

GAMERS' PERSONALITY AND THEIR GAMING PREFERENCES

by

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ABSTRACT

This thesis work researches the hypothesis that people with certain personality traits would prefer certain video game genres. The motivation is to contribute to demographic game design by identifying gamers' personality profiles in order to better satisfy their needs and enjoyment. A Gaming Preferences Questionnaire was developed and validated to identify gamers' preferences. The NEO-FFI questionnaire based on the Five Factor model was selected for measuring gamers' personality traits.

Data from 545 participants was analyzed by multiple linear regression. Eight game genre models were found statistically significant, and accounted for 2.6% to 7.5% of gamers' preferences for game genres based on personality factors. The relevant personality traits of the models matched game elements of the genre. This work shows that a refined itemization helps to begin to understand the psychological human complexity that drives players' preferences.

Keywords: personality; game elements; game preference; genre; demographic game design.

A mi Madre,
and my Husband

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1: INTRODUCTION

1.1 Toward Demographic Game Design

Identifying the video game industry demography is the million dollar question of this multibillion dollar industry. The mandate of the Entertainment Software Association (ESA), based in the U.S.A., is to support the companies that publish video games. One of its priority tasks is to provide consumer research, and for that reason it requests annual reports about the gamer population [1].

Understanding who the gamers are is not only important from a business, but also from a design perspective. According to Bateman and Boon [2] game design should reflect the desires of the audience, and consumer models are used as tools to identify gamers' tastes and needs. Some known models attempt to understand the audience by identifying common characteristics or habits, for example the Hardcore-Casual model. This model splits the market into two polarized groups, hardcore players commit more money and play more games than casual players who play fewer games, consequently hardcore gamers are literate on gaming whereas casual gamers know less about game conventions. A final distinction between the two groups is that for hardcore gamers gaming is part of their lifestyles and they enjoy challenge, whereas for casual gamers gaming is one more leisure activity and they look to have fun with it. However, this and other audience models are more concerned on how the market works

rather than understanding what design aspects are relevant for the targeted audience [2]. The game industry could improve its comprehension of gamers' tastes in order to produce more appealing and targeted games as the market keeps growing and diversifying.

Bateman and Boon [2] coined the concept Demographic Game Design (DGD) as the design process that recognizes and incorporates the targeted audience, and consequently can set a criteria for success, that is to satisfy the audience's needs. Therefore, understanding who the gamers are and what they like are the foundations of DGD. These authors present different aspects on game design that would directly benefit from comprehending their audience, for example, understanding the way people prefer to play games (if with others or in solitude) is related to their social skills and opens the question if the game should foster engaging with others or not. Knowing what strategies people use for processing information will affect how gamers will learn to play the game, this affects how the game should unfold and the role of tutorials. Different styles on coping with difficulties will be related to how problems are resolved and therefore if game situations should be centred on simple puzzles or if it should emphasize employing lateral thinking. Comprehending gamers' motivations is also very relevant for game design; it will serve to identify what kind of rewards will tap the targeted gamers and encourage them to keep playing, for example people with aesthetic appreciation will enjoy receiving a new outfit for their characters whereas gamers who are thrilled by competition will enjoy unlocking a special skill or weapon. People are also different about how they structure their activities,

for instance, some gamers will prefer to have a clear set of objectives that they can follow like precise mission goals with descriptions, whereas other gamers will prefer an unstructured world where they can pick up and leave activities as they please. Based on such information, designers should consider whether to set up constrained paths to follow or open game worlds.

This type of design process pays close attention to the characteristics of the audience in order to fulfil the needs of the target population. Nevertheless, it neither replaces nor intends to suppress the creativity and craft of the game designer.

In order to gather the characteristics of the audience, it is essential to have the right tools for gathering accurate, useful information about the targeted gamers. The field of psychology stands out as an appropriate science for this task as its objective is to understand and formalize people's needs, motivations, mental processes, and behaviours.

Personality is the aspect of a person that remains constant through different situations, and even through the years. This psychological construct combines attitudes, motivations, needs, emotional profiles, and social skills [3]. Therefore, personality defines what experiential style a person has and how he or she will face a situation. Thus, personality has been applied as a prediction tool in different fields to better accommodate a person to particular conditions. For example, in clinical psychology personality tests are administered during the first interview for assessing what psychotherapeutic techniques will be the most appropriate and effective for the patient. Such as, a person with stress and

anxiety problems who is open to different activities, enjoys arts and intellectual challenges, and pays close attention to his feelings will perform well with imagery and relaxation techniques [4]. Another field where profiling personality is extensively used is in business for both human resources and consumer behaviour. One of the main decisions taken by Human Resources departments is who to hire (or promote), personality assessment is one of the sources of information for making such decision. Potential candidates' personalities should match the requirements of the position. It is an effective measurement for predicting adaptation and success in the job [5]. For example, a managerial position will require that the person is comfortable when surrounded by people, good at facilitating tasks, and clear at identifying goals and the necessary steps to achieve them. The other business-oriented interest in personality relies on consumer behaviour. Companies are keen to understand how the market can be broken down into groups of consumers, and personality patterns have been mainly used for marketing purposes [6].

In conclusion, personality arises as a suitable variable to identify several characteristics that help to understand the gamer population, thus an important tool for demographic game design.

The other challenging aspect for DGD is a meaningful framework to understand video game aspects. Meaningful because it needs to be consistent, and to provide useful and understandable information to game designers. Genre is the most common label for grouping games, however there is no consensus among the multiple classifications that exist. Rollings and Adams' approach [7]

present a thorough comprehension of games by breaking them down to their minimum components that they identify as key-elements-of-games. This type of method seems to be promising for the objective of demographic game design.

1.2 Research Question of this Thesis

Drawing on DGD, this work looks to explore the relationship between gamers' personality and gaming preferences. These concepts are fully developed in Chapter 2: Theory and Tools, but it is time to settle down the research question that leads this work:

Is there a relationship between personality traits (according to the Five Factor Model) and preferred game genres (defined as a combination of specific game elements)?

1.3 Goals, Outcomes, and Scope of this Thesis

The main goal of this thesis is to contribute to demographic game design by providing a description of gamers' personality traits in relationship to their gaming preferences. To do so, this work has looked into identifying the most suitable tools for gathering data. A well-established and high validity personality inventory was selected from the currently available ones in the market, and a new questionnaire for assessing gaming preferences was created and validated for this research.

People's motivations, needs, and behaviours are complex. There are multiple sources that influence why people make certain decisions, personality was mentioned as one of those. Other factors that affect how and why people

behave include peer pressure, previous experience, cultural background, religious belief, and mood. Even though these variables are relevant for understanding people from multiple angles, this work acknowledges their influences but they are out of the scope of this thesis.

Results from assessing the adult gamer population in terms of their preferences and personality would contain valuable information for game designers who want to tailor gameplay for a certain niche audience. It could also be relevant as a prediction model for suggesting to players what games they would enjoy playing. For example, certain games can be recommended to new players based on their personality traits, by doing so they would be exposed to games that they likely would enjoy, therefore marking their first game encounters positive experiences.

1.4 Methodology

Different theories on personality and gaming classification are described in Chapter 2. After identifying the most appropriate frameworks for this research, the selected tools for data collection are introduced. This study has a cross-sectional research design which involves collecting data on personality traits, gaming preferences, and demographic variables by using questionnaires. The objective is to explore the relationship between personality traits and gaming preferences. This relationship only involves concurrent changes in the variables, and does not explain causality.

Participants were solicited through multiple announcements on a variety of mailing lists, websites, and forums. They were self-selected adults (at least 18 years old) who considered themselves as hardcore or casual gamers. Participants accessed the research survey through the internet, and completed it during a single session.

1.5 Summary of Results

Five hundred and forty five hardcore and casual gamers from thirty six countries completed the entire survey. The average age was 28.43 years old, and was heavily composed of male participants (83.7%). Distribution between hardcore and casual gamer was fairly even (46.2% and 53.8% respectively).

Data was analyzed by using a multiple linear regression (MLR) statistical technique. This type of evaluation constructs models for prediction, in this case predicting the likelihood of preferring a particular game genre. Models for each proposed game genre were constructed based on the personality traits.

Eight game genre models were found statistically significant. The segment of data that they were able to predict was between 2.6% and 7.5%. This means that personality factors can account for a certain proportion for preferring specific game genres. These models provide a modest percentage of prediction, however, considering the multiple variables that might influence gaming preferences (country location, exposure to media, mood, themes, just to name a few), the found prediction values scrutinize how gamers' profiles are composed

and their role in preferences. These findings provide trends about specific personality traits that are more likely to be linked to certain game genres.

2: THEORY AND TOOLS

This chapter introduces the theoretical frameworks of the two main concepts of this work (personality and game preference), setting up the foundations for analysis and discussion. Following the understanding of each concept, the most appropriate tools for measuring such constructs are presented.

2.1 On Personality

2.1.1 Psychological Frameworks on Personality

The concept of personality can be traced back in history as far as the Ancient Greek times when actors used to wear masks to represent roles; these masks were referred as 'persona' from which the term personality derives. Since then, the concept of personality has been used in a variety of fields including game studies.

Some game developers and game researchers have used the concept in an intuitive way, relying on an artistic expression to highlight core characteristics [8;9], whereas others have used well established psychological models, for instance in works on implementation of personality models for game characters [10;11;12]. Identifying a suitable personality theory for game studies is a fruitful endeavour.

Personality is defined in psychology as the organized totality that makes a person unique, this particular combination of traits, needs, and motivations

influences the way of behaving, thinking, and approaching internal and external situations. Although there is consensus on this broad personality definition, there are several theories that highlight different aspects, some of them relying on abstract conceptualizations, others rooted in operationalization processes [13].

Personality theories can be clustered into two groups according to how generalizable (or not) the conceptualization of personality is. On the one hand, there is the nomothetic perspective that looks for models from where patterns of personality can be identified. On the other hand, there is the idiographic perspective which sustains that personality is so unique to every person that there are as many personalities as people in the world [14].

The following paragraphs present several personality theories from both the idiographic and the nomothetic clusters. In the ideographic group, we find psychoanalytical, and phenomenological theories. In the nomothetic group, we find somatotype, type, and factor theories.

The psychoanalytical theory was founded by Sigmund Freud who describes personality as composed by three entities (id, ego, and superego) that each has different levels of awareness (unconscious, preconscious, and conscious) [15]. The id entity contains the most basic instincts and wants to satisfy them immediately; the id operates completely at an unconscious level. The superego represents an ideal image of one's self, and wants to obey the mandates learnt through life; it has unconscious, preconscious, and conscious levels. The ego manages the requests from the id, the superego, and the external world, resolving situations based on the consequences of actions. The

ego also contains the three levels of awareness. This topology of personality is shaped by psychoenergy which explains why a person is the way he is. There are different stages during the evolution of a person, and the flowing psychoenergy can be fixated by a particular event during a person's life. There will be particular implications depending on which development stage such event happened. There are six stages in the psychosexual development, in each stage different organs are the primary source of satisfaction [16]. The oral stage (from birth to one year and a half old) is centred in the mouth which brings satisfaction through actions like eating and sucking. In the anal stage (from one year and a half to three years old) the anus is the primary source of satisfaction such as in retaining and defecating. During the phallic stage (from three to six years old), satisfaction is around the sexual organs in an egocentric and rudimentary way. Then, during the latency phase (from six to twelve years old) the psychoenergy moves away from the sexual organs until the genital phase (from 12 years old) when they are once more the centre of satisfaction but this time in a mature, sexual way. If a stressful event happens and it is not resolved effectively, the psychoenergy will be fixated, and certain behaviours and preferences will appear according to the psychosexual stage when the fixation occurred. For example, obsessive-compulsive behaviour is linked to the anal stage when gratification was acquired by retaining actions, such as in controlling feces. Despite the richness of psychoanalysis, it would be extremely difficult to standardize results; the very nature of this theory is to view individual cases as unique [17].

Phenomenological theories such as Rogers's [18] emphasize a person as the narrator of their life, and their uniqueness. Close attention to self-perception is encouraged. There are two recognizable selves, the 'real-self' which is the self that one identifies with, and the 'ideal-self' which is the self that one would like to be. Mental conflict arises when the gap between the real and the ideal self increases. There is no classification under this type of theory. Similar to psychoanalysis, phenomenological theories are centered in considering each person as its own system, which cannot be standardized.

Carl Jung [19;20] revised psychoanalytical work making an emphasis in personality through the way that people interact with the external world. Jung defined two basic attitudes based on how much energy a person invests towards the external world (extraversion) versus the internal world (introversion). These two attitudes can be expressed by the four functions of the ego. Thinking and feeling are two rational functions, whereas sensation and intuition are two irrational functions. Following Jung's work, Myers and Briggs [21] continue to expand his work. These authors considered all pairs as types (Extraversion-Introversion, Thinking-Feeling, Intuition-Sensation) and added one more (Judging-Perceiving). People's personality can be categorized into the 16 types that come from all possible combination of the four pair types, and they are commonly recognized by their acronym, for example EFNP. This personality type theory is summarized in Table 2-1 MBTI Personality Types.

Table 2-1 MBTI Personality Types

Trait	Refers to	Refers to	Trait
Extroversion	Outer world oriented, sociable, impulsive.	Inner world oriented, prefers ideas, and being one-on-one.	Introversion
Feeling	Empathic and altruist minds that prioritize people and objects.	Analytical, objective minds that follow logical thinking.	Thinking
Sensation	Relies on the information provided by the senses, enjoys details and the present.	Relies on associations and interpretations, enjoys complexity and creativity.	Intuition
Perceiving	Prefers autonomy, adapts to new situations, tends to procrastinate.	Follows rules, is obedient and has self-controlled.	Judging

Somatotype theories classify people according to their body shape, taking into account not only the external features but also internal organs. Main theorists in this area are Lombroso [22], Kretschmer [23], and Sheldon [24]. As an example of this type of theory, Sheldon and Stevens' [24] identify three main physical characteristics for classifying people: fatness, muscularity, and thinness. These authors associate the body types to temperament types: the fatness factor is linked to a friendly and warm attitude; muscularity is correlated to dominant behaviour; and thinness is associated to introverted, sensitive attitudes. The main problem with this type of theories is their low validity, there are too many cases that are exceptions of their classification systems. However, these theories provide an interesting repertoire of visual cues for game characters.

Factor theories are rooted in statistical techniques of factor analysis to determine patterns of characteristics from where personality traits are identified.

These characteristics have been gathered from exhausting lists of adjectives, self-reports, and life records, then they are grouped into clusters or traits based on their correlation coefficients from factor analysis. The traits are revised in terms of their logical meaning. One of the most prominent researchers in this area is Raymond Cattell who considers that psychology improves scientifically by employing statistical-mathematical techniques [17]. Due to the statistical treatment given to the data, traits are defined as a continuum, therefore it is possible to identify where the scoring for each person falls, for example it can be at any point from very low to very high. This feature allows a finer classification than personality types where the result is binary. Well-known factor theories are Hans Eysenck's super-traits, Raymond Cattell's multifactor theory, and the Five Factor Model [13;25].

Eysenck's model represents personality as the combination of three supertraits: a) introversion-extraversion, b) neuroticism, and c) psychoticism [26]. The introversion-extraversion supertrait covers the social tendencies of people. Extraverted people are outgoing, like being surrounded by and talking to others, they are also more impulsive. Introverted people are introspective, quiet, and reserved. The neuroticism supertrait is related to emotional stability. Higher levels of neuroticism indicate that the person will lose temper easily when facing frustration, gaining stress and anxiety, whereas people with lower neuroticism tend to remain calm during adverse situations. The last supertrait is psychoticism which measures the capability of rapport and empathy, for example a person with low psychoticism is able to connect with others' feelings, whereas

someone with high psychoticism tends to be egocentric, aggressive, and lacking of consideration towards others.

According to Cattell, personality is a stable configuration of characteristics and is a tool for predicting how a person will respond to a situation [27]. Cattell developed the '16 Personality Factor Questionnaire' which defines sixteen traits from where is possible to comprehend how a person will react. Table 2-2 presents an overview of Cattell's 16 Personality Factors.

Table 2-2 Cattell's 16 Personality Factors

Factor A - Affectia-Sizia : Related to social warm.	Factor L: Protension-Alaxia : Related to vigilance and trust.
Factor B – Intelligence : Related to abstract thinking and reasoning.	Factor M: Autia-Praxernia : Related to abstraction, imagination versus down-to-earth, conventional approaches.
Factor C – Ego Strength : Related to emotional stability.	Factor N: Shrewdness-Artlessness : Related to astute, discreet versus socially clumsy, involved.
Factor E – Dominance-Submissiveness : Related to assertiveness and competition versus humble and compliant.	Factor O: Guilt Proneness-Untrouble Adequacy : Related to apprehension.
Factor F – Surgency-Desurgency : Related to liveliness.	Factor Q1: Radicalism-Conservatism : Related to openness to change.
Factor G: Superego Strength : Related to conforming rules.	Factor Q2: Self Sufficiency-Group Adherence : Related to self-reliance.
Factor H: Parmia-Threctia : Related to social boldness.	Factor Q3: Self Sentiment Strength : Related to perfectionism.
Factor I: Premisia-Harria : Related to sensitivity.	Factor Q4: Ergic Tension : Related to stress.

The Five Factor Model (FFM) defines personality as a combination of attitudes, motivations, interpersonal skills, emotional, and experiential styles [4]. This combination is composed of five factors: Openness, Conscientiousness, Extraversion, Agreeableness, and Neuroticism. These factors are continuous variables, and a person's personality can be described as the likeliness that those trends will appear. For instance, a person with high Openness is curious, and enjoys new experiences, whereas a person with low Openness prefers straightforward situations and to use known methods. Costa and McCrae developed the first inventory to measure these five personality traits. The FFM stands out from other factor theories due to high consistency of its traits including across situations and cultures, and because it provides a model that is not too simple (like Eysenck's) nor over complex (like Cattell's) [13;17;28]. Table 2-3 Five Factor Model Traits shows the five factors and the adjectives from the interpretations according to the subject's scores.

Table 2-3 Five Factor Model Traits

Trait	The higher the scoring:	The lower the scoring:
Openness	Imaginative, prefers variety, sensitive	Down-to-earth, conventional, narrow scope
Conscientiousness	Well-organized, careful, reliable, self-disciplined	Disorganized, careless, weak-willed
Extraversion	Sociable, talkative, optimistic	Reserved, sober, independent
Agreeableness	Trusting, helpful, sympathetic	Suspicious, cynical, egocentric, competitive
Neuroticism	Anxious, experience negative emotions	Secure, calm, self-satisfied

The following paragraphs present a more detailed explanation of the five factors:

Neuroticism: The Neuroticism factor covers emotional stability. A person with a high score in this factor is prone to experience negative states such as stress, fear, guilt, anger, shame, aversion, and depression. Whereas low scores can be interpreted as a relaxed person who has a stable temper and can maintain this attitude when coping tense situations.

Extraversion: This factor addresses an array of sociable styles. High scores are associated to a preference for larger groups, being talkative and active, engaging with people, talking assertively, adopting optimistic and cheerful postures. When the scoring is low these characteristics dilute which does not have to be confused with turning to the opposite as Costa and McCrae [4] point out. For instance, an introvert is not unfriendly but reserved, this person would prefer to be independent rather than following the flock of people, and would keep an even pace as opposed to being slow.

