PLAYER ACCEPTANCE AND MOTIVATION FOR GAMES WITH EMERGING TECHNOLOGIES: A MULTI THEORY APPROACH IN VIRTUAL REALITY GAMING AND PERVASIVE GAMING CONTEXTS

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PLAYER ACCEPTANCE AND MOTIVATION FOR GAMES WITH EMERGING TECHNOLOGIES: A MULTI THEORY APPROACH IN VIRTUAL REALITY GAMING AND PERVASIVE GAMING CONTEXTS

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ABSTRACT

PLAYER ACCEPTANCE AND MOTIVATION FOR GAMES WITH EMERGING TECHNOLOGIES: A MULTI THEORY APPROACH IN VIRTUAL REALITY GAMING AND PERVASIVE GAMING CONTEXTS

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The thesis study presented here consists of the studies I undertook throughout my PhD studies. In this thesis study, I propose a gaming technology acceptance-motivation model (GTAM). The model amalgamates Technology Acceptance Model, Self-Determination Theory and Flow Theory. The aim of the model is to expand knowledge on the acceptance of and motivation for video gaming technologies. Initially, a systematic literature review was conducted to see the state of the art research on hedonic information systems in the information system (IS) literature. The literature review produced salient research question and the results were presented in the light of those research questions. Building on the literature, the model was created. The proposed model was tested using quantitative methods. Data collection was two-fold: First, a cross-sectional survey was carried out in the virtual reality (VR) gaming context and then, a longitudinal diary study was conducted in the pervasive gaming (PG) context to complement the survey. For the survey, structural equation modeling was employed and for the diary study, multilevel analyses were conducted. Therefore, the proposed model was tested with two empirical studies. Results showed that perceived ease of use was the antecedent of autonomy and competence. Also, in addition to flow (immersion and concentration), autonomy and competence predict enjoyment which then predicts attitude and intention play. Studies presented offer theoretical contributions to IS and games research as well as implications for managers and practitioners in the interactive hedonic information system business. The results were discussed and the implications were presented.

Keywords: Video Game Acceptance, Motivation for Video Gaming, Player Experience, Virtual Reality Games, Pervasive Games

ÖZ

YENİ TEKNOLOJİLER KULLANAN DİJİTAL OYUNLAR İÇİN OYUNCU KABULU VE MOTIVASYONU: SANAL GERÇEKLİK VE YAYGIN OYUNLAR BAĞLAMINDA ÇOKLU TEORİ YAKLAŞIMI

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Burda sunulan tez çalışması doktora sırasında yürüttüğüm çalışmalardan oluşmaktadır. Bu tezde bir teknoloji kabul motivasyon modeli önerilmektedir. Bu model, teknoloji kabul kuramını, öz belirleme teorisini ve akış teorisini birleştirmektedir. Bu modelin geliştirilme amacı dijital oyunların kabülü ve motivasyonlarıyla ilgili bilgi üretmektir. İlk olarak, hazsal bilişim sistemleri alanındaki en güncel durumu belirlemek adına sistematik literatür taraması gerçekleştirilmiştir. Bu tarama, öne çıkan araştırma soruları belirlemiştir ve sonuçlar bu soruların ışığında sunulmuştur. Literatürden yola çıkarak bir model geliştirilmiştir ve bu model sayısal metodlar kullanılarak test edilmiştir. Veri toplanması iki şekilde gerçekleşmiştir: İlk çalışmada, sanal gerçeklik kapsamında kesit şeklinde anket toplanmıştır. Ardından, yaygın oyunlar kapsamında boylamsal günlük çalışması yürütülmüştür. Analizler için yapısal eşitlik modeli ve çok seviyeli regresyon kullanılmıştır. Yani, önerilen model ampirik iki çalışma ile test edilmiştir. Sonuçlar algılanan kolaylığın özerk ve yeterlilik için gerekli olduğunu ortaya koymuştur. Ayrıca, akışa (konsantrasyon ve immersiyon) ek olarak, özerklik ve yeterliliğin algılanan haz ile pozitif ilişki içerisinde olduğu görülmüştür. Algılanan haz ise oyuncuların kullanım niyetini ve davranışlarını belirlemiştir. Bu çalışmalar bilişim sistemleri alanına teorik katkılarının yanı sıra hazsal bilişim sistemleri alanında çalışan pratisyenler ve tasarımcılar için de çıkarımlar içermektedir. Tezde, bu çıkarımlar ve sonuçlar sunulmuştur.

Anahtar Sözcükler: Dijital Oyun Kabulü, Dijital Oyun Motivasyonu, Oyuncu Deneyimi, Sanal Gerçeklik Oyunları, Yaygın Oyunlar

To My Family

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LIST OF ABBREVIATIONS

HIS	Hedonic Information Systems
IS	Information Systems
PG	Pervasive Gaming
VR	Virtual Reality

INTRODUCTION

Information systems research is defined as the discipline that is interested in the socio-technical systems comprised of information technologies that organizations and individuals use (Recker, 2012). Traditionally, IS research was directed to the research of organizational performance, information technology usage in organizations, role of information systems in global market and in governments or how it affects the business processes. Recently, usage of information technology in out-of-work contexts and at the individual level also gained prominence since the computers and digital entities are invading most of the households. Especially, with the proliferation of smart phones and pervasive computing applications, the consuming of hedonic products increased vastly. In IS research, these hedonic products were defined as hedonic information systems which are information systems that are carrying some hedonic value and engaged dominantly for fun by its users (Van der Heijden, 2004). The market size of hedonic information systems is growing every year with digital games leading the way. Digital games come in many different forms. For instance, they can be run by desktop or laptop computers, gaming consoles, arcade machines, cell phones or smart phones. Digital games can also utilize a variety of emerging technologies such as computer-aided virtual environment rooms, virtual reality headsets, location based services or augmented reality devices. Regardless of their form, digital games as a whole, became a part of human culture and they are one of the mainstream entertainment type that people prefer from different demographics.

In general, these recreational systems are designed for hedonic consumption and users dominantly interact with them for fun/leisure. The aim of such systems is to sustain persistent user engagement by creating pleasurable experiences rather than fulfilling users' utilitarian purposes. In addition, users interact with hedonic information systems voluntarily -since the activity itself is enjoyable- without expecting/needing for an external reward.

How and why people use information technology for entertainment purposes in society became an important issue and the growing in the industry is being reciprocated by the IS researchers. Theories were started to be created specific to the hedonic information

systems with significant amounts of studies being conducted also at the individual level rather than in the organizational context. However, research on hedonic information systems is young and there is no universally agreed model that is explaining the adoption of hedonic information systems.

My broad research question is: How can we explain interactive hedonic information system motivation/acceptance? Also relatedly, can there be other explanations different than the ones existing in the literature for interactive hedonic information system motivation/acceptance?

Therefore, this thesis study aims to come up with a model that is built on the literature which explains the acceptance/motivation of hedonic information systems, more specifically video games that use emerging technologies. It also attempts to come up with an alternative explanation to the existing theories in the area of hedonic information systems.

However, before trying to address the research questions posed, I have carried out a systematic literature review on hedonic information systems in IS domain to see the state of the art of the research and the contexts chosen so far by the IS researchers. More specifically, in this systematic literature review, type of peer-reviewed publications (proceeding or journal), breakdown of the publication in years, IS theories utilized in publications, hedonic information systems used as contexts and scientific methods utilized were investigated.

The rest of this thesis study is structured as follows: In the next chapter (Chapter 1), systematic literature review on hedonic information systems is presented. Then, building on the results of the review and the literature on acceptance of hedonic information systems, the hypotheses were developed and the scope of the research is defined (Chapter 2). In Chapters 3 and 4, the survey study on virtual reality gaming and diary study on pervasive gaming were presented. The analyses were presented and the results were discussed. In Chapter 5, the overall results were discussed and the limitations of the studies were presented. Lastly, in Chapter 6, this thesis study was summarized and concluded.

CHAPTER 1

SYSTEMATIC LITERATURE REVIEW ON HEDONIC INFORMATION SYSTEMS

As Kitchenham et al., (2011) states, systematic mappings and systematic literature reviews are remarkably important for providing basis for further research. The purpose of this systematic literature review was to observe the current trends in hedonic information system research, as stated above.

1.1. Review Method

The guidelines provided by Kitchenham (2004) was followed for the review. This review is a qualitative systematic review which –contrary to meta-analytic approach- uses relatively subjective methods that comes up with clusters, groupings or classifications (Paré, Trudel, Jaana, & Kitsiou, 2015). The objectives of the review can be summarized as to identify where research on this topic is published and how the publication numbers vary in years, the types of research conducted on hedonic information systems, hedonic information systems that were used or neglected in research, whether the studies focus on a specific hedonic information system, and whether they are TAM-related (Technology Acceptance Model, Davis, (1989)) or not.

By translating these objectives into formal research questions, I created the following question inventory before conducting the review:

- [RQ1] Where are the studies on hedonic information systems published?

- [RQ2] How do the publication numbers vary in years from 2004 to 2016?

- [RQ3] What are the research methods used?

- [RQ4] What is the nature of the hedonic information systems used in research? Are they considered fully hedonic or do they include an amalgamation of hedonic and utilitarian values?

- [RQ5] Which specific hedonic information systems are used in research? Is there space to research new technologies other than already studied ones?

- [RQ6] Are the studies mostly TAM-related?

1.1.1. Inclusion Criteria

Several criteria were specified before starting the systematic review. First, since Van der Heijden's study (2004) is accepted to be one of the earliest studies on hedonic information systems domain, studies after year 2004 were considered. Studies that are not necessarily considering hedonic information systems as purely hedonic were also included. I did not have any inclusion criteria for research methodology, which means that both quantitative and qualitative studies were included. To be able to decide if a study was TAM-related or not, I have inspected the constructs used in that study. Also, when unsure, to be able to determine if a study approached the hedonic information system at hand as purely hedonic or multi-purposed, I have checked if the study has included perceived usefulness as a construct which mostly referred as a construct that has utilitarian value. The studies that have the perceived usefulness construct were treated as multi-purpose systems. In general, if a study included constructs which implies that the user has some external benefit from the activity other than the joy of it, it was considered as a multi-purposed information system.

The studies that are not using the keyword "hedonic information systems" in their titles, abstracts or contents were excluded. The studies that are not in English and that are not empirical were excluded as well.

1.1.2. Data Sources

The search was carried out in two phases: First, a selection of widely known and credited online databases were searched. Then, prominent information systems academic journals were scanned. The journals were selected in-line with the previous reviews (Legris, Ingham, & Collerette, 2003). The exact search string used in both searches was "hedonic information systems". The string was searched in titles, abstracts and keywords. The search was carried out in the following electronic databases:

- IEEE Xplore
- ACM Digital Library
- ScienceDirect
- SpringerLink
- Wiley Online Library
- AISeL (Association for Information Systems Electronic Library)

The second part of the search included the following academic journals:

- MIS Quarterly
- Decision Sciences
- Information & Management
- Management Science
- Information Systems Research
- Communications of the Association for Information Systems
- Journal of the Association for Information Systems
- Journal of Management Information Systems

1.1.3. Search Strategy

The search was carried out in two phases (Figure 1). First, I have conducted an automatic search of the data sources using the exact search string "hedonic information systems" in titles, abstracts and keywords. This search resulted in 508 manuscripts.

As automatic keyword search results in manuscripts that contain the keywords regardless of the study's content, in the second phase I have conducted a thorough manual inspection to eliminate the irrelevant articles. Moreover, I have also manually double-checked the studies for the initial inclusion criteria. Initially, the paper's title, keywords and abstract were inspected -in this particular order- to eliminate papers that are not relevant for the current review. I examined whether the study is actually about hedonic information systems, and whether it includes terms such as "enjoyment", "playfulness", "fun", "game", "pleasure" and "user experience" since these terms are essential for defining hedonic information systems. Next, the contents of the remaining papers were inspected. Finally, I also used one round of snowballing procedure –using reference lists of papers to detect additional papers – following the guidelines of Wohlin (2014). The final list of the papers included in the review is presented in the APPENDIX A.

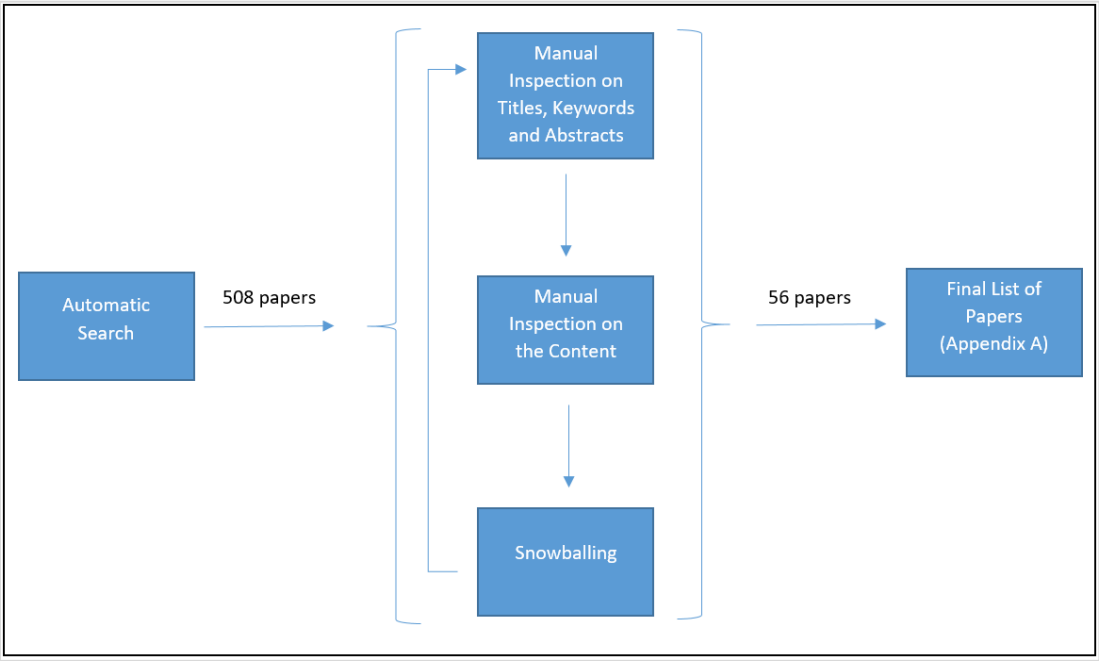
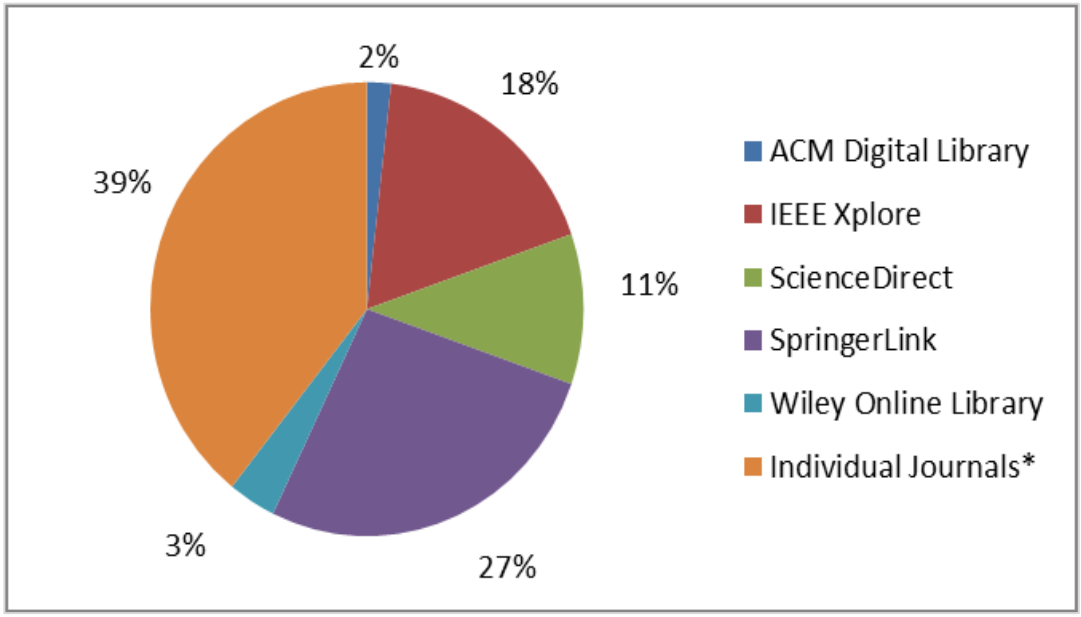


Figure 1: The Search Procedure

1.2. Results of the Review

Final list consisted of 56 papers. Most of the papers (61%) made it to the final list were from the search in electronic databases and among them, SpringerLink was the greatest contributor, followed by IEEE Xplore. 39% of the selected papers were gathered from individual journal websites (Section 2.1.2). The breakdown of the sources of the final list of papers can be observed in Figure 2.



* Journals that are not included in the above databases

Figure 2: Source of Selected Articles

Among the selected papers, journal publications (33) were more than the conference proceedings (23) which answer [RQ1].

For [RQ2], I examined how the publication numbers varied in years from 2004 to 2016. When we have a look at the yearly breakdown of the studies (Figure 3), we can see that since 2009, the number of the studies in hedonic information systems domain has increased.

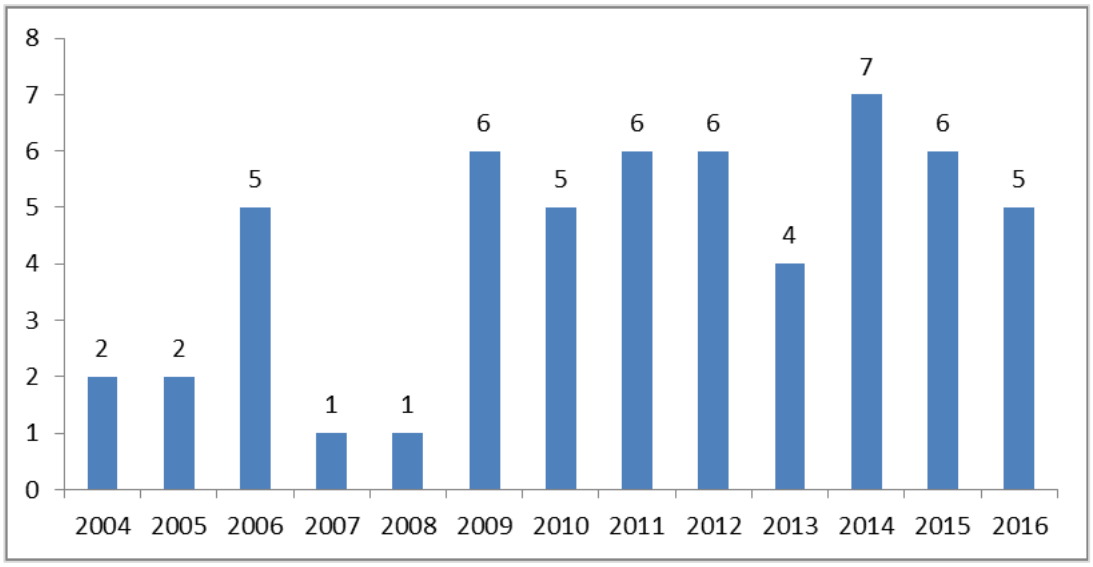


Figure 3: Number of Selected Studies in Years

For the third research question ([RQ3]), I investigated what methods were used in the studies. Most of the studies (42) used a survey methodology. There was an equal amount of studies that used qualitative (9) and experimental (9) methods. There were also two studies that conducted meta-analysis. Six papers included multiple studies (such as carrying out qualitative research after or before a survey or an experiment) (Table 1: Breakdown of Papers According to their MethodologyTable 1).

Table 1: Breakdown of Papers According to their Methodology

	Methodology
P[7] P[21] P[23]* P[26]* P[28] P[31] P[35] P[44] P[51]	Experimental
P[1] P[2] P[3] P[4] P[5] P[6]* P[8] P[9] P[10] P[12] P[13] P[14] P[15] P[16] P[17] P[18] P[19] P[20]* P[24] P[25] P[27] P[29] P[30] P[32] P[33]* P[36]* P[37] P[38] P[39] P[40] P[41] P[42] P[43] P[45] P[46] P[47] P[48] P[49] P[52] P[53] P[54] P[55]	Survey
P[6]* P[20]* P[22] P[23]* P[26]* P[33]* P[34] P[36]* P[56]	Qualitative
P[11] P[50]	Meta-analysis

*Articles that include multiple studies

I also inspected how authors approached to hedonic information systems ([RQ4]). In traditional information systems research, utilitarian values/constructs dominated to explain most of the phenomena, however with the proliferation of hedonic information systems research, hedonic motives are also started to be considered. I researched whether studies include an amalgamation of utilitarian and hedonic values or if they approach the HISs from a purely hedonic point of view. Looking from that perspective, it has been seen that 22 of the studies' nature were purely hedonic and the rest (34) were taking both utilitarian and hedonic values into account (Table 2).

Table 2: Breakdown of Papers According to their Perspective

	Perspective
P[1] P[2] P[4] P[7] P[8] P[10] P[11] P[12] P[13] P[15] P[16] P[18] P[19] P[20] P[21] P[22] P[23] P[27] P[31] P[32] P[33] P[35] P[36] P[37] P[38] P[43] P[44] P[50] P[51] P[52] P[53] P[54] P[55] P[56]	Hedonic and Utilitarian
Others	Purely Hedonic

Next, I examined which hedonic information systems were used in the included studies ([RQ5]). I have observed that the selected studies approached hedonic information

systems in different abstraction levels and the types of hedonic information systems researched so far were varied enough to come up with a small taxonomy. Since they came in different abstraction levels, a hierarchical taxonomy seemed relevant. As can be seen from Figure 4, the hedonic information systems –that were studied in IS domain- were loosely classified into 7 categories. Second level of the taxonomy shows more specific applications of these abstract systems. "Website" sub-category was the biggest set including 8 distinct hedonic information systems followed by "Mobile" and "Game" categories which consist of 7 distinct hedonic information systems. I acknowledge that some of the second-level items in the taxonomy can be placed in more than one first-level category but I have subjectively decided on a category for second-level items by trying to pay attention to which first level category the authors signify most in their study (such as putting Mobile Social Network Game in "Game" category instead of "Mobile" or "Website" category). Figure 4 explains the hierarchical taxonomy of hedonic information systems that are being studied from 2004 to 2016 in IS research.

