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External information sources and players' experiences with them in regard to MMORPGs

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Abstract: The purpose of this study is to achieve a deeper understanding of players' information behavior in regard to MMORPGs' external information sources. Despite MMORPGs being a popular recreational activity, and players of this genre of games demonstrating novel information search strategies, this is still an understudied aspect of LIS research. The empirical material was gathered by conducting five semi-structured interviews, and analyzed using a model based upon Harviainen and Savolainien's (2014) theory of MMORPGs as information systems, along with Wilsons (1999) nested model for information-seeking and information search behaviour. The findings show that external information sources play an important role for players in the information infrastructure of MMORPGs as is also confirmed by previous research on this topic. Which information sources players choose to access is determined based on convenience, habits and the nature of the players information need. The players demonstrate differences in their information behavior depending on if they are less experienced or experienced players. Less experienced players prefer utilizing other players before utilizing external information sources, while experienced players prefer utilizing external information sources as their first option. The findings show that the MMORPG *Warframe* is also applicable in Harviainen and Savolainen's (2014) theory of MMORPGs as information systems. The different types of information behaviors that a player can manifest during play seems to align with previous research on the subject.

Nyckelord: MMORPGs, digitala spel, informationssystem, informationsbeteende, informationsbehov

Contents

1. Introduction

Information started being discussed as a commodity in the middle of the 20th century. Since then, information as a commodity has expanded to encompass every aspect of modern society. This information revolution has had a notable effect on media as well. In today's information, society individuals have access to media around the clock every day of the week (Webster, 2014). Interaction with media has also been subject to change: it is now possible to watch TV shows, read books, and play games on a computer. But whereas watching TV shows and reading a book is the same, albeit on a different platform, playing a game on a *computer* in the information age has fundamentally changed how individuals interact with games of this type. A "game" is defined as: a "system in which players engage in artificial conflict, defined by rules, that results in a quantifiable outcome" (Salen & Zimmerman, 2004, p. 80). A digital game is like any other game, except for the difference that it also integrates digital technology, meaning that digital games are played on digital platforms such as phones, computers and gaming-consoles. Because of the unique way digital games function, they have been the subject of scientific research, however, it is as of yet not its own research discipline - digital games have historically been studied from the viewpoint of other scientific disciplines (Sköld et al., 2015). Digital games have been found to increase children's critical thinking skills (Mao et al., 2022), as well as their problem solving skills and social skills (Kovess-Masfety et al., 2016). Digital games have also been a target for LIS research, and studied from the viewpoint of information, specifically the digital game genre massively multiplayer online role-playing games (MMORPGs) (Harviainen & Hamari, 2015; Harviainen & Rapp, 2018; Harviainen & Savolainen, 2014; Harviainen & Vesa, 2016; Sköld, 2014; Sköld et al., 2015; Wang et al., 2011). In LIS research, information has multiple definitions, but in general terms it brings about a difference in how an individual perceives the world: information brings about a changed state of knowledge in the individual (Case & Given, 2016).

Previous studies have found that players of MMORPGs require information from a multitude of sources in order to play the game effectively and enjoyably (Sköld et al., 2015). In MMORPGs, players work in tandem to solve the problems posed by the game world. To solve these problems, players need different types of information that can be acquired by employing different searching strategies (Harviainen & Savolainen, 2014). MMORPGs encompass players by the millions, and there are a multitude of different games on the market that can be played. Despite MMORPGs - and digital games as a whole - being an immensely popular activity, and players being seen to have novel information searching strategies, this is still an understudied field in the LIS discipline (Harviainen & Hamari, 2015; Harviainen & Savolainen, 2014).

1.1 Problem

While playing MMORPGs, players can utilize many different information sources while searching for information; these information sources are available inside the MMORPG itself, as well as externally through websites, social media platforms, forums, and video-sites. Previous research has established that these external information sources play an

important role in players' information habits (Harviainen & Savolainen, 2014; Harviainen & Rapp, 2018; Harviainen & Vesa, 2016). In a study about players' utilization of external information sources it was found that 99.8% of players utilize external information sources in some manner while playing MMORPGs (af Jochnick & Toivola, 2023). Harviainen and Savolainen (2014) explain that when knowledge gaps appear in virtual worlds it sometimes becomes necessary to gather information outside the virtual world to fill the knowledge gap. In a study examining the information environments in digital games, Harviainen (2012) explains that the need to search for information often appears because a lack of information works as a tool in digital games to keep players engaged. This results in players relying on other players or external sources, such as cognitive authorities and websites, to satisfy their information needs. Furthermore, Harviainen and Rapp (2018) explains that external information resources, such as "addons" - meaning software modifications designed by third parties that gives players access to more information while playing the game - are a requirement to stay competitive amongst serious players. They go on to note that players with more experience of an MMORPG are more effective at both searching for and applying information within the game compared to players with less experience. However, the facet of how different amounts of experience affect the way players retrieve and use information within MMORPGs is an understudied aspect of this field. More research is therefore required to shed light on the relationship between players with different amounts of experience and how they retrieve and use information.