Openness: This factor refers to openness to experiences. People with high scores tend to be imaginative, prefer variety, have aesthetic appreciation, show intellectual curiosity (not necessarily intelligent), keep close attention to their emotions, and embrace new ideas. On the other side of the spectrum, people with low Openness scores are more conventional, prefer known situations, the expression of emotions are minced, and their array of interests is narrower.

Agreeableness: This factor gauges the altruistic tendency of people. A high score is related to empathy, to being helpful to others and expecting that others will be helpful as well, and to easily development of trust, whereas a low score is associated to competition rather than helpfulness, to being suspicious, and to the tendency of prioritising one's intentions.

Conscientiousness: This trait is related to the capability of self-control. When a person has a high Conscientiousness score, she is well organized and reliable, can identify clear objectives, plan accordingly, and has strong will. A low score indicates that people have more difficulties in achieving goals, involving weak-will, and lower organization skills.

Selecting a personality theory for this thesis work has been a delicate and thorough decision. Choosing the most appropriate one required alignment with the objectives of the work based on its potential of describing and explaining the construct, and thus the hypothesis. From the above-described array of personality frameworks, nomothetic theories arise as suitable candidates for game studies due to their experimental research origin but, more importantly, due to their nature to find common patterns through quantifiable variables allowing to categorize gamers' personality, and the potential to standardize results [12;29]. From within the nomothetic theories, factor theories stand out as they provide variables on a continuum which translates into a finer measurement of personality compared to bipolar types. For example, with the Five Factor Model theory we not only know that a person is extraverted but that his extraversion trait is very high. The FFM has been used extensively in

psychological research showing high consistency of results across cultures [28]. Therefore, the Five Factor Model has been chosen as the theoretical framework to define personality for this thesis work.

2.1.2 Personality Tool

After selecting the personality theory, it is necessary to choose the research tool that can measure this construct. There are several inventories for assessing the Five Factor Model. The main distinctions among them are the length of the questionnaire, the language, the population that they cover, the medium of communication, and age of subjects. For example, NEO PI-R is an in depth inventory with 240 items, the Hierarchical Personality Inventory for Children (HiPIC) is designed for kids, the Structured Interview for the Five-Factor Model of Personality (SIFFM) has semi-structured components to assess personality disorders, the Five Factor Nonverbal Personality Questionnaire (FF-NPQ) uses images instead of verbal items, and the Big Five Marker Scale (BFMS) is in Italian. However, since the intention of this work is to contribute to Demographic Game Design, gathering information on the broad international adult gamer audience is a better approach than reducing to a particular population. It should be noted as well that for this work, we are only interested in normal personality, not in psychopathological personalities or disorders.

The Neuroticism Extraversion Openness Five Factor Inventory (NEO-FFI), developed by Costa and McCrae and published by Psychological Assessment Resources, Inc. [4], satisfies the above-mentioned characteristics. It is intended to measure the five factors of normal personality. It contains 60 questions to be

answered in a 5-point Likert scale (from 'Strongly Disagree' to 'Strongly Agree'). See section 10.1 (Appendix A – NEO-FFI Items Sample) for a sample of items ¹. The answers from all 60 items are tallied towards the personality factors providing raw scores. These scores are matched against the corresponding T-scores which are the percentiles in a normal distribution.

NEO-FFI can be self-administered. Subjects should be 17 or older, and are expected to complete the questionnaire in 10-15 minutes. This inventory was chosen due to its inclusiveness, its length, its high validity and internal consistency, and its application in international research. Besides these relevant practical reasons, this inventory has been previously applied within the game studies field for assessing gamers' personality and how it is projected into avatars [30]. All the above-mentioned reasons strengthen the justification for NEO-FFI as a suitable tool within the gaming context.

2.2 On Gaming Preferences

Gaming preference is a proposed construct for referring to the aspects of video games that players enjoy the most. Being able to identify such information would allow us to make inferences about what game features people would choose on top of others. Nevertheless, those characteristics need to be grouped into a meaningful and consistent model in order to establish generalizations. There are multiple works that attempt to classify games through different conceptualizations. Some works are rooted in the game industry sphere, while others are grounded in academia [7;31;32;33;34;35]. The following sections

¹ Due to copyright agreement, the NEO-FFI questionnaire cannot be reproduced in its totality.

bring light into this debate, first opening the panorama on game classification, then moving towards the most suitable model for this research design, and how it can be translated into a gaming preferences tool.

2.2.1 Game Classifications

Video games have changed substantially since they first appeared, and they keep reshaping every year, for instance by the advances in graphics quality, in artificial intelligence, in avatar representation, in story line, and in design innovation.

The most popular way of grouping games is by genre which involves clustering according to common characteristics. However, there have been many approaches on game classification from both academia and industry, and agreement on vocabulary has not yet been achieved. Main works from both fields will be presented, setting up the path of options and suitability for this work.

Video game specialized review media (for example, GameSpot [36]) and video game companies use game genres for grouping their reviews and games, but they do not give any specific definition of what is the reasoning behind each genre. The following table 2-4 offers a comparison among the de facto genres established by some of the most influential representatives of the industry [1;37;38;39;40].

Table 2-4 Game genres according to industry and specialized media.

Genre	EA [37]	Ubisoft [38]	Activision [39]	Metacritic [40]	GameSpot [36]	ESA [1]
Action		X		X	X	X
Action and adventure	X		X		X	
Action Sports			X			
Adventure		X		X	X	X
Arcade						X
Extreme Sports				X		
Family		X				X
Family and casual			X			
Fighting		X		X	X	X
First Person Shooter			X	X	X	
Flight				X		X
Kids	X					X
Massively multiplayer					X	
Music	X	X	X		X	
Other		X			X ²	X
Party				X	X	
Platform				X	X	
Puzzle	X	X		X	X	
Racing	X	X	X	X	X ³	X
Real Time Strategy				X	X	
Role Playing	X	X		X	X	X
Shooting	X				X ⁴	X
Simulation	X	X		X	X ⁵	
Sports	X	X		X	X ⁶	X
Strategy	X	X	X	X	X ⁷	X

² Other games besides card battle and parlor games.

³ Includes car combat and other driving

⁴ Includes tactical shooters, and other shooters.

⁵ Includes combat simulation and virtual life.

⁶ Includes baseball, basketball, football, golf, hockey, soccer, alternative sports, and other sports.

⁷ Includes other strategy

Third person shooter				X		
Turn Based Strategy				X	X	
Wargame				X		
Wrestling				X	X	

The above table shows how many game genres can be identified and how their presence (and lack of presence) changes from one company to another one. It also raises questions about genres being coined by companies and media to promote certain products. For example, a very well-known franchise published by Activision is Tony Hawk's [41] which is about skateboarding, therefore the simplest category could be 'sports', however Activision uses the term 'action sports'. If only 'sports' is used, Tony Hawk's is in the same category as its competitor Skate [42] published by Electronic Arts, a company recognized by its other sports titles like FIFA [43]. This type of genre construction can be argued to respond to a marketing stratagem for claiming a niche, and presenting their product as distinctive and a leader of that genre. Thus, embracing industry models might find resistance. The specialized game review site GameSpot offers an exhaustive categorization that seems to result from a tag cloud from their database to allow users to get to the reviews faster.

The first problem with these industry approaches is that there is no definition about what game types should be included in that genre. Second, it does not seem to be completely agnostic from companies' interests. Even though these aforementioned game clusters seem to not contribute towards a deep

understanding of games, there is another work coming from the industry field that offers better comprehension of game design and game classification.

Andrew Rollings and Ernest Adams did a thorough analysis of game genres in their book “On Game Design” [7], and its revision “Fundamentals of Game Design” [44]. These authors believe that in order to learn game design it is necessary to understand which are the foundational aspects involved in the different game genres. Rollings and Adams identify 10 game genres: action, strategy, role-playing, sports, vehicle simulation, construction and management simulation, adventure, artificial life, puzzle, and games for girls. See Table 2-5 Rollings and Adams' Game Genre Classification. The authors also recognize that there are some games that fall within more than one genre, however they warn that special care needs to be taken since such games might not be appealing for any of the genre audiences.

The strength of Rollings and Adams' classification relies on their detailed explanation of the aspects involved in every genre, and how those affect game design. This work has received the support of the game community endorsing the book, and positive reviews from the specialized media [45].

Table 2-5 Rollings and Adams' Game Genre Classification

Genre	Key aspects	Example
Action	Relies mainly on conflict and physical challenge.	Quake III [46]
Strategy	Strategic and tactical challenges with administration of resources.	Civilization III [47]
Role Playing	Story based exploration with logistical challenges.	Arcanum [48]
Sports	Sport based context. Mainly in-game physical and tactical challenges.	Madden NFL 2002 [49]
Vehicle simulation	Piloting any type of craft.	Crimson Skies [50]
Construction & management simulation	Resource and development challenges.	Sim City [51]
Adventure	Based on exploration through problem solving.	Grim Fandango [52]
Artificial Life	Artificial intelligence is the motor.	Dogz [53]
Puzzle	Relies on logical challenges.	The Incredible Machine [54]
Games for Girls	Appealing to girls' values	Barbie Beach Vacation [55]

Works coming from the academic field put the emphasis in creating frameworks to set a common understanding on the object of study, which also involves gaining more knowledge in the field. Early game classification started before the digital era, for instance the work of Caillois [56] who describes four divisions for games: agôn, alea, mimicry and ilinx. Agôn covers games that are based in competition. In alea games skills are not relevant because chance is

what determines the outcome of the player, like playing dice. Games in the mimicry category emphasize simulating a role, that is, becoming someone else. Ilinx games thrill with the sensations of dizziness and chaos. Caillois mentioned that these clusters are general categories in order to be inclusive and allow the eclecticism of games to fit into this model by appealing to the most basic characteristic. Beyond the richness of this classification, it does not provide enough cues to arrange current digital games. Moving forward in time and narrowing down to academic game classifications specifically intended for digital games, the works of Apperley [33], and Wolf [57] stand out.

Apperley [33] argues that video game genres have built upon a more visual aesthetic point of view rather than interactive characteristics, therefore genres are loose clusters. This author takes two terms to make a critical analysis of game genres. The first one is ergodic to examine the player's action in the game. The second term, taken from Bolter and Grusin [58], is remediation which is used to examine how video games take formal aspects from previous media. Apperley's work covers other academic studies touching game genre classification and criticizes those relying on industry framework. He does not directly review industry-developed categorizations, thus, leaving out developed frameworks that include gameplay characteristics which govern players' actions. We argue that even though games under the same genre share some user interface conventions, game genres do not disregard player actions, in fact those are the explicit representation of the gameplay. Apperley [33] takes four genres as case studies to articulate players' actions and remediation. The first genre is

simulation which he identifies as remediating cinema, because they portray activities like watching a sport event, or soaring the sky on a airplane which according the Apperley are typical of television and cinema. The second genre is strategy that remediates strategy board games. The third genre is action which remediates the tools of cinema through perspective. The last analyzed genre is role playing that remediates the pen-and-paper role playing. Apperley's work [33] offers a critical reading on video games, claiming that they are part of a culture, thus borrowing aspects from other medias (i.e. cinema, and board games). Despite this view emphasizes not to isolate videogames as their own phenomenon, it does not present an exhaustive nor standardized approach, and it even relies on the industry-genre categorization to explain the case studies.

Also looking at other media but as an example of how genre has been a successful way of classification, Wolf [57] reflects on the film approach and argues that even though aesthetic and theme have helped clustering cinema productions, interactivity is the most relevant criteria for establishing video game genres. Wolf bases his analysis on the guidelines of the Library of Congress Moving Imagery Genre-Form Guide. This author's scrutiny defines 42 genres, and accepts that the same games can be identified into two or more genres. See Table 2-6 Wolf's game genre classification.

Table 2-6 Wolf's game genre classification

Abstract	Catching	Driving	Management Simulation	Puzzle	Sports
Adaptation (remediation)	Chase	Educational	Maze	Quiz	Strategy
Adventure	Collecting	Escape	Obstacle Course	Racing	Table Top
Artificial life	Combat	Fighting	Pencil-and-Paper	Role playing	Target
Board games	Demo	Flying	Pinball	Rhythm and Dance	Text Adventure
Capturing	Diagnostic	Gambling	Platform	Shoot 'em Up	Training Simulation
Card Games	Dodging	Interactive Movie	programming	Simulation	Utility

Wolf's work [57] puts the emphasis in the actions that the player has to perform, leaving visual aesthetic and themes in a secondary plane. Despite the detailed revision on what players need to do in-game, there are some aspects that prevent us from using this classification. For instance, there is a large margin for overlapping of genres and sub-rules for classification. For example, Checkers can be included in the board games and adaptation (remediation) genre, but it cannot be included in the capturing genre because the pieces are moved by another player, nor it can be considered in the abstract category because adaptation trumps abstract. This classification oversimplifies the multiple related aspects of video games, which mainly involve diverse types of player actions.

Some academic works have also used industry's approaches to game classification. Such studies generally evoke a recognized source of specialize

media (for example, GameSpot) and stick to the classification of their database. Main goals of these studies rely on usability and design implications, for example using heuristic methods [59;60;61].

In conclusion for the game classification map, we found that game genres do provide a framework to classify games and examine their design implications. The academic perspective leans toward building up vocabulary to discuss video games, but does not offer a suitable approach for generalization without falling too short or employing too much overlapping. From the industry side, there are multiple despotic classifications, however Rollings and Adams' work [7] stands out as a thorough and systematic analysis for game genres that allows a consistent interpretation of games for classification. In the next section, a deeper reading is given to the underlying game elements that compose game genres.

2.2.2 From Game Elements to Game Genre

Rollings and Adams [7] introduce the concept of 'key elements of games' to indicate that games are composed by certain elements, and that game genres are clusters of a particular array of elements. The idea is not to undercut designers' innovation but to set the basics components in gaming. The construct 'element' encompasses different aspects: 1) rules, 2) types of challenges to overcome, 3) victory conditions, 4) world settings, 5) level of abstraction-realism, 6) interaction mode, 7) player roles, 8) structures, and 9) narrative.

Looking closer to these aspects of elements, Rollings and Adams indicate that the rules of a game set up what the player is allowed to do, which are

identified in two layers, one implicit and another explicit. Implicit rules are related to how the player can move in-game, for example players cannot fly, or players are allowed to trigger bombs remotely. Explicit rules are related to the actions that player takes to face the challenges, this group of actions conform the gameplay. The victory condition is a rule that indicates a particular state in the game that entitles the player as the winner. There is another set of rules that indicates the state of the loss condition. The world setting is the location where such rules take place; it can adopt any form, from a racetrack to fantasy universe, or abstract worlds. The setting cohesiveness will have an impact on the player's immersion and suspension of disbelief. The worlds can be analyzed in terms spatial and temporal dimensions, for instance their scales, boundaries, continuous time or turn based. Related to the world aspect is the level of realism or abstraction that is presented in the game, implications of physics and real consequences can bring up challenges that are up to the game designer to include or simplify.

Continuing with the game elements is the interaction mode which dictates how the player interact with the world. There are two basic distinctions, one is mediated by a representation of the player such as through an avatar (for example, first or third person), and the other is when the player is omnipresent (for instance, in overseeing a map and being able to build houses). This element is linked to the next one which is the player's role, the player is given a role to perform, for example a World War II soldier, a mage, or a god. This role has implications to induce the player into the world, and the rules.

The next element is structure which assesses changes of the previous components, for example changing the mode from omnipresent to avatar by possessing one of the creatures as happens in *Dungeon Keeper 2* [62]. The last element to discuss is narrative, it presents the treatment to the game story that can go from no story at all, to a linear story that only follows one path, or integrating the decision of the player into the development of the story while it branches.

With this conceptual framework to understand game genres, Rollings and Adams [7] classify games into ten genres and describe thoroughly how the elements relate to each genre. An introduction to this classification was given in the previous section, refer to Table 2-5 Rollings and Adams' Game Genre Classification. By employing this approach, these authors were able to identify the foundational core aspects that make games cohesive as an instrument to play, and as recognizable forms. This kind of understanding is of great benefit to demographic game design.

Rollings and Adams [7] are not the only game designers who consider that understanding the components of games is a viable endeavour. Brathwaite and Schreiber in "Challenges for Game Designers" [63] present a similar thinking about analyzing games by breaking them down into small pieces. They introduce the notion of 'atoms' which refers to the smallest parts that games can have. According to Brathwaite and Schreiber, designing and analysing games is based on the comprehension of the aspects games are composed of and how they interact.

2.2.3 Gaming Preferences Tool

This 'game-element' level of granularity is ideal for an understanding of what players like about games, since it provides meticulous definitions to identify game characteristics and cluster them into genres [64].

Players are good at identifying games by genre and by direct comparison to other titles, they are able to state what the differences are between them by naturally drilling down to game elements. One of the outcomes from this research is to aid game designers during the creation process of defining the game and therefore its elements. Thus, opting for an industry-oriented classification system with strong foundations seems to be the most appropriate option, it utilizes the innate way of treating and comprehended games by the group from where the information will be gathered (gamers) and the group that have to deal with the information collected (designers).

This approach has the potential of building up towards Demographic Game Design, by creating a tool based on this understanding that could facilitate collecting those elements that are interesting to gamers and gauging their preferences towards certain genres. Such tool can also contribute towards a consistent terminology on gaming.

As part of this thesis work, a gaming preferences questionnaire has been created, validated, and used for data collection. Using as a starting point the work of Rollings and Adams [7], the classification was revised to further integrate cohesiveness of clusters, and to include game characteristics of recent game innovations with high mass market impact. After that, game elements were given

a weighting according to their relevance in each game genre. This weighting system allows tallying of the preference to game genres based on the game elements that compose them. This questionnaire is able to identify with high accuracy (> 90%) what types of games players prefer. See 9.3 Appendix C – Gaming Preferences Questionnaire.

The full description of the creation process of the questionnaire is described in Chapter 4: ‘Gaming Preferences Questionnaire’, and the data analysis in Section 6.1 ‘Gaming Preferences Questionnaire Analysis’.

3: RELATED WORK: PERSONALITY IN GAMING

It is necessary to explain the concepts of personality and gaming first in order to present and compare the works done in this area. This chapter presents a literature review of how studies on preference in gaming and personality have been approached and their implications in gaming.

3.1 Personality in Gaming

The concept of personality has been explored in its relationship to video games, but the majority of the work has been from a point of view of susceptibility to aggression and violence which is out of the scope of this research. A considerably smaller number of studies explore personality aspects as a way to better understand gamers. This section presents works that deal with identifying gamers' personalities, then continues on studies about personality as a mean to better understand game choices.

Early works on personality and gaming were focused on understanding the new phenomenon of video games and what possible effects it could have on their audience. Personality was used as a possible measurement to trace people prone to playing video games. The work of Gibb et al. [65] from 1983 examined if there were personality differences between groups of gamers of higher and lower video game usage. The specific dimensions examined were self-esteem/degradation, social-deviancy/conformity, hostility/kindness, social-

withdrawal/gregariousness, obsessive-compulsive, and achievement-motivation. No personality distinctions were found between the two groups, nor by subdividing the groups by gender.