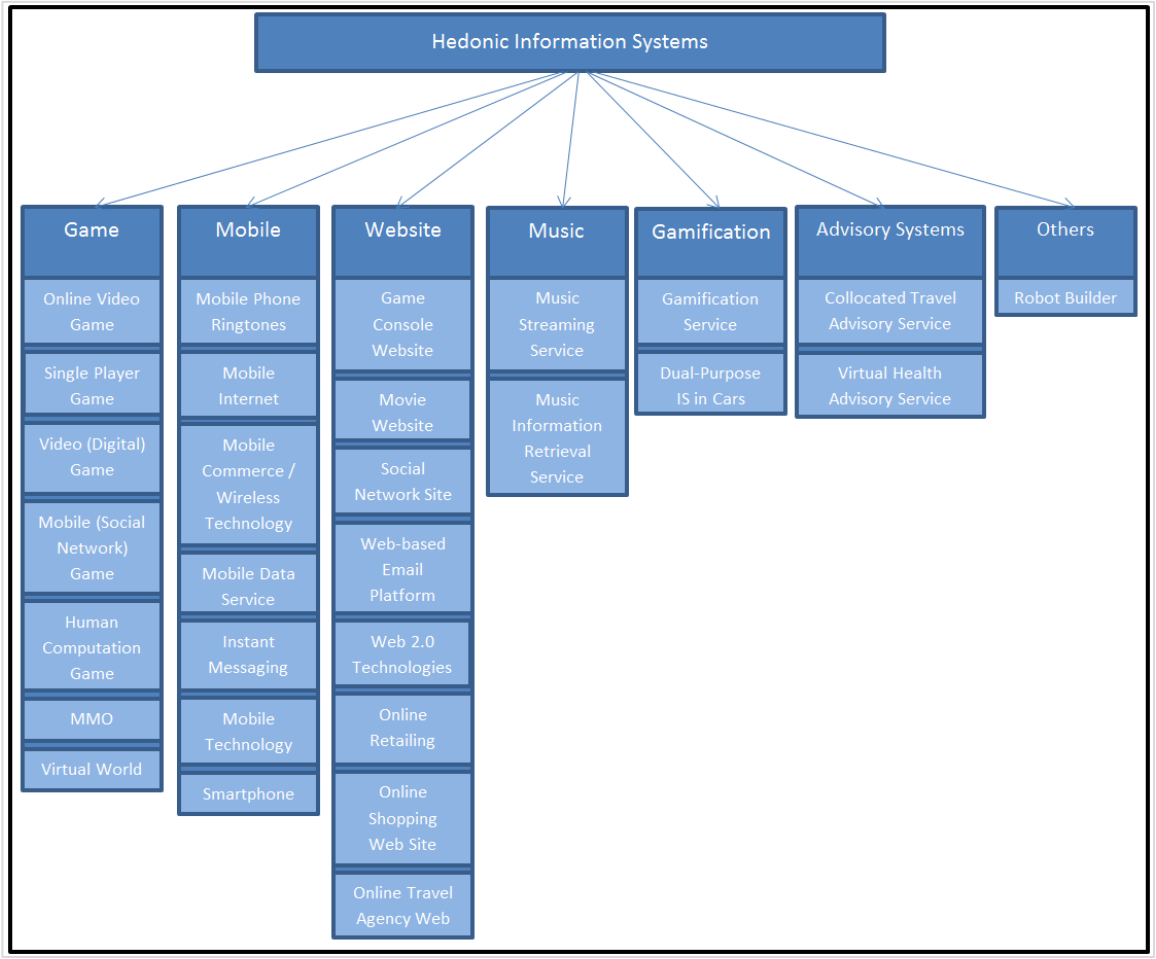


Figure 4: Taxonomy of Hedonic Information Systems

Lastly, as for [RQ6], most of the papers were related to Technology Acceptance Model (40). 16 of them were not related to TAM (Table 3).

Table 3: Breakdown of Papers According to their TAM-relatedness

Papers	TAM-Related
P[2] P[3] P[5] P[7] P[19] P[20] P[21] P[22] P[29] P[31] P[38] P[39] P[40] P[45] P[51] P[56]	No
Others	Yes

1.3. Discussion of the Review

My goal in this systematic literature review was to present an overview of a fledgling field and to identify what hedonic information systems are involved. Unlike other literature or meta-analysis studies that were more focused on the intrinsic-extrinsic motivation differences and construct relationships, main contribution of the present study was that it revealed which hedonic information systems are used in IS studies also delineating the demographics of those studies, with the purpose of identifying gaps and providing guidance for further research.

Going back to the first research question [RQ1] I have posed before, it can be stated that hedonic information system research have started to get mature in years. Prominent peer-reviewed journals accepting hedonic information system studies shows an indication of the attention being paid by the information systems research community to hedonic information systems.

For the second research question [RQ2], as can be seen from Figure 3, it can be stated that there is a slightly increasing publication rate in hedonic information systems research. Also, since 2009, hedonic information systems research showed a stable pattern in terms of the publication numbers.

The third research question [RQ3] was related to the methodology used in the studies. The analysis showed that most of the studies were survey-based studies. Utilization of experiments and qualitative research were significantly lower than survey method in numbers. This finding demonstrates the need for more qualitative and experimental research on hedonic information systems. Future qualitative research may pave the way for identifying new constructs or phenomenon that might be specific to hedonic systems. Moreover, experiments can be used for determining causal associations between constructs that were already shown to be associated in the previous survey based studies.

Regarding what hedonic information systems represent [RQ4], I found that two thirds of the papers had a hybrid approach, examining both utilitarian and hedonic values. Nevertheless, one third of studies approached hedonic information systems as purely hedonic. There is evidence that digital games –that are known to be hedonic artifacts

mainly created for fun- can be multi-purpose systems as well where hedonic and utilitarian factors are equally important (Hamari & Keronen, 2017). In sum, there is no absolute agreement in the research community if utilitarian values should also be involved in hedonic information systems or not.

Returning to the last research question [RQ5] that was posed, it was seen that the hedonic information systems research can be visualized in a hierarchical taxonomy. First-level categories of the taxonomy included "Game", "Mobile", "Website", "Music, "Gamification", "Advisory Systems" and "Others". Most of the second-level categories were from Game, Mobile and Website categories stating that hedonic information systems were mostly characterized by digital games, mobile applications and various types of pleasure-oriented websites. The taxonomy can be used as a look up table for hedonic information systems researchers to see what has been studied up to date and what the domain still lacks before determining the context of their studies.

Lastly, tying back to the sixth research question [RQ6], the review showed that most of the empirical research on hedonic information systems was related to Technology Acceptance Model. This finding might remark that researchers are interested in the adoption/acceptance of hedonic information systems. The reason why people uses specific hedonic information systems remains an important subject in the IS domain. This might also imply that the hedonic information systems domain may benefit from other theories as well.

All in all, having conducted such a study, the latest status in hedonic information systems research was observed. The diversity of the hedonic information systems that are being studied in the domain catches attention and context-specific theorizing gains importance. It has also been seen that digital games are gaining more and more importance in IS research. As seen in this systematic literature review study, digital games are one of the best representatives of hedonic information systems with 41% of all the studies followed by website studies with 30%. Although the video game related studies mentioned above consider various types of games and technologies, it is observed that emerging technologies were not addressed yet such as virtual reality gaming or digital pervasive gaming. Virtual reality games are video games that usually require players to wear head mounted displays and digital pervasive games are mobile games that usually require a smart phone that uses location based services. Since these gaming conventions necessitate using some form of emerging technology, are relatively new and adoption on them are understudied, I have selected these two as the contexts of inquiry.

Next section gives an introduction to the theories and forming of the research framework, articulates proposed hypotheses and explains how the study's scope is situated in information systems research.

CHAPTER 2

THORETICAL FOUNDATIONS, HYPOTHESES AND SCOPE OF THE RESEARCH

2.1. Self Determination Theory

Self-determination is a grounded theory, comprised of 6 mini-theories, with more than 35 years of research background. Basically, the theory makes a clear distinction between extrinsic motivation and intrinsic motivation where the former refers to doing an activity for the gains after the activity and separate from the activity and the latter refers to doing something for its own sake since one enjoys the process (Ryan & Deci, 2000). It is explained that extrinsic motivation may exist in a couple of forms according to how they regulate motivation which are: External regulation, introjected regulation, identified regulation, and integrated regulation where these sub-types are stated to be residing on the internalization continuum (Figure 5). Internalization can be defined as "reasons for behavior" which means the more internalized a behavior, the more it is closer to self and more autonomous and the less it is internalized, motivation turns into amotivation which is actually having no motivation at all (Ryan & Connell, 1989). Intrinsic motivation leads people to be more persistent, effective, efficient and satisfied (Deci & Ryan, 2002). The theory posits that competence, autonomy and relatedness are the main psychological needs of humans and they are the prerequisite of intrinsic motivation. Competence can be defined as the human's desire for mastery. Autonomy is the urge of humans to be able to see the results of their own, self-directed actions without any external intervention. Relatedness can be explained as the desire to feel connected to others.

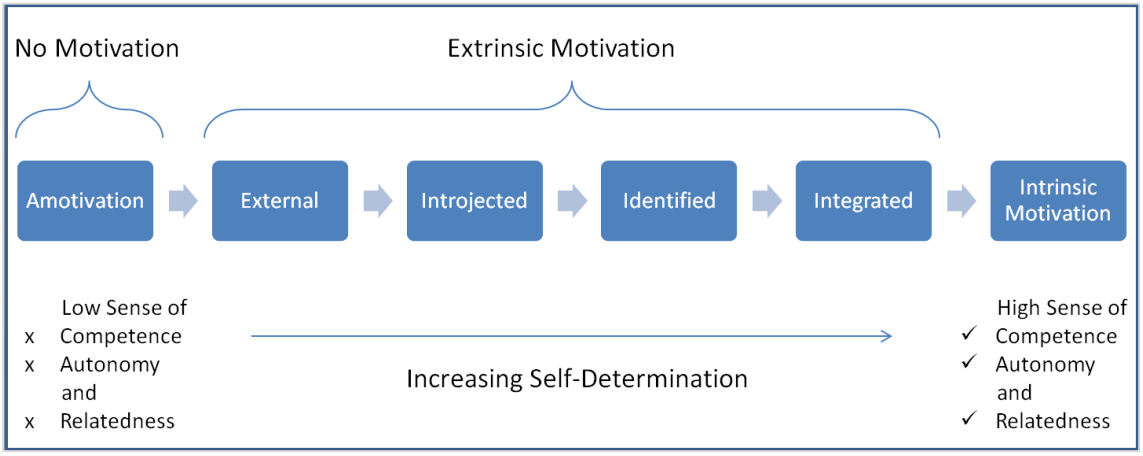


Figure 5: Internalization Continuum

Self-determination theory was studied in the video games context. It was found that competence, autonomy and relatedness were associated with perceived enjoyment and intention for future play (Ryan, Rigby, & Przybylski, 2006). Also, it was suggested that these constructs were associated with the appeal and wellbeing effects of video games (Przybylski, Rigby, & Ryan, 2010).

2.2. Flow Theory

Flow can be defined as the psychological state when one experiences optimal life experiences (Csikszentmihalyi, 1990). It is the mental state where one is fully immersed in an activity and is perfectly concentrated on the task. It is also described as when a person loses the sense of time and space during an activity. The most salient property of flow in video gaming context is usually described as the optimum challenge that the game provides. Optimum challenge create the experience of flow which lies between boredom (not challenged enough) and anxiety (too challenging) where the challenge of the game closely matches the skill of the player (Chen, 2007), frequently depicted as in Figure 6. This state is associated with greater life quality and enjoyment in the literature (Csikszentmihalyi, 1997).

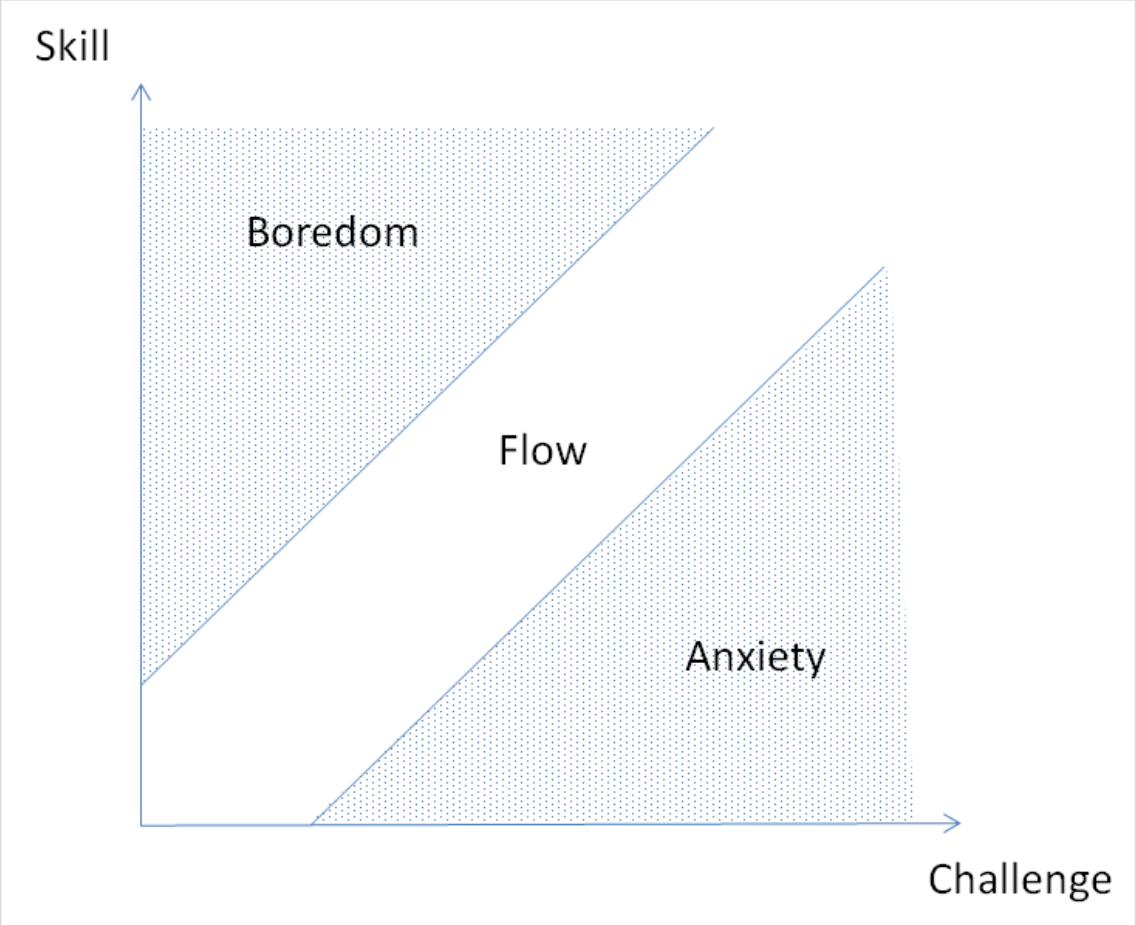


Figure 6: Flow Theory in Games

2.3. Technology Acceptance Model in Hedonic Information Systems Context

Technology Acceptance Model (TAM) (Davis, Bagozzi, & Warshaw, 1989) is arguably one of the most influential theories of information systems research. It is based on the Theory of Reasoned Action (TRA) (Ajzen & Fishbein, 1980) (Fishbein & Ajzen, 1977). Basic premise of TAM is that the people's attitudes towards acceptance of a technology depends on two constructs which are perceived ease of use and perceived usefulness. Several studies provided support for this basic premise of TAM (Porter & Donthu, 2006; Dishaw & Strong, 1999; Vijayasarathy, 2004). TAM also states that attitude predicts behavioral intention to use (Figure 7). Although, attitude might not fully mediate the effect of perceived ease of use and perceived usefulness on intention (Davis, 1989; Lederer, Maupin, Sena, & Zhuang, 2000), research on VR adoption shows that attitude towards VR technology is important (Liao, Shao, Wang, & Chen, 1999; Bertrand & Bouchard, 2008).

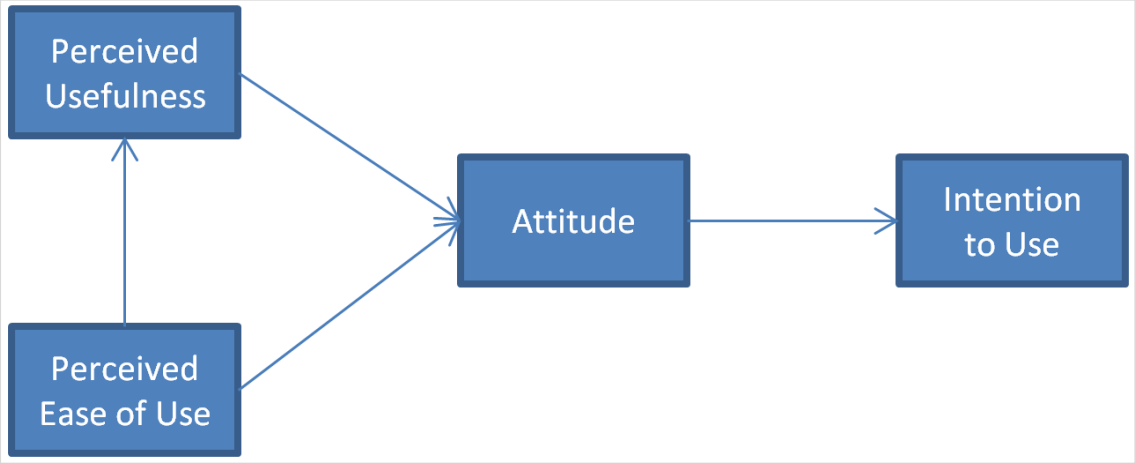


Figure 7: Original TAM

Majority of research on TAM focuses on utilitarian information systems. Utilitarian information systems can be defined as information systems that are mainly designed to accomplish business-oriented work with effectiveness. For instance, researchers tested TAM in the context of physicians' acceptance of telemedicine technology and found that perceived usefulness and perceived ease of use predicts attitude and attitude predicts intention to use (Hu, Chau, Sheng, & Tam, 1999). Another study found similar associations in the adoption of information technology in business settings (Hernandez, Jimenez, & Martín, 2008). Several other studies supported TAM in adoption of utilitarian information systems (Legris, Ingham, & Collerette, 2003).

Some studies extended TAM with enjoyment and intrinsic motivation constructs. It has been observed that these constructs, which are related to emotions and user experiences, also played a significant role for the acceptance of task-oriented systems (Partala & Saari, 2015). Similarly, it was argued that intrinsic motivation is also important for understanding utilitarian information systems' acceptance and even their post-adoption uses (Gerow, Ayyagari, Thatcher, & Roth, 2009; Gerow, Ayyagari, Thatcher, & Roth, 2013). For instance, pleasure was found to be a key predictor of website success (De Wulf, Schillewaert, Muylle, & Rangarajan, 2006). In fact, some of the information systems were defined as multi-purpose information systems which have both hedonic and utilitarian attributes such as social network sites or mobile data services (Xu, Ryan, Prybutok, & Wen, 2012; Hong & Tam, 2006). Social network sites were found to be good examples for multi-purpose information systems where the system use is determined by both perceived usefulness and perceived enjoyment (Ernst, Pfeiffer, & Rothlauf, 2013; Hung, Tsai, & Chou, 2016). Gu et al. (2010) introduced the concepts of perceived utilitarian usefulness and perceived hedonic usefulness dividing the traditional perceived usefulness into two to be used for multi-purpose systems. Hamari and Koivisto (2015) stated that gamification is a mixed system and driven by both utilitarian

and hedonic predictors[1]. Although the utilitarian information systems may have hedonic values and hedonic information systems may have utilitarian attributes, the dominant motivators for utilitarian information systems are extrinsic and dominant motivators are for hedonic information systems are intrinsic (Wu & Lu, 2013).

As mentioned before, information systems that are created just for entertainment purposes are called hedonic information systems (HIS) (Van der Heijden, 2004). These systems may include games (desktop, console or mobile), mobile applications used for entertainment, music streaming services, gamified apps and so on (Chapter 1). In a pioneering study that applied TAM to hedonic information systems, researchers suggested that TAM in its basic form is a limited model for explaining the acceptance or adoption of entertainment based information systems (Van der Heijden, 2004). In fact, researchers found that perceived enjoyment was the main predictor of intention to use these systems rather than perceived usefulness. This finding was endorsed by another study which found that technology type (hedonic vs utilitarian) moderated the relation between perceived usefulness and intention where the effect of perceived usefulness on intention was attenuated when the type of the technology is hedonic (Im, Kim, & Han, 2008).

Researchers also found that perceived enjoyment and social image both predicted attitude, which in turn, predicted intention to use online video games (Lin & Bhattacherjee, 2010). Another video game study on Massively Multiplayer Online Role Playing Games found that perceived enjoyment and perceived ease of use predicted behavioral intentions (Wu & Holsapple, 2014). Similarly, perceived enjoyment and perceived playfulness predicted attitudes toward and intention to use social network games (Shin & Shin, 2011; Li, Liu, Xu, Heikkilä, & Van Der Heijden, 2015). Attitude was found to be predicted by enjoyment also in online games context (Lee & Tsai, 2010). Direct effect of perceived enjoyment on intention to use was also shown in other contexts such as social networking websites (Rosen & Sherman, 2006), mobile games and music streaming services (Merikivi, Nguyen, & Tuunainen, 2016; Hechler, Born, & Kroenung, 2016). Recent meta-analyses shows that perceived enjoyment and perceived ease of use predict attitude toward HIS, which in turn, predicts the intentions to use (Wu & Lu, 2013; Hamari & Keronen, 2017), providing support for the predictions on TAM in hedonic information systems.

Sun and Zhang (2006) state that perceived enjoyment is the predictor of perceived ease of use. However, they also acknowledge that their study is in utilitarian domain and this relationship can be different in hedonic contexts. I argue that, enjoyment can be a

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[1] Gamification is the term that refers to the usage of game elements in non-game contexts to motivate people (Deterding, Dixon, Khaled, & Nacke, 2011) and gamified systems are an attempt to incorporate hedonic attributes to utilitarian systems. An extensive review on gamification can be found in Hamari et al. (2014).

facilitator for ease of use in complex utilitarian systems, however in general, video games should be ease to learn/play to begin with, to be enjoyable.

Consequently, I also hypothesized that these basic associations of TAM would be also applicable to virtual reality and pervasive games. That is, perceived ease of use and perceived enjoyment would predict more positive attitudes toward virtual reality and pervasive games, and positive attitudes and perceived enjoyment would predict greater intentions to use these systems.

