | .23** | .22** | 1 |

*Note.* **p < .01. The reported p-values are two-tailed.

Multiple decision criteria were used to determine the number of clusters: (1) a dendrogram visualising cluster arrangements of hierarchical clustering (Figure 7), (2) the total within-cluster sum of squares measuring the variability of cases within the clusters (Figure 8), (3) the average silhouette method comparing the similarity of cases within their own cluster to their similarity with other clusters (Rousseeuw, 1987), (4) the gap statistic method measuring the deviation of observed intra-cluster variations from variations that would be expected when no clustering is present (Figure 9; Tibshirani, Walther, & Hastie, 2001) and (5) cluster plots visualising different cluster-number solutions (Figures 10 & 11).

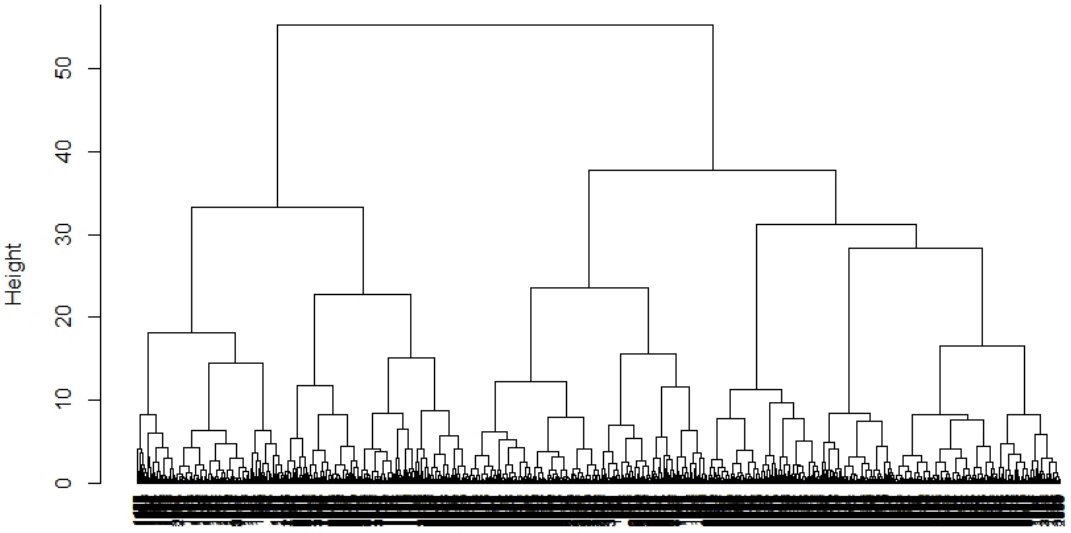


*Figure 7.* Dendrogram of hierarchical cluster analysis of gaming motivations

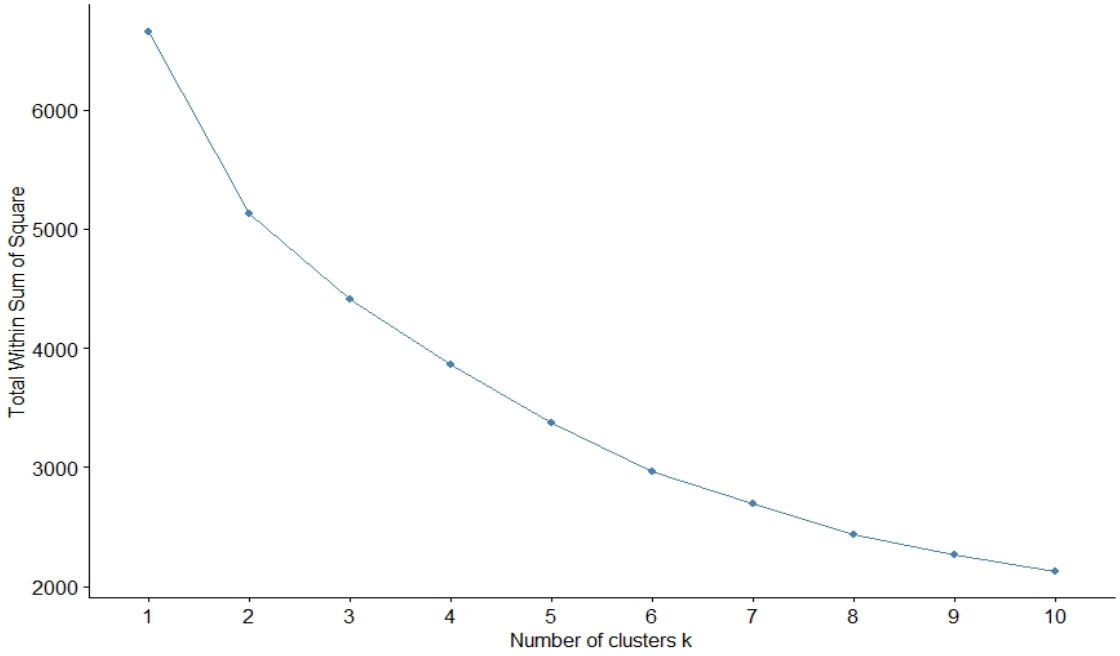


*Figure 8.* Elbow criterion plot of total within sum of squares

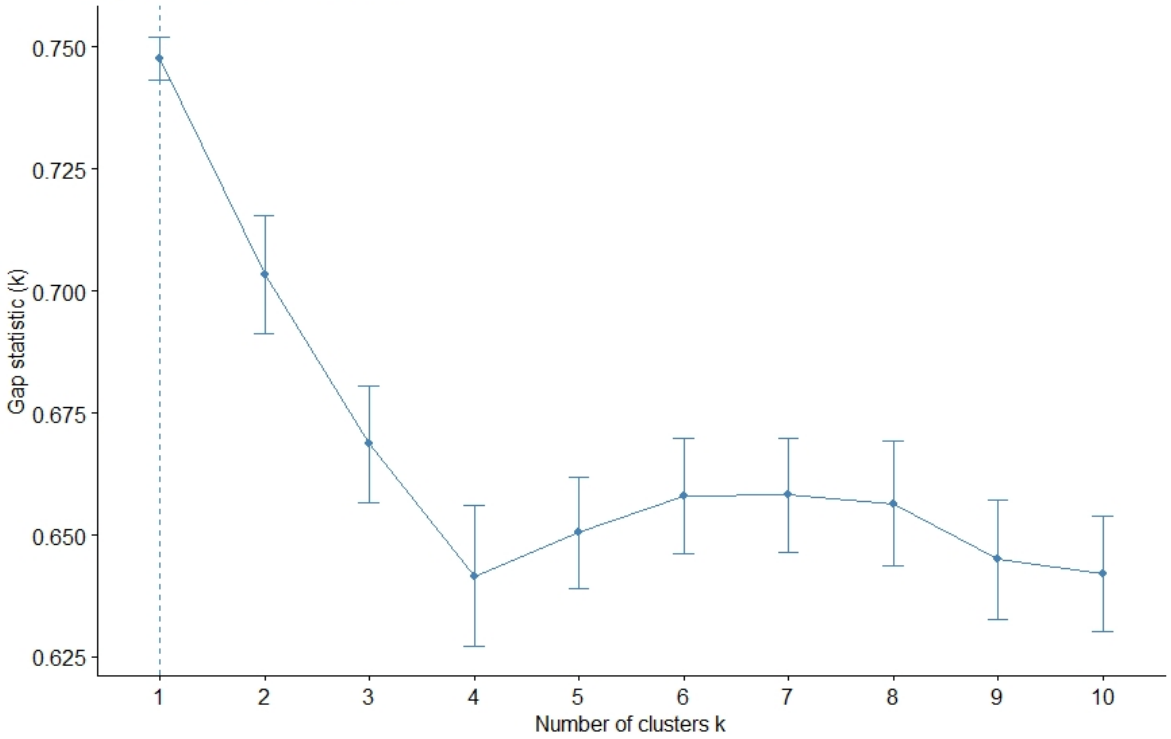


*Figure 9.* Gap statistic plot of hierarchical clustering

There were either two or four clusters identifiable in the dendrogram, whereas the elbow plot of the total within-cluster sum of squares did not indicate any form of clustering. The average silhouette width (*ASW*) peaked at two clusters with $ASW = 0.22$, a relatively low value which suggested that no substantial structuring was present in the data (Kaufman & Rousseeuw, 1990). The gap statistic also strongly indicated a lack of clustering since it peaked at one cluster and fell rapidly afterwards (Tibshirani et al., 2001). All cluster identification criteria indicated a lack of clustering with exception of the dendrogram. For the sake of completely exploring both indicated clustering options, two cluster-plots were created, one with two (Figure 10) and one with four (Figure 11) clusters.

These cluster plots helped visualising the conclusion to which the previous decision criteria had already come, namely that no meaningful clustering was present in the data. The identifiable clusters were overlapping, and cluster affiliation was largely inconsistent. Clustering gamers into groups, while statistically possible, would be artificial and not meaningful. Accordingly, hypothesis 7a and all related hypotheses (7b, 7c, 7d, 7e) are not supported by the data.

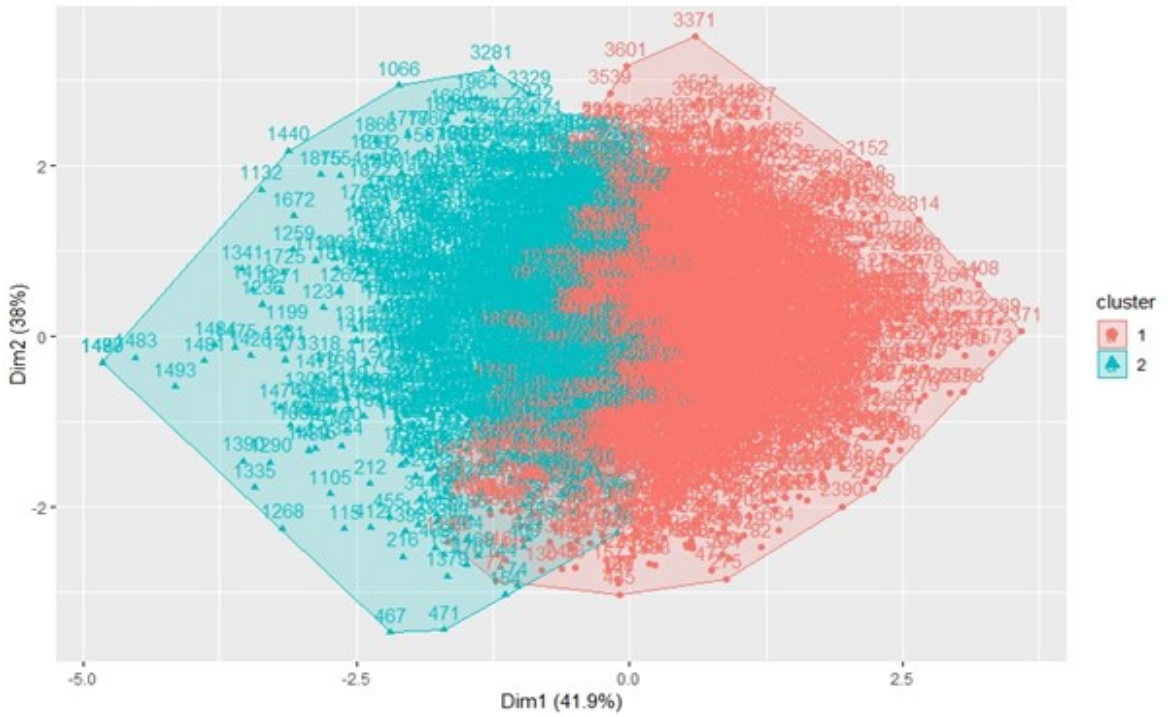


*Figure 10.* 2-Cluster solution cluster plot


*Figure 11.* 4-Cluster solution cluster plot

# 4. Discussion

## 4. 1. Summary

This study aimed to provide a deepened understanding of video gaming, an activity which originated in the early 1970's and has become exceedingly popular within the past two decades (Newzoo, 2018). Paralleling its increasing success has been research from various disciplines which addresses different aspects of this new phenomenon. Over the years the focus of psychological studies has shifted from an initially problem-centred approach (Anderson & Bushman, 2001; Sherry, 2001) to a more comprehensive view which also acknowledges the benefits of gaming (e.g., Chiappe et al., 2013; Dye et al., 2009; Kato, 2010; Russoniello et al., 2013). At the same time, another development of the video games market has gained scientific attention: the implementation of the Internet as a gaming platform. This new type of online environment primarily differs from already established games regarding the game design and the opportunity for social interactions (Király et al., 2014b). Studies have started emerging which report problem-behaviours observed in online gamers (Griffiths & Meredith, 2009; Smyth, 2007). Yet, the lacking consensus on the topic of problematic gaming behaviours has led to vastly heterogenous prevalence estimations (e.g., Ferguson et al., 2011; Gentile et al., 2011; Hussain et al., 2012). This has given rise to the proposition of the behavioural disorder titled *Internet Gaming Disorder* by the APA (2013). *IGD* itself is very controversial and the applied disorder framework (De Leo & Wulfert, 2013; Király et al., 2015b), the lack of a distinction to similar problem-behaviours (Griffiths & Pontes, 2014; Starcevic & Billieux, 2017) and an ambiguous online-offline distinction (Király et al., 2015b) are the centre of criticism. Based on an extensive literature review, the current study adapted an integrative concept which sees *IGD* as an independent behavioural disorder characterised by its online platform.