In 1994, Estallo [66] explored personality differences between video game users and non-users. This author studied seven personality and behavioural variables identified as neuroticism, extraversion, psychoticism, honesty, antisocial behaviour, criminal behaviour, and gambling. Only extraversion was found as a significant difference between the two groups, showing that players have a higher extraversion level than non-players. There was a lead towards criminal behaviour by players, but the author warns that such finding might be a cofounded result due to the positive correlation with other variables (psychoticism, antisocial behaviour, and honesty) corresponding to a tendency to novelty and higher self-criticism. In conclusion, Estallo [66] suggests that there is no strong personality profiling to differentiate players from non-players.

These studies have set a trend into exploring gamers' personality aspects, however they are only looking into distinctions of video game usage and not into personality differences according to video game content, genres, or preferences. It is not until recent years that research into this direction started.

Hartmann and Klimmt [67] identify personality as a viable concept for exploring people choices. They recognize that selecting a personality theory for research is related to methodological implications. However, these authors express concern about being able to recognize specific behaviours such as preferring certain games from personality characteristics. We consider that this

statement is partially true, it only applies if no other data were collected and such findings were expressed from personality inventories alone. However, if a questionnaire or interview asks about specific in-game circumstances, it is possible to connect game-behaviours to personality traits. It is a matter of methodological design.

Hartmann and Klimmt [67] reviewed several studies that involve personality aspects and gaming, and proposed a framework about computer game exposure. Their ultimate objective is to identify personality traits that influence selecting digital games on top of other forms of media entertainment, they do not refer to specific game type preference. The reviewed studies are clustered into seven groups according to what aspects were investigated. The clusters are: 1) global tendencies, 2) aggressive tendencies, 3) competitive tendencies, 4) challenge tendencies, 5) fantasy tendencies, 6) frustration, and 7) skills. Meta-findings show mixed results, it should be noted that regarding cluster (1), no significant findings were achieved, thus Hartmann and Klimmt imply that more specificity is necessary to link personality factors to game types. This thesis work is covering such gap.

Although these authors consistently refer to 'computer games' in their work, such terminology decision is a problematic use of the concept. First of all, it implies that their work is focused on video games that run on a personal computer platform, which is not the case, their reviewing work covers studies that have analysed gamers exposed to a variety platform games such as arcade, console and computer. A more appropriate term to use would have been 'digital

games' to clearly differentiate from board and social games without attaching to a specific hardware technology. Such platform distinction is very important in the game industry [1]. Additionally, their reviewed studies cover a scope of more than 20 years which makes it very hard to generalize trends from studies on games that have radically changed in such a timeline. Moreover, the studies reviewed by Hartmann and Klimmt did not necessarily focus on investigating players' choice, but mainly the outcomes of exposure to videogames. Lastly, different theoretical frameworks of personality were used in the multiple reviewed studies which shows a need to reflect on which established personality theory would be more appropriate for game studies. Hartmann and Klimmt [67] proposed their own personality framework specifically for understanding digital game exposure based on an array of psychological models. This framework encompasses beliefs, needs, motivations, skills, affective evaluations, expected gratification, and evaluated situations and outcomes. Although it is arguable that this extensive framework can be summarized as a new personality model, it does present an interesting, thorough model that comprehends the different human aspects involved in the consumption of digital games.

Griebel's study [30] focuses on how gamers' personality and values are projected into avatars and playing style. His research is an exploratory case study on *The Sims 2* [68]. This game is an open-ended virtual 'doll house', its genre from the proposed classification in this thesis is Simulation Artificial Intelligence. The game setting is a house and its neighbourhood. Players control the behaviours of one or more avatars, called Sims, through multiple aspects

such as profession, leisure activities, eating, and friendships. The selected personality model for Griebel's research is the Five Factor Model, and the selected questionnaire is the NEO-FFI. This approach matches the selected framework of this thesis study. Griebel also administered a values survey to participants, as well as a The Sims 2 survey that the author designed in order to collect data on how they played the game, for example, what behaviours their Sims performed, and how their social and economic careers developed. Thirty undergraduate students participated in Griebel's study [30] by playing 30 Sims-days, that is approximately 10 hours of gameplay. Results implied that participants did project aspects of their personality, values, and demographic information onto their Sims. Specifically for personality, the traits of neuroticism, openness and conscientiousness had significant correlations with in-game behaviours. For example, gamers with higher neuroticism were prone to miss their Sims' goals and bills payments, whereas players with higher openness were likely to make their Sims have exciting lives and to achieve their goals, to engage their Sims in sex but not related to having children. Finally, players with higher conscientiousness leaned toward having a clean house for their Sims, and to feel in control of their avatars.

Griebel's work [30] is promising about using personality traits for understanding players' in-game behaviours and playing styles. This author discusses the idea of using The Sims 2 [68] as a projective test for psychotherapy. This work also makes a leap from no-findings or contradictory ones when looking at personality aspects of gamer versus non-gamer

populations, to certain profiling possibilities by looking at game elements and gamers' personality traits. Nevertheless since these findings are circumscribed to The Sims 2 gameplay, it is not possible to establish generalizations about other games or genres.

An extensive study on personality and video game playing styles was done by Bateman and Boon [2], in which they map gamer types according to the Myers-Briggs Type Indicator (MBTI) and the hardcore-casual cluster. According to the authors, hardcore gamers are the most supportive group of the game industry. Based on the hardcore gamers' behaviours towards games, Bateman and Boon's starting hypothesis is that these gamers correspond to the MBTI types⁸ of introversion (energy oriented towards the inner world), thinking (decisions made in an objective, logic fashion), and judging (planning ahead and sticking to it). With this starting point, Bateman and Boon reflect on the different styles that people approach games, and how such information can affect game design, which became a pivotal point in demographic game design.

For their study, four hundred and eight (408) participants completed a MBTI test and a questionnaire on playing habits and gaming purchases. Although cluster analysis did not provide consistent results, Bateman and Boon noticed general trends that were mainly dictated by the thinking-feeling and judging-perceiving pairs. The combinations of these two axes set the foundations of their playing style model. The sixteen personality types that are assessed by the MBTI were grouped into four basic playing styles: Conqueror, Manager,

⁸ See Table 2-1 MBTI Personality Types on page 12 for a quick reference.

Wanderer, and Participant. The hardcore versus casual gamer’s habits distinction is present in their model, but it does not shape the playing styles. See Table 3-1 Bateman and Boon's playing styles.

Table 3-1 Bateman and Boon's playing styles

Play Style	MBTI Types	Relevant Aspects
Conqueror	ISTJ, INTJ, ESTJ, ENTJ	Winning and challenge driven.
Manager	ISTP, INTP, ENTP, ESTP	Process oriented with strategy or tactical components.
Wanderer	INFP, ENFP, ISFP, ESFP	Search for enjoyment through fun and novelty.
Participant	ESFJ, ISFJ, ENFJ, INFJ	Story and social driven.

The Conqueror playing style is associated to the thinking and judging personality traits, players in this category are mainly concerned with winning, either the game or against their opponents. Challenges are welcome since the sense of fulfilment will be greater. These gamers enjoy feeling strong, knowledgeable, and as conquerors. It seems that the in-game story is not important to them, and they just pay attention to main events.

Manager type players are related to thinking and perceiving personality types. Learning and optimizing their efficiency in setting up strategic and tactical techniques are great motivations for manager players. Too much difficulty can

make them stop playing, so the challenge has to provide them with a sensation of steady pace progress. Stories are relevant as a tool for plot set up.

The Wanderer style is characterized by feeling and perceiving personality types. These players are driven by enjoyment which takes the form of fun and novelty. It seems like they want to be amazed by the game, otherwise they are not interested to keep playing it. Difficulty is not wanted either, and even support from within the game is welcome. Characters are the narrative hooks for these players, developing emotional connections.

The last playing style is Participant which is marked by feeling and judging personality types. Results did not present conclusive characteristics. Bateman and Boon consider that this cluster might be composed of different styles, being the two main possible preferences a tendency of interests towards the narrative of the game, and to the social experience.

It is undoubted that their contribution is highly valuable and groundbreaking. Their model informs demographic game design, and creates awareness of market tendencies. However, Bateman and Boon's focus on playing styles seems to overlook more precise information related to game mechanics. Instead, this thesis work picks up game elements through specificity of game genre classification as presented in the Game Preference Questionnaire developed for the presented study outlined in section 2.2.4 and fully developed in Chapter 4.

Another difference between Bateman and Boon's study and this one is the personality model selected. These authors utilize the Myers-Briggs typology,

explaining that their selection is based on what they considered the simplest personality model and thus an appropriate entry point for this area. Bateman and Boon refer to their playing style clusters as a continuum, but the psychological model only supports opposite pairs types. Instead, as explained in section 2.1.1, for the presented work the personality Five Factor Model (FFM) was chosen because it presents traits as a continuum instead of in siloed, polarized types.

It is of public knowledge that Bateman [69] is working towards a new player satisfaction model, however there has not been any publication of results by the time of this writing. Bateman is looking into a classification of gameplay behaviours based on the human nervous system. This new model is called BrainHex, which cluster playing styles into seven categories, each attached to specific elements of the nervous system. The different clusters are: Seeker (*Endomorphin*), Survivor (*Amigdala*), Daredevil (*Adrenaline*), Mastermind (Orbitofrontal cortex), Conqueror (*Epinephrine and Norepinephrine*), Socialiser (*Hypothalamus*), Achiever (*Dopamine*). Bateman increases the number of identified playing styles from his previous model, bringing more precision to the description of each cluster. Bateman's approach on playing styles looks for broad in-game behavioural patterns, and it is not concerned about linking those to specific game genres as this present work does. Nevertheless, there is common interest between his and this work on identifying key game elements for each cluster. For instance, in Bateman's Mastermind category solving puzzles and employing strategies are the most relevant aspects which seems to resemble the Conscientiousness personality factor that plays a key role for the puzzle genre.

Bateman's Socialiser builds on trust that is a main characteristic of the Agreeableness personality factor which is related to adventure games. However, this thesis work identifies all relevant personality factors for each genre whereas Bateman looks to improve his audience model by looking towards the nervous system elements to depict playing styles.

4: GAMING PREFERENCES QUESTIONNAIRE

This chapter presents the process undergone for the creation of the gaming preferences questionnaire that has been built for the purpose of this thesis work. There are three sections that describe the steps taken in the design of this tool, starting from the analysis of the framework that sustains this approach, to converting the game elements into scalable aspects of game genres, and finally presenting the expert validation.

4.1 Foundations

Gathering information on gaming preferences in detail by a standardized valid methodology requires the creation of a questionnaire, since there has not been previous work done to develop such a tool.

The foundation of the proposed questionnaire is the granular understanding of game genres, and how they are relevant to game design. Rollings and Adams' work [7] provide a thorough description of game elements (as described in section 2.2) that set the basis for constructing a gaming preferences questionnaire. However, the continuous evolution of video games makes it necessary to revisit game classifications. As Myers [35] pointed out in 1990, previous research studies in the 80s' on video games mentioned genres that were no longer representative of the panorama of games available by the end of that decade. Wolf [57] made a similar statement in 2001.

Rollings and Adams' description on genres [7] was reviewed with three objectives in mind: 1) to identify the specific descriptions of the elements for each genre that they proposed, 2) to assess the cohesiveness of the genres, and 3) to update any genre or element in response to changes in the current game market. All this information set the starting point for the construction of a matrix that could integrate all the data.

4.2 The Matrix

The game classification of Rollings and Adams [7;44] was revised and fine-tuned in order to achieve precision and consistency for the creation of a new tool to measure gaming preferences. Their term game element is the concept that sustains the game genre clustering.

As introduced in section 2.2.1, Rollings and Adams defined 10 game genres, but after revision only 7 genres were final. To get to this conclusion, game elements and genres were analyzed and evaluated in a table form. Game elements were entered in rows and game genres in columns. If a game element belonged to a genre, the cell was checked. Once that the table was fully completed, genres were compared among each other to identify if genres were overlapping significantly which was the case for the simulation and the game-for-girls genres. See Table 4-1 for a comparison of genres listed by Rollings and Adams, and the ones used for continuing the development of the Gaming Preferences Questionnaire.

Table 4-1 Comparison between Rollings and Adams genre and Gaming Preference Questionnaire genres

Rollings and Adams' Genres		Gaming preferences questionnaire genres	
Action	Shooting	Shooting	Action
	No Shooting	No shooting	
		Fighting	
Strategy	Turn Based	Turn Based	Strategy
	Real Time	Real Time	
Role Playing		Role Playing	
Sports		Sports	
Vehicle simulation		Vehicle	Simulations
Construction & management simulation		Construction	
Artificial Life		Artificial Intelligence	
Adventure		Adventure	
Puzzle		Puzzle	
Games for Girls		(none)	

Simulation games share a critical game element of emulating aspects of the real world (beyond the level of photorealism), thus they were considered under the same genre but still distinct as subgenres. The games-for-girls genre did not present a differential approach of game elements, but it was rather a thematic identifier, for example fashion.

A subgenre was added to Action in order to further differentiate within Rollings and Adams' no-shooter games, because during recent years new games that rely on skills, reaction times, physical coordination, or twitchy

movements have been gaining terrain in the market, for example Guitar Heroes [70] and WarioWare [71]. Music and rhythm based game elements were included as well. This is the kind of revision necessary through the passage of years to include the continuous changes in gaming innovation, which push genre redefinitions and set new boundaries.

Online games were identified as a valence for genres but not as a genre by itself. For example, World of WarCraft [72] is classified as a Role Playing Game plus Online.

Once the genre revision and adjustment phase was concluded, there was one more iteration to the new game genre map in order to work out the standardization of gaming preferences.

All final 50 game elements were formulated in first person, referring to the preference and enjoyment of a particular game characteristic. Then, those cells in the matrix where a game element meets a game genre were given a weight that depended on the relevance of the game element to that genre. There were three possible weights: high (20), medium (10), and low (5). Some game elements belong only to one genre, others to multiple genres. For example, the game element “I prefer games where events happen once I’ve finished my turn.” belongs to the Strategy Turn Based genre, while “I prefer games with big, complex worlds” is related to Role-Playing, Strategy-Turn-Based, and Adventure genres. See the full list of game elements and their relationship to game genres in section 9.2: Appendix B - Gaming Preferences Matrix.

The number of game elements per genre varies, there are some genres with more than ten items and others with six. The total sum of game elements per genre also changes, for example for Strategy Turn Based the total is 110 whereas for Adventure is 70. For comparison reasons, the difference in total scoring among genres can be easily overcome by normalizing the participants scoring. The advantage of this approach is that it provides flexibility to the model, for example if new game elements or genres are introduced in the market, they can be incorporated easily in the table without altering the whole tally. The same is applicable if a genre or element becomes obsolete, it can be taken out from the framework without affecting the integrity of the structure.

This matrix is the source of the game preferences questionnaire. The language and wording used for the items pays close attention to the terms that gamers are familiar with, and particular care was taken to avoid double meanings. Beyond making sure that the information collects what is intended, it has to be meaningful to the game designer who will be using the data during the game design process. Using statements that are recognizable for both groups has the advantage of being transparent from one group (gamers) to the other (designers) without diluting the information with unnecessary intermediate translations.

The order of the game elements was changed from the matrix to the questionnaire to avoid presenting items in a recognizable order that resemble game genres. Thus, all items of the matrix were assigned a random number and then were sorted from the lowest to the highest.

When gamers fill out the questionnaire, they have to indicate their level of agreement (on a four-point Likert scale) for each statement about preferring a game element. For example, the item “I prefer games where I have to resolve puzzles frequently” can be answered as strongly agree, agree, disagree, or strongly disagree. Neutral answers are not possible. This questionnaire has been purposefully designed to make participants take a stand about each game element. This decision was seconded by experts (more about it in the next section 4.3) because gamers can have the halo perception of ‘liking games’ and then would tend to choose a neutral option which is a common problem in five-point Likert scales [73]. It might have the risk of forcing answers from those who are truly neutral, but the intention is to identify what aspects are preferred, and this is a way of enforcing a deliberate answer. For the full questionnaire, see Appendix C – Gaming Preferences Questionnaire.

Game elements are tallied towards the game genre that they belong. If the participant response is ‘strongly agree’, it will enable the total weight of the element towards the genres where it belongs. Agreeing accrues a 66% of game element value, whereas disagreeing a 33%. Strongly disagree will not count towards any genre. It needs to be noted that this weighting system was the result of reviewing answers statistically, since responses from strongly agree to strongly disagree are subjective. For example, it raises the question ‘are the four possible answers equidistant from each other?’ which can be answered with statistical techniques, once the data has been collected. Ponderating the scale and exploring the difference among values is fully explained in section 6.1.

Once all answers are computed, every genre has a total number that describes the likelihood of leaning towards that type of game, thus identifying the gaming preferences of players.

4.3 Expert Validation

The concept of expert jury validity consists of involving a group of experts in the field to revise and provide advice on the measurement tool judging its merit [74]. The process of expert jury validation for this Gaming Preferences Questionnaire was achieved by presenting the matrix table of game genres and elements with weighting (explained in the previous section) to six professional game designers.

All experts were male and their professional careers were fully dedicated to video game development. In average, they had seven years of experience in the game industry. Their educational background ranged from college to master's degree, in the areas of computer sciences, engineering, game design, and psychology.

The experts were interviewed individually in order to dedicate full attention to each of them during the meetings, and to avoid influencing behaviours that are common in group dynamics. A series of steps were taken during the interviews as summarized in Table 4-2.

Table 4-2 Interview steps for expert validation.

Step	Description
1	Introduction to the project and its goals, and explanation of his role as expert.
2	Expert is given a copy of the game preferences matrix-table.
3	Expert reviews the matrix-table using think aloud method and introducing changes.
4	Pre-defined judging questions are asked.
5	Open time for further comments and suggestions.
6	Expert is thanked and interview is adjourned.

Interviews lasted in average one hour and fifteen minutes. Experts were introduced to the overall research study, the objectives, and their role as experts to revise and advise on the Gaming Preferences Questionnaire. After that, they were given a copy of the matrix-table loaded with the weightings. Experts were asked to review the matrix, and to adjust it doing as many changes as they considered necessary while employing a think-aloud technique. All of them confirmed their familiarity with this technique, and they were vocal throughout the interview. Once they were satisfied and no more changes were considered, they were asked five specific questions that judges the tool. The questions were:

1. Would you add or change any genre?
2. Would you add any other game characteristic?
3. Do you think that all games currently in the market can be analyzed with this table?
4. Do you consider that the matrix is consistent?

5. Would you approve it as an appropriate tool for measuring gaming preferences?

After answering these questions, they were welcome to add further comments or suggestions. Then, they were thanked for their time and contributions, and the interview was adjourned.

The six of them agreed to question number 5, approving the tool for measuring gaming preferences. Therefore, the matrices that they changed were used for the comparison process to build up the final version of the matrix. This final validation step consisted of revising the six matrices and comparing what changes were made. If at least three of the experts made the same modification, that change was incorporated as final. For example, for the game element “It’s important for me to get a high score”, it was pointed out by three of the experts that such item was relevant for the sports genre to a lesser extent, and they weighted it as a 5. This change was incorporated in the final version of the matrix, the same process was applied for the rest of the items.

Even though some of the experts suggested new items, none of them appeared in a consistent fashion to be incorporated into the final version of the matrix. Nevertheless, since video games change through the passage of the years, those and other suggestions are highly valuable for revisions to be made in future work.