2.4. The Integration of SDT and Flow Theory with TAM in Hedonic Information Systems Context

Although there is robust support for the basic predictions of TAM, researchers also expanded the model with constructs from other theories. For hedonic information systems flow related constructs seem to play an important role. In one study (Agarwal & Karahanna, 2000), it was found that cognitive absorption, a construct based on flow (Csikszentmihalyi & LeFevre, 1989) significantly predicted intention to use, along with perceived usefulness and perceived ease of use in the world wide web context. Similarly in another study on online games, flow was found to significantly predict intention use (Hsu & Lu, 2004). In an extension of TAM, called Hedonic-Motivation System Adoption Model, it was proposed that flow mediates the relationship between perceived ease of use and intention to use (Lowry, Gaskin, Twyman, Hammer, & Roberts, 2012). Other studies also found that flow significantly predicted attitude (Wang & Scheepers, 2012) and enjoyment (Sweetser & Wyeth, 2005; Jegers, 2007; Weibel, Wissmath, Habegger, & Steiner, 2008). In line with these, I hypothesized that flow predicts enjoyment (which predicts intention to use) in virtual reality or pervasive game contexts as well.

There are some studies that incorporated SDT constructs in TAM, for utilitarian information systems. In one recent study, it was found that basic needs (autonomy, competence and relatedness) predicted perceived ease of use and perceived usefulness in mobile-based assessment context (Nikou & Economides, 2017). Similarly, another study found that basic need satisfaction predicted perceived usefulness, which then predicted intention to use (Sørebø, Halvari, Gulli, & Kristiansen, 2009). Finally, in the context of e-learning in work settings, autonomy, competence and relatedness significantly predicted perceived usefulness and perceived playfulness (Roca & Gagné, 2008).

However, studies examining TAM and SDT in hedonic information systems are lacking. According to SDT literature, satisfaction of autonomy and competence needs in games predicts players' enjoyment (Ryan, Rigby, & Przybylski, 2006; Przybylski, Rigby, & Ryan, 2010; Peng, Lin, Pfeiffer, & Winn, 2012; Vorderer, Hartmann, & Klimmt, 2003; Sheldon & Filak, 2008; Neys, Jansz, & Tan, 2014). Moreover, studies suggest that basic need satisfaction also predicts flow (Moreno, Cervelló, & Cutre, 2010; Kowal & Fortier, 1999). Thus, I hypothesized that basic need satisfaction would predict greater enjoyment

and flow in virtual reality and pervasive games. Finally, it can also be suggested that perceived ease of use would facilitate satisfaction of autonomy and competence needs. When a system is hard to use, it is likely to frustrate users, leading to feelings of incompetence. Moreover, not being able to do what they want to do because of a hard to use system would also lower users' feelings of autonomy. In fact, research shows that intuitive controls in games are positively associated with satisfaction of autonomy and competence needs (Ryan, Rigby, & Przybylski, 2006). In brief, I hypothesized that basic need satisfaction would mediate the link between perceived ease of use and enjoyment, as well as the link between perceived ease of use and flow in virtual reality and pervasive games.

To sum up, the hypotheses become:

H1 – Intention to play is predicted by the positive attitude.

H2 – Increasing perceived enjoyment results in intention to play.

H3 – Increasing perceived enjoyment results in positive attitudes.

H4 – Heightened experience of flow results in higher perceived enjoyment.

H5 – As the players feel more competent and autonomous, they enjoy the game better.

H6 – Experience of flow is predicted by perceived competence and perceived autonomy.

H7 – Perceived ease of use predicts competence and autonomy.

The final research framework is provided in Figure 8.

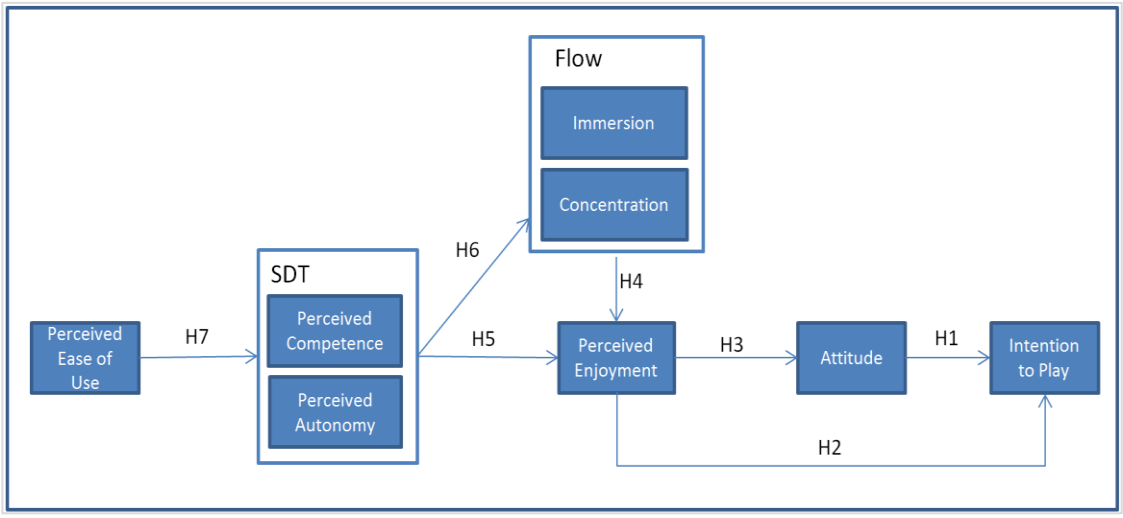


Figure 8: Proposed Research Framework

There are a couple of studies that are mostly related with extrinsic motivator related constructs. Extrinsic motivation is not the main focus of this study, nevertheless for the sake of completeness and to express what I tend to omit, I give several examples of those studies. For example, a study in the mobile social network games context incorporated usefulness characteristics such as perceived mobility or perceived connectedness in addition to enjoyment as determinants of attitude (Park, Baek, Ohm, & Chang, 2014), however they are not included in my model because of the perceived usefulness's extrinsic motivation nature. Turel et al. (2010) studied acceptance of HIS in an interesting context that is the ringtones of mobile phones from the theory of consumption values (Sheth, Newman, & Gross, 1991). They have reported that the value of a hedonic artifact is the determinant of intentions to use in the future and intensions for positive word-of-mouth. As for the value of the hedonic artifact, they say that it is predicted by visual/musical appeal, social, playfulness (escapism, enjoyment) and money values (cost). In the context of online games, Yoon et al. (2013) also considered monetary value but as perceived economic value in addition to critical mass and original TAM constructs which are the determinants of attitude. Perceived economic value, in contrast to cost, is the monetary value that a player expects to get by playing the game. Since these constructs are mostly extrinsic motivation related factors, I do not include them in my model.

All in all, in the light of the literature review on HIS, and understanding the importance of context-specific theorizing and their ability to unravel hidden relationships (Hong, Chan, Thong, & Chasalow, 2013), main hypothesis of my research is that interactive HIS usage motivation and acceptance, more specifically gaming technology motivation and acceptance can be better explained by incorporating self-determination and flow theory elements into the traditional acceptance models. It is known that research and theory from the area of psychology plays an important role understanding the impact of games (Boyle, Connolly, & Hainey, 2011). By incorporating relevant theories, this thesis study aims to generate new knowledge in the IS domain by showing that SDT elements are important factors in acceptance of gaming technologies.

2.5. Scope of the Research

Looking at the literature, we can observe that the divide between utilitarian and hedonic information systems had begun by placing them on a one-dimensional continuum separated by whether one had enjoyment in it or not (Van der Heijden, 2004). Although that was an approach which opened up new research possibilities in the IS domain, as the research got more mature, it has been realized that one-dimensional continuum was too simple to explain the whole terrain. Wu and Holsapple (2014) created a 2D diagram, where both information systems could possess both hedonic and utilitarian values. Building on this idea and the literature, I posit that the elements on the internalization continuum can be mapped onto the diagram as shown in Figure 9. Dominant motivator type for utilitarian information systems is extrinsic whereas dominant motivator type for

hedonic information systems is intrinsic motivation. The research presented here focuses on the bottom-right part of this figure.

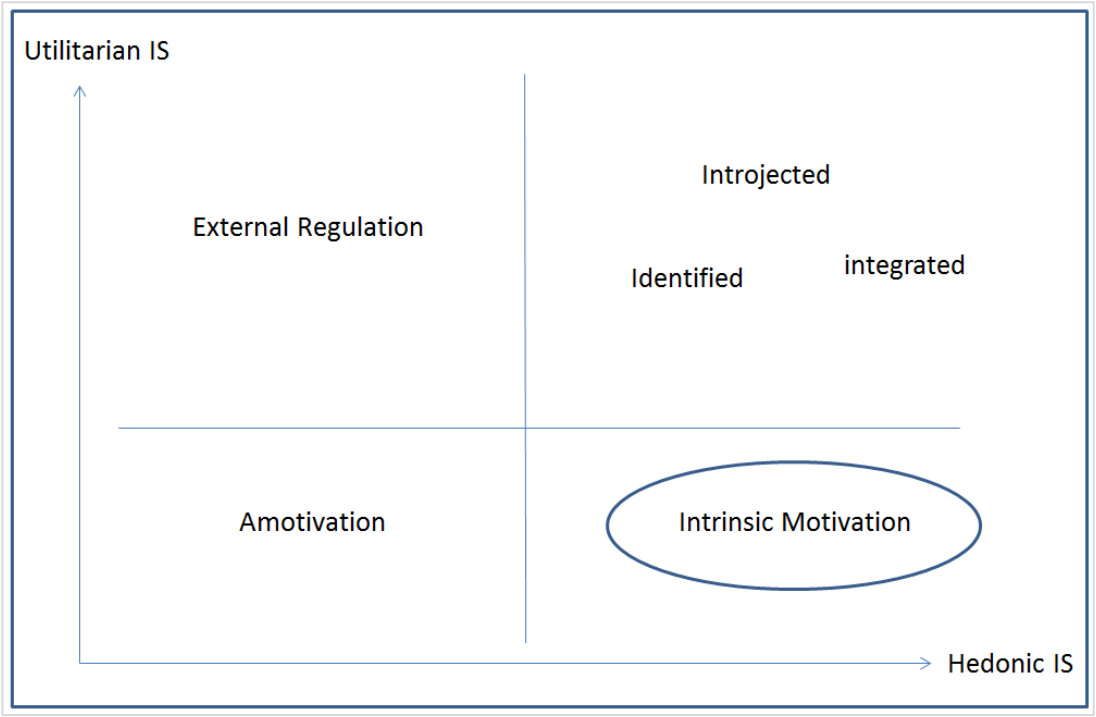


Figure 9: Dominant Motivation Types among Information Systems

Although this is useful consideration, this is only true if the users are using the information systems according to the designers' intend. As Chesney (2006) states, one person may place a software in the utilitarian domain whereas other users may place the same software in the hedonic domain. This shows the subjectivity of the user perspective on information systems. Also, Salovaara and Tamminen (2009) claim that "a single technology can be used for multiple purposes". Video games can be viewed also as utilitarian products by both experienced and inexperienced players (Storgårds, 2011). Although there might be a utilitarian part of hedonic information systems, this study does not consider the utilitarian value of hedonic information systems in-depth. Users may use a purely hedonic information system for her/his own utilitarian purposes, which may completely change why people adopt/continue using these systems. I situate this study on the upper right corner of the graph on Figure 10, where designers build the software with hedonic attributes in mind and users use it with hedonic purposes.

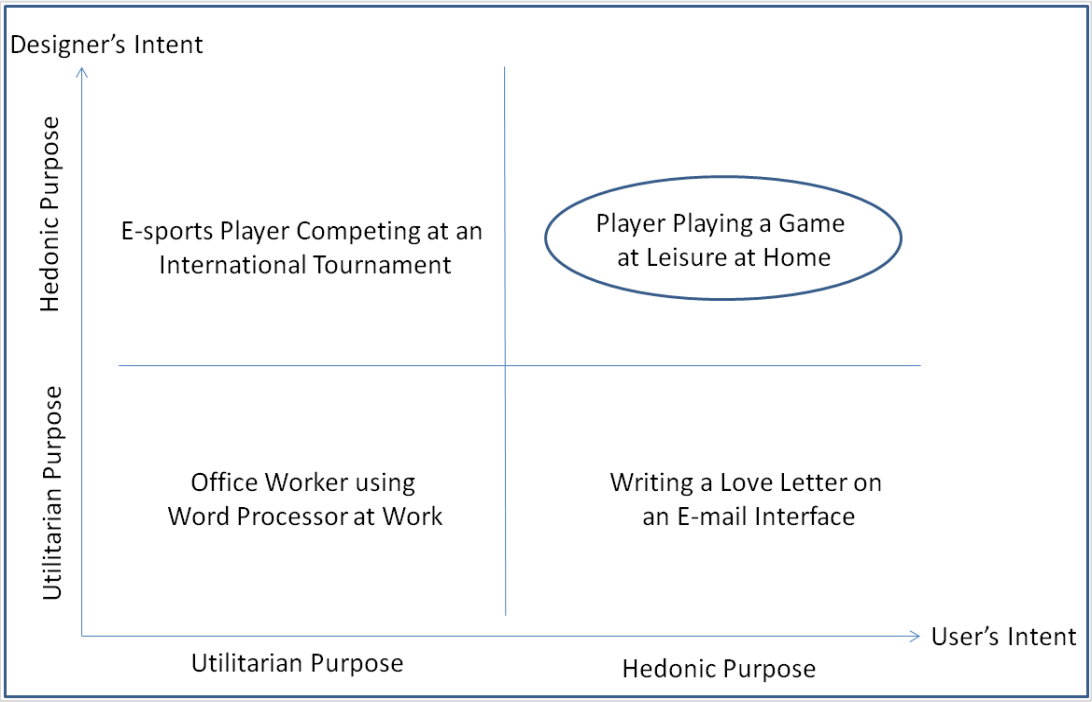


Figure 10: Example Uses of Information Systems

As explained while articulating the main research question above, the study seeks explanation for the technology acceptance in the gaming domain. Therefore the scope of the study is limited to hedonic information systems and narrowed down further to interactive artifacts that are intended to be enjoyable. Also, in spite of acknowledging the utilitarian values in interactive hedonic information systems, the model considers only the intrinsic motivation side of those systems (Figure 8). The context is selected as video games. To be more specific, the context is determined to be virtual reality games and pervasive games.

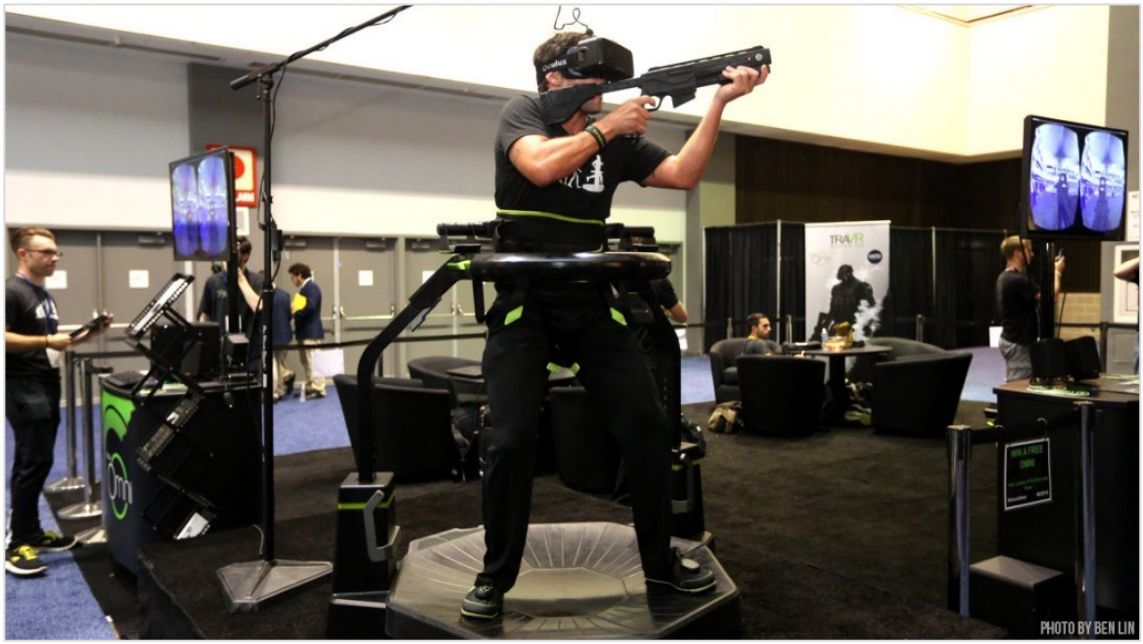
To answer the research question I pose above, I needed to test my formed hypotheses. Since I have well-defined hypotheses to be tested depending on a research model, I needed a confirmatory approach. That is why I find quantitative methods to be useful in my research. The research I carried out consisted of two parts in terms of data collection: A survey and a diary study.

First study is selected to be a survey to be able to reach out to a wider user/player base and to predict their behaviors.

CHAPTER 3

STUDY 1: VIRTUAL REALITY GAMING SURVEY

VR games can be defined as games that use head mounted displays which display preferably near photorealistic visual content to the player generated by a digital machine. VR game systems may also include a motion platform (Figure 11) and/or custom made controllers instead of traditional controllers such as keyboard and mouse (Figure 11 and Figure 12). Therefore according to this definition, an application that is creating a fully enclosed virtual environment that only appeals to the visual sensory organ is a VR game provided that it carries the fundamental properties of games such as having a quantifiable outcome, creating artificial conflicts and approached voluntarily by the players (Salen & Zimmerman, 2004).



https://www.goodworklabs.com/how-virtual-reality-can-impact-the-gaming-industry/

Figure 11: Virtual Reality System with a Motion Platform

https://www.pocket-lint.com/ar-vr/news/playstation/137053-sony-playstation-vr-headset-release-date-revealed-with-50-launch-games

Figure 12: Virtual Reality System with a Custom Controller

VR systems are conceptually modelled in the literature (Bystrom, Barfield, & Hendrix, 1999). On a human perception level, these systems are mostly related to the subjective experiences of immersion and presence (Slater & Wilbur, 1997). VR systems were also found to be creating more pleasurable experiences and better performance (Pausch, Proffitt, & Williams, 1997) than the conventional displays.

Previously, virtual reality adoption/acceptance was studied in couple of contexts such as construction (Fernandes, Raja, White, & Tsinopoulos, 2006), medical (Fagan, Kilmon, & Pandey, 2012) or virtual worlds in general (Fetscherin & Lattemann, 2008). Nevertheless, VR systems are understudied in the gaming context and literature on acceptance of VR gaming is scarce. One of the main reasons of the present survey study is to close this gap.

3.1. Method

3.1.1. Participants

The survey was open to the participants residing in USA to be able to keep the scales in their original forms without translating. In total, 626 people have participated in the study. After the data screening (that is explained below), there were 396 participants left (183 male and 213 female). There were 20 parameters to be estimated in the model and

Bentler and Chou (1987) state that there should be at least 5 participants per parameter to carry out structural equation model analysis. Therefore the number of participants was more than enough. The participants were between 19 and 64 years old (M = 33.78, SD = 9.67). Most of the participants reported that they were heterosexual (338). Other than that, there were also homosexuals (20) and bisexuals (36). 1 of the participants marked "Other" and 1 did not want to answer. In the sample, there were 285 white, 46 African American, 6 American Indian or Alaska Native, 36 Asian, 2 Native Hawaiian or Pacific Islander participants. 21 of the participants preferred not to disclose their ethnicity. Although the most frequently stated yearly income was 20000$ - 29999$, the median of yearly income of the participants was 30000$ - 39999$. There were 151 participants that have a 4-year degree. There were also high school (49), some collage (99), 2 year degree (57), MSc level (32) or doctorate (8) graduates. Most of the participants were full-time employees (263). There were also participants who were employed part-time (57), unemployed looking for work (25), unemployed not looking for work (23), retired (4), student (20) or disabled (4). Weekly video game play hours varied from 0 to 60 (M = 9.68, SD = 8.45). Years of video game play varied from 1 to 40 (M = 18.50, SD = 8.95). Years of computer usage ranged from 1 to 39 (M = 18.96, SD = 7.23).

154 of the participants claimed that they have played a VR game once. 98 stated that they have played twice, 54 stated that they have played three times, 19 stated that they played four times and 71 stated that they have played five times. No participant has played a VR game more than 5 times. When we have a look at the total hours spent with VR games, we see a range from 1 hour to 1550 hours (M = 40.57, SD = 136.80).

The distribution of participants on owning a VR device is as follows: 49 Oculus Rift, 27 HTC Vive, 134 Sony PlayStation VR, 96 Samsung Gear VR, 40 Google Daydream VR, 12 Microsoft HoloLens, 6 Razer OSVR HDK 2, 4 Fove VR and 17 Other (Figure 13). Some of the VR hardware written by participants who marked "Other" were: Google Cardboard, Logitech, PavaPro 360, Promark, VR Shinecon, Weareality Sky and Xtreme VR. 110 participants stated that they do not own VR hardware. 62 of the participants claimed that they have more than one VR hardware.

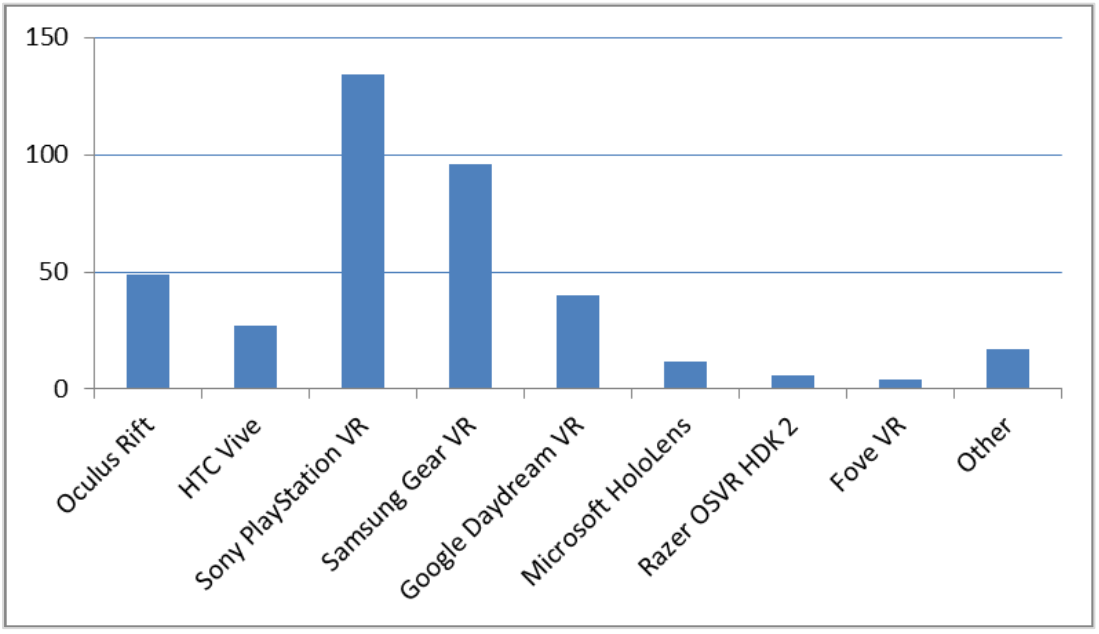


Figure 13: VR Hardware Participants Own

The distribution of participants on playing with a VR device is as follows: 130 Oculus Rift, 62 HTC Vive, 188 Sony PlayStation VR, 149 Samsung Gear VR, 62 Google Daydream VR, 25 Microsoft HoloLens, 9 Razer OSVR HDK 2, 6 Fove VR and 26 Other (Figure 13). Some of the VR hardware written by participants who marked "Other" were: Google Cardboard, Logitech, PavaPro 360, Promark, Utopia 360, VR Box, VR Shinecon and Xtreme VR. 8 of the participants stated that they did not remember or unsure of the name of the VR hardware that they have tried. 162 of the participants claimed that they have experienced more than one VR hardware.