A causes and risk-factors framework of gaming in general (Rehbein & Mößle, 2012) was applied to *IGD* (Ferchow et al., 2015), listing three main areas of interest: the gamer, the games and the environment of the gamer. While all three aspects are relevant, gamer related variables like personality traits, individual characteristics and comorbidities have most frequently been liked to problematic gaming (e.g., Charlton & Danforth, 2010; Lemmens et al., 2011; Mehroof & Griffiths, 2010; Metzoni et al., 2011; Peters & Malesky, 2008). Nevertheless, there have been studies suggesting that the effects of gamer related factors, such as loneliness and anxiety, are at least partially mediated by gaming motivations (Kardefelt-Winther 2014b, Király et al., 2015b). Consistent with *Self-Medication-Theory* (Khantzian, 1985), some people may be motivated to play games by the need to compensate for issues they experience in other

areas of life. These sorts of compensatory motivations are thought to be linked to more negative outcomes than other motivations (Kardefelt-Winther, 2014b; Király et al., 2015b). Furthermore, the importance of considering game genres when investigating gaming motivation has been pointed out (Demetrovics et al., 2011; Hilgard et al., 2013; Kahn et al., 2015). Games differ in many aspects (Adams, 2014; King et al., 2010), and they consequently have different potentials to satisfy the individual needs of gamers (Hilgard et al., 2013). Moreover, it has been suggested that certain structural aspects of games are connected to *IGD* (King et al., 2011). Drawing from these findings, the current study aimed to explore the interplay of gaming motivations and game genres and their relationship to *IGD*. The questions asked were "*Why* do people play?" (motivations), "*What* do they play?" (genres) and "How are these aspects related to each other and *IGD*?".

Games can be categorised according to various classification criteria like their platform (ESA, 2018; Newzoo, 2018), their genre (Adams, 2014; Steffano, 2018) and their utilisation of the Internet (e.g., Thorens et al., 2014; Van Rooij et al., 2014). Despite a lack of consensus regarding the exact classifications (e.g., Donati et al., 2015; Elliott et al., 2012b; Rehbein et al., 2016), a categorisation according to game genre is advantageous because, out of all three criteria, it retains the most information about specific game characteristics (Adams, 2014). Due to the online nature of *IGD*, only Internet based game genres were considered in this study. The three most popular (Plarium, 2017), homogeneous and distinct online genres were selected; *MMORPG*, *MOBA* and *FPS*. Subsequently, only PC- or console-based games were included since the chosen genres are primarily being played on those two platforms.

Previously proposed gaming motivation frameworks have been rather heterogeneous. Many studies base their investigations on established motivational frameworks like *Maslow's Hierarchy of Human Needs* (Wan & Chiu, 2006), *Self Determination Theory* (Lafrèniere et al, 2012; Przybylski et al., 2010; Ryan et al., 2006), *Social Cognitive Theory* (De Grove et al., 2014, 2016; De Grove & Van Looy, 2015) and *Uses and Gratifications Theory* (Sherry, 2006; Wu et al., 2010). However, there is a variety of approaches which base their taxonomies on empirically derived gaming motivations. Following Bartle's (1996) original work, Yee (2006b) developed one such model which proposes three main motivations: *Achievement*, *Social* and *Immersion*. Since its development it has been internally and externally validated (Billieux et al., 2013; Li et al., 2013; Yee et al., 2012) and has also been compared to theoretically based frameworks (Hilgard et al., 2013; Li et al., 2013). Accordingly, Yee's (2006b) gaming motivation questionnaire was used in the current study despite the existence of other, more recent instruments (Demetrovics et al., 2011; Hilgard et al., 2013; Kahn et al., 2015).

Next to the three main constructs of gaming motivations, game genre and *IGD*, the current study also paid specific attention to age, gender and gaming time due to their relevance in previous research (e.g., Festl et al., 2013; Hellström et al., 2012; Lemmens & Hendriks, 2016). Based on the discussed literature, the combination of all six aspects resulted in the following research questions (for a visualisation see Figure 2, p.26): (1) Does age influence the expression of motivations, genre preferences, gaming time and *IGD* scores? (2) Are there differences between men and women regarding motivations, genre preferences, gaming time and *IGD* scores? (3) Does gaming time influence the expression of *IGD* scores? (4) Do gaming motivations influence the expression of *IGD* scores? (5) Do genre preferences influence the expression of *IGD* scores? (6) Does genre preference mediate the connection between motivations and *IGD* scores (Consequently: Do gaming motivations influence genre preferences)? (7) Can gamers be grouped into meaningful gamer-types according to their gaming motivations?

To investigate these questions, the *Internet Gaming Disorder Short Scale* (*IGD-SF9*; Pontes & Griffiths, 2015), the aforementioned *Motivations to Play Online Games Questionnaire* (*MPOGQ*; Yee, 2006b) and three simple Likert-scale items inquiring about genre preferences were employed. The *IGDS9-SF* is based on the nine diagnostic criteria proposed in the DSM-5 (APA, 2013) and reached an acceptable model fit in the current study. The *MPOGQ* had to be revised because of its diverging factor structure and unacceptable model fit. The final motivational model retained 26 of the initial 39 items and accounted for the three originally proposed main motivations (*Achievement, Social, Immersion*), but not for the 10 subscales.

The data were collected by the means of an online survey which was posted on forums (Subreddits) related to gaming. The obtained sample had a few notable characteristics. Firstly, considering that the target group were adults of 18 years or older, the average age of the present sample was comparably low at just under 26 years. Other studies regarding online gaming have found similar results (e.g., Billieux et al., 2015; Király et al., 2017; Laconi, et al., 2017; Šporčić & Glavak-Tkalić, 2018), suggesting that these findings are typical for the online gamer population. Wittek and colleagues (2015) propose that this age effect might be caused by the fact that gaming has become a popular activity only recently and that gamers will become more evenly distributed across all ages as the current generation grows older.

Secondly, the male-female ratio in the current study was rather unbalanced with females merely making up 11.3% of the whole sample. Again, other studies have found similarly uneven gender distributions (e.g., Billieux et al., 2015; Fuster et al., 2012; Kaptsis et al., 2016; Király et al., 2017; Kuss et al., 2012; Šporčić & Glavak-Tkalić, 2018; Yen et al., 2017). This could be indicative of a gender gap in online multiplayer games. Statistics suggest that women

and men are nearing an equal representation in the general gaming population (including offline games, mobile games and browser games; Statista, 2018b). However, this might not yet be the case for the types of online games investigated in the current study. Out of the three included genres, men have been shown to prefer both *FPS* and *MOBA* games to a higher degree than women (Ghuman & Griffiths, 2012; Lucas & Sherry, 2004; Nagygyörgy et al., 2013; Scharkow et al., 2015). On that account, a certain degree of participant self-selection seems probable, with men being more interested in participating due to their interest in the included genres. It is further possible that, just like in the beginning stages of offline video games, males are the "pioneers" of online gaming and that female gamers will eventually follow suit.

A similar imbalance was found for gaming platform preferences. 85.2% of the surveyed gamers indicated that they preferred playing on PC over playing on console. This could be a result of the selected game genres as well. PCs are generally slightly more popular than consoles (ESA, 2018). Additionally, only *FPS* games are approximately equally represented on both platforms (see examples in subchapter 1.3., p.19). It is also crucial to note that the study only asked for *preferred* and not for *used* platform and that it is highly probable that participants play games on multiple platforms despite preferring a specific one.

A last interesting observation was the reported average amount of gaming time with participants spending nearly four hours per day on games. In contrast to studies investigating the general population which reported average daily gaming times of 1.0 – 1.6 hours (Festl et al., 2013; Lemmens & Hendriks, 2016; Männikö et al., 2017), this value is quite high. Yet, when comparing it to other gamer-based samples, a gaming time of four hours falls within the range of previously found values between 3.0 and 4.1 hours (Billieux et al., 2011; Li et al., 2013; Šporčić & Glavak-Tkalić, 2018; Yee, 2006a; Zanetta-Dauriat et al., 2011). Moreover, Kuss and colleagues (2012) directly compared non-gamers with gamers (specifically *MMORPG* players) and found that the participants of their sample who identified as gamers reported playing for almost four hours a day, whereas non-gamers played for just over half an hour. The high average gaming times were therefore seen as a result of the sample composition. To summarise, the observed sample characteristics have typically been found in studies investigating online gamers and the current sample was consequently deemed fit for analysis.

The most important finding of the current study was the observation of connections between gaming motivations and genre preferences. In both samples, *Immersion* motivations positively predicted *MMORPG* preferences, whereas *Achievement* motivations positively precited *MOBA* and *FPS* preferences. The link between *Immersion* and *MMORPG*s as well as the one between *Achievement* and *FPS* games were consistent with the results of other studies

(Fuster et al., 2012, 2013; Ghuman & Griffiths, 2012; Király et al., 2015b; Kneer & Rieger, 2015). An important addition to existing research was the finding that *MOBA* preferences were also positively predicted by *Achievement* motivations. A closer inspection of the game characteristics of *MMORPG*s, *MOBA*s and *FPS* games reveals why these connections were present. As initially described, *MMORPG*s are immersive online worlds in which players can move freely and have many opportunities for exploration and discovery. In-game characters can be individually designed, and they develop throughout the game according to the choices made by the player. Furthermore, it is possible to choose whether to follow a more competitive or more relaxed playstyle (Kneer & Rieger, 2015; Kuss et al., 2012; www.techopedia.com/definition/1919/massively-multiplayer-online-role-playing-game-mmorpg). Most of these aspects cater to the needs of people driven by *Immersion* which consists of discovery, role-playing and customization motivations. In comparison, *MOBA*s and *FPS* games are a lot more restrictive regarding the offered choices, behaviours and tasks, and they rarely give the option to create a unique character. Both genres are mainly built on competitive play which heavily relies on skill and performance (Bonny & Castaneda, 2017; Király et al., 2014b; Kokkinakis et al., 2017; Kuss et al., 2012; www.techopedia.com/definition/241/first-person-shooter-fps). Considering these characteristics, it is not surprising that *MOBA* and *FPS* games are connected to *Achievement* needs which consists of advancement, mechanics and competition motivations.

Despite these findings, hypothesis 6a was only partially supported since *Social* motivations failed to reach significance for any of the three genres. This is surprising because online multiplayer games such as *MMORPG*s are inherently social environments (Choi & Kim, 2004; Cole & Griffiths, 2007; Griffiths et al., 2004; Jansz & Martens, 2005) and have previously been linked to *Social* motivations (Fuster et al., 2013; Laconi et al., 2017). Considering that the target-group of the study were online gamers, a possible cause for the lacking effect becomes apparent. Most online games are multiplayer games (Király et al., 2014b) and people who choose to play them are expected to already be somewhat socially motivated. Consequently, if most survey participants are driven to play these types of games by *Social* motivations, detecting small variations between specific multiplayer genres can prove difficult.

The current study was able to replicate the results of previous research which implied gaming time as a predictor of *IGD* (Ferchow et al., 2015; Gentile, 2009; Gentile et al., 2011; Hellström et al., 2012; Király et al., 2014a; Kuss et al. 2012; Lemmens & Hendriks, 2016; Männikö et al., 2017; Pontes et al., 2014; Šporčić & Glavak-Tkalić, 2018; Yee, 2006b). Hypothesis 3 was supported by these results. Moreover, a new and important detail regarding the role of gaming time was uncovered: The time spent playing games had a significantly stronger

effect on problematic gaming behaviours of women than it did on men. Many studies have suggested that a higher time investment takes away from other activities such as sleep, work, education and offline socialising (Hellström et al., 2012; Ng & Wiemer-Hastings, 2005; Peng & Liu, 2010) and that this increases the likelihood of negative outcomes (Šporčić & Glavak-Tkalić, 2018). According to that theory, it seems likely that gaming time is an amplifying factor rather than a cause of *IGD*. While the heightened investment can indeed lead to problematic outcomes, the *need* to spend increasing amounts of time on games is the driving force initiating the whole process. This conclusion is supported by studies which suggest (1) that gaming time loses predictive value when including other variables (Hellström et al., 2012), (2) that a reduced time investment alone may not be sufficient to prevent problematic outcomes (Peng & Liu, 2010) and (3) that a heightened investment does not necessarily lead to difficulties in daily life (Billieux et al., 2013). It is therefore necessary to consider the aspects behind the need to spend more time gaming as well when investigating possible risk-factors for *IGD*.