5: METHODOLOGY

This chapter presents the framework that shapes the data collection and analysis for answering the research question. Section 1 explains the research design and methodology. Section 2 focuses on participants. Section 3 describes the process for data collection.

5.1 Design

This study employs a cross-sectional research design (sometimes also referred to as survey design) which involves quantifiable data collection from hundreds of participants within a specific point in time in order to identify patterns or associations [75]. The patterns of interest correspond to the research question of this study about the relationship between personality factors and gaming preferences. It should be noted that no causal influences are established, it is not possible to say that a certain personality profile causes preference for a type of game genre, nor is possible to say that preferring to play a particular game genre causes a certain personality profile. The relationships look to detect that changes in one variable are reflected by changes in the other variable. For example that an increase in the extraversion factor is reflected by an increase in the shooting genre, or that a decrease in agreeableness is linked to an increase in preferring shooting games.

Quantitative data is collected for the two variables key variables: personality and gaming preferences. The quantification of information makes it possible to systematize the relationships and assess if the variations are consistent. For example, when each increase of the percentile of openness is related to an increase of 2 percent for choosing puzzle games.

In Chapters 1 and 2 the relevancy of the selected variables was explained. Personality reveals motivations, needs, and dispositions to certain behaviours across different situations [3]. This concept has been used as a prediction tool in order to know what activities and situations will be more suitable for people with certain personality profiles, such as in the Human Resources field to assess what roles, positions, and tasks people will perform better [5]. When playing games, users are faced to specific situations where certain tasks have to be performed; personality can lead to an understanding if game scenarios tap onto people's profile. Gaming preference is a slippery concept. Game genres have been historically used as labels for clustering games, often as a generic reference for the type of games that a gamer enjoys. In order to have more precision about what is meant for each genre the gaming questionnaire was developed (see section 2.2.4: Gaming Preferences Tool).

The research method for this study is survey. All participants completed three self-administered questionnaires during a single session. The first questionnaire collected demographical data, it gathered information on gender, age, geographical location, gamer self-denomination (casual, hardcore, does not know), buying and playing habits, and favourite game titles. For the full tool, see

section 10.4: Appendix E – Demographic Questionnaire. The second questionnaire was on gaming preferences, a thorough list of game elements assesses whether players enjoy such game characteristics. The development of this tool was explained in chapter 4. The questionnaire as presented to participants can be found in section 10.2 Appendix C – Gaming Preferences Questionnaire. The third part of the survey was the personality test NEO-FFI which was described in section 2.1.2 Personality Tool. This inventory assesses people’s personality profile according to the five factor model, results yield their scoring in Neuroticism, Extraversion, Openness, Agreeableness, and Conscientiousness. For a sample of the questionnaire, see section 10.1 Appendix A – NEO-FFI Items Sample.

The population of this research are adult gamers (at least 18 years old) including both hardcore and casual. This universe has millions of units, without census of any type, and it would impossible to have a probability sample. Therefore, the following considerations have to be taken regarding the sampling of this study.

Subjects of this research should be game-literate players since they will be more likely to have a broader gaming experience and should be able to select their preferences. The risk of including people with low or no gaming exposure is that they might select only those few gaming elements they have tried or been told about, but that would not be a selection of preferences. The problem of determining who is an experienced gamer to answer such questions has been already brought up by Bateman and Boon [2]. In their research, they have

indicated that such a person is able to recognize herself as a hardcore or casual gamer. The same approach is taken in this study. In the demographic questionnaire section, one of the questions asked “Do you consider yourself ...? a) a casual, b) a hardcore gamer, or c) you don’t know”. Accompanying this question was a note stating “There is no right or wrong answer, nor is there a given definition to follow but just what you think.” This question sets the eligibility of the participants, data from those answering a) or b) will be considered for the results, whereas those who responded c) will not be taken into account.

The other sampling consideration is that participants are self-selected, meaning that participants chose to take part in the study when they saw the announcement. Thus, generalizations from the results should be taken with caution.

The final consideration of research design is using the internet as the medium for collecting data. This study looks for worldwide outreach and the internet stands out as the propitious platform. Accessibility to the internet does not seem to be a sampling bias since gamers are technological inclined people. The complete web survey was hosted on the secure servers of the School of Interactive Arts and Technology at Simon Fraser University.

5.2 Participants

As mentioned in the previous section, participants of this study were people who recognized themselves as casual or hardcore gamer. Participation was self-selected, which has limitations for generalization of results.

Announcements to participate in this study were sent to gaming oriented mailing lists, websites, personal contacts, forums, and groups. See Table 5-1 Participant Outreach. Special care was taken to reach different types of audiences, including websites for hardcore gamers and casual gamers, different types of games, and geographical location.

Participation was voluntary. Due to ethical regulations that governed research at Simon Fraser University, subjects were required to be at least 19 years old, or 18 years old and to be a Simon Fraser University student.

Table 5-1 Participant Outreach

Website, forum, group, email list:	Comments/URL:
2K Games	http://forums.2kgames.com/
Android Community	http://androidcommunity.com/
Asociación de Desarrolladores de Videojuegos Argentina	http://www.adva.com.ar/foro/
Big Fish Games	http://forums.bigfishgames.com
Capcom	http://www.capcom-unity.com/
Civfanatics	http://forums.civfanatics.com/
Digital Games Research Association	http://www.digra.org/
DiGRA Latinoamerica	http://www.digra.org/chapters/LatinAmerican/ Facebook group
EA Games UK	http://forums.electronicarts.co.uk/
Game Career Guide	http://www.gamecareerguide.com/
GameDev.net	http://www.gamedev.net/community/forums/
Gamespot	http://www.gamespot.com
GameSpot UK	http://www.gamespot.com/ (UK location)

GameSpy	http://forums.gamespy.com/gaming_discussion/
Game Studio	http://www.opserver.de
Global Game Jam	http://www.globalgamejam.org/ Organizing group
Harvard College Interactive Media Group	http://www.hcs.harvard.edu/hcim/ Facebook group
International Game Developers Association	http://www.igda.org/ and Facebook group
Overclockers Australia	http://forums.overclockers.com.au/
PalGN Australia	http://palgn.com.au/
Paradox Plaza (Victoria, Hearts of Iron, Port Royale)	http://forum.paradoxplaza.com/
SFU Surrey Community Board (SFU Connect)	http://community.surrey.sfu.ca/
SIAT Grad mailing list	http://www.siat.sfu.ca/
Tom's Hardware	http://www.tomshardware.com/
Women in Games Vancouver	http://womeningamesvancouver.net/ Facebook group

The websurvey received 1,020 initial responses from around the world. However, only 624 were fully completed surveys, the other 396 did not fill out the whole survey and were disregarded.

From the completed surveys, 550 participants identified themselves as hardcore or casual gamer. Three more steps were taken to check that the data was usable, the objective was screening for honesty. First, as part of the NEO-FFI at the end of the questionnaire there are two extra questions to cover validity checks, one asking the person if the answers were in the correct boxes and

another about the honesty of their answers. Those participants who indicated not filling out the form correctly or not being honest were disregarded. The second step was screening for random responses, random patterns can be identified by having several consecutive answers under the same Likert scales, for example 7 strongly disagree items in a row. The last screening step was looking to the time taken to complete the survey, all responses were time-stamped when the survey was started and when it was finished, participants that took an unrealistic short amount of time, for instance 3 minutes and a half, were eliminated as well.

The final number of responses that fulfilled the participant criteria and passed the screening steps was 545. These were the answers considered for analysis.

5.3 Procedure and Data Collection

The data were collected from August 2009 to December 2009. Announcements calling for participation were sent out to diverse groups, lists, and websites as described in Table 5-1 Participant Outreach.

Participants completed the online survey from their own computers at their own convenient time. The survey tool was designed to not allow participants to save their progress; therefore, participants completed the whole survey in one single session.

The online survey was set up using the open source software LimeSurvey v1.85 [76]. Upon arriving to the websurvey, participants were presented with the informed consent form (see Appendix D – Participants Consent Form). If they

were older than 19 years old (or 18 years old and a Simon Fraser University student) they were able to continue to complete the demographic questionnaire (Appendix E – Demographic Questionnaire). After that, participants were presented with the Gaming Preferences Questionnaire (Appendix C – Gaming Preferences Questionnaire), then they were given the NEO-FFI personality questionnaire (Appendix A – NEO-FFI Items Sample), finally a screen thanked them for their participation.

All responses were stored at the secure servers of the School of Interactive Arts and Technology of Simon Fraser University, Canada.

6: RESULTS

This chapter describes the analysis of the collected data, and is divided into four sections. Section 6.1 'Gaming Preferences Questionnaire Analysis' shows how the answers of the Gaming Preferences Questionnaire were inspected in order to assure a truthful weighting set, and content validity. Section 6.2 'Demographic Analysis' covers the characteristics of the sample. Section 6.3 'Statistical Analysis' presents the multiple linear regression analysis between personality traits and gaming preferences. Further implications of these results are elaborated in Chapter 7 Discussion.

All statistical analysis was done using SPSS Statistics v17.0 software [77].

6.1 Gaming Preferences Questionnaire Analysis

6.1.1 Weighting Set

Three different sets of scores were created to analyze the validity of the questionnaire (see Chapter 4: Gaming Preferences Questionnaire).

There are four possible answers for each question:

- Strongly Agree
- Agree
- Disagree
- Strongly Disagree

As explained in Section 2.2.4 this is a 4-point Likert scale answer. There have been discussion on the interpretation of establishing a value to the gap between one answer and another due to their subjective nature [78;79]. For instance, is the difference between 'strongly agree' and 'disagree' double the difference than between 'strongly agree' and 'agree'? Are 'strongly agree' and 'agree' closer to each other than 'agree' and 'disagree'?

To assure that the questionnaire was collecting consistent data, different sets of weighting were given to each possible answer, exploring different distance values for the subjective responses. See 6-1 Weighting Sets for Gaming Preference Questionnaire.

Table 6-1 Weighting Sets for Gaming Preference Questionnaire

	Strongly Agree	Agree	Disagree	Strongly Disagree
Set 1	1	0.75	0.25	0
Set 2	1	0.60	0.40	0
Set 3	1	0.66	0.33	0

Set 1 emphasizes the distinction between to agree or to disagree and that the subjective response to strongly agree or strongly disagree is a smaller differentiation. Therefore, Set 1 suggests that there is a bigger gap between agreeing and disagreeing than from disagreeing to strongly disagreeing and from agreeing to strongly agreeing.

Set 2 emphasizes how strongly the person agrees or disagrees with the questionnaire statements, suggesting that the gap between agreeing and disagreeing is smaller.

Set 3 suggests that the gap among each possible answer is the same. Thus, the subjective responses are evenly distributed.

Participants' results were processed and compared employing the three weighting sets. Scoring was very consistent across all game genres. No bias was found for any weighting set. This type of finding supports the validity of the questionnaire.

Set 3 was selected to use for the analysis of results for this study since it is the most conservative approach, which assumes that the items in the Likert scaling are equidistant [79]. In the fields of education and business, Set 1 is the most commonly used.

6.1.2 Content Validity

In addition to the expert validation for the Gaming Preferences Questionnaire (see Section 4.3 Expert Validation), this section presents content validity which is a confirmation that the questionnaire collects information that reflects the game genre conceptualizations.

Participants were asked to state their three favourite games and preferred game genre. These answers were reviewed and compared to their scoring from the Gaming Preferences Questionnaire. A sub-sample representing the 10% of participants was randomly selected (n= 55), their answers were compared to the

three highest scorings that they received from the Gaming Preferences Questionnaire. The three highest scorings were chosen because the preferred games could belong to different genres, and the first preferred game may not necessarily match the preferred indicated genre. For example, participant ID 626 mentioned the following games in this order: *Mega Man 3* [80], *Super Mario World* [81], and *Star Wars: Knights of the Old Republic* [82], and indicated Role Playing as preferred genre; however, *Mega Man 3* and *Super Mario World* fall into the Action No Shooting genre from the categorization presented in this work. Therefore, the third game that participant ID 626 mentioned is the one that matches the genre that he specified. Nevertheless, it seems that the Action No Shooting genre is relevant for this participant. The three highest genre scorings that this participant got were: RPG, Adventure, and Action No Shooting. Thus, there was a match between what the participant stated (Action No Shooting and RPG game titles, and RPG genre) and the highest scorings obtained from the questionnaire (RPG and Action No Shooting). This shows an example of how the Gaming Preferences Questionnaire was collecting data from the participants that correspond to the game genre construct.

From the 55 participants randomly selected for assessing the content validity of the questionnaire, there were 50 participants (over 90%) with matching between their stated preferred games and genre, and the three highest scorings from the Gaming Preferences Questionnaire.

6.2 Demographic Analysis

As part of the survey (see section 5.3 'Procedure and Data Collection') participants provided information about their age, location, gender, buying habits, platform used, and playing mode preferences. This section describes findings on these demographic aspects.

6.2.1 Age

The average participant age is 28.43, median is 26, mode is 19, standard deviation 8.915, minimum age is 18 and maximum age is 68 (50 years range).

See Figure 6-1 Distribution of participants' age.

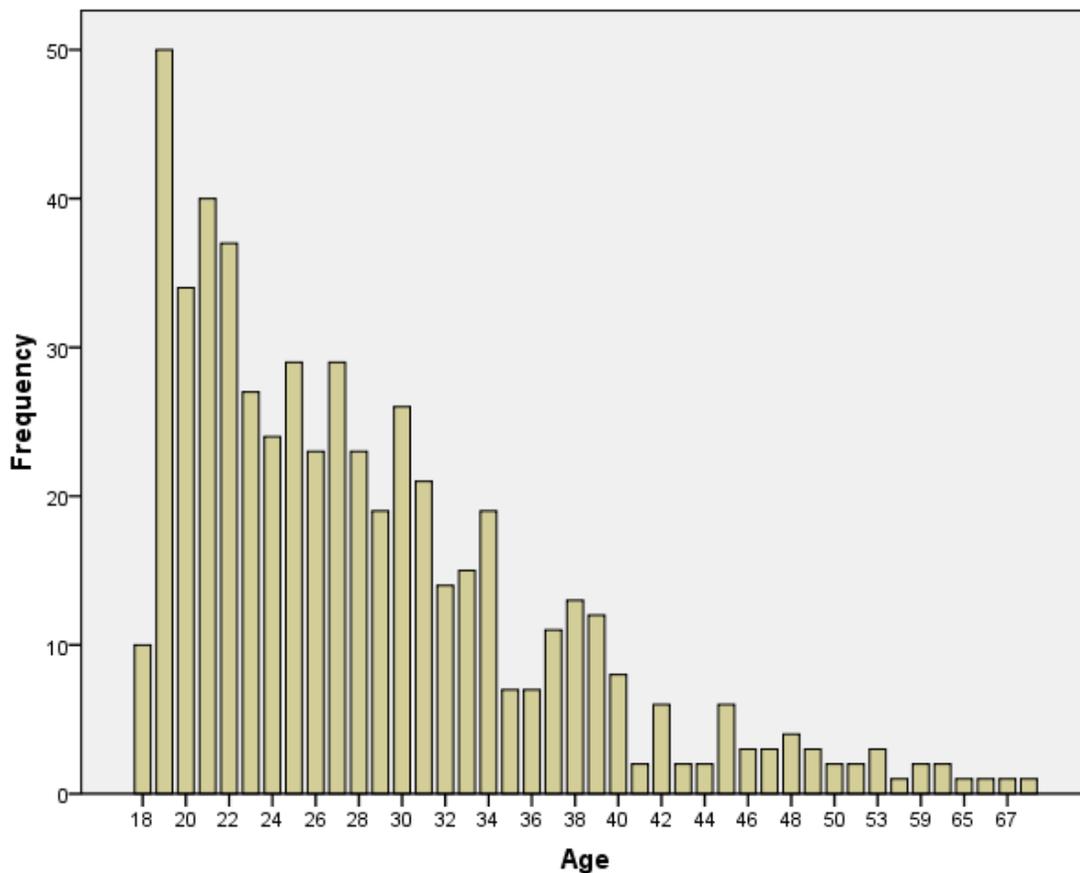


Figure 6-1 Distribution of participants' age

6.2.2 Country Location

The design of the study was to be demographically inclusive and worldwide open. Participants' locations were spread out across 36 countries. Argentina, Canada, and the United States had the three biggest portions (20.7%, 20.6% and 21.1% respectively). Other relevant proportions are Australia (6.4%) and the United Kingdom (9%). See Figure 6-2 Participants' country location, and Table 6-2 Participants' country location.