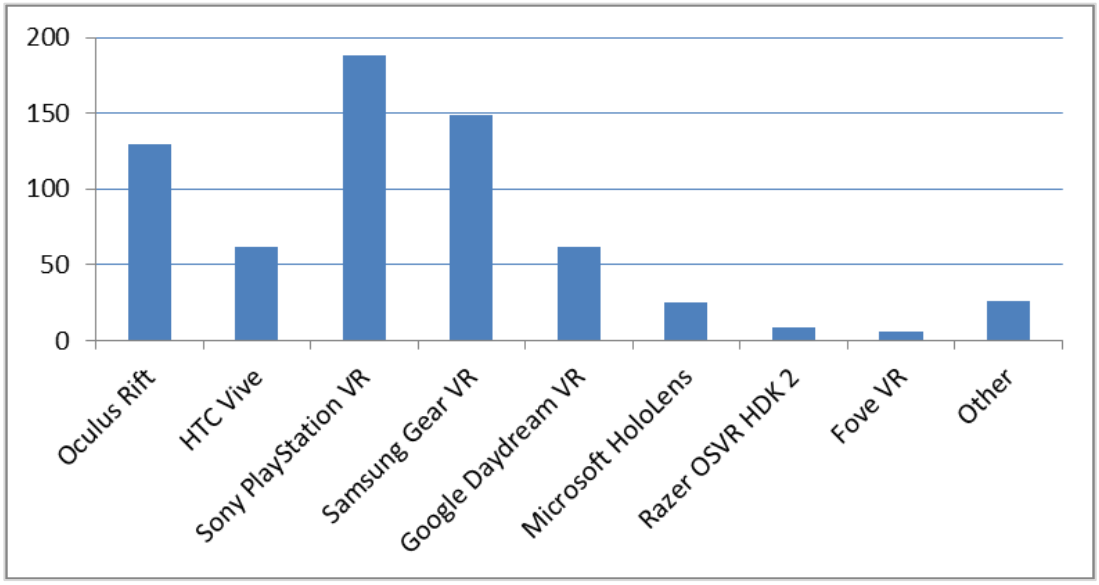


Figure 14: VR Hardware Participants Played With

Most of the participants stated that they have played VR games mostly at home (267). 10 participants claimed that they have played VR games in the office and 36 at the conventions. 83 participants marked "Other" option and provided manually written answers such as: "At a friend's house", "At an art gallery", "At brother's house", "At daughter and son-in law's house", "In a mall", "In a game store", "In a movie theater", "In a store", "At parties" or "At school".

Lastly, the participants were asked which three most VR games they played. As can be seen from the graph in Figure 15, Batman Arkham VR and Minecraft VR were the most played VR games among the participants. After these games, comes the Job Simulator and The Climb. I did not differentiated between the first, second and third written games in terms of importance and included all while calculating the numbers on the graph. Other than that, only the games that are mentioned 10 or more times were included in the graph. The complete list and the game mention frequencies can be observed at APPENDIX B. In 36 of the entries participants stated that they either did not remember or did not know the name of the game that they have played.

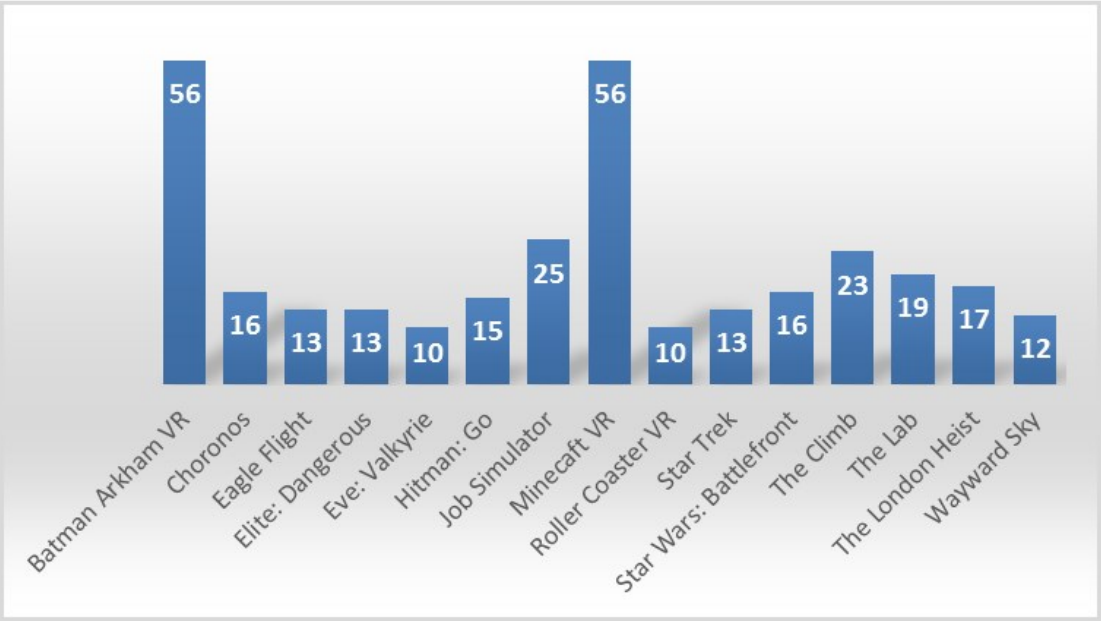


Figure 15: VR Games Played by Participants

3.1.2. Measures

In the survey, before presenting the scales items, first, a consent form is displayed and asked if they voluntarily agree to participate in the study (APPENDIX C). Questions on age, gender, sexual orientation, ethnicity, education level, employment status, yearly income were some of the basic ones that were directed to participants. The questionnaire included questions such as how many years of computer usage experience they had (Venkatesh & Morris, 2000), how many hours a weeks they play video games and for how many years they have been playing video games. Data on prior experience with computers and games were collected as potential control variables since there might be some differences between experienced and inexperienced users on intention (Taylor & Todd, 1995). Related to VR gaming, whether they have ever played a VR game or not (discarded if they have not), what hardware they own, which hardware they have tried before, how many times they have played VR games in total (in hours), where they have played VR games mostly and names of the three VR games they have played are asked.

All of the measures used in the study were adapted from previous studies and were rephrased to fit in to the VR gaming context. All constructs were measured on a 1-7 Likert scale ranging from "strongly agree" to "strongly disagree". Exploratory scales were also added.

Perceived ease of use scale which contains 8 items was used directly from Lowry et al. (2012) since it has already been adapted to the gaming context ($\alpha = 0.917$). Self-determination constructs, autonomy and competence, were measured by the "Player Experience of Need Satisfaction, PENS" which was developed by Ryan et al. (2006). PENS consists of 5 sub-scales that are presence/immersion, relatedness, intuitive

controls, competence and autonomy (Johnson & Gardner, 2010). Among those, competence (3 items, α = 0.887), autonomy (3 items, α = 0.825), intuitive controls (3 items, α = 0.881) and presence (9 items) sub-scales were utilized. Presence had three subscales which were physical presence, emotional presence and narrative presence that have 3 items each (α = 0.904, α = 0.642 and α = 0.809, respectively). I have excluded "relatedness" construct of PENS in this study since it is too much dependent on how the content is presented in the VR games. Concerning flow, the scale GameFlow was used which was developed specifically for the flow concept measurement in gaming context (Sweetser & Wyeth, 2005). I find two of the subscales of GameFlow useful which are immersion (4 items) and concentration (6 items) (α = 0.800 and α = 0.808, respectively). Lastly, for the perceived enjoyment, attitude and intention constructs, the scales from Wang and Scheepers's (2012) study were utilized that are consisting of 3, 3 and 4 items, respectively (α = 0.931, α = 0.900 and α = 0.941, respectively).

I have incorporated additional scales relevant to the literature as exploratory questions. First, I have added Gaming Motivation Scale (Lafrenière, Verner-Filion, & Vallerand, 2012) which is relevant since it is part of the SDT. It consists of 18 items in total where every 3 of them constitutes a sub-scale which are the elements in the internalization continuum: intrinsic, integrated, identified, introjected, external and extrinsic motivations (α = 0.607, α = 0.864, α = 0.810, α = 0.856, α = 0.839 and α = 0.845, respectively). Escapism (4 items), fantasy (4 items) and role projection (4 items) scales were added which are related to imaginal experiences that are "mental activities of imagining things and events that are not perceived as real" as stated by Wu and Holsapple (2014) (α = 0.886, α = 0.826 and α = 0.918, respectively). Usefulness scale is added from two sources where one was from the original TAM article (Davis, 1989) (4 items, α = 0.864) and the other from a game study (Lowry, Gaskin, Twyman, Hammer, & Roberts, 2012) (5 items, α = 0.900). Positive word of mouth (3 items) (Turel, Serenko, & Bontis, 2010) and intention to purchase (2 items) (Van der Heijden, Verhagen, & Creemers, 2003; Dodds, Monroe, & Grewal, 1991) were other scales used in the pertinent literature that were added (α = 0.884 and α = 0.910, respectively). General Attitude towards Technology (Ardies, De Maeyer, & Gijbels, 2013) which consists of 4 sub-scales was added. Interest in technology, tediousness towards technology, consequences of technology and difficultness of technology were the sub-scales and each had 3 items (α = 0.643, α = 0.842, α = 0.715 and α = 0.792, respectively). Lastly, 10 item Big Five Personality Traits (Rammstedt & John, 2007) questionnaire was also added. There were 5 sub-scales (Extraversion, Agreeableness, Conscientiousness, Neuroticism, and Openness) and each of them consisted of 2 items (α = 0.586, α = 0.349, α = 0.552, α = 0.601 and α = 0.247, respectively).

The core scales, additional scales, corresponding items of the scales and their citations are summarized in Table 4, below. The survey took around 15 minutes to finish in total.

Table 4: Scales for VR Gaming Survey

Constructs	Items	Descriptions

Perceived Ease of Use	PEOU1	My interaction with VR games is clear and understandable.	(Lowry, Gaskin, Twyman, Hammer, & Roberts, 2012)
	PEOU2	Interacting with VR games does not require a lot of my mental effort.	
	PEOU3	I find VR games to be trouble free.	
	PEOU4	I find it easy to get VR games to do what I want it to do.	
	PEOU5	Learning to operate VR games is easy for me.	
	PEOU6	It is simple to do what I want with VR games.	
	PEOU7	It is easy for me to become skillful at using VR games.	
	PEOU8	I find VR games easy.	
Perceived Enjoyment	PENJ1	I have fun when I am playing VR games.	(Wang & Scheepers, 2012)
	PENJ2	Playing VR games provides me with a lot of enjoyment.	
	PENJ3	I enjoy playing VR games.	
Attitude	ATT1	I like playing VR games.	(Wang & Scheepers, 2012)
	ATT2	I like the idea of playing VR games.	
	ATT3	I have a positive attitude toward playing VR games.	
Intention to Play	ITP1	I think I will continue to play VR games.	(Wang & Scheepers, 2012)
	ITP2	I plan to play VR games in the future.	
	ITP3	I intend to continue playing VR games.	
	ITP4	I predict I will play VR games in the future.	
Positive Word of Mouth	PWOM1	I would say positive things about VR games to other people.	(Turel, Serenko, & Bontis, 2010)
	PWOM2	I would recommend VR games to someone who wishes to try.	
	PWOM3	I would encourage friends and relatives, who wish to play VR games.	
Gaming Motivation (Intrinsic, Integrated, Identified, Introjected, External, Amotivation)	GAMS-INT1	Because it is stimulating to play.	(Lafrenière, Verner-Filion, & Vallerand, 2012)
	GAMS-INT2	For the pleasure of trying/experiencing new game options.	
	GAMS-INT3	For the feeling of efficacy I experience when I play.	
	GAMS-ING1	Because it is an extension of me.	
	GAMS-ING2	Because it is an integral part of my life.	
	GAMS-ING3	Because it is aligned with my personal values.	
	GAMS-IDF1	Because it is a good way to develop important aspects of myself.	
	GAMS-IDF2	Because it is a good way to develop social and intellectual abilities that are useful to me.	
	GAMS-IDF3	Because it has personal significance to me.	
	GAMS-INJ1	Because I feel that I must play regularly.	
	GAMS-INJ2	Because I must play to feel good about myself.	
	GAMS-INJ3	Because otherwise I would feel bad about myself.	
	GAMS-EXT1	To acquire powerful and rare items and virtual currency or to unlock hidden/restricted elements of the game.	
	GAMS-EXT2	For the prestige of being a good player.	
	GAMS-EXT3	To gain in-game awards and trophies or character/avatar's levels and experiences points.	
	GAMS-AMO1	It is not clear anymore; I sometimes ask myself if it is good for me.	
	GAMS-AMO2	I used to have good reasons, but now I am asking myself if I should continue.	
	GAMS-AMO3	Honestly, I don't know; I have the impression that I'm wasting my time.	

PENS-Autonomy	PENS-A1	VR games provide me with interesting options and choices.	(Ryan, Rigby, & Przybylski, 2006)
	PENS-A2	VR games let you do interesting things.	
	PENS-A3	I experienced a lot of freedom in VR games.	
PENS-Competence	PENS-C1	I feel competent at VR games.	(Ryan, Rigby, & Przybylski, 2006)
	PENS-C2	I feel very capable and effective when playing VR games.	
	PENS-C3	My ability to play VR games is well matched with the game's challenges.	
PENS-Intuitive Controls	PENS-IC1	Learning VR game controls is easy.	(Ryan, Rigby, & Przybylski, 2006)
	PENS-IC2	VR game controls are intuitive.	
	PENS-IC3	When I wanted to do something in VR games, it was easy to remember the corresponding control.	
PENS-Presence (Physical, Emotional, Narrative)	PENS-PHYS1	When playing VR games, I feel transported to another time and place.	(Ryan, Rigby, & Przybylski, 2006)
	PENS-PHYS2	Exploring VR game worlds feels like taking an actual trip to a new place.	
	PENS-PHYS3	When moving through VR game worlds I feel as if I am actually there.	
	PENS-EMO1	I am not impacted emotionally by events in VR games.	
	PENS-EMO2	VR games were emotionally engaging.	
	PENS-EMO3	I experience feelings as deeply in VR games as I have in real life.	
	PENS-NARR1	When playing VR games I feel as if I was part of the story.	
	PENS-NARR2	When I accomplished something in VR games I experienced genuine pride.	
	PENS-NARR3	I had reactions to events and characters in VR games as if they were real.	
GameFlow-Immersion	GF-IMM1	I become unaware of my surroundings while playing VR games.	(Sweetser & Wyeth, 2005)
	GF-IMM2	I temporarily forget worries about everyday life while playing VR games.	
	GF-IMM3	I feel emotionally involved in VR games.	
	GF-IMM4	I feel viscerally involved in VR games.	
GameFlow-Concentration	GF-CONC1	VR Games provide a lot of stimuli from different sources.	(Sweetser & Wyeth, 2005)
	GF-CONC2	VR Games provide stimuli that are worth attending to.	
	GF-CONC3	VR Games quickly grab my attention and maintain my focus throughout the game.	
	GF-CONC4	I am not burdened with tasks that don't feel important in VR games.	
	GF-CONC5	VR Games have a high workload, while still being appropriate for my perceptual, cognitive and memory limits.	
	GF-CONC6	I am not distracted from tasks that I want / need to concentrate on.	
Escapism	ESC1	Playing VR games helps me escape from the world of reality.	(Wu & Holsapple, 2014)
	ESC2	Playing VR games helps me escape from problems and pressures.	
	ESC3	Playing VR games helps me escape from things that are unpleasant and worrisome.	
	ESC4	Playing VR games makes me feel as if I am in a different world of reality.	
Fantasy	FNT1	Playing VR games helps me construct fantasies.	(Wu & Holsapple, 2014)
	FNT2	Playing VR games stimulates my imagination.	
	FNT3	Playing VR games helps me create daydreams.	
	FNT4	Playing VR games helps me augment reality.	
Role Projection	RP1	Playing VR games enables me to project myself into a particular role.	(Wu &

	RP2	Playing VR games enables me to project myself into a particular character.	Holsapple, 2014)
	RP3	Playing VR games enables me to project myself into a particular task.	
	RP4	Playing VR games enables me to project myself into someone else.	
Perceived Usefulness 1	PU11	VR games decreased my stress.	(Lowry, Gaskin, Twyman, Hammer, & Roberts, 2012)
	PU12	VR games helped me better pass time.	
	PU13	VR games provided a useful escape.	
	PU14	VR games helped me think more clearly.	
	PU15	VR games helped me feel rejuvenated.	
Perceived Usefulness 2	PU21	VR makes playing games easier for me.	(Davis, 1989)
	PU22	VR gaming is useful to me.	
	PU23	VR enhances my gaming performance.	
	PU24	VR makes my gaming more effective.	
General Attitude Toward Technology (Interest in Technology, Tediousness towards Technology, Consequences of Technology, Difficultness of Technology)	GATT-IIT1	Technology lessons are important in schools.	(Ardies, De Maeyer, & Gijbels, 2013)
	GATT-IIT2	I am not interested in technology.	
	GATT-IIT3	There should be more education about technology.	
	GATT-TTT1	Most jobs in technology are boring.	
	GATT-TTT2	I think machines are boring.	
	GATT-TTT3	A technological hobby is boring.	
	GATT-COT1	Technology makes everything work better.	
	GATT-COT2	Technology is very important in life.	
	GATT-COT3	Everyone needs technology.	
	GATT-DOT1	You have to be smart to study technology.	
	GATT-DOT2	Technology is only for smart people.	
	GATT-DOT3	To study technology you have to be talented.	
Big-Five Personality (Extraversion, Agreeableness, Conscientiousness, Neuroticism, Openness)	BF-E1	I see myself as someone who is reserved. (R)	(Rammstedt & John, 2007)
	BF-A1	I see myself as someone who is generally trusting.	
	BF-C1	I see myself as someone who tends to be lazy. (R)	
	BF-N1	I see myself as someone who is relaxed, handles stress well. (R)	
	BF-O1	I see myself as someone who has few artistic interests. (R)	
	BF-E2	I see myself as someone who is outgoing, sociable.	
	BF-A2	I see myself as someone who tends to find fault with others. (R)	
	BF-C3	I see myself as someone who does a thorough job.	
	BF-N1	I see myself as someone who gets nervous easily.	
	BF-O2	I see myself as someone who has an active imagination.	
Intention to Purchase	ITPURCH1	It is likely that I will purchase virtual reality headset/equipment in the future.	(Van der Heijden, Verhagen, & Creemers, 2003)
	ITPURCH2	I am willing to buy virtual reality headset/equipment.	(Dodds, Monroe, & Grewal, 1991)

R : Reversed Item

3.1.3. Procedure

To test the research model, an online survey was prepared using Qualtrics and the data collection is conducted via MTurk. First, the participants were faced with a consent form (APPENDIX C). After agreeing the terms of participation, they have completed the questionnaires. After finishing the survey, they have a given an MTurk code to be paid. Each participant was rewarded with 30 cents.

3.2. Results

This part consists of the results gathered from the data collected. First, I have screened data for abrupt or missing values. Required changes have been made. Then, I have conducted some preliminary analysis concerning the validities and reliabilities. After that, primary analysis is presented. Lastly, the results of the analyses were discussed.

3.2.1. Data Screening

Once the data collection was over, I have a carried out a data screening that would remove the unwanted data entries and fix the peculiar ones. In total there were 626 entries at the end of the data collection session. First, the ones that have no MTurk code were discarded. Those included participants that have never played a VR before and hence could not access the content of the survey, as desired. Once those are discarded, 473 entries left. After that, I inspected the missing data. Participants who have a progression of less than 90% were discarded and 400 participants have left. Then, I have checked the overall standard deviation of all scales of participants and found out that 3 of them were 0 which means that they have marked the same option for all items in the whole survey. After discarding the unengaged participants, 397 of them have been left. In terms of outliers, there were none concerning the age. There was one value (129) in the question asking the hours of play in a week, which was clearly an outlier. I have corrected it to the mean score of that question. Also, a participant claimed that the she has been playing video games for 50 years whereas her age was 23. That was clearly a mistake. I have corrected the years of play to the mean score of that question. There were no outliers in the question asking the computer usage in years. There was one participant stated that the hours she has spent with VR games was 20000 which was a strong outlier. That participant was discarded. Finally, there were no outliers in the question asking how many times the participants played a VR game.

There were some erroneous entries in fields that require numeric values, since I have not restricted non-numeric kinds of entries in the first place. Some of the participants answered the questions that require a pure numeric number as an interval. For instance, a question asking the video game play hours on a week were answered as “5-10” which obviously cannot go in a statistical analysis. Therefore I have corrected these kinds of

instances as taking the average (7.5 in this case) of the answer and rounding it up (8). Another similar respond was "60+" probably meaning "more than" the given number. In those cases (there were only two), I have just deleted the plus sign and saved the value (60 in this case). Some of the participants also answered the questions asking the video game play years, years using computers or hours spent with VR games as "over 10" or "10 years". I have also discarded the string value and just saved the number value. There were one "very good and nice" and one "a great deal" answer for numeric questions. I also have changed them to the mean of their respected questions.

Then I have checked the missing data values of individual participants. Since the overall missing values were less than 5% no multiple imputations was applied. I have filled them with mean or median depending whether they were continuous (age and times VR game played) or categorical (ethnicity, education level and employment status) variables, respectively. Then, I have looked at the kurtosis and skewness values of all numerical data. As for the kurtosis, values between 2 and -2 are acceptable and non-problematic (George & Mallery, 2010). Only abnormal value was at the question which was asking hours spent on VR games (61.69). The reason for this was that some of the frequencies of some numbers were too high (for instance, 52 of the participants stated that they have played 2 hours of VR games). Inspecting the skewness, same question was problematic (7.36) which means that the variance in distribution was too much (the range of VR game play hours varying from 1 to 1550). This was because some participants played VR games much more than the others and it was expected. Therefore, no further action was taken.

Lastly, I have carried out the scoring: The final scores were computed by taking the average of all the items corresponding to the related scale.