Accordingly, another aim of the current study was to understand how gaming motivations and genre preferences affect the expression of *IGD* in online gamers. *Achievement* motivations were the only ones which showed significant effects for male and female gamers in predicting elevated *IGD* scores. This is consistent with hypothesis 4c and the multitude of findings which suggest connections between *Achievement* motivations (or specific subscales) and unhealthy gaming behaviours (Billeux et al., 2013; Hussain et al., 2015; Kardefelt-Winther, 2014b; Kneer & Glock, 2013; Kuss et al., 2012; Li et al., 2013; Männikö et al., 2017; Šporčić & Glavak-Tkalić, 2018; Zanetta-Dauriat et al., 2011). There have only been few attempts at explaining this link. Kardefelt-Winther (2014b) puts forward the idea that it might be a sort of compensation mechanism for an absence of real-life success or low self-esteem. Another explanation is that people who are generally more driven by *Achievement* motivations are more likely to invest extra time into games in order to improve their performance (Kuss et al., 2012). As mentioned before, the heightened time investment can in turn lead to increased negative outcomes in real life (Šporčić & Glavak-Tkalić, 2018). This notion is supported by the finding that *Achievement* motivations are related to specific in-game behaviours (Billieux et al., 2013). Both theories could also work hand in hand. People might seek out certain challenges in games and invest a lot of time into improving at them in order to compensate for a lack of *Achievement* experiences in real life.

Contrary to *Achievement* and the assumptions of hypothesis 4b, *Social* motivations did not show any effect on *IGD* at all. This finding replicated the results of a few other studies which did not observe any effects of *Social* motivations on problematic gaming behaviours

either (e.g., Billieux et al., 2013; Kardefelt-Winther, 2014b; Knier & Rieger, 2015). In the current study this lack of an effect is most likely caused by the aforementioned focus on online multiplayer games. Due to their social nature, variations in *Social* motivations might not be as pronounced as they would have been across a broader spectrum of game genres. In comparison to offline single-player games for example, the social component seems to correlate strongly with *IGD* symptoms in online multiplayer games (Lemmens & Hendriks, 2016).

The observed effects of *Immersion* motivations on *IGD* were either insignificant or irrelevant in size and did not support hypothesis 4a. However, when specifically investigating the *Immersion* subscale escapism, significant effects emerged across both genders and replicated the results of previous research (Billieux et al., 2013; Hellström et al., 2012; Kardefelt-Winther, 2014b; Kuss et al., 2012; Laconi et al., 2017; Li et al., 2011; Männikö et al., 2017; Šporčić & Glavak-Tkalić, 2018; Xu et al., 2012; Zanettta-Dauriat et al., 2011). The *Mood Management Theory* (Zillmann, 1988, cited in Reinecke, 2017) as well as conclusions drawn from the *Self-Medication-Theory* (Khantzian, 1985) suggest that some individuals may use gaming as a strategy to deal with issues in their everyday life. As a result, some researchers have treated escapism as a type coping mechanism since its primary goal is to escape from negative moods and real-life problems (Billieux et al., 2013; Kardefelt-Winther, 2014b; Li et al., 2011). This notion is further supported by the finding that, contrary to *Achievement*, escapism is not related to specific in-game behaviours (Billieux et al., 2013). People looking for an escape therefore seem to play for the sake of playing instead of playing to achieve individually set goals. Nevertheless, escapism is not always related to negative outcomes (Kardefelt-Winther, 2014b), and it is likely that it only becomes a maladaptive coping mechanism in interplay with other variables like personality traits, psychological problems or specific game characteristics.

Contrary to hypotheses 5a, 5b and 5c, neither of the three genre preferences significantly or consistently predicted *IGD* in the current sample. This could be interpreted as an indicator for a lack of notable relationships between those variables. Yet, other studies have consistently observed unhealthy gaming habits in *MMROPG* players (Elliott et al., 2012a; Hellström et al., 2012; Kuss et al., 2012; Lee et al., 2007; Ng & Wiemer-Hastings, 2005; Rehbein et al., 2010). Moreover, *FPS* games have been linked to problem-behaviours as well (Elliott et al., 2012a; Festl et al., 2013; Männikö et al., 2017). It is thus more likely that the insignificant connections between genre preferences and *IGD* were caused by something other than a lacking connection. The nonparametric item properties of genre preferences made it necessary to employ less powerful analyses than would have been desirable, which in turn might have caused a failure to detect existing effects. Another possibility is that controlling for gaming

time made genre preferences lose predictive value. While certain genres are played because of their capability to fulfil specific needs, it might not be the genres themselves which lead to *IGD*. Instead it is possible that the need satisfaction offered by games is more successful when increasing amounts of time are invested in the game (Kardefelt-Winther, 2014b) and that this heightened time investment is responsible for the observed negative outcomes. Donati and colleagues (2015) propose that, additionally to the time spent on one genre, it is the versatility (the number of played genres) which can influence the expression of *IGD*.

Another significant contribution to the understanding of online gaming was the observation of gender differences. In accordance with hypothesis 2c, men reported significantly higher *Achievement* motivations than women. The reverse was true for *Social* and *Immersion* motivations. These results parallel the findings of previous studies which yielded similar results (Király et al., 2015b; Ko et al., 2005; Williams et al., 2009; Yee, 2006a, 2006b). The effects of *Achievement* and *Immersion* motivations were medium sized, whereas the effect of *Social* motivations was small. This was probably caused by the exclusive investigation of inherently social multiplayer games. Gamers who are interested in them are expected to be socially motivated to a certain extent. Accordingly, gender differences may not have presented themselves as prominently as they would have done if all available game genres (offline and online, across all platforms) were explored simultaneously.

An interpretation of gender differenced regarding genre preferences was limited due to the employed analysis (Mood's Median Test). Nevertheless, it did indicate significant differences between men and women across all three genres, supporting hypothesis 2d. Almost two thirds of women chose the highest agreement category for *MMORPG* preferences, and close to three quarters of them indicated some degree of enjoyment. In comparison, just over a third of men chose the highest agreement category. Yet, more than two thirds of male gamers also reported enjoying *MMORPG*s to some degree. *MOBA*s were deemed not enjoyable by the majority of both genders, but with more than two thirds of women stating that they did not like playing *MOBA*s, they showed a significantly stronger dislike than men. Regarding *FPS* preferences, almost two thirds of men reported enjoyment and nearly a quarter of them chose the highest preference category. In contrast, half of the female gamers reported not enjoying *FPS* games and almost a third chose the strongest disagreement category. Taken together, the observed genre preferences can be described as follows: (1) Both genders enjoyed playing *MMORPG*s, women just did so more strongly. (2) The majority of gamers across both genders disliked playing *MOBA*s with women reporting more extreme values. (3) Most men enjoyed playing *FPS* games, whereas women were more divided but frequently reported a strong dislike

for this genre. These findings reflect results of other studies which found that men were more likely to prefer *FPS* games, while women were more likely to prefer *MMORPG*s (Ghuman & Griffiths, 2012; Nagygyörgy et al., 2013). The current study further supported the notion that men would enjoy *MOBA*s more than women because of their higher preferences for Action and Strategy games (Lucas & Sherry, 2004; Scharkow et al., 2015). It seems likely that the observed gender differences were caused by the varying motivations that drive men and women. As noted above, men reported higher *Achievement* motivations and women reported higher *Immersion* motivations. At the same time, *MOBA*s and *FPS* games showed connections with *Achievement* motivations and *MMORPG*s with *Immersion* motivations. The *MOBA* and *FPS* preferences of men could consequently be interpreted as the result of their *Achievement*-orientation and the *MMORPG* preferences of women as a result of their need for *Immersion*. Some studies have also suggested that women generally prefer games with a more "casual" playstyle, such as platformers, puzzle and card games (Elliott et al., 2012a, 2012b; Manero et al., 2016; Nagygyörgy et al., 2013), which are typically characterised by low competitiveness. Seeing as competition is a subscale of *Achievement* this could imply that women do not only seek out competitive or *Achievement*-oriented games to a lesser degree than men but that they might even actively avoid these types of games.

Gaming time and *IGD* did not vary between male and female gamers, contradicting hypothesis 2a and 2b. This was not expected since studies have often found male gamers to report higher gaming times and *IGD* scores than female gamers (e.g., Ferchow et al., 2015; Festl et al., 2013; Floros & Siomos, 2012; Hellström et al., 2012; Laconi et al., 2017; Lemmens et al., 2015; Männikö et al., 2017; Rehbein et al., 2016; Zanetta-Dauriat et al., 2011). There is some evidence implying that female gamers sometimes play more than their male counterparts (Williams et al., 2009). In fact, women in the present study also spent significantly more time gaming than men, but no gender differences were assumed due to the observed effect being irrelevant in size. Such findings are likely the result of self-selection processes during data collection. It has been suggested that a participation in surveys with specific game related topics could be more appealing to highly invested gamers (Király et al., 2015b). Only a small portion of female gamers have been known to fall into this category (Manero et al., 2016) and the percentage of women participating in these surveys is accordingly low (e.g., Billieux et al., 2015; Kaptsis et al., 2016; Király et al., 2017; Šporčić & Glavak-Tkalić, 2018; Yen et al., 2017). The female gamers that *do* end up participating might be disproportionately invested. This would explain the lack of gender differences regarding gaming time and *IGD* scores.

Additionally to gender, potential effects of age were also investigated. This addressed the need for research on adult gamer populations, arising from the circumstance that many studies primarily focus on children and adolescents (Petry, 2011). In accordance with hypotheses 1a and 1b, the current study revealed that older gamers spent less time gaming and reported lower *IGD* scores than younger ones. These results are an important addition to the effects observed in prior research (Caplan et al., 2009; Festl et al., 2013; Gentile, 2009; Lemmens et al., 2015; Lemmens & Hendriks, 2016; Mentzoni et al., 2011; Rehbein et al., 2016; Wittek et al., 2015) and can be explained in various ways. One proposal is that the higher gaming times and *IGD* scores are a result of gaming being a "young" phenomenon, and that over time these effects will even out (Wittek et al., 2015). Another suggested reason is a decrease in the leisure time available to older people. Younger people are more likely to still be in education and to have more flexible time schedules. As a result, they can allocate more time to gaming (De Leo & Wulfert, 2013; Rehbein et al., 2016). This claim is also supported by studies reporting that unemployment, which comes with an increase in leisure time, is also connected to problematic gaming behaviours (e.g., Elliott et al., 2012a; Kim et al., 2008). It has further been implied that the observable age effects are, in fact, the result of varying genre preferences across age. It should therefore be possible to trace differences in gaming time and *IGD* scores back to distinct game choices of different age groups (Rehbein et al., 2016).

Regarding gaming motivations, only *Social* and *Achievement* decreased over age, whereas *Immersion* stayed constant across all ages. Hypothesis 1c was partially supported by these results. A similar trend for *Achievement* motivations has previously been found in other studies (Birk, Friehs & Mandryk, 2017; Fuster et al., 2013; Yee, 2006a, 2006b). In contrast, the effects of the other two gaming motivations have not yet been observed and constitute an important addition to this field of research. A possible explanation for the age-related motivational differences is the context in which different generations grew up (Birk et al., 2017). Older people have been shown to experience technology (such as digital games) in a different way than younger people do. They often feel less competent with new technologies (Aguaded-Gómezu, Tirado-Morueta & Hernando-Gómez, 2015; Marquié, Jourdan-Boddaert & Huet, 2002) and form other expectations regarding the potential consequences of their use (De Schutter & Malliet, 2014; Ferguson & Olson, 2013). Hence, the motivations for playing games might vary across age since younger people expect different outcomes from their use than older people. This reasoning, however, implies that the observed effect of age is a cohort effect rather than a development which happens over the course of life (Wittek et al., 2015).

Only limited conclusions could be drawn about the effect of age on genre preferences. Nevertheless, some trends could be identified which suggested that older gamers were less inclined to state high *MOBA* or *FPS* preferences. No age effects were found for *MMORPG*s. Hypothesis 1d was thereby only partially supported. While *FPS* games have previously been linked to a younger player base (Elliott et al., 2012a, 2012b; Lemmens & Hendriks; Nagygyörgy et al., 2013; Scharkow et al., 2015), the finding that younger gamers also show higher *MOBA* preferences is new and gives important insights into the significance of age for the choice of games. The lower *FPS* and *MOBA* preferences of older players can be explained by the interplay of age, gaming motivations and game genre. As stated above, *Achievement* motivations decline over age and are further linked to *MOBA* and *FPS* preferences. Younger people, who are driven by *Achievement* motivations to a higher degree, are thus more likely to seek out games which can satisfy their need for *Achievement* such as *MOBA*s and *FPS* games. In contrast, older gamers report significantly lower *Achievement* motivations and consequently do not feel the need to play games capable of satisfying those needs. By linking age to genre preferences, the findings also support the assumption that the effect of age on gaming time and *IGD* could be caused by distinct genre preferences instead of aging processes (Rehbein et al., 2016).