Within the MMORPG genre, there are a multitude of games that an individual can play. Games within this genre share many aspects and rules but they can differ in fundamental ways in how players engage with them. Previous research has specifically focused on the MMORPG *World of Warcraft*, or the discontinued MMORPG *City of Heroes* (Harviainen & Savolainen, 2014; Harviainen & Rapp, 2018; Harviainen & Vesa, 2016; Sköld, 2015). To expand the research of players' external information retrieval, how player experience affects information retrieval, and the applicability of this type of research, a study focusing on another MMORPG with several notable differences to the games previously researched becomes necessary.

2. Purpose

The purpose of this study is to achieve a deeper understanding of players' information behavior in regard to MMORPGs' external information sources.

2.1 Research questions

To study this phenomenon, two research questions have been formulated:

1. Which external information sources do players use, and how do players retrieve information from external information sources in relation to *Warframe*?
2. What differences and/or similarities in methods for retrieving information from, as well as reasons for utilization of, external information sources can be seen between players of different amounts of experience with *Warframe*?

3. Background

To understand what an MMORPG is and how it functions, we first need to understand what characterizes virtual worlds, virtual spaces and virtual play spaces. When this has been established, we can then discuss what characterizes the typical role playing game (RPG) and MMORPG. Lastly, since this thesis will study players of the MMORPG *Warframe*, we will present how *Warframe* functions, and how it differs from previously studied MMORPGs. Establishing the rules and functions of MMORPGs is necessary to understand why information is a vital resource for players of this genre, and how information is tied to progression in the game. Understanding the difference between *Warframe* and other previously studied MMORPGs is necessary to punctuate that players might retrieve and utilize information in different ways in *Warframe* as opposed to other MMORPGs.

3.1 Virtual Play Spaces and MMORPGs

The core of an MMORPG is the virtual play space. Before we can deeper discuss MMORPGs, we must first establish virtual play spaces, which in turn requires us to establish virtual worlds and virtual spaces. Virtual worlds are defined as:

> [...]expansive, world-like, large-group environments made by humans, for humans, and which are maintained, recorded and rendered by computers. They are constructed, semi-separate realities that exist within what is commonly called the real world, stay active even when a player is not engaged with them and can be contrasted with the real world. (Harviainen & Hamari, 2015, p.1-2).

Virtual worlds encompass both virtual spaces and virtual play spaces. In a virtual space, a player creates an "avatar" that represents the player in the virtual world and other players are represented by other avatars. The players can interact with each other through their avatars, and may enter or leave the game world at any time. However, as noted in the definition, these virtual worlds are persistent, meaning that they are active even when players are not online. In a virtual space, the players are not required to do anything specific, there is not an intended goal by the virtual world for the players to achieve, they can exist and communicate with other players as they see fit (Adams, 2009).

A virtual play space is the same with two notable differences: the virtual world having rules for the players to adhere to, and the concept of being "at play". In a virtual play space, the virtual world is governed by complex game systems and rules that have an effect on players' interaction, both with the virtual world itself and with other players. The virtual play space also has an intended purpose: the action of play (Adams, 2009). Play in this context, we define as: "It is a significant function-that is to say, there is some sense to it. In play there is something "at play" which transcends the immediate needs of life and imparts meaning to the action. All play means something." (Huizinga, 2014, p. 1). In short, meaning is imparted in play. The virtual play space has, by rules

and systems, an intended goal for the players to achieve. However, this goal is not something that players *need* to interact with, but the virtual play space will, through its inherent design, influence the player to engage with its intended purpose.

With the virtual play space being the core of an MMORPG, it can be understood that MMORPGs have fundamental rules and game systems that both set goals and restrictions for its players. This can be likened to the MMORPGs' foundation: the role playing game (RPG). RPGs exist in several different formats, from the older pen and pencil versions, such as *Dungeons and Dragons*, to more recent, online iterations, such as *World of Warcraft*. RPGs are not only a game in the traditional sense, they are described as an experience (Adams, 2009). The player takes the role of a character in the world. This world can exist either in the player's imagination, in such examples as *Dungeons and Dragons*, or in a virtual world, such as *World of Warcraft*. The RPG-world itself is governed by rules that dictate how the player can interact with it. MMORPGs are a unique genre of RPGs; in that they exist in a virtual play space and are persistent. This means that interactions between players and the virtual play space take place even when one individual player is not online, and they constitute a massive number of players interacting with the game-world at any one time.