3.2.2. Preliminary Analysis

First, I have checked if age and gender were associated with the core constructs of the study. For age, most of the correlations were non-significant and none of the r value was more than 0.2. This means that the relationships that were significant showed very weak correlations. Specifically, age was correlated with perceived ease of use ($r = -0.17$, $p < 0.01$) and competence ($r = -0.19$, $p < 0.01$) suggesting that as VR players get older they may have more difficulty in getting used to the game controls and hence may feel less competent. As for gender, independent t-test analysis showed that males ($M = 4.96$, $SD = 1.01$) rated perceived ease of use more than females ($M = 4.69$, $SD = 1.19$), $t(394) = 2.41$, $p = 0.02$. This suggested that males found VR games easier to use than female VR players. There was no other significant relationship between age/gender and core constructs of the study.

Then, I have checked the reliability of the scales. All of the Cronbach's alpha values of the main constructs were well above 0.7, which meant that they were internally consistent and reliable (Nunnally, 1978). Table 5 shows all of the alpha values of scales used in the study, main and exploratory ones. Mainly, the values below 0.6 are the

personality scales (Big-Five) that were added as exploratory questions which were the shortened versions of their original scales. They were not included in my research framework and therefore were not used in this thesis study.

Table 5: Reliability of Scales

	Cronbach's Alpha (α)
PEOU	0.917
PENJ	0.931
ATT	0.900
ITP	0.941
PWoM	0.884
GAMS-INT	0.607
GAMS-ING	0.864
GAMS-IDF	0.810
GAMS-INJ	0.856
GAMS-EXT	0.839
GAMS-AMO	0.845
GAMS ALL	0.924
PENS-A	0.825
PENS-C	0.887
PENS-IC	0.881
PENS-PHYS	0.904
PENS-EMO	0.642
PENS-NARR	0.809
GF-IMM	0.800
GF-CONC	0.808
ESC	0.886
FNT	0.826
RP	0.918
PU1	0.864
PU2	0.900
ITPURCH	0.910
GATT-IIT	0.643
GATT-TTT	0.842
GATT-COT	0.715
GATT-DOT	0.792
BF-E	0.586
BF-A	0.349
BF-C	0.552
BF-N	0.601

BF-O	0.247

Correlations between the main constructs showed strong significance between every pair of constructs. Pearson values, means and standard deviations of the main constructs can be seen in Table 6.

Table 6: Correlations of Main Constructs

	PEOU	PENS-C	PENS-A	GF-IMM	GF-CONC	PENJ	ATT	ITP
PEOU	-							
PENS-C	0.757*	-						
PENS-A	0.550*	0.691*	-					
GF-IMM	0.319*	0.377*	0.467*	-				
GF-CONC	0.444*	0.495*	0.630*	0.527*	-			
PENJ	0.562*	0.682*	0.760*	0.445*	0.607*	-		
ATT	0.528*	0.623*	0.731*	0.398*	0.585*	0.879*	-	
ITP	0.442*	0.605*	0.688*	0.415*	0.533*	0.849*	0.866*	-
Mean	4.82	5.14	5.57	4.81	5.07	5.80	5.84	5.77
SD	1.11	1.20	1.03	1.20	0.91	1.08	1.06	1.16

* : $p < 0.001$

3.2.3. Primary Analysis

The factor structure of the model was examined by carrying out confirmatory factor analysis using SPSS AMOS software. For the goodness of fit, I have computed the root mean square of approximation (RMSEA) where values below 0.06 indicate good fit (Hu & Bentler, 1999). Also, the values of comparative fit index (CFI) and Tucker-Lewis index (TLI) close to 0.95 indicate good fit (Byrne, 2016). The confirmatory factor analysis showed good fit ($\chi 2$ (499) = 1177.4, $p < 0.001$, RMSEA = 0.059, CFI = 0.94, TLI = 0.93) which therefore indicated that measurement model achieved the construct validity. The factor loadings of the scale items are provided in Table 7 and Figure 16.

Table 7: Factor Loadings of Scale Items

	PEOU	PENJ	ATT	ITP	AUT	COMP	GF-IMM	GF-CONC
My interaction with VR games is clear and understandable.	0.82							
Interacting with VR games does not require a lot of my mental effort.	0.56							
I find VR games to be trouble free.	0.76							
I find it easy to get VR games to do what I want it to do.	0.83							
Learning to operate VR games is easy for me.	0.82							
It is simple to do what I want with VR games.	0.80							

It is easy for me to become skillful at using VR games.	0.80						
I find VR games easy.	0.74						
I have fun when I am playing VR games.		0.90					
Playing VR games provides me with a lot of enjoyment.		0.91					
I enjoy playing VR games.		0.91					
I like playing VR games.			0.90				
I like the idea of playing VR games.			0.83				
I have a positive attitude toward playing VR games.			0.87				
I think I will continue to play VR games.				0.90			
I plan to play VR games in the future.				0.91			
I intend to continue playing VR games.				0.92			
I predict I will play VR games in the future.				0.85			
VR games provide me with interesting options and choices.					0.83		
VR games let you do interesting things.					0.77		
I experienced a lot of freedom in VR games.					0.77		
I feel competent at VR games.						0.88	
I feel very capable and effective when playing VR games.						0.88	
My ability to play VR games is well matched with the game's challenges.						0.80	
I become unaware of my surroundings while playing VR games.							0.58
I temporarily forget worries about everyday life while playing VR games.							0.65
I feel emotionally involved in VR games.							0.76
I feel viscerally involved in VR games.							0.82
VR Games provide a lot of stimuli from different sources.							0.78
VR Games provide stimuli that are worth attending to.							0.81
VR Games quickly grab my attention and maintain my focus throughout the game.							0.79
I am not burdened with tasks that don't feel important in VR games.							0.45
VR Games have a high workload, while still being appropriate for my perceptual, cognitive and memory limits.							0.64
I am not distracted from tasks that I want / need to concentrate on.							0.38

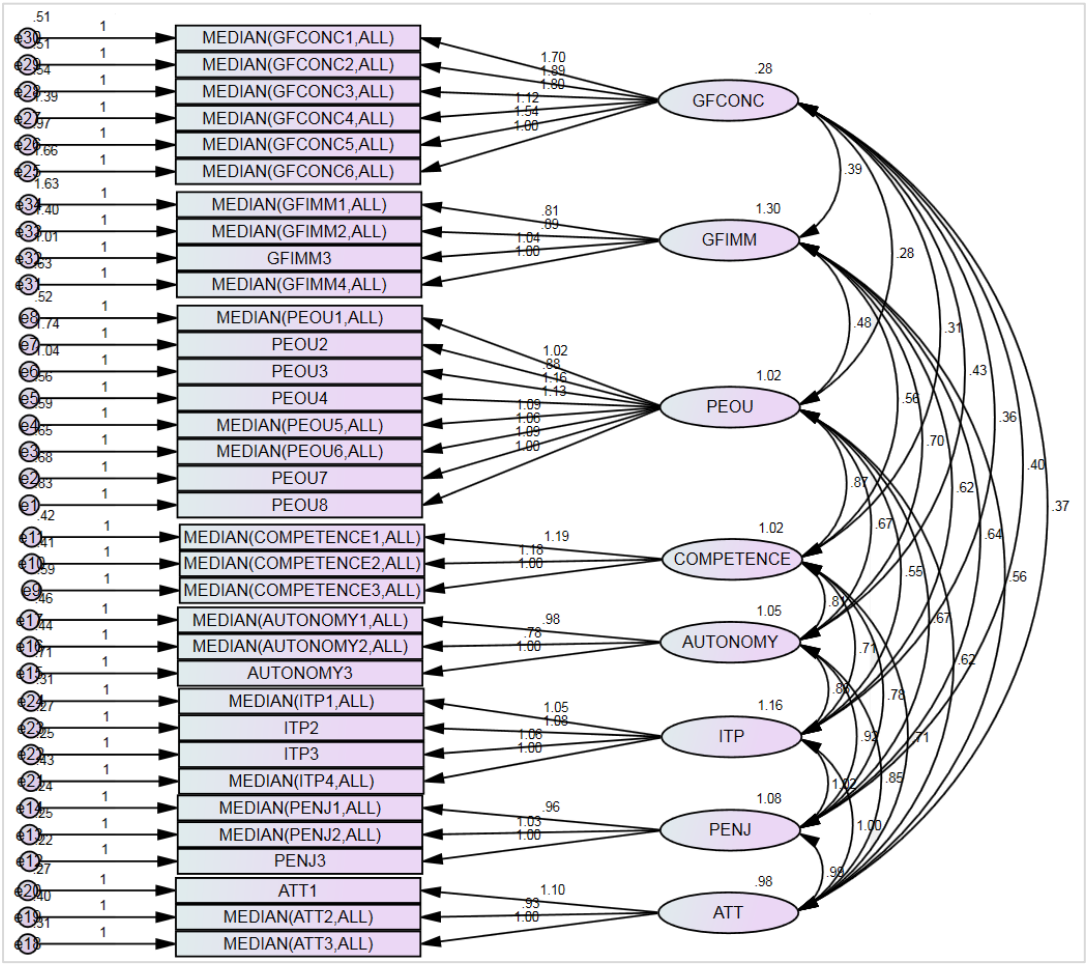


Figure 16: Measurement Model of VR Gaming Player Acceptance

Then, I have calculated the AVE (average variance extracted) and CR (composite reliability) values for each construct. As can be seen from Table 8, all of the CR values were above the threshold level 0.7 and all of the AVE values were above the threshold value of 0.50 (Fornell & Larcker, 1981) however only the AVE value of GF-CONC construct was 0.44. One solution to this was to discard the least loading item of this construct which would improve the value of AVE. However, the value was only slightly less than 0.5. More importantly, if the value of AVE is less than 0.5 but its CR is above 0.6 then the validity is still adequate (Huang, Wang, Wu, & Wang, 2013). The CR for the aforementioned construct was 0.82 therefore the convergent validity of the model was ensured.

Table 8: Average Variance Extracted and Composite Reliability Values

	AVE	CR	sqrt(AVE)
ATT	0.75	0.90	0.87
PENJ	0.82	0.93	0.91

ITP	0.80	0.94	0.90
PENS-A	0.62	0.83	0.79
PENS-C	0.68	0.87	0.83
PEOU	0.59	0.92	0.77
GF-IMM	0.50	0.80	0.71
GF-CONC	0.44	0.82	0.66

When using well-established scales from the literature, discriminant validity is less of a concern. Nevertheless, I have checked it. According to Hair et al. (2014), the square-root value of AVE of a construct should be more than its correlation values with other constructs. Calculating the square roots of AVEs and comparing them with correlations, it was seen that all of them ensured the criteria.

After checking for reliabilities and validities, I have conducted path analysis to test my model. In terms of fit statistics, CFI and TLI are frequently used when reporting the results of path analyses. They are in the range of 0 to 1 and values above 0.90 indicates a good fit (Cheung & Rensvold, 2002). Also, the root mean square of approximation (RMSEA) was reported for path analysis which indicates an acceptable fit for values less than 0.08 (MacCallum, Browne, & Sugawara, 1996). After dropping the non-significant paths from the model, the results showed acceptable fit (Figure 17); $\chi 2\ (16) = 55.66$, $p < 0.001$, RMSEA = 0.079, CFI = 0.99, TLI = 0.97. In general, the results showed that perceived ease of use predicted perceived autonomy and perceived competence where perceived autonomy predicted flow as well as enjoyment. Perceived competence predicted enjoyment and enjoyment was an antecedent of attitude and intention to play. These results were in line with the developed hypotheses.

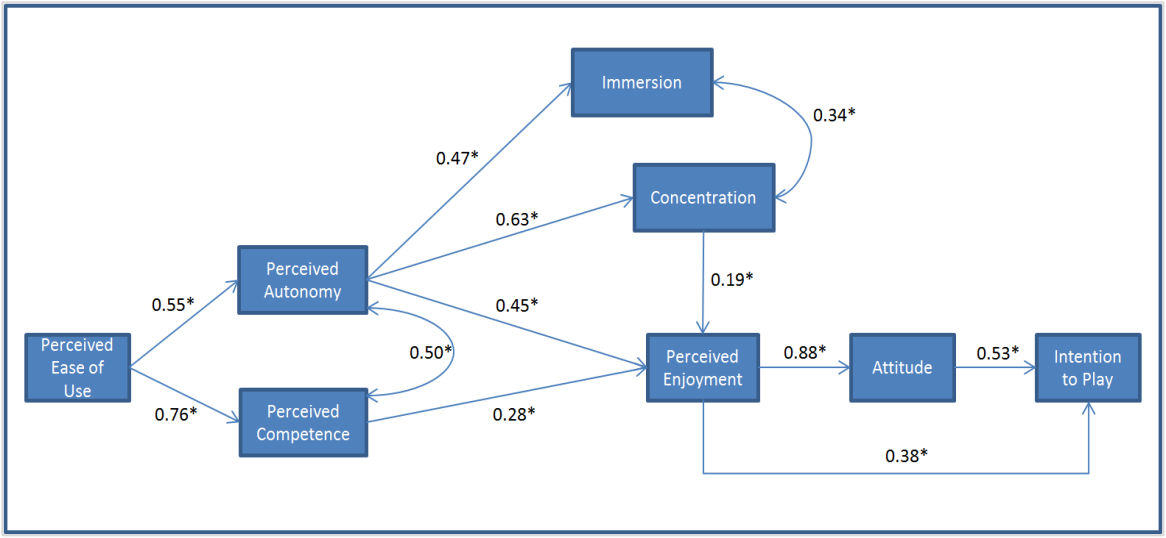


Figure 17: Structural Model of VR Gaming Player Acceptance

3.2.4. Discussion

In this survey study, I have used technology acceptance model, self-determination theory and flow theory constructs to come up with a unified motivational model for video gaming and tested it in the virtual reality gaming domain. Results showed that perceived ease of use was the determinant of autonomy and competence which means that a given game's controls should be relatively easier to be able to create a feeling of mastery and self-rule. Players should not have to struggle with the use of the game controls, they should be given frictionless interfaces so that they can easily transfer their intentions to actions, otherwise their feelings of competency and autonomy decreases. Therefore, intuitive and effortless game controls are a prerequisite as can be seen in the model. Perceived autonomy predicts immersion and concentration that are constructs of flow, which means that flow state can only be achieved by players who feel that they are autonomous in their actions. This suggests that autonomy is the main construct that creates the association of self-determination and flow. Autonomy, competence and concentration predicted game enjoyment together. This suggests that creating opportunities for players to feel autonomous, competent and also affording player concentration results in enjoyment. This is crucial since, as my model suggests, perceived enjoyment predicts both attitude of the players and their intentions to play again.

We can see that perceived ease of use did not predict intention to play or attitude directly, since players do not generally play virtual reality games because the controls are easy. Instead they tend to play a virtual reality game that is easy to control because it helps them to go into flow or experience competency or autonomy easier.

An unexpected finding was that perceived competence has not correlated with flow constructs, which might be because of the fact that the other self-determination construct -autonomy- significantly predicted them.

The method used in the study was path analysis which gave us correlational results. The causalities of the relationships of variables were theory-based, therefore experimental studies should complement the present study to better explain the associations between constructs. In addition to this, future studies should seek out to reveal what system characteristics determine the perceived ease of use, SDT constructs and flow theory constructs. Some of the system characteristic examples are given in the literature as objective usability of the system (Venkatesh, 2000), interactivity of the system (Merikivi, Nguyen, & Tuunainen, 2016), appeal and visual aesthetic of the system (Merikivi, Nguyen, & Tuunainen, 2016), novelty of the system (Merikivi, Nguyen, & Tuunainen, 2016), curiosity that the system invokes (Hechler, Born, & Kroenung, 2016), technical and interaction quality of the system (Lin & Bhattacherjee, 2010), information and service quality of the system (Ahn, Ryu, & Han, 2007) and so on.

There might be several threats to validity in studies that may affect the outcome (Creswell & Creswell, 2017) and there are at least three threats to external validity in the

presented study. First, since the questionnaire was limited to US citizens, participant pool was not diverse in terms of nationality. This limits the generalizability of the study however this can be overcome in future studies by true random sampling. Second, the nature of the study was cross-sectional which means that the measurements were time-bound and taken only one time like a snapshot. Future studies may involve repeated measure design to address this issue. Third, the participants were paid to participate in the study which might had an effect on their participation behavior. There is debate on how money compensation may affect the participant answers. Although it may reduce random responses, there is also no relationship between pay rates and quality of the data (Paolacci & Chandler, 2014). To be able to completely rule out this threat, future studies may use voluntary participants.

VR environments in general have motivational and volitional effects on users and players (Harris & Reid, 2005). The survey presented here might explain the motivation and acceptance of virtual reality players however, longitudinal studies in other gaming contexts should be carried out as well to be able to see if the model also holds for repeated / continuous play. To be able to address this issue, I have carried out a diary study.

CHAPTER 4

STUDY 2: PERVASIVE GAMING DIARY STUDY

To be able to better understand the game acceptance I wanted to test the hypotheses in a different gaming environment and with a different methodology. Therefore, the second study was selected to be a diary study in pervasive gaming context. Diary study is a research method that is used to collect repeated data from participants about their activities and experiences over time. It is named after the tradition of people that jot down attitudes and feelings as private notes every day (Iida, Shrout, Laurenceau, & Bolger, 2012). In scientific contexts, it has become more systematic and structured and used to be referred as the experience sampling method. One of the advantages of this method is that it gives insight into how people change over time and how individual differences are related to this. Also, it makes way for advanced statistical analyses such as multilevel analysis. It is known that ecological validity is a common concern in social sciences. Diary studies overcome this by allowing participants to submit data in their own environment and sometimes in their own convenience (Stanford HCI Group, 2007). Diary studies were shown to be useful in video games research. Main advantage of the methodology is that it might give insight into how a real user interacts with and perceives the game "in the wild" (Kobayashi & Iloreta, 2013). It was also shown that it creates rich and actionable data for AAA games research as well (Hillman, Stach, Procyk, & Zammitto, 2016).

Pervasive games are defined as the games that have spatial, temporal and social aspects (Montola, Strenros, & Waern, 2009). By spatial, it is meant that the game can be played anywhere on earth and is geographically expandable. Temporal aspect implies that the game may be played anytime by the players and the game world is persistence in the sense that the game continues even the players are not actively playing it. Social means that the players are interconnected and can interact with each other by design. They are also known as the games that blend everyday activities into gaming activities (Karpashevich, Hornecker, Dankwa, Hanafy, & Fietkau, 2016). Digital pervasive games are sometimes called synonymously as augmented reality games, mixed reality games or transgressive games. The best fundamental and non-digital example to this kind of genre might be "The Game" in which all people on earth play this game and whenever one thinks about "The Game" itself loses and should announce the loose (Boyle, 2007).

According to its definition, it is a game where all the players in the world are playing it even without noticing (spatiality), the game goes on even if they do not realize it (temporality) and it is socially expandable (sociality). Digital pervasive games on the other hand have the same three properties as the analog ones but they also utilize smart phones, location based services, internet of things and virtually any emerging technology. They tend to have mixed/augmented reality aspects that incorporate both real world and virtual world elements (Hinske, Lampe, Magerkurth, & Röcker, 2007). Some of the earlier examples of digital pervasive games are "Can You See Me Now?" (Anastasi, et al., 2002), "Uncle Roy Around you" (Benford, et al., 2004) and "Day of the Figurines" (Flintham, Giannachi, Benford, & Adams, 2007). These games are relatively new with respect to traditional video gaming and inspecting the acceptance of and motivation for pervasive gaming is relevant and timely. The most prominent contemporary versions of pervasive games that use pervasive computing technologies are Ingress (Niantic, Ingress [Mobile Game], 2013) and Pokémon Go (Niantic, 2016). Although, Pokémon Go was a more recent game and the more famous one, I have chosen to carry out the diary study with Ingress (https://fevgames-public.s3.amazonaws.com/uploads/2016/03/google-game-ingress-gameplay.jpg

Figure 18) since I wanted to minimize the occurrences that a participant has already played the game and have some idea about it. I wanted participants to experience the game first time in the wild since I am investigating the "acceptance".

https://fevgames-public.s3.amazonaws.com/uploads/2016/03/google-game-ingress-gameplay.jpg

Figure 18: Three Snapshots from Ingress Game

Ingress is a pervasive game developed by Niantic which is a spinoff company from Google. The game can be played on Android and iOS supported devices. The story of the game is that the statues in the real world contain some unknown energy and a matter called exotic matter is leaking into the world and an allegedly an alien race called Shapers are behind all this. The players assume the role of an agent of one of the two factions. First one is the "Enlightened" who want Shapers to infiltrate the world and who believe that this unknown race will bring enlightenment to humanity. The second one is the "Resistance" who fight to save the world from Shapers since they think that Shaper invasion would be the end of the world. Players try to capture the designated locations in the real world (portals) or recapture from the opponent faction. For that they can hack the neutral or enemy portals, create links between friend portals to strengthen them and also accumulate resource to carry out these actions. Therefore the game requires players to be active out in the real world instead of sitting in front of a screen.

Apart from being able to collect longitudinal data, another motivation for choosing the pervasive gaming context is that it is one of the best ways to ensure ecological validity since participants would be playing the game outside at their own leisure (Gordon, 2015).

4.1. Method

In this section, the methodology of the diary study is explained. The details of the participants, scales used in the study and the procedure that was carried out are stated.

4.1.1. Participants

For the diary study, undergraduate students from Middle East Technical University (METU) were recruited and they were compensated for bonus points in their psychology classes. In total, 49 students were participated (29 female and 20 male). The age of the participants ranged from 18 to 27 with a mean of 21.12 and standard deviation of 1.88. Students from social sciences and engineering departments constituted the majority of participants (18 and 16 respectively). Rest of them was from economics (9), physical sciences (4) and education (2) departments. 34 of the participants reported that they play video games regularly. 25 of them reported that they were playing more than 7 years. Also, 26 of them stated that they were playing video games less than 5 hours a week. 33 of the total participants stated that they were using Android in their smart phones and 16 of them were using iOS. The average walking time in a day of the participants ranged from 1 to 270 minutes ($M = 61.18$, $SD = 48.16$).

None of the participants had played Ingress before. I have also asked if they have played Pokémon Go, another popular pervasive game, to see if they are familiar with the genre. 27 of the participants stated that they have never played Pokémon Go before. The rest of the participants (22) stated that they had experience with Pokémon Go at least once. Among them, 18 of them reported that they have 1 month or less experience with the

game. Only one participant stated that she still plays Pokémon Go, however she also stated that she opens the game once in a month. Therefore, participants, as a group, had low familiarity with the pervasive gaming genre in general.

Participants completed 607 of the 686 possible entries. The maximum percentage of entry completed was on the 1st day as 100% and the minimum percentage of entry was on the 11th day by 73%. The breakdown of percentages of entries completed by day can be seen in Figure 19.