Neither hypothesis 6b nor hypothesis 7 were supported by the current study. Due to genre preferences failing to predict *IGD*, it was unnecessary to calculate the proposed mediation model whereby genre preferences mediated the effect of gaming motivations on *IGD*. The previously theorised process of specific motivations leading to a heightened time investment in certain genres might serve as explanation for the lacking mediation. Rather than genres directly influencing *IGD* and mediating the motivational effects, the experienced need satisfaction could lead to an increased time investment which takes over the mediating role. However, this is purely speculative and does not exclude the possibility of genre-specific aspects leading to problem-behaviours. Research investigating those game-related effects would have to focus on the structural characteristics of different games instead of the subjective preferences of gamers. Furthermore, there was no clear clustering present in the data. Contrary to another study which found distinct groups of gamers based on just two motivational categories (Tseng, 2011), the current participants could not be clearly classified according to *Achievement, Immersion* and *Social* motivations. It is possible that the present sample was either too homogeneous regarding these motivations or that the chosen clustering criteria were simply not the defining variables for different types of gamers.

Figure 12 visually summarizes the effects that were found in the current study.

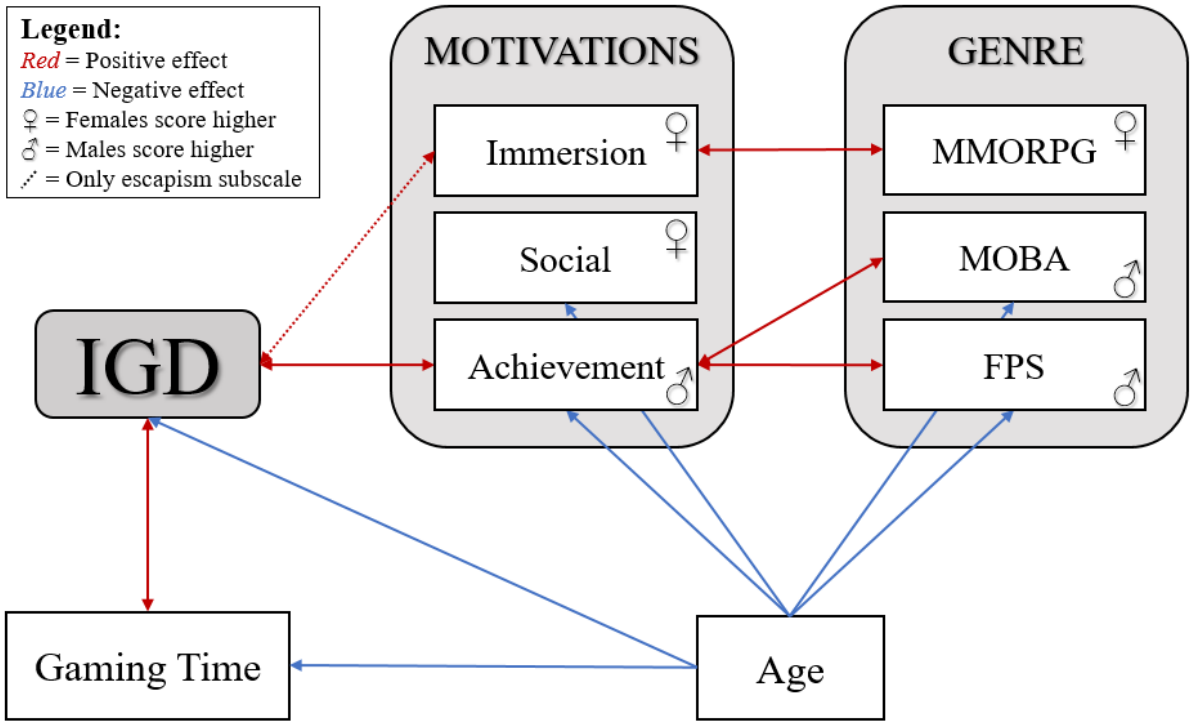


*Figure 12.* Summary of found effects

### 4. 2. Strengths and Implications

Overall, the current study makes an important contribution to the growing field of research investigating online gaming and focuses on areas that have previously fallen short. It has several strengths, and the obtained results do not only advance the scientific understanding of this increasingly popular activity but also have practical implications for the assessment and treatment of related problem behaviours.

Notable strengths of the present study are (1) the large sample size, (2) the high number of female participants and (3) the broad age range of adult gamers. The large sample size (N = 3768) enabled the statistical analyses to provide more accurate estimates[22] and to uncover small effects that would have otherwise stayed hidden. Thanks to the high number of participants, conclusions about female gamers (N = 425) could be drawn as well despite them only making up a small portion of the total sample (11.3%). Considering that several other studies only include few or even no women (e.g., Fuster et al., 2012; Šporčić & Glavak-Tkalić, 2018; Yen et al., 2017), the present study plays an instrumental role in uncovering gender-specific aspects of online gaming. Furthermore, the issue of predominantly adolescent samples, which was

[22] For the population of which the sample is representative.

brought forward by Petry (2011), was addressed by specifically targeting adult gamers with the survey. The obtained age range of participants (18 – 52 years) provides fundamental insights into the age effects of online gaming which have often fallen short in other studies.

Another key strength of this study is the inclusion of various game genres (*MMORPG, MOBA, FPS*). While this aspect has previously been mentioned as critical for research focusing on gaming behaviours (Demetrovics et al., 2011; Hilgard et al., 2013; Kahn et al., 2015), only few studies have actually investigated and compared multiple genres (e.g., Elliott et al., 2012a, 2012b; Männikö et al., 2017). The current paper thus adds to the knowledge in an area which has previously been neglected and is an important step towards understanding the connections between specific types of games, related gaming motivations and *IGD* better.

The conducted study also critically discusses the theoretical frameworks and instruments used to investigate the phenomenon of online gaming and related problem-behaviours. The DSM-5 (APA, 2013) disorder framework and its nine diagnostic criteria were specifically addressed regarding their ability to reliably assess *IGD*. The *IGDS-SF9* (Pontes & Griffiths, 2015) is based on these nine aspects and was employed in the current study to measure unhealthy gaming behaviours. The proposed one-factor structure was replicated on an international sample and showed satisfactory psychometric properties. These results support the diagnostic ability of the DSM-5 criteria for *IGD* and add to the existing literature validating the use of the *IGDS9-SF* (e.g., Monacis et al., 2016; Palo et al., 2018; Schivinski et al., 2018; Stavropoulos et al., 2017).

Contrary to the *IGDS9-SF*, an inspection of Yee's (2006b) gaming motivations questionnaire (*MPOGQ*) did not show acceptable psychometric properties and could not replicate the originally proposed factor structure. It was thus revised for its use in the current study. Apart from giving important insights into shortcomings of the framework, its scales and items, the revision was able to reproduce the three main gaming motivations *Achievement, Immersion* and *Social*. This is a crucial finding since it supports the notion that these three motivational aspects do indeed play a significant role in driving online gaming. Moreover, the revised version of the *MPOGQ* was able to assess the main motivations as reliably as the original questionnaire but did so with fewer items. Similar to Yee and colleagues (2012), the current study therefore provides a short version of the *MPOGQ* developed on an international sample of adult gamers and offers the possibility of a more efficient assessment of gaming motivations.

Next to these theoretical implications, the current study also holds practical value. This becomes clear when looking at the way health professionals are dealing with problematic gaming. Over the past few years various treatments for *IGD* and related disorders have emerged

with the majority being cognitive-behavioural therapies (e.g., Du, Jiang & Vance, 2010; Kim, Han, Lee & Renshaw, 2012; Malak, 2018). Most of them are still in the early stages of development and have yet to prove their long-term effectiveness (Griffiths, Pontes & Kuss, 2015; King & Delfabbro, 2014; Winkler, Dörsing, Rief, Shen & Glombie, 2013; Zajac, Ginley, Chang & Petry, 2017). Apart from their lack of evaluation, a big issue with these treatment plans is the fact that they primarily focus on the symptoms of *IGD*. They rarely consider the importance of other aspects like gaming motivations for the development, perpetuation, prevention and treatment of *IGD* (King & Delfabbro, 2014). While recreational gaming is not problematic, specific motivational patterns can facilitate unhealthy behaviours (Király et al., 2015b; Laconi et al., 2017). Hence, being able to identify them amongst other risk factors is instrumental if health professionals want to set preventative measures and carry out effective interventions. The present study provides an understanding of exactly these aspects and consequently holds immense practical value. For example, young gamers and men have a higher potential to develop problematic gaming behaviours than other gamers since they are often driven by *Achievement* motivations which show significant effects on *IGD*. No comparable risks are indicated for gamers motivated by *Immersion* or *Social* motivations. One exception is the *Immersion* subscale escapism which is strongly connected with unhealthy gaming habits in men and women. Furthermore, a high time investment tends to go hand in hand with higher *IGD* scores for both genders, but it poses a much stronger risk factor for female gamers. Taken together, these insights are able to provide crucial information for developing screening tools and effective treatment plans for *IGD*.

The improved understanding of gaming motivations and genre preferences of specific age and gender groups does, of course, not only hold value for clinicians but also for game developers. With the knowledge about "who plays what and for which reasons", games can be specifically shaped to suit the needs and wants of specific target audiences. It is necessary to note that the interests of game developers and the health of gamers could easily come into conflict. On the one hand, it is the goal of the former to develop successful games with large audiences and using mechanisms to keep gamers interested or "hooked" on a game is in their best interest. On the other hand, the implementation of such aspects can heighten the risk of an individual to develop problematic gaming behaviours. The outcomes resulting from an implementation of the provided information are therefore in the hands of the practitioner.

### 4. 3. Limitations

There are some limitations that need to be considered when interpreting the results of this study. The data collection was conducted entirely online for reasons of cost effectiveness, accessibility and availability. The requirement of Internet access for participation in the survey was not seen as an issue because it is also necessary for playing online games. Accordingly, only people with Internet access fulfilled the study's participation criteria in the first place. Nevertheless, there are disadvantages of conducting online surveys, namely (1) that there is no way of checking whether the information given by the participants is, in fact, true (e.g., age, gender), (2) that some people might not participate in a serious manner and distort the overall results and (3) that the sample might be heavily self-selected due to the voluntary nature of participation. Since the survey was only posted on one Website (Reddit), it is also likely that most of the participants were Reddit users despite the appeal to share the survey-link with friends. Due to the nature of the data collection process, the obtained sample was a convenience sample. The possibility of a sampling bias and a lack of representativeness for the online gamer population can consequently not be excluded.

The generalisability of the results is further limited due to the sociodemographic characteristics of the sample. Even though there is a certain degree of variability, most participants of the current study were from "*WEIRD*" (western, educated, industrialised, rich and democratic) societies which have been criticised for being one of the least representative societies in the world (Henrich, Heine & Norenzayan, 2010). An extension of the results to populations that are underrepresented in the present dataset is therefore not warranted. Considering that participants were predominantly male and between 20 and 30 years old, the effects of gender and age have to be interpreted critically as well. However, since other studies have found similar discrepancies (e.g., Billieux et al., 2015; Fuster et al., 2012; Kuss et al., 2012; Laconi et al., 2017; Ng & Wiemer-Hastings, 2005; Pontes et al., 2014), it is possible that these imbalances merely reflect the composition of the online gamer population.

Another limitation originates from the use of an adapted, exploratory version of Yee's (2006b) motivation scales. As elaborated above, the original model did not show satisfactory scale properties and fit indices for the current sample and were revised. Despite checking the stability of the factor structure with randomly drawn subsamples, the employed scales have not yet been validated on other samples and the findings must be interpreted with caution. Moreover, the employed genre preference items were extremely skewed and could only be treated as ordinally scaled. This limits the power of the employed analyses and raises questions as to why they were not normally distributed. It could have been a result of the mentioned self-selection

bias with some gamers feeling more inclined to participate than others. Regardless of the item properties, no conclusions about gaming in an offline context or genres other than *MMORPG*s, *MOBA*s and *FPS* games can be drawn since the study focused exclusively on these three online genres.

The current study also depends entirely on self-reported data. This can be problematic for a number of reasons. Self-reported measures rely on the honesty of a person which is likely to be compromised when uncomfortable topics such as societal taboos or problem-behaviours (like *IGD*) are brought up. The willingness to remain truthful throughout these types of questions often depends on the survey setting as well as the personality of the participants. Even if someone is trying to be honest, the accuracy of their responses can be diminished by a lack of introspective capabilities. Individual differences in response behaviours can also affect the accuracy of the given answers. One person might be more inclined to answer with extreme values such as "never" or "always", whereas the next person might prefer more neutral answers like "sometimes". Furthermore, rating scales may be interpreted differently across participants. There is for example no guarantee that everyone rates the value "six" the same way when confronted with a seven-point Likert-scale. Similarly, the interpretation of questions asking for abstract constructs such as motivations is likely to differ between individuals. All these tendencies and subjective interpretations could result in varying scores between people with the same behaviours, thoughts and feelings and lead to a distortion of the collected data.