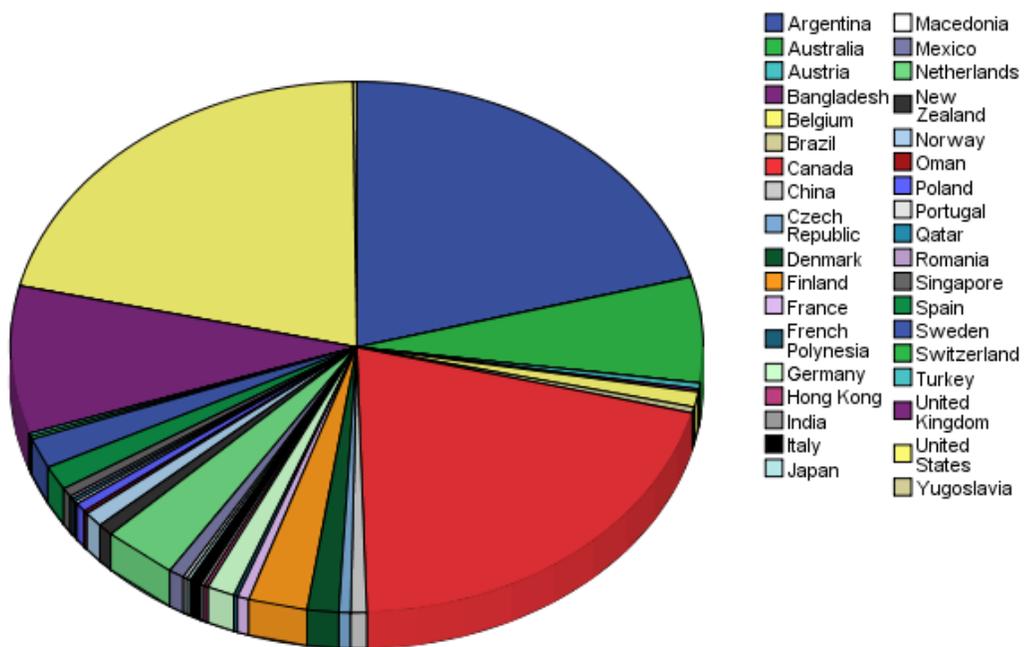


Figure 6-2 Proportion of participants' country location

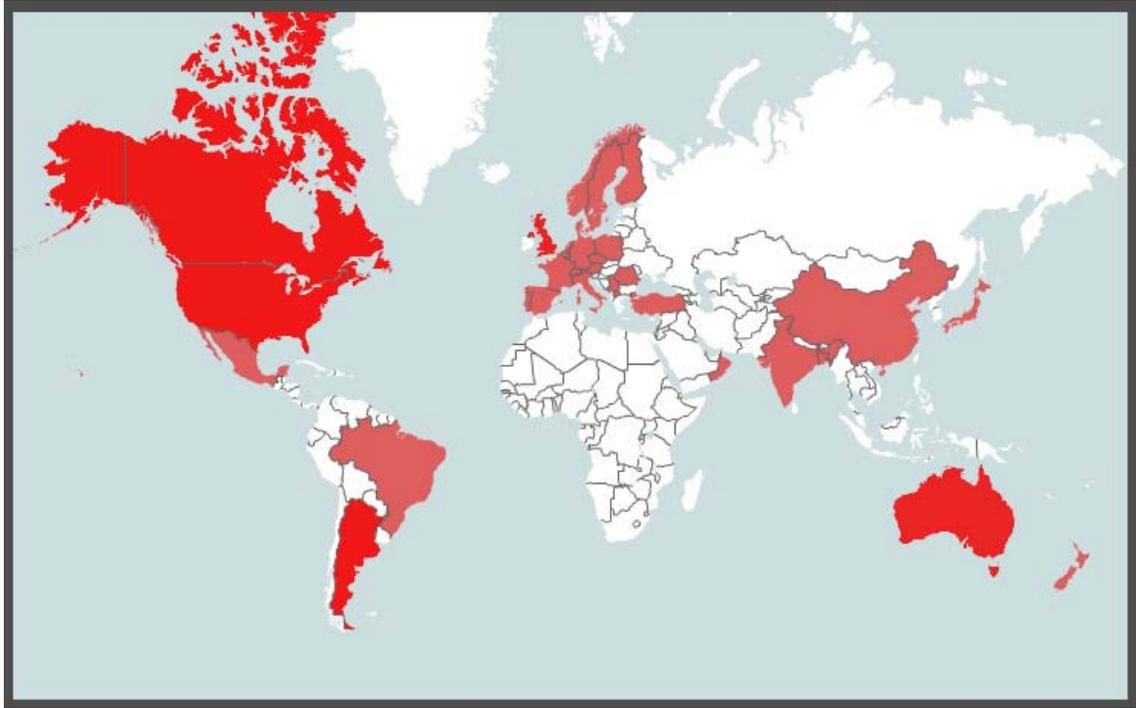


Figure 6-3 Participants' country location map

Table 6-2 Participants' country location

County	Frequency	Percentage
Argentina	113	20.7
Australia	35	6.4
Austria	2	.4
Bangladesh	1	.2
Belgium	5	.9
Brazil	2	.4
Canada	112	20.6
China	4	.7
Czech Republic	3	.6
Denmark	8	1.5
Finland	15	2.8
France	3	.6
French Polynesia	1	.2
Germany	7	1.3
Hong Kong	1	.2
India	1	.2
Italy	3	.6
Japan	1	.2
Macedonia	1	.2
Mexico	4	.7
Netherlands	19	3.5
New Zealand	4	.7
Norway	5	.9
Oman	1	.2
Poland	3	.6
Portugal	1	.2
Qatar	1	.2
Romania	1	.2
Singapore	3	.6
Spain	8	1.5
Sweden	10	1.8
Switzerland	1	.2
Turkey	1	.2
United Kingdom	49	9.0
United States	115	21.1
Yugoslavia	1	.2
Total	545	100.0

6.2.3 Gender

Participants' gender distribution was heavily inclined to males, 89 out of the 545 subjects were female, and 456 were males, 16.3% and 83.7% respectively. This seems to indicate that male gamers still represent the major sector of the market.

6.2.4 Gaming Habits

The distribution between casual and hardcore gamers was very even, 53.8% for casual, and 46.2% for hardcore. There were no casual nor hardcore definitions given to participants who were instructed that there was no right or wrong answer. Participants were asked to reflect on how they considered themselves: if casual, hardcore, or don't know. As explained in Section 5.2 Participants, only those who answered casual or hardcore were considered for analysis.

Buying habits analysis showed that there was an average of 8.12 games bought per year. A closer look at the countries with more participants is shown in Table 6-3 Average amount of games bought per participant per year.

Table 6-3 Average amount of games bought per participant per year

	Canada	United States	Argentina	Sample
Games bought per year	7.44	7.05	6.18	8.12

From the sample, 89.5 % bought games for themselves, 20.6% bought games for their family, 17.6% bought games for their partners, and 9.9% did not

buy games. This last cluster of participants was included in the analysis since the purpose of this research is to predict gaming preferences for gamers independently of the amount of money they spend on games. Not buying games also suggests acquiring pirated copies, partners buying the games, and free-to-play games.

Participants listed in order of priority what platforms they use; the options to choose from were PC, console, portable, and none. See Table 6-4 Percentage of Platform Usage. In the first place, the most used platform is PC (72.3%), then console (23.3%), and last portable (4.4%). In the second place platform used, console was the most used (43.5%), portable (22.4%), no second platform used (18.7%), and finally PC (15.4%). In a third place platform used, none is used (38.5%), portable (38.5%), console (13.2%), and PC (9.7%).

Table 6-4 Percentage of Platform Usage

	PC	Console	Portable	None
1st platform	72.3	23.3	4.4	0
2nd platform	15.4	43.5	22.4	18.7
3rd platform	9.7	13.2	38.5	38.5

Regarding playing habits, almost half of the sample prefers to play single player mode alone (45.3%). Then multiplayer cooperative is preferred, in its variation on the internet (14.1%) and in the same room (13.9%). Following by playing multiplayer competitive, on the internet (13.2%), and in the same room (8.8%). Single player with other people (passing pads, hot seat) is the least preferred (4.6%). See Figure 6-3 Preferred Play Mode. Condensing all the

values into single player and multiplayer shows a very even split: 49.9% for all modes of single player, and 50.1% for all types of multiplayer modes.

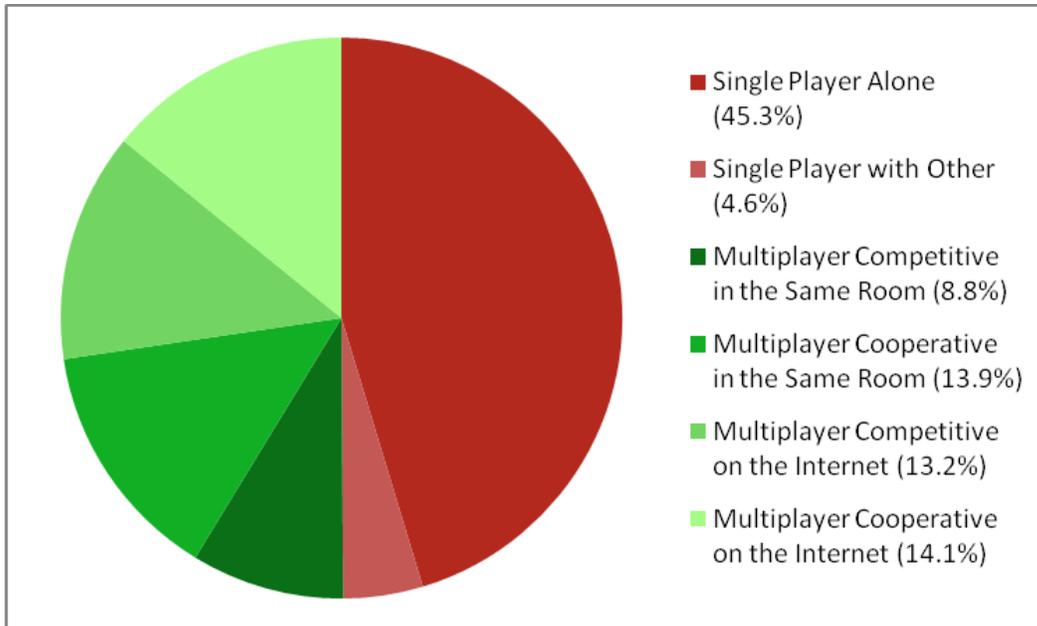


Figure 6-4 Preferred Play Mode

6.3 Statistical Analysis

This analysis explores the idea of obtaining models for each game genre for predicting a value of likelihood for preferring a type of game based on personality traits. Each model is composed of predictor variables (personality traits) with their own coefficients where the predicted value is a specific linear combination of these variables. The analysis performed to the collected data is a multiple linear regression by ‘forced entry’ method, which forces all predictor variables into the model simultaneously.

The independent variables are the T scores for the five personality traits (Openness, Agreeableness, Extraversion, and Neuroticism) obtained for every participant from their personality questionnaire (NEO-FFI inventory) described in section 2.1.2 'Personality Tool'. The dependent variables are the normalized score for each game genre from the Gaming Preferences questionnaire described in section 4: 'Gaming Preferences Questionnaire'.

R square is a measure of the proportion of variation in the scores that is explained by the variables in the model. The closer to 1 the more strongly the variables explain the response. The closer to 0 the less strongly the variables explain the response.

This type of statistical analysis was chosen because multiple regression allows predicting the value of the dependent variable from several independent variables. A correlation coefficient, such as Pearson's, only measures the relationship between two variables. In the presented study, the research methodology includes five independent variables, therefore a multiple regression is appropriate to explain the relationship among the more than two variables. A linear model is constructed to fit to the data by using the method of least squares that identifies the line with the least deviations from the data. Thus, the model can be expressed as an equation. The following is an abstract representation of a multiple linear regression formula:

$$\begin{aligned} \text{Dependent variable} = & \text{constant} + (\text{coefficient}_{i_{v1}})\text{independent_variable1} + \\ & (\text{coefficient}_{i_{v2}})\text{independent_variable2} + (\text{coefficient}_{i_{v3}}) \\ & \text{independent_variable3} + (\text{coefficient}_{i_{v4}})\text{independent_variable4} \end{aligned}$$

An example of multiple linear regression explained by Field [83] is presented in the scenario of predicting music record sales. In order to predict how many records will be sold, data is collected on the amount of money spent on advertisement (advertising budget), and number of times the song is aired per week (aired number). The equation explaining the model would be the following:

$$\text{Record sales} = \text{constant} + (\text{coefficient}_{\text{adv budget}}) \text{ advertising budget} + (\text{coefficient}_{\text{aired number}}) \text{ aired number}$$

The following sections describe the multiple linear regression results for each of the twelve game genres and online valence.

6.3.1 Action Shooting

The value of R Square for the genre Action Shooting multiple linear regression is .061 meaning that the model composed by the 5 personality factors can only account for 6.1 % of the preference for shooting genre games, this regression value is low, and that there are other variables that are influencing the preference for game genres. See Table 6-5 Model Summary for Action Shooting genre.

Table 6-5 Model Summary for Action Shooting genre.

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
Action shooting	.247	.061	.052	14.52445

The model itself is highly significant (ANOVA $p = 0.000$), therefore the presented model is a better explanation than using just mean values. See Table 6-6 ANOVA of Model Action Shooting genre

Table 6-6 ANOVA of Model Action Shooting genre

Model	Sum of Squares	df	Mean Square	F	Sig.
Regression	7410.617	5	1482.123	7.026	.000 ^a
Residual	113707.178	539	210.960		
Total	121117.795	544			

a. Predictors: (Constant), T_Conscientiousness, T_Openness, T_Agreeableness, T_Extraversion, T_Neuroticism b. Dependent Variable: Action Shooting

The model is composed by parameters: 5 personality traits (Neuroticism, Extraversion, Openness, Agreeableness, and Conscientiousness) and a constant. See Table 6-6 Coefficients for Shooting Model. The constant represents the percentage of preferring the shooting genre if there were no information on personality trait score. The beta value (column B) for the constant is 43.740. The beta values for the other parameters represent the slope of the regression line. This gives information about two aspects: if there is a positive or negative regression, and the change in the predicted value for each unit change in the parameter. All personality traits except Conscientiousness are significant in this model.

Table 6-7 Coefficients for Shooting Model

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
(Constant)	43.740	6.886		6.352	.000
T_Neuroticism	.158	.063	.118	2.513	.012
T_Extraversion	.260	.059	.207	4.448	.000
T_Openness	-.136	.059	-.099	-2.321	.021
T_Agreeableness	-.181	.055	-.142	-3.280	.001
T_Conscientiousness	.054	.056	.043	.975	.330

The slopes for Neuroticism and Extraversion are a possibility which imply that the higher the values of these traits the chances of preferring Action shooting games increases. The slope for Openness and Agreeableness are negative, therefore the lesser the value of these traits indicates more likeliness to prefer Action shooting games.

Based on the coefficients of the Shooting genre model, we arrive to the following formula for predicting preference for the shooting genre:

$$\text{Action Shooting} = 43.740 + (.158 * T_Neuroticism) + (.260 * T_Extraversion) - (.136 * T_Openness) - (.181 * T_Agreeableness) + (.054 * T_Conscientiousness)$$

Here is an example of how this formula is applied to one of the participants (ID 56). This person indicated “Action” as his preferred genre, and mentioned as his preferred games of all times: Mafia (third-person shooter), Call of Duty (first-person shooter) and Battletoads (action no-shooting). His normalized score for Action Shooting is 82.67.

We notice that this participant obtained a high score for the Action Shooting, his first two preferred game are shooting and the third one is within the action genre. This information supports that the data collected by the questionnaire is sensitive to the player's preferences and is able to predict the genre suitable for him.

Now only looking at his personality, we replace his T scores for the personality traits in the Action Shooting model formula:

$$\begin{aligned} \text{Action Shooting} &= 43.740 + (.158 * 55) + (.260 * 68) - (.136 * 46) - (.181 * \\ &38) + (.054 * 43) \\ &= 43.740 + 8.69 + 17.68 - 6.256 - 6.878 + 2.322 \\ &= 59.298 \end{aligned}$$

The predicted value for participant ID 56 is low and does not reflect the high scoring obtained for Action shooting. This case seems to be outside the 6.1% prediction of the model.

6.3.2 Action No Shooting

The value of R Square for the genre Action No Shooting multiple linear regression is .073, thus can only account for 7.3 % of the preference for this genre based on personality. See Table 6-8 Model Summary for Action No-Shooting genre.

Table 6-8 Model Summary for Action No-Shooting genre

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
Action No Shooting	.270 ^a	.073	.064	14.04604

The model itself is highly significant (ANOVA $p = 0.000$), which supports that the model is a better explanation than using just mean values. See Table 6-9 ANOVA of Model Action No Shooting genre.

Table 6-9 ANOVA of Model Action No Shooting genre

Model	Sum of Squares	df	Mean Square	F	Sig.
1 Regression	8363.702	5	1672.740	8.479	.000 ^a
Residual	106339.912	539	197.291		
Total	114703.614	544			

a. Predictors: (Constant), T_Conscientiousness, T_Openness, T_Agreeableness, T_Extraversion, T_Neuroticism b. Dependent Variable: Action No Shooting

Following the same analysis as for the previous genre, the model has a constant and the information of the five personality factors. See Table 6-10 Coefficients for Action No Shooting Model. The constant represents the percentage of preferring the shooting genre if there were no information on personality trait score. In this model the beta value (column B) for the constant is 31.820. The beta values for the other parameters represent the slope of the regression line. This gives information about two aspects: if there is a positive or negative regression, and the change in the predicted value for each unit change in the parameter. All personality factors except Openness are significant in this model.

Table 6-10 Coefficients for Action No Shooting Model

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
(Constant)	31.820	6.659		4.778	.000
T_Neuroticism	.185	.061	.143	3.048	.002
T_Extraversion	.298	.057	.244	5.270	.000
T_Openness	-.050	.057	-.038	-.892	.373
T_Agreeableness	-.141	.053	-.114	-2.647	.008
T_Conscientiousness	.158	.054	.129	2.937	.003

The formula for predicting preference for the shooting genre is composed by the coefficients of the Action No Shooting genre model:

$$\text{Action No Shooting} = 31.820 + (.185 * T_Neuroticism) + (.298 * T_Extraversion) - (.050 * T_Openness) - (.141 * T_Agreeableness) + (.158 * T_Conscientiousness)$$

The higher the value for Neuroticism, Extraversion and Conscientiousness, the more likely to prefer Action No shooting. A lower value of Agreeableness increases the preference towards Action No Shooting.

6.3.3 Action Fighting

The R Square value of the multiple linear regression for the genre Action Fighting is .055, the model can only account for 5.5 % of the preference for this genre based on personality. See Table 6-11 Model Summary for Action Fighting genre.

Table 6-11 Model Summary for Action Fighting genre

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
Action Fighting	.234 ^a	.055	.046	14.12702

Even though this model has a low percentage of prediction, it is highly significant. See Table 6-12 ANOVA of Model Action Fighting genre.

Table 6-12 ANOVA of Model Action Fighting genre

Model	Sum of Squares	df	Mean Square	F	Sig.
Regression	6247.473	5	1249.495	6.261	.000 ^a
Residual	107569.684	539	199.573		
Total	113817.156	544			

a. Predictors: (Constant), T_Conscientiousness, T_Openness, T_Agreeableness, T_Extraversion, T_Neuroticism. b. Dependent Variable: Action Fighting

In the Action Fighting genre the constant has a value of 39.573 and only the following three personality traits are significant in the model: Neuroticism, Extraversion, and Agreeableness. See Table 6-13 Coefficients for Action Fighting Model.

Table 6-13 Coefficients for Action Fighting Model

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
(Constant)	39.573	6.698		5.908	.000
T_Neuroticism	.170	.061	.131	2.782	.006
T_Extraversion	.249	.057	.204	4.372	.000
T_Openness	-.097	.057	-.073	-1.696	.090
T_Agreeableness	-.156	.054	-.127	-2.915	.004
T_Conscientiousness	.074	.054	.060	1.360	.174

Higher values of Neuroticism and Extraversion, and a lower value of Agreeableness contribute to the output of predicting the Action Fighting genre.

The formula of model for the Action Fighting genre is as follows:

$$\text{Action Fighting} = 39.573 + (.170 * T_Neuroticism) + (.249 * T_Extraversion) - (.097 * T_Openness) - (.156 * T_Agreeableness) + (.074 * T_Conscientiousness)$$

6.3.4 Strategy Turn Based

The R square model for the Strategy Turn Based genre is 0.020 and, although close, it is not significant. See Table 6-14 Model Summary for Strategy Turn Based genre, and Table 6-15 ANOVA of Model Strategy Turn Based genre.

Table 6-14 Model Summary for Strategy Turn Based genre

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
Strategy Turn Based	.140 ^a	.020	.011	14.23657

Table 6-15 ANOVA of Model Strategy Turn Based genre

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	2194.893	5	438.979	2.166	.057 ^a
	Residual	109244.538	539	202.680		
	Total	111439.432	544			

a. Predictors: (Constant), T_Conscientiousness, T_Openness, T_Agreeableness, T_Extraversion, T_Neuroticism b. Dependent Variable: Strategy Turn Based

Consequently all coefficients in the model except one are not significant. See Table 6-16 Coefficients for Strategy Turn Based Genre. Nevertheless, it is relevant how the role of the personality traits change from the previous Action

genre cluster where Neuroticism, Extraversion, and Agreeableness were playing key aspects in the models; whereas in Strategy Turn Based, it seems that there is a trend that the personality trait Openness is contributing to the preference for this genre.