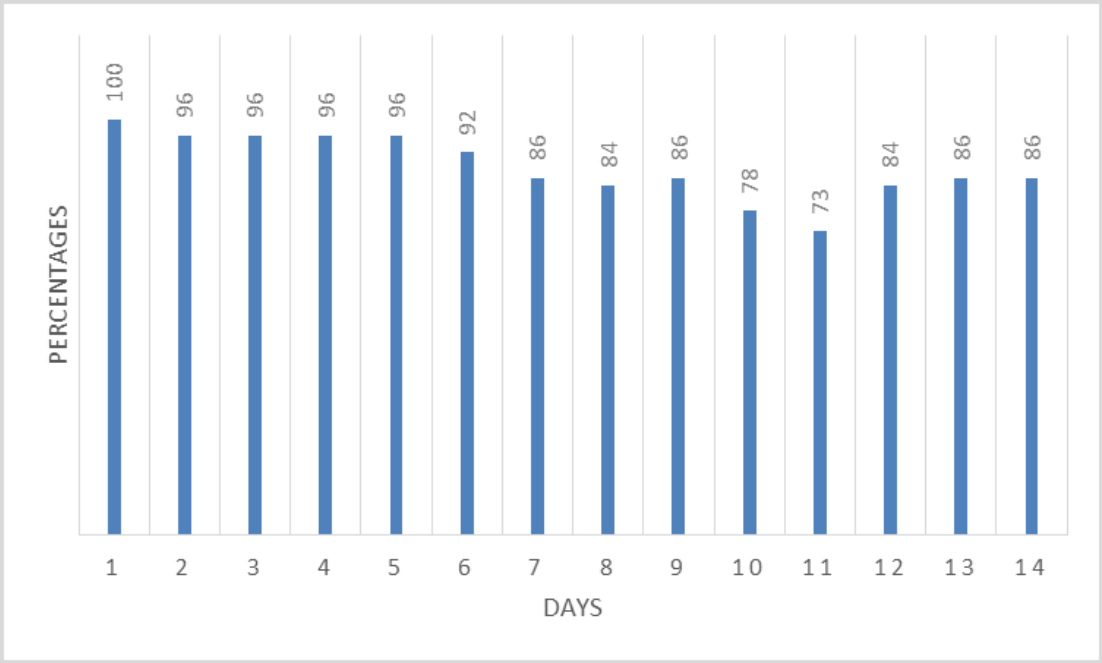


Figure 19: Percentage of Complete Entries in 14 Days

4.1.2. Measures

The measures were distributed to the participants in three batches, therefore in this sub-section, measures are inspected in three sub-sections: Starting questionnaire, Everyday Questionnaire (Diary Study) and Ending Questionnaire. Participants rated the items on a 1 (strongly disagree) to 7 (strongly agree) in all of the below mentioned scales.

4.1.2.1. Starting Questionnaire

The starting questionnaire was distributed online to be filled only once after the briefing has been carried out and before the diary study started. It asked about the nick name selected for the game, demographics such as age, gender, faculty of the participants, the frequency of general video game play and mobile operating system that they use. Other than these basic questions, participants were also asked how many minutes they walked daily on average to be able to see at the end of the study whether they have changed their walking habits or not. Also, since Pokémon Go (Niantic, 2016) is another popular

pervasive game, the participants were asked if they ever played Pokémon Go. If they did, it was also asked for how long and whether they were still playing or not. This was done to discard active pervasive game players and to ensure all the players were somewhat less familiar to the genre. Then, these scales were followed: Self-Control Scale, Mindfulness Scale, General Attitude towards Technology Scale, Big Five Personality Scale and International Physical Activity Questionnaire. Self-Control and Mindfulness Scales were added to be used in another study. General Attitude towards Technology Scale was added as a potential control scale to see if the attitude of the participant towards technology affected the results. Big Five Personality Scale was added as an exploratory scale. Finally, International Physical Activity Questionnaire (Booth, et al., 2003) was added to measure the regular physical activity of participants to be able to compare the participant's physical activity level before they started to play the game and their physical activity levels after the study (Same questionnaire was also directed to the participants at the end of the study.). This scale was added since research showed that mobile augmented reality games may increase physical activity levels of players (Wong, 2017; Monroe, Thompson, Bassett Jr, Fitzhugh, & Raynor, 2015). The questionnaire asked 4 questions: During the last 7 days, how many days did you carry out moderate physical activities that make you breathe somewhat harder than normal for at least 10 minutes? How much time did you spend doing these activities on average on one of those days? During the last 7 days, how many days did you walk for at least 10 minutes? How much time did you spend walking on average on one of those days?

The scales' items are summarized in Table 9.

Table 9: Scales of Pervasive Gaming Starting Questionnaire

Constructs	Items	Descriptions	
Self-Control	SC1	I am good at resisting temptation.	Tangney et al. (2004)
	SC2	I have a hard time breaking bad habits. (R)	
	SC3	I am lazy. (R)	
	SC4	I say inappropriate things. (R)	
	SC5	I do certain things that are bad for me, if they are fun. (R)	
	SC6	I refuse things that are bad for me.	
	SC7	I wish I had more self-discipline. (R)	
	SC8	People would say that I have iron self- discipline.	
	SC9	Pleasure and fun sometimes keep me from getting work done. (R)	
	SC10	I have trouble concentrating. (R)	
	SC11	I am able to work effectively toward long-term goals.	
	SC12	Sometimes I can't stop myself from doing something, even if I kow it is wrong. (R)	
	SC13	I often act without thinking through all the alternatives. (R)	
Mindfulness	MIND1	I could be experiencing some emotion and not be conscious of it until some time later.	Brown and Ryan (2003)
	MIND2	I break or spill things because of carelessness, not paying attention, or thinking of something else.	
	MIND3	I find it difficult to stay focused on what's happening in the present.	

	MIND4	I tend to walk quickly to get where I'm going without paying attention to what I experience along the way	
	MIND5	I tend not to notice feelings of physical tension or discomfort until they really grab my attention.	
	MIND6	I forget a person's name almost as soon as I've been told it for the first time.	
	MIND7	It seems I am "running on automatic" without much awareness of what I'm doing.	
	MIND8	I rush through activities without being really attentive to them.	
	MIND9	I get so focused on the goal I want to achieve that I lose touch with what I am doing right now to get there.	
	MIND10	I do jobs or tasks automatically, without being aware of what I'm doing.	
	MIND11	I find myself listening to someone with one ear, doing something else at the same time.	
	MIND12	I drive places on "automatic pilot" and then wonder why I went there.	
	MIND13	I find myself preoccupied with the future or the past.	
	MIND14	I find myself doing things without paying attention.	
	MIND15	I snack without being aware that I'm eating.	
General Attitude Toward Technology (Interest in Technology, Tediousness towards Technology, Consequences of Technology, Difficultness of Technology)	GATT-IIT1	Technology lessons are important in schools.	Ardies et al. (2013)
	GATT-IIT2	I am not interested in technology.	
	GATT-IIT3	There should be more education about technology.	
	GATT-TTT1	Most jobs in technology are boring.	
	GATT-TTT2	I think machines are boring.	
	GATT-TTT3	A technological hobby is boring.	
	GATT-COT1	Technology makes everything work better.	
	GATT-COT2	Technology is very important in life.	
	GATT-COT3	Everyone needs technology.	
	GATT-DOT1	You have to be smart to study technology.	
	GATT-DOT2	Technology is only for smart people.	
	GATT-DOF3	To study technology you have to be talented.	
Big-Five Personality (Extraversion, Agreeableness, Conscientiousness, Neuroticism, Openness)	BF-E1	I see myself as someone who is reserved. (R)	Rammstedt and John (2007)
	BF-A1	I see myself as someone who is generally trusting.	
	BF-C1	I see myself as someone who tends to be lazy. (R)	
	BF-N1	I see myself as someone who is relaxed, handles stress well. (R)	
	BF-O1	I see myself as someone who has few artistic interests. (R)	
	BF-E2	I see myself as someone who is outgoing, sociable.	
	BF-A2	I see myself as someone who tends to find fault with others. (R)	
	BF-C3	I see myself as someone who does a thorough job.	
	BF-N1	I see myself as someone who gets nervous easily.	
	BF-O2	I see myself as someone who has an active imagination.	
International Physical Activity Questionnaire	IPAQ1	Think about the activities which take moderate physical effort that you did in the last 7 days. Moderate physical acticities make you breathe somewhat harder than normal. During the last 7 days, on how many days did you do moderate physical activities (such as carrying light loads, bicycling at a regular pace)? _____ days per week.	Booth et al. (2003)

	IPAQ2	How much time did you usually spend doing moderate physical activities on one of those days? _____ hours per day.
		Think about the time you spent walking in the last 7 days. This includes at work and at home, walking to travel from place to place, and any other walking that that yiou might do solely for recreation, sport, exercise or leisure.
	IPAQ3	During the last 7 days, on how many days did you walk for at least 10 minutes at a time? _____ days per week.
	IPAQ4	How much time did you usually spend walking on one of those days? _____ hours per day.

(R) = Reversed Item

4.1.2.2. Everyday Questionnaire (Diary Study)

Participants filled this questionnaire that takes around 5 minutes every night for fourteen (14) days. First, the questionnaire asked the nickname of the participant. Then for that day, it asked how many minutes the game play time is, how many times has been played, approximately how many meters walked and how many hours of time spent sitting. After these questions, the main body part of the questionnaire started. Here, smaller versions of scales of the core constructs and additional exploratory questions were asked. The everyday diary questionnaire was essentially prepared based on the previous study on virtual reality gaming. One or two most representative questions from the original scales have been selected and added back to back forming the main body part of the everyday questionnaire (Table 11). Some constructs were operationalized by single item only on purpose to keep the questionnaire at a reasonable length. The use of single item measurements in longitudinal studies is recommended in the literature for making the participation to the study less burdensome for participants (Drolet & Morrison, 2001; Nagy, 2002; Wanous, Reichers, & Hudy, 1997).

For perceived ease of use I have used 2 items out of 8 items from the original scale used in Lowry et al. (2012). Perceived enjoyment, attitude and intention to play constructs contained 2 items as well, where they have originally had 3, 3 and 4 items (Wang & Scheepers, 2012). Autonomy and competence contained 2 items out of 3 items (Ryan, Rigby, & Przybylski, 2006). Lastly, the flow construct that consisted of immersion and concentration contained 1 item each from the original scale that had 4 and 6 items. Ranges of daily Cronbach's alpha values across 14 days for these scales are presented in Table 10.

Table 10: Ranges of Cronbach's Alpha Values of Core Scales across 14 Days

	Ranges of Cronbach's Alphas (α)
PEOU	0.823-0.972
PENJ	0.913-0.985
ATT	0.903-0.989
ITP	0.945-0.993

PENS-A	0.814-0.965
PENS-C	0.914-0.987
Flow	0.715-0.891

Other than these, exploratory scales were included which may be of relevance according to the literature. Positive word of mouth construct was one of them that contained 1 item from the original scale of 3 items (Turel, Serenko, & Bontis, 2010). Intuitive controls and PENS-Presence items were included as 1 item questions from 3 itemed scales (Ryan, Rigby, & Przybylski, 2006). I have also included 1 item for escapism, fantasy and role projection constructs which had 3 items originally (Wu & Holsapple, 2014). Lastly, two perceived usefulness questions were added which were originally 5 and 4 itemed scales respectively (Lowry, Gaskin, Twyman, Hammer, & Roberts, 2012; Davis, 1989).

Table 11: Scales of Core Constructs of Pervasive Gaming Study

Constructs	**Descriptions**	
Perceived Ease of Use	My interaction with this game was clear and understandable. It was simple to do what I want with the game.	(Lowry, Gaskin, Twyman, Hammer, & Roberts, 2012)
Perceived Enjoyment	Playing this game provided me with a lot of enjoyment. I had fun when I am playing the game.	(Wang & Scheepers, 2012)
Attitude	I had a positive attitude toward playing this game. I liked the idea of playing the game.	(Wang & Scheepers, 2012)
Intention to Play	I plan to play this game in the future. I think I will continue to play the game.	(Wang & Scheepers, 2012)
Positive Word of Mouth	I would recommend this game to someone who wishes to try.	(Turel, Serenko, & Bontis, 2010)
PENS-Autonomy	This game provided me with interesting options and choices. This game let me do interesting things.	(Ryan, Rigby, & Przybylski, 2006)
PENS-Competence	I felt competent at this games. I felt very capable and effective when playing this game.	(Ryan, Rigby, & Przybylski, 2006)
PENS-Relatedness	I didn't feel close to other players. (R) I found the relationships in this game important.	(Ryan, Rigby, & Przybylski, 2006)
PENS-Intuitive Controls	Game's controls were intuitive.	(Ryan, Rigby, & Przybylski, 2006)
PENS-Presence-Physical	Exploring this game world felt like taking an actual trip to a new place.	(Ryan, Rigby, & Przybylski, 2006)
PENS-Presence-Emotional	The game was emotionally engaging.	(Ryan, Rigby, & Przybylski, 2006)
PENS-Presence-Narrative	I had reactions to events and characters in this game as if they were real.	(Ryan, Rigby, & Przybylski, 2006)
GameFlow-Immersion	I became unaware of my surroundings while playing this game.	(Sweetser & Wyeth, 2005)
GameFlow-Concentration	This game quickly grabbed my attention and maintained my focus throughout the game.	(Sweetser & Wyeth, 2005)
Escapism	Playing this game helped me escape from the world of reality.	(Wu & Holsapple, 2014)

Fantasy	Playing this game stimulated my imagination.	(Wu & Holsapple, 2014)
Role Projection	Playing this game enabled me to project myself into a particular character/task/role.	(Wu & Holsapple, 2014)
Perceived Usefulness 1	This game helped me better pass time.	(Lowry, Gaskin, Twyman, Hammer, & Roberts, 2012
Perceived Usefulness 2	This game was useful to me.	(Davis, 1989)

Some additional exploratory scales were added at the end. They were well-being, mood, in-game mindfulness and achievement goal questionnaires. Wellbeing was measured with four scales and hence operationalized by four constructs -2 items each- which are perceived stress, subjective vitality, life satisfaction and self-esteem (Table 12).

Table 12: Wellbeing Scales

Constructs	**Descriptions**	
Perceived Stress	I felt nervous and stressed.	(Cohen, Kamarck, & Mermelstein, 1994)
	I felt the difficulties were piling up so high that I could not overcome them.	
Subjective Vitality	I felt energized.	(Ryan & Frederick, 1997)
	I felt alive and vital.	
Life Satisfaction	In most ways my life was close to my ideal.	(Diener, Emmons, Larsen, & Griffin, 1985)
	The conditions of my life were excellent.	
Self-Esteem	I was able to do things as well as most other people.	(Rosenberg, 1965)
	On the whole, I was satisfied with myself.	

Mood was measured to be used as a controlling variable and consisted of 9 items from Multiple Affect Adjective List (MAACL) (Zuckerman & Lubin, 1965). It is used as in Taylor and Gollwitzer's study (1995) where the resulting mood score was calculated by subtracting the negative mood scores from the positive scores. Mood items can be seen in Table 13.

Table 13: Mood Scale

Descriptions	
I was happy.	(Zuckerman & Lubin, 1965)
I was downhearted.	
I was upbeat.	
I was contented.	
I was upset.	
I was sad.	
I was satisfied.	
I was lonely.	
I was distressed.	

Mindfulness was measured with the same scale that was used in study 1 with fewer items. Also, goal achievement scale was added (Elliot & McGregor, 2001) for exploratory studies since the types of motivational constructs called goal achievements were found to be related to player gender and gaming frequency (Heeter, Lee, Medler, & Magerko, 2011). The items of these scales are summarized in Table 14.

Table 14: Mini Versions of Mindfulness and Goal Achievement Scales

Constructs	**Descriptions**	
Mindfulness	I played the game automatically, without being aware of what I'm doing. (R) I rushed through the gaming activities without being really attentive to them. (R)	(Brown & Ryan, 2003)
Goal Achievement (Mastery - approach)	My aim was to master the game and learn as much as possible from it today.	(Elliot & McGregor, 2001)
Goal Achievement (Mastery - avoidance)	Today, I was often concerned that I may not learn all that there is to learn in the game.	
Goal Achievement (Performance - approach)	I tried to play better than the other players today.	
Goal Achievement (Performance - avoidance)	My aim today was to avoid performing poorer than the other players.	

Lastly, an open ended question asked the participant whether they wanted to share anything or have anything to add which was adopted from a similar diary study on video games (Mekler, Tuch, Martig, & Opwis, 2014).

4.1.2.3. Ending Questionnaire

After the participants played the game and filled the diaries for 14 days, one last questionnaire was sent them in the 15th day. First, nickname and the selected faction of the participant were asked. Then three open-ended questions were directed asking what they liked and did not liked about the game and what they learned in/from the game. Also, participants reported how much they were in touch/communication with the Ingress community on a 7 point Likert scale and reported the number of days out of fourteen they played the game willingly instead of feeling obliged because of their participation to the study.

To explore situational contexts and critical incidents during gameplay, participants were asked to write the most interesting event that occurred to them (Kari, 2016). Then they asked to report how good/bad was that experience, where it happened and who they were with.

Lastly, the batch of questions that was asking about the physical activity levels of participants was presented again (Table 9) as in the starting questionnaire to be able to see if the activity levels were increased after the participants started to play the game (International Physical Activity Questionnaire) (Booth, et al., 2003).

4.1.3. Procedure

Before conducting a diary study, some choices have to be made by the researcher such as how and when the participants should be alerted, how the alert should be delivered, and how the questions were designed (Consolvo & Walker, 2003). The type of the alerts was scheduled where the participants were alerted once, same time every day. The alerts were delivered via email in which case participants may have audible, tactile, both or no feedback depending on their set preferences in their devices. The questions were delivered written and in fixed order every day.

First, a call for study has been constituted through the METU SONA System very briefly explaining the study (https://metu-tr.sona-systems.com/). The information given in the explanation was that the participant is required to attend to one of the briefing sessions that takes around 30 minutes before qualifying to participate in the study and the study involved playing an (undisclosed to the readers at that time) game every day for 14 days at participant's discretion and filling out a questionnaire at the end of each day that takes around 5 minutes. Having a smart phone with 100 megabytes of free space was stated as the prerequisite for the study.

A semi-structured lab procedure script was prepared prior to participant briefing. 56 participants were interested and were invited to the lab in two consecutive days (in April, 2017). In these days, separate sessions were held and every session took around 30 minutes including participants to a maximum of 10 in each session. In each session, participants were welcomed to the lab, they have been kept waiting for 5 minutes past the appointment time to wait for any latecomers. Before distributing any measures or questionnaires, at the start of the briefing, an informed consent form is handed out to the participants to sign if they agree to participate to the study (APPENDIX D). In the briefing, participants were first told about the diary study and the requirements. Then, the game was announced and participants were asked to download the game (Ingress) at that time before leaving the lab. None of the participants had played Ingress before. Once they had the game in their smart phones, they were asked to determine an in-game nickname through the game and fill a form consisting of their names, surnames and nicknames. Participants' real names were never used in the questionnaires to be able to secure the anonymity. The real name - nick name match was only collected to be able to compensate them for bonus points. After the participants were asked if they had any questions and were answered if any, the lab procedure ended. After that moment, the participants were free to test the game in the wild at their own pleasure.

For 14 days, every night between 8:00 p.m. and 11.59 p.m., a reminder of the study was e-mailed to the participants with the link that contains the questionnaire.

4.2. Results

In this part, I report the data screening for abrupt or missing values. Then, I go over the initial preliminary analysis and descriptive statistics. After that, the primary analysis is presented. Lastly, the results of the analyses were discussed.

4.2.1. Data Screening

In the starting questionnaire some of the data of several participants were unavailable therefore the empty parts were filled with the mean values for numeric variables and median values for categorical values. The values for the question asking how many minutes the participants walk in general during a day were text values, therefore for instance I have changed "1 hour" to 60 or "4-5 hours" to 4.5*60 = 270. One value was in kilometers therefore that one changed to the group's mean value of 61. In the question asking the number of days moderate physical activities were carried by the participants, some of the answers were above 7 which cannot be true. They were changed with the mean value of the variable.

The everyday questionnaire filling ratio has been examined participant-wise. 7 of the participants who have filled their diary questionnaires 3 or less times (out of 14) were discarded. 49 participants were left. After that, all the entry date and times of the participants were inspected. The diary questionnaires that were filled after 14:00 p.m. the next day were flagged as possible discards. Moreover, I have corrected the string values that need to be numerical in the questions asking how many minutes the game was played, how many times the game was played, how many meters walked while playing, how many minutes walked while playing and how many hours sit through the day (30 minutes to 30 or 15-20 to 17.5). Overall, there was a total of 607 days for analyses.

Same way, in the ending questionnaire, the required values were changed and filled with mean/median values.

4.2.2. Preliminary Analysis

The reliabilities of exploratory starting questionnaires can be seen in Table 15. As I realized in the first study as well, Big Five Personality questionnaire was not determined to be a reliable measure. However, this does not affect the present study since they are not included in the hypotheses and therefore discarded for future studies as well.

Table 15: Reliabilities of the Starting Questionnaire

	Cronbach's Alpha (α)
Self-Control	0.859
Mindfulness	0.881
GATT-IIT	0.772
GATT-TTT	0.902
GATT-COT	0.855
GATT-DOT	0.558
BF-E	0.498
BF-A	0.292

BF-C	0.568
BF-N	0.531
BF-O	0.350

For the reliability of the everyday questionnaire, I have inspected every non-single item scale in every distinct day separately. As for the single item subscales of flow (immersion and concentration), since they are the subscale of one construct, I have inspected them together as a batch of 2 items for flow construct (I have also applied similar approach to Presence (PENS-Presence-Physical, PENS-Presence-Emotional, PENS-Presence-Narrative), Imaginal Experiences (Escapism, Fantasy, Role Projection) and Usefulness (Usefulness1, Usefulness2)). Besides, if required, single item measurements can be used and their reliabilities and validities were found be as adequate as the multiple item measurements (Christophersen & Konradt, 2011; Postmes, Haslam, & Jans, 2013; Yohannes, Dodd, Morris, & Webb, 2011). Therefore, I have left some of the exploratory scales as single items that are not related to this thesis study. All of the Cronbach's Alpha values were above the 0.7 threshold for every construct used in the study except for PENS-Relatedness which was not included in the analyses. The alpha averages over 14 days can be seen in Table 16.