Finally, most reported effects were small and must therefore be interpreted with caution, especially on a practical level. Only the gender differences between *Achievement* and *Immersion* motivations reached a medium effect size. The small effect sizes suggest that there are other important factors which have not been accounted for in the present study. As mentioned before, there are a multitude of known aspects contributing to *IGD* (Ferchow et al., 2015; Rehbein & Mößle, 2012) and models of similar complexity must be assumed for gaming motivations and genre preferences. Still, it is crucial for small effects not to be overlooked, and analyses based on big samples like the present one are ideal to explore those.

### 4. 4. Future research

Drawing from the findings and limitations of the present study, a major aspect which future studies should aim to investigate more closely, is the causal nature of existing connections. Many crucial questions regarding gaming are directed at and understanding of the causality of effects. Do pre-existing motivations cause genre preferences and a higher time investment in the chosen games or do the structural aspects of the games themselves shape

motivations? Is a heightened gaming time indeed an antecedent of *IGD*, is it an amplifying factor or could it even be a result of it? Do motivations, genre preferences, gaming time and *IGD* really change over age or are the observed connections merely cohort effects? All these questions require longitudinal studies of which only a few have been conducted so far. Most of them exclusively investigate young gamer populations since they are more easily reachable through the school system (e.g., Gentile et al., 2011; Lemmens et al., 2011). Future research needs to overcome this limitation and conduct long term studies on a wider range of age groups.

Another important aspect that must be addressed in the future, is the lack of a cohesive genre classification system suitable for psychological research. Many studies rely on lists of genres created by other disciplines or develop their own versions of categorisations, which are often very dissimilar to each other (e.g., Donati et al., 2015; Elliott et al., 2012b; Rehbein et al., 2010, 2016). This does not only make an investigation of game genres difficult due to lacking instruments, but it also makes a comparison of the obtained results problematic. With genre categories that are overlapping, missing or dissimilarly defined, it becomes nearly impossible to directly compare the observed effects. As a result, most studies exclusively focus on one or a few selected genres that are easily distinguishable. Consequently, an in-depth understanding of the interactions between game genres and other variables is still in its beginning stages. Future research must tackle this issue and attempt to develop an instrument fit to unambiguously and distinctly categorise games.

A last interesting aspect is the motivational model initially proposed by Yee (2006b). It has been subject to some adaptions since its development (Yee et al., 2012) and has recently been drastically revised to form the base of a much bigger project undertaken by a company called *Quantic Foundry* (*QF*; Yee & Ducheneaut, 2015, www.quanticfoundry.com). *QF* is a market research company focusing on understanding the motivations which are driving gamers. It provides a freely available online survey on their website and is thereby able to continuously collect data from gamers worldwide. It has surmounted 300,000 participants up to date. Instead of the original three main motivations, the new model proposes six factors with two subscales each: Action (destruction, excitement), Social (competition, community), Mastery (challenge, strategy), Achievement (completion, power), Immersion (fantasy, story) and Creativity (design, discovery). The main achievement of this project is the development of gamer profiles on a large scale and the corresponding insights into the role of different types of games. Unfortunately, scientific papers based on this model are not freely available. However, there are regular updates about new and interesting findings on the *QF* website.

## 4. 5. Conclusion

In summary, the current study supports the notion that gaming motivations, age and gender all play an important role in the subjective enjoyment of different game genres. *Achievement*-oriented, young and male gamers report preferences for *MOBA* and *FPS* games while *Immersion*-motivated and female gamers of all ages prefer *MMORPGs*. High *Achievement* motivations and escapism (a subscale of *Immersion*) are further linked to increases in *IGD*, as are longer gaming times and a younger age. Age also shows connections to motivations and gaming time, with older gamers spending less time gaming and scoring lower on *Achievement* and *Social* motivations. Gender shows similar effects, with male gamers reporting higher *Achievement*, but lower *Social* and *Immersion* motivations than women.

It can be concluded that gaming behaviours and their outcomes are part of an extremely complex model with many interlinked variables that influence each other via different pathways. Telling antecedents and consequences apart is nearly impossible without longitudinal studies and the presented findings must therefore be interpreted with the knowledge that they are purely correlational. Nevertheless, the study offers important theoretical and practical insights into a subject of great recency and relevance. With the understanding that motivations play a crucial role in the choice of game genres but that only a small set of them increase the risk of negative outcomes, strategies tackling problematic gaming behaviours can be developed and utilised effectively without problematising gaming itself.

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# Appendix A

## List of Abbreviations

| | |
|---|---|
| *HHN* | Maslow's Hierarchy of Human Needs |
| *IA* | Internet Addiction |
| *CFA* | Confirmatory Factor Analysis |
| *EFA* | Exploratory Factor Analysis |
| *FPS* | First Person Shooter |
| *GAMES* | Gaming Attitudes, Motives and Experiences Scale |
| *IGD* | Internet Gaming Disorder |
| *IGDS9-SF* | Internet Gaming Disorder Short Scale |
| *ISCED* | International Standard Classification of Education |
| *MMORPG* | Massively Multiplayer Online Role-Playing Game |
| *MOBA* | Multiplayer Online Battle Arena |
| *MOGQ* | Motivations for Online Gaming Questionnaire |
| *MPOGQ* | Motivations to Play Online Games Questionnaire |
| *MUD* | Multi-User Dungeon |
| *PAF* | Principal Axis Factoring |
| *PCA* | Principal Component Analysis |
| *RTS* | Real Time Strategy |
| *RQ* | Research Question |
| *SCT* | Social Cognitive Theory |
| *SDT* | Self Determination Theory |
| *TPT* | Trojan Player Typology |
| *UGT* | Uses and Gratifications Theory |
| *WLS* | Weighted Least Squares |
| *WLSMV* | Mean- and Variance Adjusted Weighted Least Squares |
| *QF* | Quantic Foundry |

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# Appendix B

## Survey Text Material

### Introduction

Thank you for taking the time to help us learn more about video games!

In this study you will be asked to answer questions about:

- Your *gaming habits*,
- your *preferences* regarding three of the most popular online gaming genres (*MMORPG, MOBA, FPS*),
- your *motivations* for gaming,
- and *effects of gaming* on other parts of your life.

This study focuses specifically on online games that are played either on a computer or console. (Offline games, as well as games on other platforms such as mobile devices are not included in the current research.)

### Requirements, Information and Consent

What requirements do you have to fulfil to participate in this survey?

- You have to be at least 18 years old,
- you have to speak English fluently,
- and you have to play online multiplayer games at least once a week.

This survey will take approximately 10 minutes to complete.

This research is completely *anonymous* (you will not be asked to provide your name or any other information that would compromise your anonymity). Your participation is completely *voluntary* (you are free to withdraw from the study at any time, and your decision to withdraw will have no penalty). If you agree to these conditions, and are at least 18 years old, please proceed with the study!

**Closing Statement**

Thank you for your participation!

In this study you were asked to indicate your genre preferences, gaming motivations and possible negative effects of those on other aspects of your life. We are trying to find out if certain motivations are connected to specific genre preferences or whether people play the same types of games for different reasons. We also asked about the effects of gaming on other aspects of life because we wanted to see if this was directly connected to motivations or if those just lead to certain genre preferences which in turn have different effects.

**Survey Items**

| Sections | Items |
|---|---|
| *Demographics:* | |
| Gender | Gender<br>(1 = female, 2 = male) |
| Age | Age<br>(free input 18-100) |
| Nationality | Nationality (English name)<br>(free input) |
| Time Spent on Main Occupation | How many hours per week do you approximately spend on your main occupation (work/university/college/training/school)?<br>(free input for "hours per week") |
| Education Level | What is the highest education level that you have completed?<br>(1 = Primary education or less (did not complete lower secondary/obligatory education), 2 = Lower secondary (end of obligatory education), 3 = Upper secondary (high school, vocational training), 4 = Lower tertiary (Bachelors or similar), 5 = Upper tertiary (Masters, Doctors, PhD. or similar)) |
| *Gaming Habits:* | |
| Time Spent Gaming | [Week] During the week (Monday – Friday) …<br>I usually game on … days.<br>(free input 0-5)<br>I usually spend … hours gaming on the days I play.<br>(free input 0-24)<br>[Weekend] During the weekend (Saturday & Sunday) …<br>I usually game on … days.<br>(free input 0-2)<br>I usually spend … hours gaming on the days I play.<br>(free input 0-24) |

| | |
|---|---|
| Preferred Platform | Which one is your preferred platform to play games on?<br>(1 = Computer (PC, Laptop, Notebook), 2 = Console (PS, Xbox, Nintendo, Wii, etc.)) |
| Genre Preference | What types of games do you enjoy playing?<br>MMORPG (World of Warcraft, Everquest, Guildwars, …)<br>MOBA (League of Legends, Dota, Battlerite, …)<br>FPS (Call of Duty, Overwatch, Counter-Strike, …)<br>(visually scaled with 3 anchor points at 1 = completely agree, 4 = neither agree nor disagree, 7 = completely agree) |
| *Gaming Motivations:* | |
| MPOGQ | [Importance] The following aspects of a game are important to me.<br>9.1. Optimising your character for their role.<br>9.2. Your character being able to solo (play alone) well.<br>9.3. To be well known in the game (have a high status/rank).<br>9.4. Having your characters armour/outfit match in colour and style.<br>9.5. Having your character look different from other characters.<br>9.6. Levelling up your character as fast as possible.<br>9.7. Acquiring items that most players will never have.<br>9.8. Becoming powerful/ranking up.<br>9.9. Accumulating resources, items or money.<br>9.10. Knowing as much about the game mechanics and rules as possible.<br>9.11. Having a self-sufficient character.<br>9.12. Being immersed in a fantasy world.<br>9.13. Escaping from the real world.<br>9.14. Knowing the precise numbers and percentages underlying the game mechanics.<br>(visually scaled with 3 anchor points at 1 = completely disagree, 3 = neither agree nor disagree, 5 = completely agree, -1 = does not apply) |

[Enjoyment] The following aspects of a game are enjoyable to me.

10.1. Working with others in a group or team.

10.2. Exploring the map/world just for the sake of exploring it.

10.3. Finding quests, NPCs or locations that most people don't know about.

10.4. Collecting things without functional value in the game (e.g., clothing, skins).

10.5. Helping other players.

10.6. Getting to know other players.

10.7. Chatting with other players.

10.8. Competing with other players.

10.9. Dominating/killing other players.

10.10. Exploring every map or zone in the game.

10.11. Being part of a friendly, casual guild/group/team.

10.12. Being part of a serious, competitive guild/group/team.

10.13. Trying out new roles or personalities.

10.14. Doing things that annoy other players.

10.15. Playing alone (soloing).

(visually scaled with 3 anchor points at 1 = completely disagree, 3 = neither agree nor disagree, 5 = completely agree, -1 = does not apply)

[Frequency] How often do you do the following things in-game?

11.1. Using a character builder, a template or a guide.

11.2. Having meaningful conversations with other players.

11.3. Talking to online friends about personal issues?

11.4. Asking your online friends for support when you have real-life problems.

11.5. Making up stories and histories for your character.

11.6. Role-playing your character.

11.7. Playing so you can avoid thinking about some of your real-life problems or worries.

11.8. Playing to relax.

11.9. Purposefully trying to provoke or irritate other players.

| | |
|---|---|
| | 11.10. Spending a lot of time customising your character during character creation/selection.<br>(visually scaled with 3 anchor points at 1 = never, 3 = sometimes, 5 = always, -1 = does not apply) |
| *Internet Gaming Disorder* | |
| IGDS9-SF | How often have you experienced or done these things within the past year?<br>1. Felt preoccupied with gaming (e.g., thinking about it, anticipating it, it's your main activity).<br>2. Felt more irritable, anxious or sad when you tried to reduce or stop gaming.<br>3. Felt the need to spend more time gaming to feel satisfied or pleased.<br>4. Failed when you tried to control or decrease your gaming activity.<br>5. Lost interest in previous hobbies or other activities because of gaming.<br>6. Continued to game despite knowing it was causing problems between you and other people.<br>7. Lied to any of your family members, friends or others because of the amount you game.<br>8. Played to escape or relieve a negative mood (e.g., helplessness, guilt, anxiety).<br>9. Risked or lost an important relationship, job or educational/career opportunity because of gaming.<br>(1 = never, 2 = rarely, 3 = sometimes, 4 = often, 5 = very often) |

## Original Items

*Internet Gaming Disorder Short Scale (IGDS9-SF*; Pontes & Griffiths, 2015) Items:

1. Do you feel preoccupied with your gaming behaviour? (Some examples: Do you think about previous gaming activity or anticipate the next gaming session? Do you think gaming has become the dominant activity in your daily life?)
2. Do you feel more irritability, anxiety or even sadness when you try to either reduce or stop your gaming activity?
3. Do you feel the need to spend increasing amount of time engaged gaming in order to achieve satisfaction or pleasure?
4. Do you systematically fail when trying to control or cease your gaming activity?
5. Have you lost interests in previous hobbies and other entertainment activities as a result of your engagement with the game?
6. Have you continued your gaming activity despite knowing it was causing problems between you and other people?
7. Have you deceived any of your family members, therapists or others because the amount of your gaming activity?
8. Do you play in order to temporarily escape or relieve a negative mood (e.g., helplessness, guilt, anxiety)?
9. Have you jeopardised or lost an important relationship, job or an educational or career opportunity because of your gaming activity?