Table 6-16 Coefficients for Strategy Turn Based Genre

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
(Constant)	56.411	6.750		8.358	.000
T_Neuroticism	.029	.061	.022	.466	.641
T_Extraversion	.004	.057	.003	.070	.944
T_Openness	.179	.057	.136	3.118	.002
T_Agreeableness	-.063	.054	-.052	-1.169	.243
T_Conscientiousness	-.012	.055	-.010	-.226	.821

6.3.5 Strategy Real Time

The R square model for the Strategy Real Time genre is 0.018 and, it is not significant. See Table 6-17 Model Summary for Strategy Real Time genre, and Table 6-18 ANOVA of Model Strategy Real Time genre.

Table 6-17 Model Summary for Strategy Real Time genre

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
Strategy Real Time	.135	.018	.009	13.55828

Table 6-18 ANOVA of Model Strategy Real Time genre

Model	Sum of Squares	df	Mean Square	F	Sig.
Regression	1835.164	5	367.033	1.997	.078 ^a
Residual	99082.794	539	183.827		
Total	100917.958	544			

a. Predictors: (Constant), T_Conscientiousness, T_Openness, T_Agreeableness, T_Extraversion, T_Neuroticism. b. Dependent Variable: Strategy Real Time.

The model is weak and not significant, three out of the five coefficients yield as not significant, two were significant: Extraversion (positive slope) and Agreeableness (negative slope). See Table 6-19 Coefficients for Strategy Real Time Genre.

Table 6-19 Coefficients for Strategy Real Time Genre

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
(Constant)	54.150	6.428		8.424	.000
T_Neuroticism	.075	.059	.062	1.280	.201
T_Extraversion	.126	.055	.110	2.314	.021
T_Openness	.057	.055	.045	1.041	.299
T_Agreeableness	-.110	.051	-.095	-2.149	.032
T_Conscientiousness	.007	.052	.006	.136	.892

6.3.6 Role Playing Game

The R square value for Role Playing Game (RPG) genre is 0.014, and is not significant ($p = 0.196$). See Table 6-20 Model Summary for RPG genre and Table 6-21 ANOVA of Model RPG genre.

Table 6-20 Model Summary for RPG genre

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
RPG	.116 ^a	.014	.004	15.79109

Table 6-21 ANOVA of Model RPG genre

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	1840.058	5	368.012	1.476	.196 ^a
	Residual	134404.322	539	249.359		
	Total	136244.380	544			

a. Predictors: (Constant), T_Conscientiousness, T_Openness, T_Agreeableness, T_Extraversion, T_Neuroticism. b. Dependent Variable: RPG

Consequently, the model is unstable and only one variable is significant (Neuroticism). See Table 6-22 Coefficients for RPG Genre.

Table 6-22 Coefficients for RPG Genre

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
(Constant)	49.764	7.487		6.647	.000
T_Neuroticism	.150	.068	.106	2.196	.028
T_Extraversion	.044	.064	.033	.694	.488
T_Openness	.087	.064	.060	1.369	.172
T_Agreeableness	.016	.060	.012	.260	.795
T_Conscientiousness	-.017	.061	-.013	-.286	.775

6.3.7 Sports

The multiple linear regression applied to the Sports genre yield an R square value 0.075, therefore it can only account for 7.5 % of the preference for this genre based on personality traits. See Table 6-23 Model Summary for Sports

genre. This model is statistically significant. See Table 6-24 ANOVA of Model Sports genre.

Table 6-23 Model Summary for Sports genre

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
Sports	.275 ^a	.075	.067	11.12016

Table 6-24 ANOVA of Model Sports genre

Model	Sum of Squares	df	Mean Square	F	Sig.
Regression	5442.374	5	1088.475	8.802	.000 ^a
Residual	66651.643	539	123.658		
Total	72094.018	544			

a. Predictors: (Constant), T_Conscientiousness, T_Openness, T_Agreeableness, T_Extraversion, T_Neuroticism. b. Dependent Variable: Sports

This model has four personality traits that are significant. Neuroticism and Extraversion have a positive regression, thus a higher value of these traits will yield a higher value for preferring the Sports genre. Openness and Agreeableness have a negative slope which means that values of these traits decreases the preference of this genre. The lower the Openness and Agreeable trait value, the higher the preference value for the Sports genre. See Table 6-25 Coefficients for Sports Genre.

Table 6-25 Coefficients for Sports Genre.

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
(Constant)	44.918	5.272		8.520	.000
T_Neuroticism	.101	.048	.098	2.095	.037
T_Extraversion	.233	.045	.240	5.195	.000
T_Openness	-.155	.045	-.147	-3.466	.001
T_Agreeableness	-.107	.042	-.109	-2.531	.012
T_Conscientiousness	.056	.043	.058	1.313	.190

The formula for the predicting value of the Sports Genre is as follows:

$$\text{Sports} = 44.918 + (.101 * T_Neuroticism) + (.233 * T_Extraversion) - (.155 * T_Openness) - (.104 * T_Agreeableness) + (.056 * T_Conscientiousness)$$

6.3.8 Simulation Vehicles

The R square value of the multiple linear regression for the Simulation Vehicles genre is 0.026, thus accounting only for 2.6% of the prediction. The model is statistically significant ($p = 0.015$). See Table 6-26 Model Summary for Simulation Vehicles Genre and Table 6-27 ANOVA of Model Simulation Vehicles Genre.

Table 6-26 Model Summary for Simulation Vehicles Genre

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
Simulation Vehicle	.161 ^a	.026	.017	17.26236

Table 6-27 ANOVA of Model Simulation Vehicles Genre

Model	Sum of Squares	df	Mean Square	F	Sig.
Regression	4264.359	5	852.872	2.862	.015 ^a
Residual	160616.123	539	297.989		
Total	164880.482	544			

a. Predictors: (Constant), T_Conscientiousness, T_Openness, T_Agreeableness, T_Extraversion, T_Neuroticism. b. Dependent Variable: Simulation Vehicles

Only one coefficient is significant in the Simulation Vehicles genre model:

Conscientiousness (p = 0.016). The slope of this coefficient is negative. See

Table 6-28 Coefficients for Simulation Vehicles Genre.

Table 6-28 Coefficients for Simulation Vehicles Genre

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
(Constant)	43.424	8.184		5.306	.000
T_Neuroticism	.124	.075	.080	1.660	.097
T_Extraversion	.133	.070	.091	1.911	.057
T_Openness	.083	.070	.052	1.195	.233
T_Agreeableness	.011	.065	.008	.173	.862
T_Conscientiousness	-.161	.066	-.109	-2.425	.016

The formula of the predicting value for the Simulation Vehicles Genre:

Simulation Vehicle Genre: $43.424 + (.124 * T_Neuroticism) + (.133 * T_Extraversion) + (.083 * T_Openness) + (.011 * T_Agreeableness) - (.161 * T_Conscientiousness)$

6.3.9 Simulation Construction

The R square of the Simulation Construction Genre is 0.010 and is not significant (p = 0.377). None of the coefficients in the model were significant. See

Table 6-29 Model Summary for Simulation Construction Genre and Table 6-30 ANOVA of Model Simulation Construction Genre.

Table 6-29 Model Summary for Simulation Construction Genre

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
Simulation Construction	.099 ^a	.010	.001	15.71158

Table 6-30 ANOVA of Model Simulation Construction Genre

Model	Sum of Squares	df	Mean Square	F	Sig.
Regression	1319.263	5	263.853	1.069	.377 ^a
Residual	133054.236	539	246.854		
Total	134373.499	544			

a. Predictors: (Constant), T_Conscientiousness, T_Openness, T_Agreeableness, T_Extraversion, T_Neuroticism

b. Dependent Variable: P_Sim_Construction

6.3.10 Simulation Artificial Intelligence

The multiple linear regression analysis for the Simulation Artificial Intelligence (AI) Genre yields an R Square of 0.047 which is significant ($p = 0.000$). See Table 6-31 Model Summary for Simulation AI Genre and Table 6-32 ANOVA of Model Simulation AI Genre.

Table 6-31 Model Summary for Simulation AI Genre

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
Simulation AI	.218 ^a	.047	.039	14.93218

Table 6-32 ANOVA of Model Simulation AI Genre

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	5984.475	5	1196.895	5.368	.000 ^a
	Residual	120180.864	539	222.970		
	Total	126165.340	544			

a. Predictors: (Constant), T_Conscientiousness, T_Openness, T_Agreeableness, T_Extraversion, T_Neuroticism. b. Dependent Variable: Simulation AI

Only one personality trait coefficient is significant from this model: Openness ($p = 0.000$). The slope is positive, thus values of this trait and the predicted value for the Simulation AI genre increase together. See Table 6-33 Coefficients for Simulation AI Genre.

Table 6-33 Coefficients for Simulation AI Genre

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
(Constant)	50.746	7.080		7.168	.000
T_Neuroticism	.079	.064	.058	1.227	.220
T_Extraversion	-.068	.060	-.053	-1.134	.257
T_Openness	.256	.060	.183	4.257	.000
T_Agreeableness	-.047	.057	-.037	-.838	.403
T_Conscientiousness	-.084	.057	-.065	-1.469	.142

The predicting value formula for the Simulation AI Genre is the following:

$$\text{Simulation AI} = 50.746 + (.079 * T_Neuroticism) - (.068 * T_Extraversion) + (.256 * T_Openness) - (.047 * T_Agreeableness) - (.084 * T_Conscientiousness)$$

6.3.11 Adventure

The R square of the Adventure Genre is 0.060 and is significant ($p = 0.000$). This means that the model based on five personality traits accounts for 6% of the preference of this genre. See Table 6-34 Model Summary for Adventure Genre and Table 6-35 ANOVA of Model Adventure Genre.

Table 6-34 Model Summary for Adventure Genre

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
Adventure	.245 ^a	.060	.051	12.70889

Table 6-35 ANOVA of Model Adventure Genre

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	5543.130	5	1108.626	6.864	.000 ^a
	Residual	87057.090	539	161.516		
	Total	92600.221	544			

a. Predictors: (Constant), T_Conscientiousness, T_Openness, T_Agreeableness, T_Extraversion, T_Neuroticism. b. Dependent Variable: Adventure

Two personality traits are significant within this model: Openness and Agreeableness. Both of them have a positive slope, thus the higher the value of these personality traits, the higher the predictive value for the Adventure genre. See Table 6-36 Coefficients for Adventure Genre.

Table 6-36 Coefficients for Adventure Genre

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
(Constant)	40.297	6.025		6.688	.000
T_Neuroticism	.065	.055	.055	1.178	.239
T_Extraversion	-.057	.051	-.052	-1.107	.269
T_Openness	.246	.051	.205	4.802	.000
T_Agreeableness	.106	.048	.096	2.202	.028
T_Conscientiousness	.090	.049	.082	1.848	.065

Applying the coefficient values of this model, we obtain the following formula for predicting the preference value for the Adventure genre:

$$\text{Adventure} = 40.297 + (.065 * T_Neuroticism) - (.057 * T_Extraversion) + (.246 * T_Openness) + (.106 * T_Agreeableness) + (.090 * T_Conscientiousness)$$

6.3.12 Puzzle

The multiple linear regression for the Puzzle Genre yields an R square of 0.064, and it is significant (p = 0.000). This model based on personality traits accounts 6.4% of the preference for the Puzzle genre. See Table 6-37 Model Summary for Puzzle Genre and Table 6-38 ANOVA of Model Puzzle Genre.

Table 6-37 Model Summary for Puzzle Genre

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
Puzzle	.254 ^a	.064	.056	16.13866

Table 6-38 ANOVA of Model Puzzle Genre

Model	Sum of Squares	df	Mean Square	F	Sig.
Regression	9664.399	5	1932.880	7.421	.000 ^a
Residual	140386.034	539	260.456		
Total	150050.432	544			

a. Predictors: (Constant), T_Conscientiousness, T_Openness, T_Agreeableness, T_Extraversion, T_Neuroticism. b. Dependent Variable: Puzzle

There are two significant traits in this model: Openness and Conscientiousness. For both variables the correlation is positive, therefore higher values of these traits contribute to a higher value of predictive preference for the Puzzle genre. See Table 6-39 Coefficients for Puzzle Genre.

Table 6-39 Coefficients for Puzzle Genre

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
(Constant)	25.799	7.652		3.372	.001
T_Neuroticism	-.037	.070	-.025	-.532	.595
T_Extraversion	-.041	.065	-.029	-.631	.529
T_Openness	.315	.065	.206	4.843	.000
T_Agreeableness	.065	.061	.046	1.057	.291
T_Conscientiousness	.180	.062	.128	2.912	.004

Based on the coefficient of the model, the predicting formula for the Puzzle genre is as follows:

$$\text{Puzzle} = 25.799 - (.037 * \text{T_Neuroticism}) - (.041 * \text{T_Extraversion}) + (.315 * \text{T_Openness}) + (.065 * \text{T_Agreeableness}) + (.180 * \text{T_Conscientiousness})$$

6.3.13 Online

The R square for the Online valence is 0.057 and is significant ($p = 0.000$). Only a 5.7% of the preference for playing online games can be understood from the model based on the five personality traits. See Table 6-40 Model Summary for Online and Table 6-41 ANOVA of Model Online.

Table 6-40 Model Summary for Online

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
Online	.240 ^a	.057	.049	26.12383

Table 6-41 ANOVA of Model Online

Model	Sum of Squares	df	Mean Square	F	Sig.
Regression	22441.233	5	4488.247	6.577	.000 ^a
Residual	367842.901	539	682.454		
Total	390284.133	544			

a. Predictors: (Constant), T_Conscientiousness, T_Openness, T_Agreeableness, T_Extraversion, T_Neuroticism. b. Dependent Variable: Online

The Online model has three significant traits: Extraversion, Openness, and Agreeableness. Extraversion has a positive slope, therefore higher values of this trait correspond to higher predicting values of preference for Online. Openness and Agreeableness have a negative slope, thus lower values of these two traits match a higher predicting Online value. See Table 6-42 Coefficients for Online.

Table 6-42 Coefficients for Online

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
(Constant)	58.935	12.386		4.758	.000
T_Neuroticism	.153	.113	.064	1.355	.176
T_Extraversion	.454	.105	.201	4.311	.000
T_Openness	-.357	.105	-.145	-3.393	.001
T_Agreeableness	-.239	.099	-.105	-2.412	.016
T_Conscientiousness	.010	.100	.004	.100	.921

The predicting value formula for the Online valence is the following:

$$\text{Online} = 58.935 + (.153 * T_Neuroticism) + (.454 * T_Extraversion) - (.357 * T_Openness) - (.239 * T_Agreeableness) + (.010 * T_Conscientiousness)$$

6.3.14 Summary

This section presented the multiple linear regression statistical technique employed to explore predictive models for each proposed game genre (see Section 4) based on the five personality traits (see Section 2.1.2).

The values obtained by the participants for Neuroticism, Extraversion, Openness, Agreeableness and Conscientiousness are the independent variables (or predictor variables) which are entered in the model simultaneously using the force entry method. The dependent variable is the scoring that participants got for each game genre.

The models for eight out of the twelve game genres plus the Online valence were statistically significant. Their R square values were rather low, closer to 0 rather than to 1, this means that personality factors can account between the 2% and 8% for preferring certain game genres. Although modest, these values bring understanding to gaming preferences. These results suggests that there are more variables that play a role in preferring certain game genres. Nevertheless, the significant personality traits of the models might indicate trends about gamers' characteristics for different genres; this implication is described in the Section 7: Discussion.

7: DISCUSSION

7.1 Game Genre Discussion

As described in chapter 6 “Results”, multiple linear regression analysis yielded that for eight of the twelve game genres there are statistically significant models to establish relationships between gaming preferences and personality traits; however, the models explain only a very small portion (between 4.7 and 7.3%) of preference for certain genres (see Table 7-1 Game Genre Preference Models). Thus, these models cannot be proposed as strong predictors for assessing gaming preferences based on personality traits. Nevertheless, the models seem to indicate what personality traits are more relevant for each genre.

Table 7-1 Game Genre Preference Models. Cells in pink mark that the personality trait is significant for the model. Cells in red represent a positive relationship. Cells in light blue represent negative relationships. Sh: Action Shooting. N-Sh: Action No Shooting. F: Action Fighting. Sp: Sports. S-Ve: Simulation Vehicle. S-AI: Simulation Artificial Intelligence. Adv: Adventure. Puzz: Puzzle. On-L: Online

	R ²	T ₋ Neuroticism		T ₋ Extraversion		T ₋ Openness		T ₋ Agreeableness		T ₋ Conscientiousness	
		Sig.	Coefficient	Sig.	Coefficient	Sig.	Coefficient	Sig.	Coefficient	Sig.	Coefficient
Sh	0.061	0.012	0.158	0.000	0.260	0.021	-0.136	0.001	-0.181	0.330	0.056
N-Sh	0.073	0.002	0.185	0.000	0.298	0.373	-0.050	0.008	-0.141	0.003	0.158
F	0.055	0.006	0.170	0.000	0.249	0.090	-0.097	0.004	-0.156	0.174	0.074
Sp	0.075	0.037	0.101	0.000	0.233	0.001	-0.155	0.012	-0.107	0.190	0.056
S-Ve	0.026	0.097	0.124	0.057	0.133	0.233	0.083	0.862	0.011	0.016	-0.161
S-AI	0.047	0.220	0.079	0.257	-0.068	0.000	0.256	0.403	-0.047	0.142	-0.084
Adv	0.060	0.239	0.065	0.269	-0.057	0.000	0.246	0.028	0.103	0.065	0.090
Puzz	0.064	0.595	-0.037	0.529	-0.041	0.000	0.315	0.291	0.065	0.004	0.180
On-L	0.057	0.176	0.153	0.000	0.454	0.001	-0.357	0.016	-0.239	0.921	0.010

The following sections discuss the role that the personality traits of the Five Factor Model (described in Section 2.1.1: Psychological Frameworks on Personality) have for the eight game genres with significant models.

7.1.1 Action Shooting

The Action Shooting genre has a positive relationship with Neuroticism and Extraversion which means that increases in those two personality traits correspond to an increase in Action Shooting preference. There is a negative relationship with Openness and Agreeableness where lower scoring of these two personality traits correspond to higher Action Shooting preference.

Regarding the positive relationship with Neuroticism, we find that higher Neuroticism characteristics match gameplay dynamics of Action Shooting. For example, higher levels of anxiety, impatience and impulsive reactions are present in this fast-paced type of game. Action Shooting games are not for relaxing but they build up tension which is another common characteristic of higher Neuroticism. A subset of Action shooting games called Horror Games, like the titles of the Silent Hill series [84], rely heavily on provoking fear which people with higher Neuroticism are prone to look for such experience. Action shooting games seem to reassure the behaviours, feelings and tendencies typical of those with normal to higher of the Neuroticism trait.

Regarding the positive relationship of Action Shooting with Extraversion, there is also a link about the fast pace of the game and the active, quick, energetic, in a hurry attitude of higher extroverted people. Another aspect

supported by Action Shooter games is social encounters through the multiplayer mode both online and co-located. Online multiplayer mode contributes significantly to the popularity of the Action Shooting genre [85]. Online sessions are supported for these games where players log on to a server to compete against other people, like in Battlefield: Bad Company 2 [86]. A sociable atmosphere is populated by real people and not by non-player characters. Co-located gaming known as a LAN (Local Access Network) party is characterized by people who get together bringing or renting their own hardware (like a PC) and connecting it to the same network for playing games. The most popular type of game in LAN parties are FPS games, and the main motivation for playing in this modality is socializing [87]. These characteristics are the ones that people with higher extraversion scores show.