Table 16: Reliabilities of the Scales in Diary Study

	Average Cronbach's Alphas (α)
PEOU	0.900
PENJ	0.972
ATT	0.937
ITP	0.977
PENS-A	0.898
PENS-C	0.950
PENS-R	0.358
PRESENCE	0.870
FLOW	0.817
IMAGINAL EXP	0.876
USEFULNESS	0.787
PSTRSS	0.709
SVIT	0.954
LSATIS	0.836
SESTEEM	0.833
MINDFUL	0.748
MOOD	1 item
MASTERYAPP	1 item
MASTERYAVO	1 item

PERFAPP	1 item
PERFAVO	1 item
PWoM	1 item
PENS-IC	1 item

Among the 43 participants who have filled in the ending questionnaire, 20 people reported that have selected the Resistance (blue) faction and 23 people have selected to be in the Enlightened (green) faction. Half of the participants reported they were not in touch/communication with the Ingress community at all (22/43).

Some of the participants claimed that they did not play the game because they wanted but because the study required doing so (11/43) and only 2 participants played the game self-motivated throughout every 14 of the days (Figure 20).

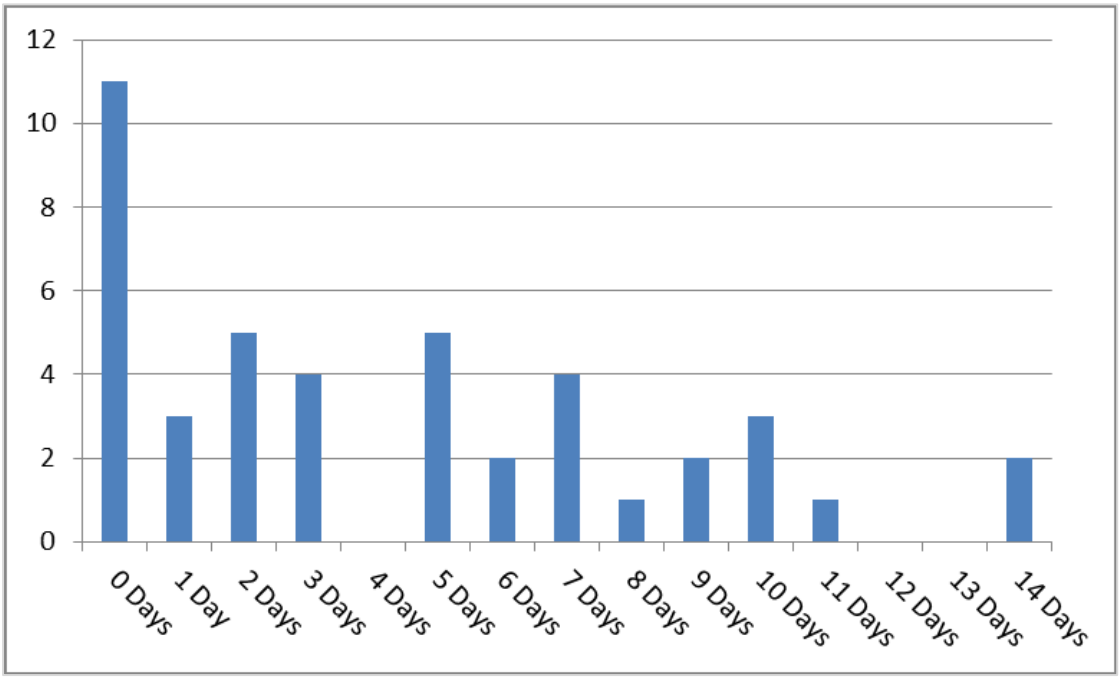


Figure 20: Number of Days Participants Played the Game Because They Wanted To

On average, throughout the study, participants reported that they have played the game for 18.27 minutes per day (SD = 21.59). Participants also reported that they have fired up the game mostly 1 time only every day (M = 1.75, SD = 1.36). Participants walked for 422.38 meters (SD = 584.80) and for 13.65 minutes (SD = 19.11) on average while playing the game. The mean of sitting per day was 7.90 hours (SD = 4.13).

As stated, International Physical Activity Questionnaire (Booth, et al., 2003) was distributed both before and after the 14 day period to be able to measure if the regular physical activity of participants has changed after they were introduced the game. Paired

sample t-test showed that the number of days of moderate physical activities carried out for at least 10 minutes before the study (M = 2.55, SD = 1.92) increased after the study (M = 3.37, SD = 2.14). The increase (-0.83, BCa 95% CI [-1.49, -0.16]) was significant, t (32) = -2.53, p = 0.02 and represented a medium sized effect, d = 0.41. Also, another paired sample t-test showed that the average number of hours spent in one of those days for moderate physical activities before the study (M = 1.14, SD = 0.82) increased after the study (M = 2.14, SD = 2.23). The increase (-1.00, BCa 95% CI [-1.79, -0.21]) was significant, t (32) = -2.56, p = 0.02 and represented a medium sized effect, d = 0.60. Number of days in the last 7 days that the participants walked for at least 10 minutes before the study (M = 6.45, SD = 1.30) increased after the study (M = 6.82, SD = 0.53), however the increase was marginally significant, t (32) = -1.79, p = 0.08. Although, the number of average walking hours among one of those days before the study (M = 1.94, SD = 2.69) increased after the study (M = 3.22, SD = 4.59), the increase was not significant, t (32) = -1.39, p = 0.18. Therefore, the results on physical activities of participants suggest that playing Ingress did not change the participants' walking behavior but changed their moderate activities throughout the days that they played the game.

4.2.3. Primary Analysis

I have analyzed the collected data using multilevel analysis. Multilevel (hierarchical) analysis is a statistical analysis method that uses data that is organized into multiple levels (Tabachnick & Fidell, 2014). For instance, football player motivation as a dependent variable may be measured within teams which are organized in leagues. Multilevel analysis takes into account the level differences. Here, motivation measured at the football player level is the level 1 variable, motivation measured at the team level is called a level 2 variable and motivation measured at league level becomes a level 3 variable. Similarly, longitudinal data can be organized into hierarchical data such that individuals have measurements in different time points. In that case, the level 1 variable becomes the motivation measured at a certain time point and level 2 becomes the football player level. Another way to see levels is to approach them as different contexts (Field, 2013). For the former example the contexts becomes the team and the league where for the latter the context becomes the player (each having multiple measurements in it). Main advantage of multilevel design is that it allows the researcher to inspect the hypotheses in different levels simultaneously by separating between and within person effects (Uysal, Lee Lin, & Knee, 2010). In other words, there is no need for assumption of independent errors or assumption of homogeneity of regression slopes (Field, 2013). This means that the errors in the same context can be dependent to each other and regression slopes of the contexts can vary. Also, the analyses are not affected by missing data.

The goal of the current analyses was to examine the associations between SDT, TAM and Flow constructs. All of the developed hypotheses were tested by separate multilevel regression analyses using SPSS software. All of the tests took into account the fixed and random effects. In general, before the main analyses, group mean centering (subtracting

the mean from the scores) is applied to the independent variables to be able to address the multicollinearity problem between the interactions and their main effects (Tabachnick & Fidell, 2014). Therefore, group mean centering was applied to the data.

The first hypothesis was that attitude of the player toward the game would predict their intention to play the game. The analyses revealed that attitude significantly predicted intention to play, $\beta = 0.60$, $F(1, 35.92) = 185.06$, $p < 0.001$. Therefore first hypothesis was satisfied. This relationship showed significant variance across participants in intercepts, $Var(u0j) = 1.25$, $p < 0.001$ and in slopes, $Var(u1j) = 0.04$, $p = 0.02$. In other words, participant was a significant factor determining the relationship between attitude and intention to play.

The second hypothesis was that perceived enjoyment of the game predicts intention to play the game. The analyses showed that perceived enjoyment significantly determined intention to play, $\beta = 0.41$, $F(1, 39.27) = 72.89$, $p < 0.001$. Second hypothesis was satisfied. The relationship between perceived enjoyment and intention to play significantly varied across participants in intercepts, $Var(u0j) = 1.24$, $p < 0.001$ and in slopes, $Var(u1j) = 0.06$, $p = 0.01$. Again, participants played a significant role in the association between perceived enjoyment and intention to play.

Third hypothesis stated that players' perceived enjoyment of the game predicts their attitude toward the game. The analyses revealed that perceived enjoyment significantly predicted attitude, $\beta = 0.60$, $F(1, 44.28) = 134.20$, $p < 0.001$. The relationship between perceived enjoyment and attitude significantly varied across participants in intercepts, $Var(u0j) = 1.50$, $p < 0.001$ and in slopes, $Var(u1j) = 1.62$, $p < 0.001$. Also, intercepts and slopes marginally significantly and negatively covaried, $Cov(u0j, u1j) = -0.13$, $p = 0.07$. This means that the players who score higher on the intercept for perceived enjoyment, tend to have less slope values with respect to other players.

Forth hypothesis claimed that if the player experiences more flow (immersion and concentration) then their perceived enjoyment from the game increase. In other words, if the players are more immersed in and more concentrated on the game, they feel more enjoyment. As we know from the previous study that there was no direct significant effect from immersion to perceived enjoyment, therefore I have dropped it from my analyses for this study. I have checked the concentration – perceived enjoyment association. The analyses showed that concentration significantly predicts perceived enjoyment, $\beta = 0.51$, $F(1, 37.01) = 73.21$, $p < 0.001$. The relationship between concentration and perceived enjoyment significantly varied across participants in intercepts, $Var(u0j) = 1.50$, $p < 0.001$ and marginally in slopes, $Var(u1j) = 0.06$, $p = 0.06$.

Fifth hypothesis was SDT constructs predicts perceived enjoyment. In other words, higher the players' perceived autonomy and perceived competence more their perceived enjoyment. First, I have checked the autonomy – enjoyment relationship. The analyses showed that perceived autonomy significantly predicted perceived enjoyment, $\beta = 0.47$,

F (1, 39.47) = 38.09, $p < 0.001$. Looking at the random effects, the association between perceived autonomy and perceived enjoyment significantly varied across participants both in intercepts, Var(u0j) = 1.50, $p < 0.001$ and in slopes, Var(u1j) = 0.13, p = 0.01. Second, I have inspected the competence – enjoyment relationship. The analyses revealed that perceived competence significantly predicts perceived enjoyment $\beta = 0.41$, F (1, 39.95) = 41.91, $p < 0.001$. The random effect parameters showed that the relationship varied significantly across participants in intercepts, Var(u0j) = 1.49, $p < 0.001$ and in slopes, Var(u1j) = 0.08, p = 0.04.

Sixth hypothesis stated that the SDT constructs predict flow constructs. The path analyses in study 1 showed that the significant paths were between perceived autonomy and flow constructs (immersion and concentration). Being informed from the first study, I have only analyzed the mentioned relationships. The analyses showed that perceived autonomy significantly predicts immersion, $\beta = 0.31$, F (1, 45.16) = 24.08, $p < 0.001$. The intercepts and the slopes for this relationship varied significantly across participants, Var(u0j) = 1.25, $p < 0.001$, Var(u1j) = 0.07, p = 0.03. Perceived autonomy also significantly predicts concentration, $\beta = 0.34$, F (1, 42.73) = 28.71, $p < 0.001$. The intercepts and slopes in this relationship were significant as well, Var(u0j) = 1.48, $p < 0.001$, Var(u1j) = 0.08, p = 0.02.

Lastly, the seventh hypothesis was that if the players perceived the game to be ease to use, they would feel more autonomous and competent. Analyses revealed that perceived ease of use significantly predicted perceived autonomy, $\beta = 0.18$, F (1, 42.08) = 6.15, p = 0.02 and perceived competence, $\beta = 0.50$, F (1, 37.37) = 66.38, $p < 0.001$. The first relationship showed significant variance across participants in intercepts, Var(u0j) = 1.55, $p < 0.001$ and in slopes, Var(u1j) = 0.15, p = 0.003. Also for the second relationship, intercepts, Var(u0j) = 1.88, $p < 0.001$, and slopes significantly varied across participants, Var(u1j) = 0.08, p = 0.02.

Having significant results in random effects justify the use of multilevel analyses. If I were to consider only fixed effects (therefore not use multilevel analyses), I could have had different and possibly less precise results. Allowing the intercepts and slopes vary, in other words taking into account the contexts relationships occur, helps a researcher to draw more accurate conclusions. The varying intercepts and slopes of the relationship of perceived enjoyment and attitude was shown as an example in Figure 21.

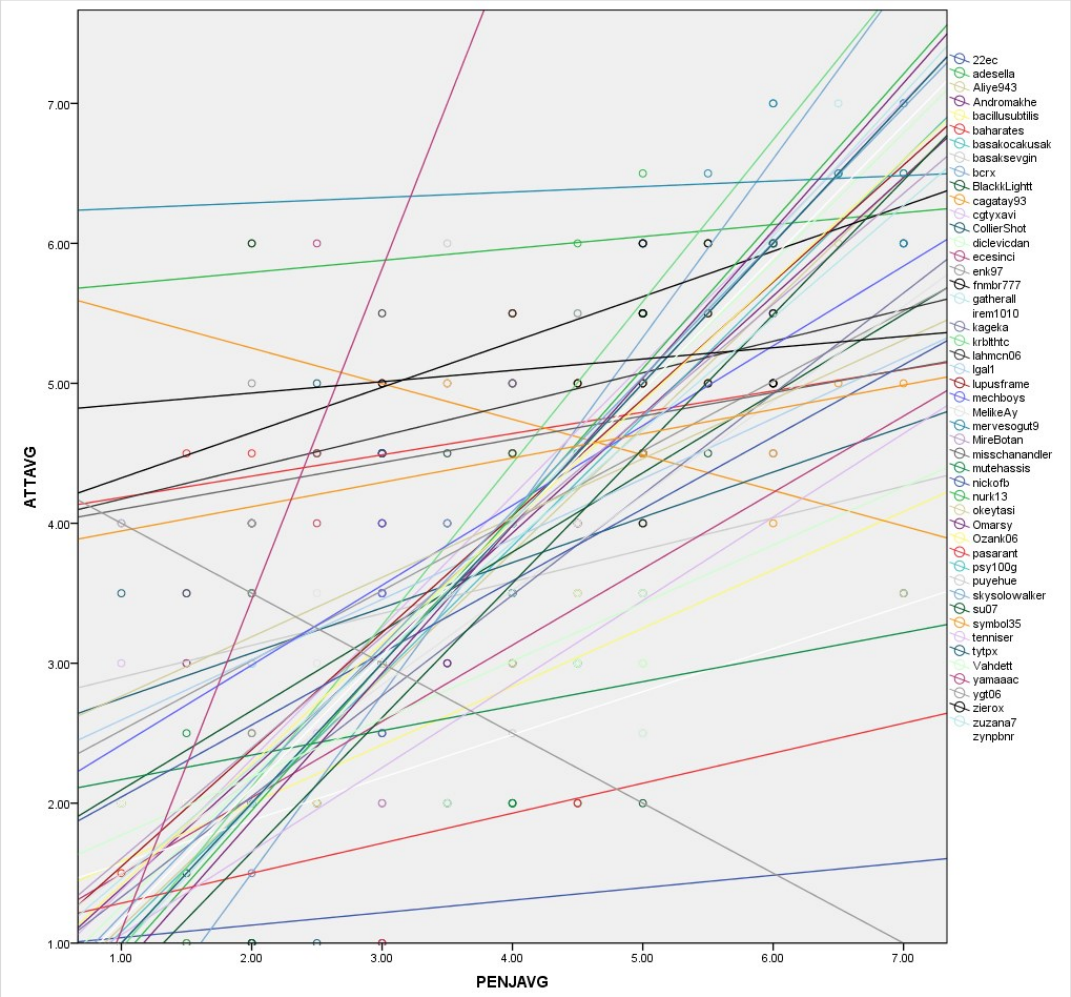


Figure 21: Regression Lines of Each Participant for Perceived Enjoyment-Attitude Relationship

All of the estimates, standard deviations and statistics can be seen in Table 17.

Table 17: The Estimates, Standard Deviations and Statistics of Fixed and Random Effects for All Relationships

	ATT-ITP		
Fixed Effects	**Estimate**	**SD**	**t**
Intercept	2.75**	0.16	16.94
ATT	0.60**	0.04	13.60
Random Effects	**Estimate**	**SD**	**Z**
var (u_{0j})	1.25**	0.26	4.82
cov (u_{0j}, u_{1j})	0.06	0.06	0.99
var (u_{1j})	0.04*	0.19	2.32

	PENJ-ITP		
Fixed Effects	**Estimate**	**SD**	**t**
Intercept	2.75**	0.16	16.94
ITP	0.41**	0.05	8.54
Random Effects	**Estimate**	**SD**	**Z**
var (u_{0j})	1.24**	0.26	4.77
cov (u_{0j}, u_{1j})	-0.01	0.06	-0.17
var (u_{1j})	0.06*	0.02	2.58
	PENJ-ATT		
Fixed Effects	**Estimate**	**SD**	**t**
Intercept	3.42**	0.18	18.61
PENJ	0.60**	0.05	11.58
Random Effects	**Estimate**	**SD**	**Z**
var (u_{0j})	1.62**	0.33	4.84
cov (u_{0j}, u_{1j})	-0.13	0.07	-1.84
var (u_{1j})	0.09*	0.03	3.30
	CONC-PENJ		
Fixed Effects	**Estimate**	**SD**	**t**
Intercept	3.33**	0.18	18.55
CONC	0.51**	0.06	8.56
Random Effects	**Estimate**	**SD**	**Z**
var (u_{0j})	1.50**	0.32	4.70
cov (u_{0j}, u_{1j})	-0.07	0.09	-0.74
var (u_{1j})	0.06	0.03	1.91
	AUT-PENJ		
Fixed Effects	**Estimate**	**SD**	**t**
Intercept	3.33**	0.18	18.55
AUT	0.47**	0.08	6.17
Random Effects	**Estimate**	**SD**	**Z**
var (u_{0j})	1.50**	0.32	4.71
cov (u_{0j}, u_{1j})	-0.05	0.10	-0.48
var (u_{1j})	0.13*	0.05	2.53
	COMP-PENJ		
Fixed Effects	**Estimate**	**SD**	**t**
Intercept	3.33**	0.18	18.55

COMP	0.41**	0.06	6.47
Random Effects	**Estimate**	**SD**	**Z**
var (u_{0j})	1.49**	0.32	4.69
cov (u_{0j}, u_{1j})	-0.03	0.08	-0.38
var (u_{1j})	0.08*	0.04	2.11
	AUT-IMM		
Fixed Effects	**Estimate**	**SD**	**T**
Intercept	2.75**	0.16	16.71
AUT	0.31**	0.06	4.91
Random Effects	**Estimate**	**SD**	**Z**
var (u_{0j})	1.25**	0.27	4.65
cov (u_{0j}, u_{1j})	0.05	0.75	0.61
var (u_{1j})	0.07*	0.03	2.20
	AUT-CONC		
Fixed Effects	**Estimate**	**SD**	**t**
Intercept	3.07**	0.18	17.26
AUT	0.34**	0.06	5.36
Random Effects	**Estimate**	**SD**	**Z**
var (u_{0j})	1.48**	0.31	4.76
cov (u_{0j}, u_{1j})	-0.02	0.08	-0.28
var (u_{1j})	0.08*	0.03	2.37
	PEOU-AUT		
Fixed Effects	**Estimate**	**SD**	**T**
Intercept	3.55**	0.18	19.55
PEOU	0.18*	0.07	2.48
Random Effects	**Estimate**	**SD**	**Z**
var (u_{0j})	1.55**	0.33	4.77
cov (u_{0j}, u_{1j})	-0.04	0.10	-0.40
var (u_{1j})	0.15*	0.05	2.93
	PEOU-COMP		
Fixed Effects	**Estimate**	**SD**	**T**
Intercept	3.47**	0.20	17.42
COMP	0.50**	0.06	8.15
Random Effects	**Estimate**	**SD**	**Z**

var (u_{0j})	1.88**	0.39	4.81
cov (u_{0j}, u_{1j})	0.02	0.10	0.22
var (u_{1j})	0.08*	0.03	2.29

*p<0.05, **p<0.001

The results revealed that perceived ease of use predicts perceived autonomy and perceived competence where perceived autonomy predicts flow (immersion and concentration) as well as perceived enjoyment. Perceived competence predicts perceived enjoyment and perceived enjoyment was an antecedent of attitude and intention to play. These results were in line with the developed hypotheses. Therefore, in the context of a pervasive game, Ingress, the results of the study 1 were replicated.

I have also run growth model (again multilevel) analyses to be able to see the rate of change of the core variables over time. In this case, time was the independent variable and the question became whether the rate of change of the dependent variables over time show linear or quadratic trend. Results showed that perceived ease of use followed a quadratic trend, $F(1, 537.10) = 14.42$, $p < 0.001$, whereas all other variables followed a linear trend (autonomy, $F(1, 44.10) = 10.75$, $p = 0.006$; competence, $F(1, 48.68) = 3.79$, $p = 0.06$; immersion $F(1, 76.36) = 6.43$, $p = 0.013$; concentration $F(1, 50.93) = 15.04$, $p < 0.001$; enjoyment $F(1, 50.58) = 11.38$, $p = 0.001$; attitude $F(1, 44.58) = 23.95$, $p < 0.001$; and intention to play, $F(1, 41.51) = 26.60$, $p < 0.001$). Those trends can be visually seen in Figure 22 (X Axis was started from the value of 2 to better fit the data to the graph).