*Motivations to Play Online Games Questionnaire (MPOGQ*; Yee, 2006) Items:

*Advancement*

1. How important is it for you to level up your character as fast as possible?
2. How important is it for you to acquire rare items that most players will never have?
3. How important is it for you to become powerful?
4. How important is it for you to accumulate resources, items or money?
5. How important is it to you to be well-known in the game?
6. How much do you enjoy being part of a serious, raid/loot-oriented guild?

*Mechanics*

7. How interested are you in the precise numbers and percentages underlying the game mechanics?
8. How important is it to you that your character is as optimized as possible for their profession/role?
9. How often do you use a character builder or a template to plan out your character's advancement at an early level?
10. How important is it for you to know as much about the game mechanics and rules as possible?

*Competition*

11. How much do you enjoy competing with other players?
12. How often do you purposefully try to provoke or irritate other players?
13. How much do you enjoy dominating/killing other players?
14. How much do you enjoy doing things that annoy other players?

*Socializing*

15. How much do you enjoy getting to know other players?
16. How much do you enjoy helping other players?
17. How much do you enjoy chatting with other players?
18. How much do you enjoy being part of a friendly, casual guild?

*Relationship*

19. How often do you find yourself having meaningful conversations with other players?
20. How often do you talk to your online friends about your personal issues?
21. How often have your online friends offered you support when you had a real-life problem?

*Teamwork*

22. Would you rather be grouped or soloing?
23. How important is it to you that your character can solo well?
24. How much do you enjoy working with others in a group?
25. How important is it for you to have a self-sufficient character?

*Discovery*

26. How much do you enjoy exploring the world just for the sake of exploring it?
27. How much do you enjoy finding quests, NPCs or locations that most people do not know about?
28. How much do you enjoy collecting distinctive objects or clothing that have no functional value in the game?
29. Exploring every map or zone in the world.

*Role-Playing*

30. How much do you enjoy trying out new roles and personalities with your characters?
31. How much do you enjoy being immersed in a fantasy world?
32. How often do you make up stories and histories for your characters?
33. How often do you role-play your character?

*Customization*

34. How much time do you spend customizing your character during character creation?
35. How important is it to you that your character's armor / outfit matches in color and style?
36. How important is it to you that your character looks different from other characters?

*Escapism*

37. How often do you play so you can avoid thinking about some of your real-life problems or worries?
38. How often do you play to relax from the day's work?
39. How important is it to you that the game allows you to escape from the real world?

# Appendix C

## Tables

Table A1

*Factor loadings, communalities and factor properties of 11-factor motivations model (N = 3768)*

| Item | Factors | | | | | | | | | | | Communalities |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | *F1* | *F2* | *F3* | *F4* | *F5* | *F6* | *F7* | *F8* | *F9* | *F10* | *F11* | |
| *10.6* | **.87** | .02 | .04 | .07 | .15 | .03 | .11 | .04 | .03 | -.04 | -.04 | .81 |
| *10.7* | **.84** | .01 | .05 | .08 | .16 | .03 | .13 | .04 | .05 | -.06 | -.04 | .77 |
| *11.2* | **.65** | -.01 | .02 | .07 | .03 | .00 | **.31** | .12 | .03 | -.05 | .14 | .50 |
| *10.11* | **.59** | .11 | .09 | .01 | -.06 | .08 | .07 | .03 | -.03 | -.03 | .03 | .39 |
| *10.5* | **.58** | .16 | .13 | -.04 | -.01 | .04 | .02 | .04 | -.05 | .06 | .08 | .39 |
| *10.1* | **.56** | .01 | .01 | .08 | .12 | -.01 | .03 | -.05 | -.02 | -.25 | .19 | .44 |
| *10.2* | .11 | **.79** | .15 | -.12 | -.09 | .11 | .00 | .11 | -.05 | .10 | -.03 | .72 |
| *10.10* | .06 | **.73** | .18 | -.01 | -.06 | .07 | .01 | .08 | -.04 | .15 | -.00 | .60 |
| *10.3* | .11 | **.68** | .17 | .08 | -.07 | .09 | .02 | .15 | -.01 | .12 | -.02 | .56 |
| *9.12* | .10 | **.36** | .26 | -.04 | -.11 | **.34** | -.03 | .27 | -.10 | .18 | .03 | .45 |
| *9.4* | .06 | .07 | **.80** | .04 | -.05 | .05 | .02 | .05 | -.03 | .07 | .02 | .66 |
| *9.5* | .09 | .11 | **.65** | .17 | .06 | .04 | .02 | .05 | .01 | .09 | -.04 | .47 |
| *11.10* | .04 | .17 | **.59** | -.00 | -.12 | .11 | .01 | .23 | -.05 | .05 | .05 | .47 |
| *10.4* | .10 | .28 | **.53** | .07 | -.09 | .06 | .04 | .10 | -.00 | .05 | -.02 | .40 |
| *9.7* | -.01 | .12 | .14 | **.68** | .15 | -.03 | .07 | -.03 | .10 | -.06 | .05 | .54 |
| *9.8* | .06 | -.05 | -.01 | **.62** | .19 | .05 | -.03 | -.05 | .02 | .06 | .20 | .48 |
| *9.9* | .06 | .14 | .10 | **.50** | -.03 | .10 | -.02 | -.02 | .02 | .15 | .11 | .33 |
| *9.6* | .00 | -.15 | .01 | **.46** | .07 | -.01 | .05 | -.05 | .07 | .10 | .08 | .27 |
| *9.3* | .14 | -.07 | .05 | **.41** | **.34** | -.05 | .08 | .01 | .13 | -.08 | .13 | .35 |
| *10.8* | .25 | -.14 | -.11 | .17 | **.77** | -.04 | .01 | -.07 | .13 | -.10 | .17 | .77 |
| *10.9* | .05 | -.11 | -.10 | .21 | **.73** | -.04 | .03 | -.06 | .23 | -.01 | .12 | .68 |
| *10.12* | **.31** | -.14 | -.08 | .27 | **.33** | -.05 | .10 | -.02 | -.10 | -.14 | .29 | .42 |
| *9.13* | .02 | .12 | .08 | .03 | -.02 | **.88** | .04 | .05 | .00 | .04 | -.02 | .80 |
| *11.7* | .01 | .03 | .07 | .08 | .00 | **.69** | .13 | .11 | .06 | .04 | -.05 | .53 |
| *11.3* | **.30** | .01 | .04 | .04 | .03 | .09 | **.85** | .05 | .06 | -.05 | .05 | .83 |
| *11.4* | .23 | .02 | .05 | .05 | .05 | .11 | **.82** | .08 | .04 | -.04 | .02 | .76 |
| *11.6* | .07 | .18 | .14 | -.07 | -.02 | .14 | .06 | **.83** | .03 | .03 | -.02 | .77 |
| *11.5* | .10 | .19 | .23 | -.11 | .08 | .13 | .11 | **.77** | -.01 | .08 | -.04 | .74 |
| *10.14* | .01 | -.03 | -.03 | .11 | .16 | .01 | .02 | .00 | **.82** | -.01 | .04 | .72 |

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| *11.9* | -.03 | -.06 | -.04 | .09 | .14 | .00 | .07 | .02 | **.82** | -.01 | .02 | .71 |
| *9.2* | -.07 | .10 | .09 | .14 | -.04 | .06 | -.02 | .01 | -.01 | **.71** | .01 | .56 |
| *10.15* | -.25 | .18 | .01 | -.02 | .02 | .09 | -.06 | .06 | .03 | **.65** | -.07 | .54 |
| *9.11* | .04 | .15 | .15 | .18 | -.13 | .10 | -.02 | .07 | -.04 | **.45** | .18 | .35 |
| *9.10* | .11 | .03 | -.02 | .21 | .13 | -.03 | .02 | -.02 | .01 | .04 | **.62** | .46 |
| *9.14* | .03 | -.05 | -.06 | .19 | .18 | -.07 | .05 | -.01 | .08 | -.05 | **.55** | .39 |
| *9.1* | .14 | .00 | .21 | .27 | -.06 | .05 | -.01 | -.01 | -.05 | .13 | **.35** | .28 |
| **Excluded Items** | | | | | | | | | | | | |
| *10.13* | .22 | .15 | .16 | .06 | -.02 | .12 | .00 | .17 | .04 | .10 | .15 | .18 |
| *11.1* | .06 | -.05 | .13 | .19 | -.12 | .05 | .00 | -.02 | -.04 | .10 | .14 | .11 |
| *11.8* | .17 | .12 | .07 | -.00 | -.06 | .29 | .01 | .08 | -.06 | .14 | .01 | .16 |
| **% of Var.** | *F1* 8.8% | *F2* 5.7% | *F3* 5.5% | *F4* 5.1% | *F5* 4.3% | *F6* 4.2% | *F7* 4.1% | *F8* 4.0% | *F9* 3.9% | *F10* 3.7% | *F11* 3.0% | **total** 52.2% |
| **EV** [a] | 5.65 | 5.08 | 3.03 | 1.99 | 1.65 | 1.59 | 1.33 | 1.29 | 1.23 | 1.08 | 1.04 | |
| **α** [b] | .85 | .80 | .77 | .70 | .77 | .78 | .89 | .86 | .82 | .66 | .58 | |
| **Items** | 6 | 4 | 4 | 5 | 3 | 2 | 2 | 2 | 2 | 3 | 3 | |

*Note.* Factor loadings over 0.3 appear in bold.

[a] EV = eigenvalue

[b] α = Cronbach's Alpha

Table A2

*Varimax rotated factor matrix with communalities and factor properties of 3-factor model (N = 3768)*

| | Factors | | | |
|---|---|---|---|---|
| **Items** | *F1* | *F2* | *F3* | **Communalities** |
| *9.12* | **.64** | .05 | -.14 | .43 |
| *10.3* | **.61** | .06 | -.06 | .38 |
| *10.2* | **.61** | .07 | -.23 | .42 |
| *10.10* | **.60** | .01 | -.11 | .38 |
| *11.10* | **.58** | .03 | -.06 | .34 |
| *10.4* | **.55** | .08 | -.00 | .31 |
| *11.5* | **.52** | .17 | -.22 | .35 |
| *9.4* | **.51** | .05 | .04 | .26 |
| *11.6* | **.46** | .15 | -.16 | .26 |
| *9.5* | **.45** | .08 | .15 | .23 |
| *9.11* [b] | **.44** | -.12 | .17 | .24 |
| *9.13* [a] | **.39** | .04 | -.02 | .16 |
| *9.2* [a] | **.37** | -.26 | .13 | .22 |
| *10.13* [a] | **.34** | .18 | .09 | .16 |
| *11.7* [a] | **.32** | .07 | .03 | .11 |
| *11.8* [a] | **.31** | .12 | -.05 | .11 |
| *10.6* | .11 | **.83** | .13 | .72 |
| *10.7* | .10 | **.82** | .16 | .71 |
| *11.2* | .12 | **.66** | .13 | .47 |
| *10.1* | -.04 | **.58** | .17 | .37 |
| *10.11* | .22 | **.55** | -.02 | .35 |
| *11.3* | .11 | **.51** | .09 | .28 |
| *10.5* | .27 | **.50** | -.01 | .33 |
| *11.4* | .13 | **.46** | .08 | .23 |
| *10.15* [a] | **.32** | **-.39** | .00 | .25 |
| *9.8* | .07 | .00 | **.64** | .41 |
| *10.9* | -.25 | .14 | **.58** | .42 |
| *9.7* | .18 | .00 | **.57** | .35 |
| *10.8* | -.28 | **.33** | **.56** | .50 |
| *9.3* | -.04 | .19 | **.55** | .34 |
| *10.12* [a] | -.16 | **.38** | **.50** | .42 |
| *9.6* | -.00 | -.05 | **.45** | .21 |
| *9.14* | -.08 | .08 | **.44** | .21 |

| | | | | |
|---|---|---|---|---|
| *9.10* | .05 | .11 | **.44** | .21 |
| *9.9 a* | **.31** | -.05 | **.40** | .26 |
| *10.14* [a] | -.09 | .04 | **.36** | .14 |
| *11.9* [a] | -.11 | .03 | **.34** | .13 |
| *9.1* [a] | .26 | .06 | **.32** | .17 |
| | | **Excluded Items** | | |
| *11.1* | .16 | -.00 | .16 | .05 |
| | *F1* | *F2* | *F3* | |
| | | | | **total** |
| **% of Var** | 11.8% | 9.9% | 8.7% | 30.4% |
| **EV** [c] | 4.60 | 3.86 | 3.39 | |
| **α** [d] | .83 | .83 | .80 | |
| **Items** | 16 | 9 | 13 | |

*Note.* Factor loadings over 0.3 appear in bold.