The Action Shooting model has a negative relationship with Openness, therefore it suggest that people who prefer this type of game will tend to have lower scoring in their Openness personality trait. Such players have a narrow scope of interests, which seems to match the slim depth of Action Shooting games. Game worlds in this genre offer a limited array of possibilities regarding exploration and discovery, encounters occur in constrained maps. Low Openness is also related to a tendency toward muttering the expression of emotions which is maintained in Action Shooting games. For example, emotions are not an important aspect of the gameplay, in FPS games the avatar controlled by the player is not even fully visualized on screen, there is just a hand holding a

gun. There are no visual emotional expressions for the player's avatar, such as body language or facial expression, as in Halo 3 [88].

The last significant personality trait in the Action shooting model is Agreeableness which has a negative relationship. The characteristics of low Agreeableness scoring seem to match those attitudes necessary for performing well in Action Shooting Games. Competition is a key aspect of this genre where shooting and killing opponents is the objective, which is the same of low Agreeableness. Being suspicious of others and prioritizing one's intentions are other common elements. Even when playing with a group of people in cooperation, such as a squad in Call of Duty: Modern Warfare 2 [89], still the main objective is to compete with the other team.

7.1.2 Action No Shooting

The Action No Shooting model has four significant personality traits, three of them with a positive relationship (Neuroticism, Extraversion, and Conscientiousness), and one with a negative relationship (Agreeableness).

Higher scoring of Neuroticism is suggested to be present in those who prefer Action No Shooting games. A key characteristic of Neuroticism that seem to be supported in the Action No Shooting gameplay is experiencing a built up floating tension. Stress levels and sense of urgency are generally encourage by time constrains and a fast pace game. For example in Sonic The Hedgehog [90], the player has to run and jump as fast as possible in order to stay on the

appropriate track and to collect more rings, a time counter is displayed permanently on screen.

The positive relationship with Extraversion suggest that players who preferred Action No Shooting games have active behaviours, like being energetic, in hurried, performing quick responses. These characteristics are also associated to the constant pace of this type of games. For example, the iconic game Super Mario Bros [91] presents a scenario where the player has to keep up with a constant forward motion, there is the urge of saving the Princess. Another game of this genre that uses energetic, quick responses is Rock Band [92], which is also extremely social. This game supports the extroverted key element of social engagement, gathering with people to play in a cheerful scenario.

The Action No Shooting model has a negative relationship with Agreeableness suggesting that players who prefer this genre would have a tendency towards competition, and prioritizing their own intentions. An illustration of such an element is when acquiring high scores are emphasized.

The last relevant personality trait for the Action No Shooting genre is Conscientiousness with a positive relationship. It suggests that people keen of this genre would have good organizational skills, clear strategies, identifying appropriate sub-objectives. These characteristics are necessary for playing a representative Action No Shooting game like Q*bert [93]. In this game the player faces an isometric triangle which is subdivided into squares that change colours. The avatar can jump from one square to the contiguous diagonal square, and

when it lands the square changes colour. Enemies move around the triangle as well. The objective of the game is to turn all squares into a different colour from the original. Playing Q*bert requires good organization, thinking ahead, and performing accordingly.

7.1.3 Action Fighting

The third sub-genre of action yielded a statistically significant model as well, and it shares a similar personality profile to the two other Action subgenres. Action Fighting shows a positive relationship with Neuroticism and Extraversion, and a negative relationship with Agreeableness.

The Neuroticism trait describes players who experience more anxiety and impulsive responses. It seems that fighting games, like Street Fighter IV [94], provide a known environment for these players where tension, impulsion, and low patience are employed in the game.

The tendency to higher Extraversion and lower Agreeableness seems to position Action Fighting games as an ideal playground for players with such personality scorings. This genre foster competition one on one, engaging in active, energetic virtual moves. Combo moves appear as the ultimate quick, vigorous behaviours that are also associated to the constant fast pace of the game, which are characteristics associated to Extraversion. However, the kind of social engagement that Fighting games mainly support is direct confrontation, which is typical of people with low Agreeableness. There is no space for

helpfulness or compassion in fighting, personal objectives have to be prioritized in order to beat the other player.

7.1.4 Sports

Although Sports is not part of the Action genre, they share several game elements and consequently players who prefer Sports titles are seen to have a similar personality profile as those who prefer the Action Shooting genre. The Sports model has a positive relationship with Neuroticism and Extraversion, and a negative relationship with Openness and Agreeableness.

The positive relationship with Neuroticism depicts players who are commonly seen in an anxious and fast-paced scenario, like in the majority of Sports video games such as the basketball NBA Live 10 [95], American football Madden NFL 10 [96], or hockey NHL 10 [97]. However, there are other Sports games like Tiger Woods PGA Tour 10 [98] that offer a calmer state. Nevertheless, the ratio of Sports games that falls heavily into those with faster, tense situations is greater, and a positive relationship with Neuroticism seems to represent this.

The positive relationship with Extraversion yielded in the model seems to correspond to situations that higher extraversion scoring people would show. Sports games contain a dual front for extraversion. First, this type of genre foments playing with other people, two people playing together against each other is a common set up. Second, sports events are gregarious by nature, involving teams or multiple participants, plus the audience; these aspects are

greatly reproduced in the video games. Aligned in the higher extroverted spectrum, there is an active profile which includes energetic, quick behaviours that can be associated to the reigning fast pace of this type of games. Most of the sports games require fast reactions to perform the sportive virtual behaviours, for example doing passes, shooting the ball to score, dismissing opponents who are trying to steal the ball, keeping constant awareness of teammates in the field.

The negative relationship with Openness delineates players with a tendency to have a narrow scope of interest. The sport setting offers a restricted environment which only includes the court field where the match happens. Such a constrained location might be more appealing to people with lower Openness than a vast open world to explore. The court contains what is interesting for these players without adding other superfluous areas. The rules of the video game are pre-defined by the rules of the real life sport which recreates known situations for them, a characteristic appreciated for low Openness scoring people. Finally in this personality trait, although emotions are present in the Sports genre and there are feelings of frustration (if losing) or happiness (if winning), there is no relevant exploration of emotions, and character development is not about their inner profile but is only related to their physical skill as a sport player.

The last relevant personality trait in the Sports model is Agreeableness in a negative relationship. The very nature of sports is to defeat the opponent, to perform better, to score more; even though the sportsmanship spirit is welcomed and appreciated, it does not involve helping others, but to perform within the rules. Thus, sportsmanship should not be confused with altruism. Even though

the members of a team will cooperate among each other, still the main objective is to defeat the other team. Competition is a key aspect of sports, and is present in various events like the FIFA World Cup and the Olympic games. In sport, winning is the main objective and it is an egocentric attitude quite representative of people with low Agreeableness. This concept of competition should be differentiated from Salen and Zimmerman's [99] which is encompassed in their definition of games as conflict. The later deals with understanding games as a broad form of challenge to be overcome that can occur between players or between a player and the system. Whereas the former relates to competition as a way of prioritizing personal objectives on top of altruistic values reflected in low scores of the Agreeableness personality factor.

7.1.5 Simulation Vehicle

The Simulation Vehicle model based on the personality traits yielded only one significant factor: Conscientiousness in a negative relationship.

Upon analysis, it seems that the logic behind a negative relationship between conscientiousness and simulation vehicles can be possible due to different attitudes toward two big types of simulation vehicles: a) complex realistic vehicles, and b) mechas. For instance, Microsoft Flight Simulator [100] is based on complex realistic reproductions of airplanes, a good understanding about the factors affecting flying, and skills at controlling multiple tasks are required. This type of game does not seem to match a tendency to a lower Conscientiousness. However, the (b) type of vehicle simulation like MechWarrior 4: Vengeance [101] engages a different set of behaviours. For instance, this type of simulation is

based on a science fiction setting involving big robotic war vehicles that are driven by humans, the players take the role of the pilot and use the equipped arsenal to engage in combat. This type of game requires a set of attitudes which does correspond to a rather lower conscientiousness scoring. For example, thorough efficiency is not necessary, a more reckless driving of the vehicle is part of the thrill of this type of game which is tinted by the combat scenario, high organization skills are not that relevant and instead impulsive and hasty movements are better aligned with the gameplay.

This last type of simulation vehicle (b) seems to provide more characteristics that are consistent with people with a lower conscientiousness scoring. However, it is leaving outside of the scope iconic games of the genre fitting the (a) type. Therefore, further analysis should be done for this genre, such as subdividing it into the above mentioned types, and confirming if the personality traits vary.

7.1.6 Simulation Artificial Intelligence

The Simulation Artificial Intelligence models suggest that as players' Openness scoring increases the more likely they would prefer this genre.

These players engage in activities that allow them to fly with their imagination, to have a variety of outcomes, and to be able to connect with their emotions. These Openness characteristics match the type of gameplay supported in Simulation Artificial Intelligence where characters come to life, and there is space for imagination and creation. For example, in Spore [102] the

player is given the opportunity of creating life from scratch, to image how this creature looks like, how it explores its world, and how it communicates and interacts with other creatures. Expressing emotions is a welcomed challenge and an important aspect of Simulation Artificial Intelligence games; matching this tendency, people with increasing Openness are attentive to their feelings. In the games of this genre, avatars (including characters and creatures) are given expressive emotional characteristics, which are part of the charm of this type of game. Crying, laughing, worrying, being annoyed, falling in love are part of the array of expressions in *The Sims* [103], an iconic game of this genre. Consequently, it is possible that people who prefer these games find appropriate and feel comfortable exploring and connecting to the emotional states of their avatars.

7.1.7 Adventure

The Adventure model showed a positive relationship with Openness and Agreeableness.

The positive relationship with Openness seems to support that players who prefer this genre enjoy imaginative scenarios like those proposed in adventure games, where there is a rich narrative, exploration is encouraged, and intellectual challenge is a key aspect of the gameplay. The intellectual curiosity of Open people is satisfied by the challenges (situations to be resolved) that are spread throughout Adventure games. A classic of this genre, *The Secrets of Monkey Island* [104], was originally released in 1990 and re-launched into the market in 2009 as a special edition. This particular game uses several appealing

characteristics for Open people, for example it is set in a fantastic pirate scenario, the player has to travel and explore Caribbean-like islands while resolving challenges. For instance, there is a sword fight that is actually battled by using rich dialogs and figuring out the appropriate continuation which involves lateral thinking typical of the curious mind of Open people.

Adventures games also offer game elements that are appealing to Agreeable people. It is common that the situations in a game are set up around sympathy for characters that ask for help, and the player will start a journey to accomplish such mission. For example, in *Myst* [105] the player is asked by the sons of Atrus to help them to escape, and by doing so the player must adventure in further exploration.

7.1.8 Puzzle

The Puzzle model identified the two most relevant traits of personality for this genre: Openness and Conscientiousness. Both traits have a positive relationship in the model and tap directly on the foundational mechanisms of puzzle, such as having an analytical mind and enjoying intellectual challenge.

Open people have curious minds, develop lateral thinking, and welcome intellectual challenge. These characteristics are essential for preferring Puzzle games. Exploring new ideas is an unavoidable exercise when resolving puzzles, since it involves thinking about the pieces in different ways, and exploring a variety of outcomes.

Puzzles are about identifying the objectives, sub-objectives of the problem to resolve, and planning accordingly, which is exactly one of the main characteristics of Conscientiousness. For example, playing the game Return of the Incredible Machine: Contraptions [106] is about achieving a simple objective (like 'place the ball into the box') by building a Rube Goldberg machine (an over complex machine composed by multiple devices). The player has to consider what devices he has, make a thorough analysis of placement, set up his planning and organize elements accordingly.

7.1.9 Online

Even though Online is not considered a video game genre but just the option of playing any type of game through the internet, there was interest to explore if the Online mode was preferred by people with a certain personality profile. The Online model yielded three significant traits, Extraversion with a positive relationship, and Openness and Agreeableness with negative relationship.

It is consistent that as the Extraversion scoring of a person increases, the more like that person would prefer playing games online. This mode allows a player to connect with other people, often enabling chatting via text or even voice. Extroverted people are talkative, they enjoy being surrounded by others, and engaging in social activities. Going online offers these appealing characteristics to extroverts. For example, in World of Warcraft [72] the player can chat with other human players, or by enabling the voice chat, coordinate with other players their strategy. Another example is playing a puzzle game from a

game community oriented website, such as Kongregate, where a chat window opens and enables players to interact with each other.

It is possible that the Openness and Agreeableness traits with negative relationships in the model might be due to crosstalk from the Online game element item “It’s important to me go get high score”. This characteristic involves a level of competition such as performing better than others. The Online personality profile model replicates the tendencies of the Action Shooting and Sports’ model. These two other genres involve mastering aspects of the game, which supports the preference for known situations, typical of lower Openness. Action shooting and Sports also emphasize competition which corresponds to low Agreeableness.

Further exploration should be done to identify the relevancy of competition versus cooperation in online gaming.

7.2 Summary

This chapter discussed the implications of the significant game genre models presented in Chapter 6 Results. The analysis involved identifying the significant personality traits, what people with those traits prefer, and checking if the game genre offers an appealing set up for these people. There was high consistency between the game element and the tendencies of the relevant personality traits. Thus, even though the proposed models do not have a high prediction value, they seem to still provide an estimate of what the personality profile is for people who prefer certain game genres.

8: SUMMARY AND CONCLUSIONS

The primary hypothesis that has driven this work is that people with certain personality traits would prefer certain video game genres. The motivation has been to contribute to demographic game design by identifying gamers' personality profiles. During the process of untwining this problem, this thesis work has proposed a new gaming preferences questionnaire, and explored the relationship between personality traits and game preferences.

The following sections draw together the main areas presented in the thesis, the contributions to the field, and continuations that can be addressed in future work.

8.1 Personality

Personality is a combination of traits, needs, and motivations that shape the way a person behaves, thinks, and deals with external and internal situations. This concept has been one of the main constructs of this work, and it was chosen because it is stable through time and it can bring valuable, accurate descriptions of a person's behaviour, predispositions, motivations, and needs. Such information is optimal for understanding the game audience for demographic game design.

In Chapter 2: Theory and Tools, it was explained that personality theories are clustered into two groups. Idiographic theories understand personality as a

unique psychological formation that cannot be generalized. Nomothetic theories look for patterns from where model can be created. Main personality theories of both groups were presented. Factor theories were found as the most appropriate for the proposed research, and specifically the Five Factor Model (FFM) which identifies variables as a continuum providing a more refined measurement than type theories such as the Myers-Briggs typology. According to the FFM, personality is defined by the degree its five traits are present. The first trait is Neuroticism, which addresses the emotional stability of the person. The second trait is Extraversion, which looks into the sociable styles that a person employs. Third trait is openness, which refers to what extent the person is open to new experiences. The fourth trait is Agreeableness, which gauges the altruistic tendency of people. Finally, the fifth trait is Conscientiousness, which is related to the self-discipline capacity of a person.

There are several personality inventories within the FFM framework. The NEO-FFI was selected as the better fit due to its population inclusiveness, its length, its focus on normal personality, its prior use in international research and game studies, and its high validity and internal consistency.

To summarize, this thesis work has investigated the concept of personality in an array of theoretical frameworks. Upon screening, the five factor model was found as the most suitable theoretical tool for studying personality within the game studies field in service to demographic game design.

8.2 Game Classification

Due to the significant variety among games and the multiple points of entry to analyze them, there are several game classifications. A main distinction arises from which community the classification is derived, if within academia or industry.

Game elements were identified as the reducible parts of games that can lead to gaming preferences. The meticulous work of Rollings and Adams [7] on game design and game genres has set the foundational framework for a systematic and thorough analysis of game classification which overcomes marketing bias and shallow approaches. Game genres become meaningful clusters derived from the itemized game elements. This analysis was used as the groundwork for creating a tool to assess gamers' preferences.

8.3 Game Preference Questionnaire

The Gaming Preferences Questionnaire is one of the major contributions of this thesis work. It was created to systematically collect information that could measure what gamers prefer about games, and thus which game genres they prefer. This new questionnaire achieved expert and content validity. These are promising results for a systematized, self-administered tool for identifying what game elements people prefer in their games.

8.4 Demographic Game Design

It is important to know who gamers are and what they like for demographic game design. This information will allow shaping the criteria of a successful

game according to audience needs. This present study assessed the adult gamer population in terms of their preferences and personality.

The demographic characteristics of the sample suggest that ‘the-young-male’ is still the iconic self-identified gamer. The sample was composed of males by 83.6%, and the age mode value was 19 years old. However, there is a trend on an aging population since the average age was 28.38 years old.

Game designers’ decisions about what game mechanisms are appealing to their target audience can be supported by the information from the game preferences questionnaire. This type of specific information is valuable during the design process when tailoring to their audiences.

8.4.1 Personality and Game Genres

The main hypothesis of this work was to deconstruct how players’ personality interacts with gaming preference. Models for eight game genres and the online valence were found statistically significant. Personality factors explained between 2.6% and 7.5% of preferring particular game genres. Even though at first sight these values might be seen as low, the broader complexity involved in gaming preferences which includes multiple variables (such as motivation, mood, aesthetic appreciation, peers influence, exposure to marketing) should be considered, thus the proportions cover by personality factors should not be minimized. Moreover, the personality factors relevant for each model matched the important game mechanics of the game genres. Hence, a comprehensive understanding of game preference is a multivariable model with

multiple layers of inner and outside personal factors, which presents a hard challenge to fully predict. However, this work shows that it is possible to begin to scientifically understand the complexity of what drives players to choose some game genres over other ones.

This study had 545 cases which were used for multiple linear regression analysis. This statistical technique allows assessing the relationship among several variables and predicting the outcome of the dependent variable, in this case five personality traits were computed for calculating gaming preferences. The number of cases suggested for multiple linear regression is ten times per independent variable which is a ratio of 10:1, this study has a ratio of 109:1, an ample surpassing of even the most strict recommendations. [107]

The findings from the models define an appraisal of game elements through personality traits. Thus, it explains how people could prefer a certain game genre because the games create a scenario with settings that they use in other situations. For instance, a game environment that would allow them to behave as they would normally do in real life, to perceive, and use their skills; in other words, situations that support who they are and how the world works for them.

For the Action Shooting genre, it was found that the significant personality traits of the model seem to be cohesive with the mechanics of shooter games. A positive relationship with Neuroticism relates to the continuous fast pace with little room for patience, the encounters as tense situations, and the appearance of negative emotions such as fear which are keystones for horror shooters. The

Extraversion trait supports the quick energetic attitude and the social playing environment, both online and in LANs. Low Openness matches the constrained scenarios and actions, and the low emotional representation with avatars in shooter gamers. Finally, low Agreeableness supports trends of competition. The above-mentioned characteristics present in Action Shooting games might be felt as a preferred situation for people with such personality traits.

In the Action No Shooting model it was found that Neuroticism matches the built-up levels of tension, and Extraversion supports the fast, in-a-hurry behaviours, and social scenarios. The low Agreeable trait encompasses competition and prioritizing players' own intentions. It is common that Action No Shooting games rely on puzzle-like situations which are appreciated by people with a higher Conscientiousness trait.

The Action Fighting model suggests that higher Neuroticism supports the impulsive, anxious actions that have to be taken in the game. The open confrontation with other players and engaging in combat offers a welcome scenario to low Agreeableness personalities. In Fighting games, combo moves which condense quick, vigorous reactions are archetypal characteristics that are preferred by high Extraversion.