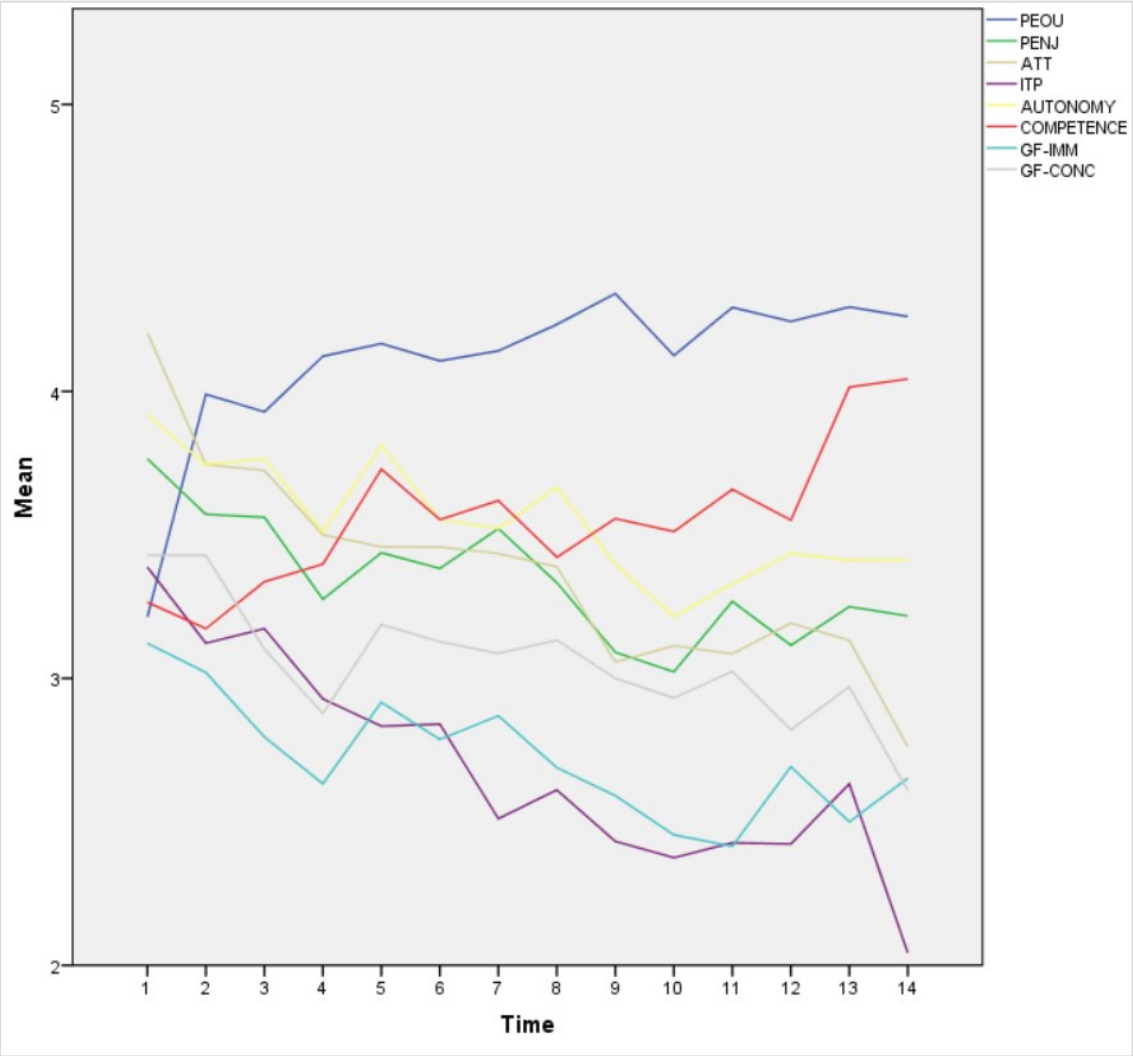


Figure 22: Rate of Change of All Variables in 14 Days across All Participants

As can be seen from Figure 22, perceived ease of use showed an increase in the second day and sustained a (mild) increase throughout the study which means that the participants got used to the game interface fairly quick and they perceived the game easier to use day by day. Autonomy and enjoyment showed a similar trend (as one increased the other one increased or as one decreased the other decreased) which was expected since autonomy was a strong predictor of enjoyment in the first study as well. Although competence predicted enjoyment in the analyses, their trends were not in accord. This might be because as the days passed players felt more and more competent without actually enjoying the game to the same extent. Immersion and concentration fluctuated together as expected since they are the subscales of flow. The trend of concentration, especially, was pretty similar to the trend of enjoyment, which was in line with the results. Attitude and intention to play were almost perfectly aligned in the beginning and at the end of the study which is line with the large body of literature on

this relationship. Also, we can see that as the enjoyment went lower, they tended to follow.

Despite having an overall negative trend, some of the constructs showed an increase in the 5th day such as autonomy, competence, enjoyment, immersion and concentration. Checking out the daily qualitative entries of the participants on and around 5th day, I found that participants reporting discovering something new in the game:

Participant A: "Arkadaslarimdan neyi nasil yapmam gerektigini ögrenince oyun daha ilgi cekici gelmeye basladi." Translated in English: "The game became more interesting when I learned what I should do and how from my friend."

Participant B: "Bugun oyunda yeni bir özellik kesfettigim icin mutlu oldum." Translated in English: "I was happy because I have discovered a new feature of the game today."

Participant C: ""Translated in English: "Bugun oyuna sadece bir dakikaligina goz ezdirdim. Bir gun icinde portallarin %90 inin takim degistirebilecegini bilmiyordum. Dun resistance ustunken bugun tum kampus yemyesildi. Sasirtici." Translated in English: "I have just played the game for a minute today. I didn't know that 90% of the portals can switch teams in a day. Yesterday resistance was superior and today the campus was all green. Surprising."

These comments might suggest that exploration or surprise elements may foster greater autonomy, competence, immersion, concentration and enjoyment in a pervasive game.

As an exploratory effort, I have checked if game enjoyment affected participants' daily mood. The results of the multilevel analyses showed that perceived enjoyment significantly predicts mood, $F(1, 47.11) = 8.14$, $p = 0.006$. The intercepts, slopes and (marginally) the covariance between them were significant, $Var(u0j) = 0.79$, $p < 0.001$, $Var(u1j) = 0.06$, $p = 0.02$, $Cov(u0j, u1j) = -0.09$, $p = 0.09$.

4.2.4. Discussion

In this diary study, I have tested my motivational model for digital gaming in the pervasive gaming domain. Results were similar to what I have found in the first study. Perceived ease of use predicted autonomy and competence emphasizing the importance of design of game's controls. Pervasive games should be designed in such a way that players can get used to the controls easily and intuitively. Perceived autonomy determined immersion and concentration that are constructs of flow showing that immersion and concentration are important factors for pervasive games as well. If players who feel that they are autonomous in their actions in a pervasive game, then they can experience the state of flow. Autonomy, competence and concentration predicted game enjoyment together in this study as well. This suggests that creating opportunities for players to feel autonomous, competent and also affording player concentration results in enjoyment. Perceived enjoyment found to be the main predictor of attitude towards and consequently intention to play pervasive games.

Growth model analysis showed that the associated constructs followed a similar trend providing extra support for the hypotheses. Also, exploratory analyses showed that perceived enjoyment was associated with daily moods of the participants. This suggests that playing enjoyable pervasive games increases the daily mood of the players.

For some of the constructs (such as immersion and concentration), I have used single item measurements. This is done for decreasing the burden of participants. Although there is evidence that single item measurements may be as good as multiple item measurements (Drolet & Morrison, 2001; Nagy, 2002; Wanous, Reichers, & Hudy, 1997), this should be noted as a shortcoming of the diary study.

One other limitation of this study was that, as can be seen from Figure 20, most of the participants did not play the game because they are internally motivated. Instead they have played the game for the sake of the study which might had some effects on the outcome of this motivation-related study.

Although diary study methodology allows the researcher to observe the data ordered in time and provides better insight then cross-sectional methods, it still cannot generate definitive causal claims (Iida, Shrout, Laurenceau, & Bolger, 2012). Future studies should manipulate the independent variables to see if the outcome changes.

CHAPTER 5

GENERAL DISCUSSION

In these survey and diary studies, I have used technology acceptance model, self-determination theory and flow theory constructs to test a unified motivational model for digital gaming. I have chosen the contexts as the virtual reality gaming and pervasive gaming as which utilizes emerging technologies in their designs. Results showed that perceived ease of use significantly predicted higher autonomy and competence satisfaction, which in turn, predicted greater flow and enjoyment. Finally, enjoyment predicted higher intention to play via more positive attitudes toward these games.

Although past studies showed the association between perceived ease of use and enjoyment in gaming contexts (Merikivi, Nguyen, & Tuunainen, 2016), how perceived ease of use affects enjoyment is not well-understood. The current study proposes a mechanism for the association between perceived ease of use and enjoyment based on self-determination theory. That is, when games are easy to use people are more likely to feel autonomous as they are able to do what they want, rather than struggling with the controls. Similarly, this also provides a sense of mastery, satisfying competence needs. This finding suggests that digital games should provide frictionless interfaces so that players can easily transfer their intentions to actions, otherwise their feelings of competency and autonomy, which are essential for enjoyment (Ryan, Rigby, & Przybylski, 2006) are likely to be frustrated.

I have also examined the role of flow in acceptance of digital games. Only autonomy satisfaction significantly contributed to the experience of flow in VR games. Satisfaction of competence needs could be less important for VR games compared to other digital games, as VR games are more oriented toward providing an immersive experience, rather than challenging the player. Thus, satisfaction of competence needs could be less important for flow in VR games currently.

The rest of the findings were in line with the past research on TAM in gaming contexts (Lowry, Gaskin, Twyman, Hammer, & Roberts, 2012). Perceived enjoyment predicted intention to play VR games via positive attitudes toward VR games. Nevertheless, to my knowledge, this is the first study to test TAM in VR and pervasive gaming contexts.

Overall, these findings suggest that TAM model also provides a valid framework for acceptance of these games. However, the model is improved by introducing constructs from self-determination theory and flow theory.

Although not widely used in the video game user research or IS research (Bélanger, 2014), diary study is a powerful tool for researchers to see how players' opinions and attitudes change over time. It is also effective when observing how the inspected relationships change between participants. Since gathering player experiences throughout time provides longitudinal data, it would also be possible to study the post-acceptance behavior with the help of diary studies. Another use of diary study would be for inspecting the reasons for discontinuance of an information system which is gaining attention in recent years (Zhang, Zhao, Lu, & Yang, 2016; Luqman, Cao, Ali, Masood, & Yu, 2017).

Previously, flow scale was adapted to the pervasive gaming context (Jegers, 2007) however, to be able to keep the scales consistent across studies, the flow constructs were measured by the more general gameflow in the second study as well (Sweetser & Wyeth, 2005). Future studies may use the pervasive gameflow (Jegers, 2007) which is more directed for measuring flow in pervasive gaming.

In the current studies, I did not use relatedness satisfaction in the model as it was irrelevant for VR games context and the measurement was found to be unreliable in the second study. However, future studies testing this model in other hedonic information systems that involve interacting with other individuals might also want to examine the role of relatedness satisfaction. Similarly, immersion and flow might be important in virtual reality and pervasive games context but they might not be essential for other hedonic information systems. Thus, whether these constructs in the model are context dependent need to be examined in future studies.

There are studies looking at the motivation for digital faming from different perspectives. For instance, passion was found to be an important element in understanding the motivation for gaming (Fuster, Chamarro, Carbonell, & Vallera, 2014; Wang, Khoo, Liu, & Divaharan, 2008). Another study stated that effectance and self-efficacy might be determinants of motivation for play (Klimmt & Hartmann, 2006). There are other studies that have inductive approaches, which came up with motivational models for video gaming as well (Yee, 2006; Sherry, Lucas, Greenberg, & Lachlan, 2006; Bostan, 2010). Investigating how these perspectives might merge with or diverge from the research model presented here might provide a more holistic view on motivation for video gaming.

It should be noted that the studies were correlational. Findings do not provide evidence for causal associations. The proposed causal associations were theoretical, and it is possible to construct alternative models. Thus experimental studies are needed to test causal associations between the constructs. Similarly, more longitudinal studies may

also provide further insight about the model for longer-term endorsement of VR and pervasive games.

The findings of these studies might be important to virtual reality and pervasive game designers. For instance, after making sure that the game controls are intuitive, designers/developers should focus on providing feelings of autonomy and competence that will result in higher levels of flow and enjoyment. Although virtual reality hardware related aspects (form factor, price etc.) could be an important aspect of endorsement of VR technology, first study shows that the content of VR games and user perception plays a major role in its acceptance as the model explains 90 percent of the variance in intentions to play VR games. Also, to be able to play digital pervasive games players need smart phones at the very least, as in the case of VR games, pervasive game acceptance also depends on how the content is presented that affects player perception.

CHAPTER 6

CONCLUSION

Over the course of couple of decades, hedonic information systems in general, more specifically video games, became a big part of society and human culture. The industry revolving around them is growing steadily and they are becoming a major leisure activity. Also, with the enabling power of new technologies such as virtual reality, smart phones and pervasive computing applications, new forms of game play activities emerged. The study of how and why people are motivated to interact with new technologies in the context of entertainment gained prominence. Understanding why people are motivated to use please-oriented information systems is also important in bringing light how these systems affect them in return.

This thesis study aimed to investigate the main motivating factors for accepting and using hedonic information systems, more specifically video games. Examining the literature, the study came up with a research model and validated it with two empirical studies: a survey and a diary study. The contexts were determined as virtual reality and pervasive games which use emerging technologies such as VR headsets and location based services.

The main contribution of this thesis study is the integration of self-determination theory and flow theory constructs with the technology acceptance model in the context of virtual reality and pervasive gaming to explain player endorsement of emerging digital games. In brief, the studies showed that basic need satisfaction and flow-concentration mediate the relationship between perceived ease of use and perceived enjoyment, which then leads to more intention to play VR and pervasive games.

The model developed here was an acceptance model which concerns mostly with the players' first interactions with a system. Therefore, the studies presented here do not aim to answer the post-acceptance or continuance intentions of the players. Future studies may address the motivation for repeated play and retention and possibly may attempt to develop a more holistic view of the motivation for digital gaming (Sorgenfrei, Ebner, Smolnik, & Jennex, 2014).

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APPENDICES

APPENDIX A

LIST OF STUDIES INCLUDED IN THE REVIEW

[P1] Ahn, T., Ryu, S., & Han, I. (2007). The impact of Web quality and playfulness on user acceptance of online retailing. Information & management, 44(3), 263-275.

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[P13] Hamari, J., & Koivisto, J. (2015). Why do people use gamification services?. International Journal of Information Management, 35(4), 419-431.

[P14] Hechler, P., Born, F., & Kroenung, J. (2016, January). Exploring vs. Enjoying: The Choice between Hedonic IS in Post-Adoption Scenarios. In 2016 49th Hawaii International Conference on System Sciences (HICSS) (pp. 1246-1255). IEEE.

[P15] Hong, S. J., & Tam, K. Y. (2006). Understanding the adoption of multipurpose information appliances: The case of mobile data services. Information systems research, 17(2), 162-179.

[P16] Hsu, C. L., & Lu, H. P. (2004). Why do people play on-line games? An extended TAM with social influences and flow experience. Information & management, 41(7), 853-868.

[P17] Hung, S. Y., Tsai, J. C. A., & Chou, S. T. (2016). Decomposing perceived playfulness: A contextual examination of two social networking sites. Information & Management.

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APPENDIX B

LIST OF VR GAMES MENTIONED BY THE SURVEY PARTICIPANTS*

	1st Game	2nd Game	3rd Game	Total
Adr1ft VR		2		2
Affected: The Manor		2		2
Alien: Isolation			2	2
Audioshield RV		2		2
Avatar		2		2
Batman Arkham VR	33	15	8	56
Battlezone	2		3	5
Call of Duty	4			4
Carnival Games	2			2
Choronos	4	9	3	16
Counter Strike	2			2
Danger Goat	2			2
Dark Walls		2		2
Dinosaur		2		2
Don't remember, Don't know, Not sure,No idea, N/A	21	5	10	36
Driveclub			2	2
Eagle Flight		6	7	13
Elite: Dangerous	8		5	13
Eve: Valkyrie	5		5	10
Farpoint	4			4
Golf	3			3
Gran Turismo VR			2	2
Halo	2			2
Haunted House		2		2
Hitman: Go	3	7	5	15
Job Simulator	13	12		25
Jurassic VR		2		2
Keep Talking and Nobody Explodes VR			4	4
Land's End	2		4	6
Lucky's Tale	2		2	4

Minescaft VR	37	13	6	56
Pool Nation VR			2	2
Proton Pulse			2	2
Resident Evil	5	3		8
Rex Infinite		2		2
RIGS: Mechanized Combat League	3			3
Robinson: The Journey	3			3
Roller Coaster VR	10			10
Second Life	2			2
Smash Hit	2	5	2	9
Sniper VR			2	2
Space Pirate Trainer		2		2
Star Trek	6	3	4	13
Star Wars: Battlefront	10	4	2	16
Subnautica	2			2
Surgeon Simulator	2		4	6
Temple Run	2			2
The Assembly		3		3
The Climb	10	7	6	23
The Lab	5	5	9	19
The London Heist	7	10		17
Thumper		2		2
Until Dawn: Rush of Blood	2	2	4	8
Wayward Sky		7	5	12
Xing: The Land Beyond			5	5

* Games that were played more than one participant were included.

* If only “Batman” was written as a game, it was assumed as the game “Batman Arkham VR”.

* If only “Valkyrie” was written as a game, it was assumed as the game “Eve: Valkyrie”.

* If only “Elite” was written as a game, it was assumed as the game “Elite: Dangerous”.

* If only “Xing” was written as a game, it was assumed as the game “Xing: Land Beyond”.

APPENDIX C

INFORMED CONSENT FORM OF STUDY 1

PROJECT TITLE: Virtual Reality (VR) Gaming Experiences

You are invited to participate in a research project conducted by Mehmet Kosa from Department of Information Systems and Dr. Ahmet Uysal from Department of Psychology at METU, Turkey. This form describes the project and what you may expect if you decide to participate.

This research project aims to investigate Virtual Reality (VR) game players' attitudes and experiences. The study involves completing an online questionnaire. In order to participate, you need to have played a VR game (any game with any VR equipment) at least 1 time.

A total of 300 participants, 18 years of age or older will be asked to participate in this project. Please complete this survey on your own time, when you are not rushed, in a quiet place. It will around 10 minutes to complete.

Upon completion the survey, you will receive a randomly generated number by which you will receive 12 cents compensation in return.

RISKS AND BENEFITS

There are no anticipated risks related directly to this study. Though there are no direct benefits to participating, your participation will help the investigators better understand the psychological aspects of VR gaming experiences.

VOLUNTARY PARTICIPATION

Your participation in this project is entirely voluntary. You may refuse to participate or withdraw at any time (for whatever reason).

CONFIDENTIALITY

Your participation in this project is anonymous. Please do not provide any identifying information in any of the responses to be submitted to the investigators. In addition, any data you provide will be stored in a secure computer for a minimum of 5 years, per

guidelines by the American Psychological Association. Only the investigators of this study and other members of our research team will have access to this data.

PUBLICATION STATEMENT

The results of this study may be published in professional and/or scientific journals. It may also be used for educational purposes or for professional presentations. However, no individual participant will be identified.

CONTACT PERSONS

The investigators will answer any questions or concerns you have. If you have additional questions or concerns at any time, you may contact the researchers, by electronic mail at kosa.mehmet@metu.edu.tr.

I have read the information provided above and voluntarily agree to participate in this study.

APPENDIX D

INFORMED CONSENT FORM OF STUDY 2

Genel Bilgiler

Bu çalışma ODTÜ Enformatik Enstitüsü Bilişim Sistemleri Doktora Programı öğrencilerinden Mehmet Kösa tarafından yürütülmektedir. Bu form sizi araştırma koşulları hakkında bilgilendirmek için hazırlanmıştır.

Bu çalışmanın amacı, zevk/keyif için tasarlanmış bilişim teknolojilerinin oyuncular tarafından hangi sebeplerden dolayı kullanıldığını anlamaktır. Araştırma "Ingress" isimli oyunun 14 gün boyunca (gün içinde katılımcının isteğine bağlı olarak) oynanması, online olarak doldurulacak olan ve 5 dakika civarında süren anketin her gün sonunda doldurulması şeklindedir. Bu süreç bittikten sonra ise, genel bir kaç anket doldurularak seans sonlandırılacaktır.

Araştırmada yaklaşık 50 katılımcı hedeflenmektedir. 18 yaş üstü üniversite öğrencileri katılımcı olarak davet edilecek, çalışmaya katılanlar bu duyurunun yapıldığı ders için bonus puan alacaklardır. Alınacak puan dersin öğretim üyesi tarafından belirlenecektir.

Riskler ve Faydalar

Araştırma katılımcı için herhangi bir risk ya da fayda içermemektedir.

Gönüllülük Esası

Bu çalışmaya katılmak tamamen gönüllülük esasına dayalıdır. Çalışmayı istediğiniz zaman bırakabilirsiniz.

Gizlilik Esası

Çalismaya katılanlardan toplanan veriler tamamen gizli tutulacak, veriler ve kimlik bilgileri herhangi bir şekilde eşleştirilmeyecektir. Katılımcıların isimleri bağımsız bir listede toplanacaktır. Ayrıca toplanan verilere sadece araştırmacılar ulaşabilecektir. Bu araştırmanın sonuçları bilimsel ve profesyonel yayınlarda veya egitim amaçlı kullanılabilir, fakat katılımcıların kimliği gizli tutulacaktır.

İrtibat

Çalışmayla ilgili soru ve yorumlarınızı araştırmacıya kosa.mehmet@metu.edu.tr adresinden iletebilirsiniz veya 555 310 6004 numaralı telefondan Mehmet Kösa'ya ulaşabilirsiniz.

Katılımcı Onayı

Yukarıdaki bilgileri okudum ve bu araştırmaya gönüllü olarak katılmayı kabul ediyorum.

Ad-Soyad: E-mail: İmza:

CURRICULUM VITAE

PERSONAL INFORMATION

Surname, Name: Kosa, Mehmet

Nationality: Republic of Turkey

Email: mehmetkosa@yahoo.com

RESEARCH INTERESTS

Psychology in Game Design, Behavioral Game Design, Gaming Experience / Enjoyment, Video Game Technology Acceptance / Motivation, Player Mindsets, Pervasive Gaming, Non-Digital Game Design, Hedonic Information Systems

EDUCATION

	Institution	Years
PhD	METU – Information Systems	2014-2018
Visiting PhD Scholar	Tilburg University	2017-2018
MSc	METU – Game Technologies	2014-2016
Research Fellow	Carnegie Mellon University	2013-2014
MSc	METU – Software Engineering	2010-2013

ARTICLES

Kosa, M., Spronck, P. (2018) What Tabletop Players Think about Augmented Tabletop Games: A Content Analysis. [Accepted by Foundations of Digital Games, FDG, August 2018, Malmö, Sweden].

Kosa, M., Uysal, A. (2018) Does Mindfulness Affect Wellbeing and Physical Activity Levels of Pervasive Game Players? The Case of Ingress. [Accepted by Games, Entertainment and Media Conference, GEM, August 18, Galway, Ireland].

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Uysal A., Kosa M. (2018) Psychological Game Design. In: Lee N. (eds) Encyclopedia of Computer Graphics and Games. Springer, Cham.

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Kosa, M., & Yilmaz, M. (2015). Designing Games for Improving the Software Development Process. In Systems, Software and Services Process Improvement (pp. 303-310). Springer International Publishing.

REVIEWING

Ad-hoc reviewing for Journal of Universal Computer Science, Press Start, International Journal of Gaming and Computer-Mediated Simulations, Future Generation of Computer Systems

AWARDS

- ERASMUS Grant for the fall semester in Tilburg University, 2017/2018.
- ACM SIGCHI Sponsorship for attending Summer School on Crowdsourcing, July 11-14 2017 in Suzhou, China.

- Gary Marsden Funding for attending Computer-Human Interaction in Play (CHI PLAY), 15-18 October 2017 in Amsterdam, Netherlands.
- Gary Marsden Funding for attending Computer-Human Interaction in Play (CHI PLAY), 16-19 October 2016 in Texas, Austin, USA.
- Dean's Fellowship from Carnegie Institute of Technology (CIT) for one full year, 2013.