[a] Items were removed due to small factor loading.

[b] Items were removed after second factor analysis with reduced item set.

[c] EV = eigenvalue

[d] α = Cronbach's Alpha

Table A3

*Shortened multinomial logistic regressions output of the predictor age for MMORPG preference (N = 3768)*

| | | | | | 95% CI OR | |
|---|---|---|---|---|---|---|
| **Outcome Category** | ***B*** | ***SE*** | **Wald** | ***OR*** | *lower* | *upper* |
| *Completely disagree* [a] | | | | | | |
| *Moderately disagree* | -0.02 | 0.01 | 1.96 | 10.98 | 0.96 | 1.00 |
| *Slightly disagree* | -0.06 | 0.02 | **13.16*** ** | 0.94 | 0.91 | 0.97 |
| *Neutral* | -0.02 | 0.01 | 1.87 | 0.98 | 0.96 | 1.01 |
| *Slightly agree* | -0.02 | 0.01 | 2.66 | 0.98 | 0.96 | 1.00 |
| *Moderately agree* | 0.00 | 0.01 | 0.00 | 1.00 | 0.98 | 1.01 |
| *Completely agree* | 0.02 | 0.01 | **5.97*** | 1.02 | 1.00 | 1.04 |
| *Pseudo* $R^2$ [b] | | | .02 | | | |
| $\chi^2$ *for -2LL* [c] | | | **64.91*** ** | | | |

*Note.* The reported p-values are two-tailed. Significant values appear in bold.

*p < .05

***p < .001

[a] Reference category

[b] Pseudo $R^2$ = estimation following Nagelkerke

[c] $\chi^2$ for -2 Log Likelihood = model fit estimation

Table A4

*Shortened multinomial logistic regressions output of the predictor age for MOBA preference (N = 3768)*

| | | | | | 95% CI OR | |
|---|---|---|---|---|---|---|
| **Outcome Category** | ***B*** | ***SE*** | **Wald** | ***OR*** | *lower* | *upper* |
| *Completely disagree* [a] | | | | | | |
| *Moderately disagree* | -0.04 | 0.01 | **25.50*** ** | 0.96 | 0.95 | 0.98 |
| *Slightly disagree* | -0.04 | 0.01 | **21.22*** ** | 0.96 | 0.94 | 0.98 |
| *Neutral* | -0.01 | 0.01 | 3.40 | 0.99 | 0.97 | 1.00 |
| *Slightly agree* | -0.08 | 0.01 | **69.40*** ** | 0.93 | 0.91 | 0.94 |
| *Moderately agree* | -0.10 | 0.01 | **75.87*** ** | 0.90 | 0.88 | 0.92 |
| *Completely agree* | -0.11 | 0.01 | **94.15*** ** | 0.90 | 0.88 | 0.91 |
| *Pseudo* $R^2$ [b] | | | .06 | | | |
| $\chi^2$ *for -2LL* [c] | | | **220.43*** ** | | | |

*Note.* CI and p-values were calculated using bootstrapping of 1000 samples to adjust for heteroscedasticity. The reported p-values are two-tailed. Significant values appear in bold.

***p < .001

[a] Reference category

[b] Pseudo $R^2$ = estimation following Nagelkerke

[c] $\chi^2$ for -2 Log Likelihood = model fit estimation

Table A5

*Shortened multinomial logistic regressions output of the predictor age for FPS preference (N = 3768)*

| | | | | | 95% CI OR | |
|---|---|---|---|---|---|---|
| **Outcome Category** | ***B*** | ***SE*** | **Wald** | ***OR*** | *lower* | *upper* |
| *Completely disagree* [a] | | | | | | |
| *Moderately disagree* | -0.03 | 0.01 | **10.99*** ** | 0.97 | 0.95 | 0.99 |
| *Slightly disagree* | -0.05 | 0.01 | **18.93*** ** | 0.96 | 0.94 | 0.97 |
| *Neutral* | -0.03 | 0.01 | **11.58*** ** | 0.97 | 0.96 | 0.99 |
| *Slightly agree* | -0.06 | 0.01 | **53.59*** ** | 0.94 | 0.93 | 0.96 |
| *Moderately agree* | -0.08 | 0.01 | **80.65*** ** | 0.93 | 0.91 | 0.94 |
| *Completely agree* | -0.08 | 0.01 | **100.31*** ** | 0.92 | 0.90 | 0.94 |
| *Pseudo* $R^2$ [b] | | | .04 | | | |
| $\chi^2$ *for -2LL* [c] | | | **140.36*** ** | | | |

*Note.* CI and p-values were calculated using bootstrapping of 1000 samples to adjust for heteroscedasticity. The reported p-values are two-tailed. Significant values appear in bold.

***p < .001

[a] Reference category

[b] Pseudo $R^2$ = estimation following Nagelkerke

[c] $\chi^2$ for -2 Log Likelihood = model fit estimation

Table A6

*Multiple regression of dummy coded genre preferences predicting IGD in males (N = 3343)*

| Predictor | Predictor Category | *B* | *SE* | β | 95% CI B | |
|---|---|---|---|---|---|---|
| | | | | | *lower* | *upper* |
| *Gaming Time* | | 0.75 | 0.06 | **.24*** ** | 0.64 | 0.86 |
| *MOBA* | *Completely disagree* [a] | | | | | |
| | *Moderately disagree* | 1.30 | 0.40 | **.06** ** | 0.52 | 2.05 |
| | *Slightly disagree* | 2.23 | 0.46 | **.09*** ** | 1.31 | 3.11 |
| | *Neutral* | 0.64 | 0.41 | .03 | -0.19 | 1.47 |
| | *Slightly agree* | 1.22 | 0.42 | **.06** ** | 0.37 | 2.03 |
| | *Moderately agree* | 1.55 | 0.48 | **.06*** ** | 0.58 | 2.52 |
| | *Completely agree* | 1.80 | 0.45 | **.08*** ** | 0.91 | 2.70 |
| *FPS* | *Completely disagree* [a] | | | | | |
| | *Moderately disagree* | -1.22 | 0.57 | **-.05*** | -2.39 | -0.09 |
| | *Slightly disagree* | -0.14 | 0.57 | -.01 | -1.24 | 1.02 |
| | *Neutral* | -0.28 | 0.55 | -.01 | -1.39 | 0.88 |
| | *Slightly agree* | -0.28 | 0.49 | -.02 | -1.26 | 0.71 |
| | *Moderately agree* | 0.01 | 0.49 | .00 | -0.96 | 1.00 |
| | *Completely agree* | 0.32 | 0.49 | .02 | -0.62 | 1.32 |
| *MMORPG* | *Completely disagree* [a] | | | | | |
| | *Moderately disagree* | -0.16 | 0.58 | -.01 | -1.34 | 0.95 |
| | *Slightly disagree* | 0.51 | 0.67 | .02 | -0.83 | 1.71 |
| | *Neutral* | 0.04 | 0.56 | .00 | -1.07 | 1.09 |
| | *Slightly agree* | 0.20 | 0.52 | .01 | -0.81 | 1.22 |
| | *Moderately agree* | -0.15 | 0.48 | -.01 | -1.09 | 0.78 |
| | *Completely agree* | 0.09 | 0.46 | .01 | -0.84 | 0.94 |
| $R^2_{adj}$ | | | .07 | | | |

*Note.* All CI and p-values were calculated using bootstrapping of 1000 samples to adjust for heteroscedasticity. The reported p-values are two-tailed. Significant values appear in bold.

*p < .05

**p < .01

***p < .001

[a] Reference category

Table A7

*Multiple regression of dummy coded genre preferences predicting IGD in females (N = 425)*

| Predictor | Predictor Category | *B* | *SE* | β | 95% CI B | |
|---|---|---|---|---|---|---|
| | | | | | *lower* | *upper* |
| *Gaming Time* | | 1.21 | 0.16 | **.42*** ** | 0.87 | 1.53 |
| *FPS* | *Completely disagree* [a] | | | | | |
| | *Moderately disagree* | 2.34 | 1.20 | **.10*** | 0.02 | 4.68 |
| | *Slightly disagree* | 0.82 | 1.19 | .03 | -1.51 | 3.18 |
| | *Neutral* | 1.84 | 1.09 | .09 [b] | -0.26 | 4.03 |
| | *Slightly agree* | 1.80 | 0.96 | .09 [b] | -0.07 | 3.69 |
| | *Moderately agree* | 1.58 | 1.10 | .07 | -0.38 | 3.75 |
| | *Completely agree* | 2.88 | 1.18 | **.13*** | 0.49 | 5.29 |
| *MMORPG* | *Completely disagree* [a] | | | | | |
| | *Moderately disagree* | 0.41 | 2.83 | .09 | -5.18 | 6.02 |
| | *Slightly disagree* | 6.20 | 2.16 | **.11**** | 1.91 | 10.23 |
| | *Neutral* | 3.36 | 2.95 | .07 | -2.76 | 9.07 |
| | *Slightly agree* | 1.29 | 1.97 | .05 | -2.80 | 4.87 |
| | *Moderately agree* | 1.74 | 1.86 | .09 | -2.28 | 5.08 |
| | *Completely agree* | 2.04 | 1.79 | .14 | -1.79 | 5.21 |
| *MOBA* | *Completely disagree* [a] | | | | | |
| | *Moderately disagree* | 0.33 | 0.90 | .02 | -1.37 | 2.11 |
| | *Slightly disagree* | 0.53 | 1.17 | .02 | -1.71 | 2.78 |
| | *Neutral* | -0.78 | 1.20 | -.03 | -3.19 | 1.48 |
| | *Slightly agree* | 2.25 | 1.24 | .09 | -0.33 | 4.64 |
| | *Moderately agree* | -1.02 | 1.22 | -.04 | -3.44 | 1.53 |
| | *Completely agree* | -1.52 | 1.59 | -.05 | -4.93 | 1.35 |
| $R^2_{adj}$ | | | .18 | | | |

*Note.* All CI and p-values were calculated using bootstrapping of 1000 samples to adjust for heteroscedasticity. The reported p-values are two-tailed. Significant values appear in bold.

*p < .05

**p < .01

***p < .001

[a] Reference category

[b] Marked values become significant for one-sided hypothesis

Table A8

*Hierarchical ordinal regression models for motivations predicting MMORPG preference, male sample (N = 3343)*

| | **Model 1** | | | | | |
|---|---|---|---|---|---|---|
| | | | | | **95% CI OR** | |
| **Predictor** | **B** | **SE** | **Wald** | **OR** | *lower* | *upper* |
| *Immersion* | 0.73 | 0.04 | **276.16*** ** | 2.08 | 1.91 | 2.27 |
| *Social* | | | | | | |
| *Achievement* | | | | | | |
| *Pseudo $R^2$* [a] | | | | .08 | | |
| *$\chi^2$ for -2LL* [b] | | | | **274.12*** ** | | |
| | **Model 2** | | | | | |
| | | | | | **95% CI OR** | |
| **Predictor** | **B** | **SE** | **Wald** | **OR** | *lower* | *upper* |
| *Immersion* | 0.69 | 0.05 | **234.18*** ** | 1.99 | 1.82 | 2.17 |
| *Social* | 0.22 | 0.04 | **28.1*** ** | 1.24 | 1.15 | 1.35 |
| *Achievement* | | | | | | |
| *Pseudo $R^2$* [a] | | | | .09 | | |
| *$\chi^2$ for -2LL* [b] | | | | **301.96*** ** | | |
| | **Model 3** | | | | | |
| | | | | | **95% CI OR** | |
| **Predictor** | **B** | **SE** | **Wald** | **OR** | *lower* | *upper* |
| *Immersion* | 0.68 | 0.05 | **221.55*** ** | 1.97 | 1.80 | 2.15 |
| *Social* | 0.23 | 0.04 | **30.31*** ** | 1.26 | 1.16 | 1.37 |
| *Achievement* | -0.06 | 0.04 | 1.90 | 0.94 | 0.87 | 1.03 |
| *Pseudo $R^2$* [a] | | | | .09 | | |
| *$\chi^2$ for -2LL* [b] | | | | **303.81*** ** | | |

*Note.* The reported p-values are two-tailed. Significant values appear in bold.