In the Sports model, it was identified that the presence of Neuroticism seems to capture a market dominated by fast-paced, tension-builder sport titles. The Extraversion trait recognizes the fact that sports are gregarious activities not only in the real life scenario but in gaming habits as well. The lower Openness trait shows how people prefer to funnel their range of interest to a more precise

scenario as the one offered in sport games. Finally yet importantly, low Agreeableness supports competition which is the main objective in sports.

The Simulation Vehicles model only showed one significant personality factor, which was low Conscientiousness. This result opened the discussion that there are games that fall into this genre but they require completely different sets of attitudes and skills. A lower Conscientiousness supports Mecha-like Simulation Vehicles where there is thrill for a more reckless driving and fast, impulsive reactions, which help to perform better in this game.

In the Simulation Artificial Intelligence model, higher Openness was the only relevant personality factor, which perfectly encompasses the main game elements of this genre. The player can explore different scenarios and the avatars will be rich in emotional responses. This type of game provides a playground to Open people to expand their imagination and connect with their emotions.

The Adventure model identifies Agreeableness and Openness as relevant personality traits. Agreeable people will easily engage with game characters as they are moved by sympathy and trust easily, and will start journeys and quests to help others on such premises. Open people will likely prefer big complex worlds where they can unravel challenges like those presented in Adventure games.

The Puzzle model touches the two most relevant personality traits, Conscientiousness and Openness, involved in the game elements of this genre. Higher Conscientiousness is associated to thorough, methodical, organized

behaviours which are necessary to enjoy and resolve puzzles. Open people have curious minds, and take pleasure in intellectual challenges and exploring different outcomes.

The Online model was also analyzed, and presented Extraversion as a relevant personality trait, which seems a natural outcome for people who enjoy being surrounded by others. The model also identified low scoring for Agreeableness and Openness, which suggest that there might be aspects of competition and perfectionism when playing online.

These results suggest that the significant personality aspects of the relevant models play a role when gamers opt for video game genres.

8.5 Future work

The future work section proposes ideas on how to continue this work from two angles, one more involved with the relevancy of personality factors as valuable information for demographic game design, the other on how to continue building-up from the Gaming Preferences Questionnaire.

This work showed that there are relationships between personality and gaming preferences. These results are aligned with those of Bateman and Boon [2]. Their work looks into playing-styles, which at certain extents can be linked to some game genres, but this thesis work provides more specificity about which personality factors lean towards certain genres, thus can give more refined information to game designers. This study also suggests that there are additional, still unidentified, aspects that impact choosing certain games. Further

work is necessary to gauge what other variables play a role in gaming preferences. A starting point could be to cross-analyze genre preference with the information from the demographic questionnaire, such as age, gender, location, playing and buying habits. For instance, preferences to certain games can be shaped by geographical location, affected by beliefs and motivations through cultural background. On the other hand, preferences could also be affected by funnelled exposure and accessibility to certain games due to the impact of currency exchange, and to differences in services from one country to another. A simple example of how this market penetration varies can be seen in Xbox Live, the Microsoft service that offers game trials and downloadable content, but it is not available worldwide.

In the different game genres models, not all personality factors were significant. These results seem to suggest that only some personality factors are necessary for preferring certain types of genre, and the other factors might be irrelevant from a demographic game design perspective. For example, for the Puzzle model only Openness and Conscientiousness proved to be significant, as explained in section 7, such factors are emblematic of the behaviours and motivations of this gameplay genre (analytical and lateral thinking driven), whereas Extraversion was not significant nor had any theoretical weight towards puzzles.

Personality traits identified as having a significant impact on the models should be pursued with further work to better understand their role and influence. For example, from the information already gathered it could be possible to search

for correlations between the game elements of the genre and the significant personality trait of each model.

In the same line of thought, new work could be done on specific genres with questionnaires exclusively focused on a certain genre to investigate how the leading personality traits interact with them.

Another interesting direction of research is on those genre models that were not supported by subsequent data but could have a logical explanation, and on the model that had mixed interpretations. What happened? Is not any personality factor relevant for such group of game elements? For instance, strategy games involved tasks that are typical of high conscientiousness such as administering resources, identifying objectives, and organizational skill; however, this genre did not yield a significant model. The simulation vehicles genre obtained low conscientiousness which only satisfies mecha-type games but it does not explain the diametrical opposed skills necessary for complex realistic simulation vehicles. Further research is necessary to shed more light on this result.

Another model to pay attention to is the online valence. This model is not a game genre but looks into the likelihood of playing online. The relevant personality factors for the online model, beyond the logical explanation of Extraversion, were a tendency to low scoring for Agreeableness and Openness. These findings suggest aspects of competition and perfectionism which seem to follow a logic for engaging with other players online. However, it would be interesting to extend the array of possibilities of online behaviours by increasing

the number of items in the gaming preferences questionnaire that are relevant to online gaming.

The last section on future work involves dealing with game genre classifications, and work that can continue based on the Game Preferences Questionnaire.

Game classifications are a challenging topic when discussing games, in this work a systematic, weighted clustering was presented. Nevertheless, follow-up work in this area can continue to expand the analytical understanding of genres. For instance, tracking how the market and specialized media change their classifications through time (adding or excluding genres), and how such reclassification might impact the genres accepted by the extended gaming community.

Even though the presented Gaming Preferences Questionnaire has satisfied expert jury validity (section 4.3) and content validity (section 6.1.2), it is possible to keep working towards other forms of validity. A common statistical test employed to assess the internal reliability of new tool is Cronbach's alpha. This test calculates a 'meta'-reliability coefficient by examining all possible split-halves from the respondents' data. The idea behind this approach is that if the tool successfully measures the construct (in this case gaming preferences) by splitting the questionnaire in half and calculating the results for each half, then the participant should have similar scoring in both halves. Results from each half across all participants should be aligned. However, the way that the set is split can bias the result, and Cronbach's alpha overcomes this problem by

considering all possible split halves. The Cronbach's alpha ranges from 0 to 1, with 1 being a perfect internal reliability; a desirable alpha is 0.80, however, some authors accept an alpha of 0.70 as acceptable [75;83].

Another statistical test that this questionnaire can take advantage of is factor analysis, which allows identifying clusters of data. For instance, it offers one extra way of confirming the game genre clusters. But more interesting would be to explore the data to see if there are other grouping of items that can lead to emerging or hybrid genres. This potentially new clustering may take full advantage of the game element approach. If such information is found, it could support innovation in game design.

Further work can be done building on and refining the techniques of this study. As mentioned before, games evolve and change, and as they do so the Gaming Preferences Questionnaire should reflect those transformations. Thus, the questionnaire should be re-examined in the future. The following are thoughts to keep in mind when that time comes. Maintaining around the same current amount of items to not fatigue the participants, but adjusting items to those genres with lower amounts of items. From the conversations with the experts, the subgenre Action No-Shooting should be renamed since the term could be misleading because it does not summarize in one word its essence. Even though the full description of a No-Shooting game comes from the game elements that composed it, the experts believe that when introducing this genre to other peers in the industry it would be better to have a different word. No strong suggestions arose during the interviews.

The subgenre simulation vehicles presented a model that seems to accommodate better certain game titles than others. Further work could be done on this game segmentation, by adding distinctive game elements which relate to realistic as opposed to combat characteristics. Information from this result could foster the creation of a new game genre.

Other games which may require some future genre assessment are those that rely on rhythm as main game element, such as Rock Band [92]. From interviews with experts, game elements of these games are well described within the Action No-Shooting genre, however if such games keep evolving they might need to spin-off into their own genre.

8.6 Final Words

This thesis work has explored the relationship between personality factors and game preferences. Findings showed that there are relationships between these variables, which in conjunction with other sources, play a role when people choose to play a certain type of game.

This work has also developed a new tool, the Gaming Preferences Questionnaire, for assessing gamers' preferences that can be used in the game design and game studies fields to quickly gather data about an intended population.

Profiling gamers' personalities can contribute to demographic game design, by providing information on what behavioural, motivational, and cognitive styles gamers prefer to have in their games.

9: APPENDICES

9.1 Appendix A – NEO-FFI Items Sample

NEO-FFI is a commercialized personality test regulated by Psychological Assessment Resources, Inc. (PAR). It consists of 60 questions in form of sentences that the participant has to indicate if he or she strongly agrees, agrees, is neutral, disagrees, or strongly disagrees with the statement. The 60 answers are tallied to identify the participant's score for the five personality factors (Neuroticism, Extraversion, Openness, Agreeableness, and Conscientiousness).

Due to copyright agreement, it is not possible to reproduce NEO-FFI in its totality, however permission has been granted to include 3 sample items.

1. Once I find the right way to do something, I stick to it.
2. I am intrigued by the patterns I find in art and nature.
3. I would rather go my own way than be a leader of others.

9.2 Appendix B - Gaming Preferences Matrix

Game elements	Shooting		Action		Strategy		Simulation		Adventure		Puzzle		Online	
	No-shooting	Fighting	No-shooting	Fighting	turnBased	realTime	Construction	AI	Vehicle	Sport	RPG	AI	Vehicle	Puzzle
I prefer games with fast pace.	10	10	10	10	10	10			10					
I enjoy being challenged with eye-hand coordination tasks.	10	10	10	10	10	10			10					
It's important for me to get high score.	5	10	5	10	5	5			5					10
I prefer to control only one avatar at a time.	10	10	10	10	10	10			5					10
I enjoy more taking decision on the fly.	10	10	10	10	10	10			10					
I enjoy moving around my avatar really fast.	10	10	10	10	10	10			5					
Having a good aiming skill is a must for the games that I like.	10	10	10	10	10	10			5					
I prefer games where I can shoot.	20													
I prefer games where using guns is extremely important.	10													
I prefer games where I engage opponents in small maps or arenas.	10	10	10	10	10	10			10					
I prefer games that have a tougher enemy at the end of the level.	5	5	5	5	5	5								
I prefer games where music and rhythm are an important part of gameplay	10			10										
I prefer games that try to scare me	10													
I prefer games where I have to mainly kick and punch enemies.				10										
I prefer games where my character uses blade weapons.				10										
I enjoy doing combo moves for hitting harder.				10										
I prefer games where I can conquer, explore, or commercialize.					10	10								
I enjoy controlling multiple units.					10	10								
I prefer games that are carefully balance by setting initial attributes comparable equal to all players.					10	10								
I prefer games that I can decide evolution paths for my units.					10	10						5		
I prefer games where I can manage resources.					10	10						10		
I prefer games where I can make buildings and structures.					10	10						20		
I prefer games where events happen once I've finished my turn.					10	10								
I prefer games with big and complex worlds.					10	10				10				10
I prefer games that are an intellectual challenge.					10	10								
I enjoy games where I can move my units around tactically.					10	10								
I prefer games with a story that unfolds while I play.	5				10	10								
I enjoy exploring and establishing relationships with other characters.					10	10								
I enjoy fooling around the game world without any main reason or objective.					10	10			10					
I prefer games where I have the chance of controlling several avatars at a time.					20	5								
I enjoy setting up my character's stats (strength, intelligence, etc.)					10	5								
I enjoy leveling my character.					10	10								
I prefer games where my character can learn abilities.					10	10								10
I enjoy doing quests.					10	10								
I enjoy that only sometimes I've to engage with a character stronger than the average.					10	10								
I prefer games where my character's stats have a key role to hit and resist while fighting.					5	20								
I enjoy resolving just a few puzzles.										5				
I prefer sport games.										20				
I prefer games that emulate aspects of the real world.										10			10	
I prefer games where I can drive or fly a vehicle, craft or robot.										20				
I prefer games where some events continue by themselves.											10		10	
I prefer games with intelligent life												10		
I prefer games that show hints about how to optimize my play.												5		
I prefer games that don't have any specific goal.													10	
I prefer games where I have to resolve puzzles frequently														10
I prefer games that engaging in combat is not that relevant.										5		5	10	10
I prefer games where I only have to resolve puzzles.														20
I enjoy resolving puzzles for their own sake.														10
I prefer games that I can play online.														
I prefer games that I can play with other people on the internet														
	125	70	105	110	105	110	105	135	110	45	65	55	70	85
														35

9.3 Appendix C – Gaming Preferences Questionnaire

Instruction: We want to know what you like about games. Read the following statements, and mark each of them as they apply to you. Strongly Agree (SA), Agree (A), Disagree (D), Strongly Disagree (SD)

	SA	A	D	SD
I prefer games where I engage opponents in small maps or arenas.				
I prefer games that try to scare me				
I prefer games with fast pace.				
I enjoy setting up my character's stats (strength, intelligence, etc.)				
I enjoy moving around my avatar really fast.				
I enjoy games where I can move my units around tactically.				
I prefer games where using guns is extremely important.				
I prefer games that have a tougher enemy at the end of the level.				
I prefer games that show hints about how to optimize my play.				
It's important for me to get high score.				
I prefer games where I can shoot.				
I prefer games where I can drive or fly a vehicle, craft or robot.				
I prefer games with big and complex worlds.				
I prefer games where I only have to resolve puzzles.				
I prefer to control only one avatar at a time.				
I prefer games where I have to mainly kick and punch enemies.				
I prefer games where I can conquer, explore, or commercialize.				
I enjoy fooling around the game world without any main reason or objective.				
I prefer games that I can decide evolution paths for my units.				
I prefer games that I can play online.				
I enjoy more taking decision on the fly.				
I prefer games where my character can learn abilities.				
I prefer games that are an intellectual challenge.				
I enjoy resolving just a few puzzles.				
I prefer games where I can make buildings and structures.				
I prefer games that emulate aspects of the real world.				
I prefer games that don't have any specific goal.				

I prefer games where my character uses blade weapons.				
I enjoy resolving puzzles for their own sake.				
I prefer games where events happen once I've finished my turn.				
I enjoy that only sometimes I've to engage with a character stronger than the average.				
I prefer games with intelligent life.				
I prefer sport games.				
I prefer games where some events continue by themselves.				
I prefer games that I can play with other people on the internet.				
I enjoy levelling my character.				
I prefer games where I can manage resources.				
I enjoy exploring and establishing relationships with other characters.				
I prefer games that I have the chance of controlling several avatars at a time.				
I prefer games where I have to resolve puzzles frequently.				
I prefer games with a story that unfolds while I play.				
I enjoy being challenged with eye-hand coordination tasks.				
I prefer games where my character's stats have a key role to hit and resist while fighting.				
I enjoy controlling multiple units.				
I prefer games in which engaging in combat is not that relevant.				
I prefer games that are carefully balanced by setting initial attributes comparable equal to all players.				
I enjoy doing quests.				
I enjoy doing combo moves for hitting harder.				
Having a good aiming skill is a must for the games that I like.				
I prefer games where music and rhythm are an important part of gameplay.				

9.4 Appendix D – Participants Consent Form

Gamers' Personality and their Gaming Preferences

In this survey, we aim to identify what aspects of games you enjoy the most and to relate those preferences to your personality traits.

Informed consent by participants

The University and those conducting this research study subscribe to the ethical conduct of research and to the protection at all times of the interests, comfort, and safety of participants. This research is being conducted under permission of the Simon Fraser Research Ethics Board. The chief concern of the Board is for the health, safety and psychological well-being of research participants.

Should you wish to obtain information about your rights as a participant in research, or about the responsibilities of researchers, or if you have any questions, concerns or complaints about the manner in which you were treated in this study, please contact the Director, Office of Research Ethics by email at hal_weinberg@sfu.ca or phone at 778-782-6593.

By choosing to continue with the completion and submission of this online survey, it will signify that you have read the description of the procedures, whether there are possible risks, and benefits of this research study, that you have received an adequate opportunity to consider the information in the documents describing the study, and that you voluntarily agree to participate in the study. Completing and submitting this online survey signifies that you are either a student of Simon Fraser University, or are 19 years of age or older.

Statement of confidentiality:

Any information that is obtained during this study will be kept confidential to the full extent permitted by the law of British Columbia and Canada. Responses gathered in the online survey will remain confidential through the use of an encrypted, secure website. Materials will be maintained in a secure location. The data obtain in this study may be used in future works that may be similar and may required future contact with you.

Purpose and goals of this study

This study is designed to investigate correlations among personality factors – according to the Big Five model- and the preference for certain game elements, in order to better understand gaming preferences.

What the participants will be required to do:

Participants will complete online questionnaires about their gaming preferences, personality, demographic information.

The risks to participants of this study:

There are no risks associated with participation in the study.

The benefits of this study:

There are no benefits associated with participation in the study.

Copyright Notice:

On the personality questionnaire: Adapted and reproduce by special permission of the Publisher, Psychological Assessment Resources, Inc., 16204 North Florida Avenue, Lutz, Florida 33549, from the NEO Five-Factor Inventory by Paul Costa and Robert McCrae, Copyright 1978, 1985, 1989, 1991, 2003 by PAR, Inc. Further reproduction is prohibited without permission from PAR, Inc.

You may withdraw your participation at any time. You may register any concern or complaint with the Director of the Office of Research Ethics:

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email: hal_weinberg@sfu.ca

You may obtain results of this study by contacting Veronica Zammitto (Principal Investigator), School of Interactive Arts and Technology, by sending an e-mail to vzammitt@sfu.ca

By continuing with this survey, you are agreeing that you have been informed that the research will be confidential, you understand the risks and contributions of your participation in this study, and you agree to participate.

By continuing to participate, you are confirming that you are either a student of Simon Fraser University or are 19 years of age or older. By filling out this survey, you are complying to participate.

*** I confirm that I am 19 years of age or older, OR**

Yes

No

*** I confirm that I am a Simon Fraser University student.**

Yes

No

*** I agree to future contact.**

Yes

No

***If yes, please, complete with your email address.**

Next >>

9.5 Appendix E – Demographic Questionnaire

Gamers' Personality and their Gaming Preferences

In this survey, we aim to identify what aspects of games you enjoy the most and to relate those preferences to your personality traits.

Demographic Information

Answer the following questions about yourself.

*Age:

Only numbers may be entered in this field

*Gender:

Female

Male

*Where do you live?

Please, select your country.

Choose one of the following answers

*Do you consider yourself ...?

Choose one of the following answers

a casual gamer

a hardcore gamer

I don't know



There is no right or wrong answer, nor is there a given definition to follow but just what you think.

*How many games have you bought in the last 12 months?

Only numbers may be entered in this field

*Do you buy games for...?

Check any that apply

- yourself
- your family
- your partner
- you don't buy games

*What platforms do you use?

Click on an item in the list on the left, starting with your highest ranking item, moving through to your lowest ranking item.

Your Choices:

PC
Console
Portable

Your Ranking:

1:	<input type="text"/>	
2:	<input type="text"/>	
3:	<input type="text"/>	

Click on the scissors next to each item on the right to remove the last entry in your ranked list

 Please, select the platforms in the order that you use them most.

* You prefer playing...

Choose one of the following answers

- Single player alone
- Single player with other people (passing pads, hot seat) or helping out.
- Multiplayer in the same room in competitive mode
- Multiplayer in the same room in cooperative mode
- Multiplayer on the internet in competitive mode
- Multiplayer on the internet in cooperative mode

*What are your three most favourite games ever?

1st

2nd

3rd

Next >>

[\[Exit and Clear Survey\]](#)

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