***p < .001

[a] Pseudo $R^2$ = estimation following Nagelkerke

[b] $\chi^2$ for -2 Log Likelihood = model fit estimation

Table A9

*Hierarchical ordinal regression models for motivations predicting MOBA preference, male sample (N = 3343)*

| | **Model 1** | | | | | |
|---|---|---|---|---|---|---|
| | | | | | **95% CI OR** | |
| **Predictor** | **B** | **SE** | **Wald** | **OR** | *lower* | *upper* |
| *Achievement* | 0.52 | 0.04 | **153.28*** ** | 1.68 | 1.55 | 1.82 |
| *Immersion* | | | | | | |
| *Social* | | | | | | |
| *Pseudo $R^2$* [a] | | | | .05 | | |
| *$\chi^2$ for -2LL* [b] | | | | **154.38*** ** | | |
| | **Model 2** | | | | | |
| | | | | | **95% CI OR** | |
| **Predictor** | **B** | **SE** | **Wald** | **OR** | *lower* | *upper* |
| *Achievement* | 0.51 | 0.04 | **148.05*** ** | 1.67 | 1.54 | 1.81 |
| *Immersion* | -0.07 | 0.04 | 2.77 | 0.93 | 0.86 | 1.01 |
| *Social* | | | | | | |
| *Pseudo $R^2$* [a] | | | | .05 | | |
| *$\chi^2$ for -2LL* [b] | | | | **157.03*** ** | | |
| | **Model 3** | | | | | |
| | | | | | **95% CI OR** | |
| **Predictor** | **B** | **SE** | **Wald** | **OR** | *lower* | *upper* |
| *Achievement* | 0.49 | 0.04 | **126.04*** ** | 1.63 | 1.50 | 1.78 |
| *Immersion* | -0.09 | 0.04 | **4.28*** | 0.91 | 0.84 | 1.00 |
| *Social* | 0.08 | 0.04 | 3.16 | 1.08 | 0.99 | 1.17 |
| *Pseudo $R^2$* [a] | | | | .05 | | |
| *$\chi^2$ for -2LL* [b] | | | | **160.10*** ** | | |

*Note.* The reported p-values are two-tailed. Significant values appear in bold.

*p < .05

***p < .001

[a] Pseudo $R^2$ = estimation following Nagelkerke

[b] $\chi^2$ for -2 Log Likelihood = model fit estimation

Table A10

*Hierarchical ordinal regression models for motivations predicting FPS preference, male sample (N = 3343)*

| | **Model 1** | | | | | |
|---|---|---|---|---|---|---|
| | | | | | **95% CI OR** | |
| **Predictor** | **B** | **SE** | **Wald** | **OR** | *lower* | *upper* |
| *Achievement* | 0.66 | 0.04 | **243.87*** ** | 1.92 | 1.77 | 2.09 |
| *Social* | | | | | | |
| *Immersion* | | | | | | |
| *Pseudo* $R^2$ [a] | | | | .07 | | |
| $\chi^2$ *for -2LL* [b] | | | | **246.97*** ** | | |
| | **Model 2** | | | | | |
| | | | | | **95% CI OR** | |
| **Predictor** | **B** | **SE** | **Wald** | **OR** | *lower* | *upper* |
| *Achievement* | 0.62 | 0.04 | **207.54*** ** | 1.86 | 1.71 | 2.02 |
| *Social* | 0.14 | 0.04 | **11.60*** ** | 1.15 | 1.06 | 1.24 |
| *Immersion* | | | | | | |
| *Pseudo* $R^2$ [a] | | | | .08 | | |
| $\chi^2$ *for -2LL* [b] | | | | **258.35*** ** | | |
| | **Model 3** | | | | | |
| | | | | | **95% CI OR** | |
| **Predictor** | **B** | **SE** | **Wald** | **OR** | *lower* | *upper* |
| *Achievement* | 0.60 | 0.05 | **188.77*** ** | 1.82 | 1.67 | 1.98 |
| *Social* | 0.17 | 0.04 | **16.61*** ** | 1.19 | 1.09 | 1.29 |
| *Immersion* | -0.13 | 0.04 | **9.23*** ** | 0.88 | 0.80 | 0.95 |
| *Pseudo* $R^2$ [a] | | | | .08 | | |
| $\chi^2$ *for -2LL* [b] | | | | **267.18*** ** | | |

*Note.* The reported p-values are two-tailed. Significant values appear in bold.

***p < .001

[a] Pseudo $R^2$ = estimation following Nagelkerke

[b] $\chi^2$ for -2 Log Likelihood = model fit estimation

Table A11

*Hierarchical ordinal regression models for motivations predicting MMORPG preference, female sample (N = 425)*

| | | | **Model 1** | | | |
|---|---|---|---|---|---|---|
| | | | | | **95% CI OR** | |
| **Predictor** | **B** | **SE** | **Wald** | **OR** | *lower* | *upper* |
| *Immersion* | 0.57 | 0.15 | **13.91*** ** | 1.76 | 1.31 | 2.37 |
| *Achievement* | | | | | | |
| *Social* | | | | | | |
| *Pseudo $R^2$* [a] | | | | .03 | | |
| *$\chi^2$ for -2LL* [b] | | | | **12.56*** ** | | |
| | | | **Model 2** | | | |
| | | | | | **95% CI OR** | |
| **Predictor** | **B** | **SE** | **Wald** | **OR** | *lower* | *upper* |
| *Immersion* | 0.55 | 0.15 | **12.77*** ** | 1.73 | 1.28 | 2.33 |
| *Achievement* | -0.14 | 0.13 | 1.15 | 0.87 | 0.68 | 1.12 |
| *Social* | | | | | | |
| *Pseudo $R^2$* [a] | | | | .04 | | |
| *$\chi^2$ for -2LL* [b] | | | | **13.67*** ** | | |
| | | | **Model 3** | | | |
| | | | | | **95% CI OR** | |
| **Predictor** | **B** | **SE** | **Wald** | **OR** | *lower* | *upper* |
| *Immersion* | 0.52 | 0.16 | **11.04*** ** | 1.68 | 1.24 | 2.28 |
| *Achievement* | -0.18 | 0.13 | 1.82 | 0.84 | 0.64 | 1.09 |
| *Social* | 0.14 | 0.13 | 1.10 | 1.14 | 0.89 | 1.47 |
| *Pseudo $R^2$* [a] | | | | .04 | | |
| *$\chi^2$ for -2LL* [b] | | | | **14.76** ** | | |

*Note.* The reported p-values are two-tailed. Significant values appear in bold.

**p < .01

***p < .001

[a] Pseudo $R^2$ = estimation following Nagelkerke

[b] $\chi^2$ for -2 Log Likelihood = model fit estimation

Table A12

*Hierarchical ordinal regression models for motivations predicting MOBA preference, female sample (N = 425)*

| | **Model 1** | | | | | |
|---|---|---|---|---|---|---|
| | | | | | **95% CI OR** | |
| **Predictor** | **B** | **SE** | **Wald** | **OR** | *lower* | *upper* |
| *Achievement* | 0.56 | 0.12 | **23.96*** ** | 1.76 | 1.40 | 2.20 |
| *Social* | | | | | | |
| *Immersion* | | | | | | |
| *Pseudo* $R^2$ [a] | | | | .06 | | |
| $\chi^2$ *for -2LL* [b] | | | | **23.06*** ** | | |
| | **Model 2** | | | | | |
| | | | | | **95% CI OR** | |
| **Predictor** | **B** | **SE** | **Wald** | **OR** | *lower* | *upper* |
| *Achievement* | 0.61 | 0.12 | **25.91*** ** | 1.84 | 1.46 | 2.33 |
| *Social* | -0.15 | 0.11 | 1.76 | 0.86 | 0.69 | 1.07 |
| *Immersion* | | | | | | |
| *Pseudo* $R^2$ [a] | | | | .06 | | |
| $\chi^2$ *for -2LL* [b] | | | | **24.82*** ** | | |
| | **Model 3** | | | | | |
| | | | | | **95% CI OR** | |
| **Predictor** | **B** | **SE** | **Wald** | **OR** | *lower* | *upper* |
| *Achievement* | 0.62 | 0.12 | **25.84*** ** | 1.86 | 1.46 | 2.36 |
| *Social* | -0.16 | 0.11 | 1.90 | 0.86 | 0.69 | 1.07 |
| *Immersion* | 0.06 | 0.14 | 0.19 | 1.06 | 0.80 | 1.41 |
| *Pseudo* $R^2$ [a] | | | | .06 | | |
| $\chi^2$ *for -2LL* [b] | | | | **25.01*** ** | | |

*Note.* The reported p-values are two-tailed. Significant values appear in bold.

***p < .001

[a] Pseudo $R^2$ = estimation following Nagelkerke

[b] $\chi^2$ for -2 Log Likelihood = model fit estimation

Table A13

*Hierarchical ordinal regression models for motivations predicting FPS preference, female sample (N = 425)*

| | **Model 1** | | | | | |
|---|---|---|---|---|---|---|
| | | | | | **95% CI OR** | |
| **Predictor** | **B** | **SE** | **Wald** | **OR** | *lower* | *upper* |
| *Achievement* | 0.77 | 0.12 | **44.63*** ** | 2.17 | 1.73 | 2.72 |
| *Immersion* | | | | | | |
| *Social* | | | | | | |
| *Pseudo $R^2$* [a] | | | | .10 | | |
| *$\chi^2$ for -2LL* [b] | | | | **44.23*** ** | | |
| | **Model 2** | | | | | |
| | | | | | **95% CI OR** | |
| **Predictor** | **B** | **SE** | **Wald** | **OR** | *lower* | *upper* |
| *Achievement* | 0.75 | 0.12 | **42.13*** ** | 2.12 | 1.69 | 2.67 |
| *Immersion* | -0.21 | 0.14 | 2.33 | 0.81 | 0.62 | 1.06 |
| *Social* | | | | | | |
| *Pseudo $R^2$* [a] | | | | .11 | | |
| *$\chi^2$ for -2LL* [b] | | | | **46.58*** ** | | |
| | **Model 3** | | | | | |
| | | | | | **95% CI OR** | |
| **Predictor** | **B** | **SE** | **Wald** | **OR** | *lower* | *upper* |
| *Achievement* | 0.76 | 0.12 | **39.52*** ** | 2.15 | 1.69 | 2.72 |
| *Immersion* | -0.20 | 0.14 | 2.11 | 0.82 | 0.62 | 1.07 |
| *Social* | -0.03 | 0.11 | 0.06 | 0.97 | 0.78 | 1.21 |
| *Pseudo $R^2$* [a] | | | | .11 | | |
| *$\chi^2$ for -2LL* [b] | | | | **46.63*** ** | | |

*Note.* The reported p-values are two-tailed. Significant values appear in bold.

***p < .001

[a] Pseudo $R^2$ = estimation following Nagelkerke

[b] $\chi^2$ for -2 Log Likelihood = model fit estimation

## German Summary
## (Zusammenfassung)

Untersuchungen zu dem komplexen Einflusssystem, welches dem Online-Spielverhalten zugrunde liegt, sind derzeit noch relativ selten. Das Ziel dieser Studie war es daher, die Zusammenhänge zwischen individuellen Charakteristiken (Geschlecht und Alter), Spielmotivationen (Yee, 2006b), Spielgenre-Präferenzen (*MMORPG, MOBA, FPS*), Spielzeit und problematischem Online-Spielverhalten (Internet Gaming Disorder (*IGD*); APA, 2013) im Zuge einer Onlinestudie zu erforschen. Die Daten von 3678 Online-Spielern in einem Alter von 18-52 Jahren ($M$ = 25.72; $SD$ = 6.83) wurden dafür analysiert. Die drei Spielmotivationen *Erfolg*, *Immersion* und „*Socializing"* wurden mithilfe einer adaptierten Version von Yee's (2006b) Motivationsskala erfasst. *IGD* wurde anhand einer kurzen Skala (*IGDS9-SF*; Pontes & Griffiths, 2015) gemessen, welche auf den neun vorgeschlagenen diagnostischen Kriterien des DSM-5 (APA, 2013) basiert. Genre-Präferenzen wurden in Form von drei Items operationalisiert, die nach dem empfundenen Vergnügen beim Spielen von *MMORPG*s, *MOBA*s und *FPS* Spielen fragten. Die Ergebnisse zeigten, dass Genre-Präferenzen signifikant durch Alter, Geschlecht und Spielmotivationen vorhergesagt wurden. *MOBA*s und *FPS* Spiele wurden von jüngeren, *erfolgs*orientierten Spielern und Männern bevorzugt, während *Immersions*-motivierte Spieler und Frauen *MMORPG*s bevorzugten. Motivationen, Alter und Spielzeit sagten außerdem *IGD*-Werte voraus. Jüngere, viel Zeit investierende und *Erfolgs*-, oder „Flucht"-motivierte Spieler, gaben höhere *IGD*-Werte an. Alter- und Geschlechtseffekte wurden ebenfalls beobachtet. Ältere Spieler verbrachten weniger Zeit mit dem Spielen und waren weniger durch *Erfolg* oder „*Socializing"* motiviert als junge. Frauen gaben niedrigere *Erfolgs*-, aber höhere „*Socializing"*-, und *Immersions*motivationen an als Männer. Es wurden weder Effekte von Spielpräferenz auf *IGD*, noch eine Gruppierung von Spielern anhand deren Spielmotivationen beobachtet. Theoretische und praktische Implikationen werden diskutiert.