3.2 MMORPGs structure and meaningful play

Harviainen and Vesa (2016) defines MMORPGs as:

> MMORPGs are online role-playing games that have active player bases between tens of thousands and several millions. Players interact with the worlds, their virtual denizens (e.g., monsters and computer-controlled characters), the environment and each other through avatars, virtual representations of fictional personas. The avatars develop as play progresses, in both skill and wealth, including the acquisition of powerful items. (p. 2)

Of special note in the quote is "the avatars develop as play progresses". This is referring to the various tasks that can be completed in the game which are also called "quests". By completing these quests, the player's avatar can acquire the powerful items mentioned which make them more powerful in the game's world. This leads to the player being able to complete more difficult quests that rewards the player with even more powerful items. Some of these quests are especially designed to be of harder difficulty. They often include one significantly harder monster or foe called a "boss" monster. These boss monsters, and the quests attached to the monster, oftentimes require the collective teamwork of multiple players to defeat, and also yield special items that can only be acquired by completing that specific quest. Because the MMORPG is constructed in this manner, social interactions between players become inevitable, even promoted. Because of this, information has an integral role to play in the MMORPG. To complete tasks within the MMORPG, information is required which is given to the player by the MMORPG in the form of non-player characters (NPCs) that are controlled by the game. This information will inform the player what quest needs to be done, and where within the game world it is located. The MMORPG will

actively lock players out of the quest if they have not retrieved the information from the NPC. On top of this, MMORPGs also restrict access to information based on progression within the game. This means that players will need to gain more experience in the game by doing multiple quests that make the player's avatar "level up", which in turn provides the player access to new information. Because specific types of information are required to perform different tasks within the game, and the MMORPG restricts access to information, different players will have access to different amounts of information within the MMORPG.

The concept of being at play, and how it relates to virtual play spaces, was defined above. An extension of this concept is the idea of "meaningful play", which becomes relevant when discussing how players interact with MMORPGs. The relationship between the game's system and its players is the important part of meaningful play. When a player takes action within the game's system and the system responds to that action with a specific outcome, meaningful play is created (Salen & Zimmerman, 2004). Meaningful play has a fundamental role in motivating players to engage with the content of the MMORPG, since MMORPGs are virtual play spaces in the sense that they have intended goals for the players to pursue within the game world (Harviainen & Savolainen, 2014). However, as mentioned in 3.1, the players of the MMORPG are not required to engage with the intended goals of the virtual play space. This free-flow nature of the MMORPG has as a consequence that players can engage with the game in ways that are not intended by the game system. Instead of pursuing the intended goals of the game design, players can instead, as an example, engage in a competition amongst themselves for the most impressive looking armor. The players' ability to engage in this behavior is not inhibited by the game system, the notable difference is that the game system will not respond to the players' actions. No reward will be given to the player with the most impressive armor by the game system. While player driven actions and goals can create meaningful play in unintended ways, it is nevertheless the intention of the game designers to create meaningful play as often as possible. Because of this the MMORPGs will, as Harviainen and Rapp (2018) explains, provide incentives to the players to engage with, e.g. "quests", which have a higher likelihood of achieving meaningful play.

What needs to be emphasized is that the inherent design of MMORPGs is meant to encourage meaningful play for its players. However, in order for players to achieve meaningful play, it is required that the players engage with the systems provided by the game. This means that in order for players to play meaningfully, information is not only useful, but a necessity to engage with the game in this way (Harviainen and Rapp, 2018). In other words, the design of MMORPGs necessitates players' access to information.

3.3 Warframe

The MMORPGs *City of Heroes* and *World of Warcraft* that have previously been studied from the viewpoint of information (Harviainen & Savolainen, 2014; Harviainen & Rapp, 2018; Harviainen & Vesa, 2016; Sköld, 2015) both follow the game structure

explained in 3.2 *MMORPGs structure and meaningful play*. *Warframe* generally follows this game structure as well but differs in several ways. While the typical MMORPG has, as a major feature, a persistent open world players inhabit, *Warframe* takes a different approach to this concept. In *Warframe*, the open world is an optional feature which players can choose to ignore. Instead, the gameplay of *Warframe* mainly comes in the form of "missions" (quests or tasks) that players can initiate either alone or together with other players. In this respect, the social aspect is something that players of *Warframe* choose to engage in. A *Warframe* player has the ability to engage with the game without communicating with other players, compared to *World of Warcraft* where a player has the chance of stumbling upon other players in the open world. However, the game promotes players to actively seek out other players in order to complete missions together. Players of *Warframe* often choose to engage with other players because playing missions together brings no disadvantages, but several advantages (Wikipedia, 2023).

The central gameplay loop of *Warframe* is similar to what has been explained before in 3.2 *MMORPGs structure and meaningful play*. A player wants to become more powerful in the game's world by gaining experience and collecting more powerful equipment than they had before. There are, in general, three types of equipment that are relevant to this study: warframes, weapons and mods. Warframes are the different avatars that a player can choose to play as. A player can equip a warframe with weapons and also, equip mods on weapons and warframes. Players need to discover and collect new equipment in the game's world, which can take a long time. Instead of this, a player can choose to buy equipment from other players on the different marketplaces connected to the game. An important thing to note is, just like the cases of other MMORPGs, *Warframe* can withhold the knowledge about equipment, and where to find it from a player because of their avatars level. Certain pieces of equipment are only available at specific locations in the game's world, which the player has to unlock by progressing in the game. If a player wants some information about the game that it does not provide, they can visit the internet. As detailed in 1.1 *Problem*, for games such as *World of Warcraft*, there are a multitude of websites a player can visit to learn about different aspects of the game. This is also true for *Warframe*: if a player needs a specific piece of information that is restricted, the player can find this information on a source outside of the game (Wikipedia, 2023).

4. Previous research

To understand how the players of *Warframe* search for information and why, it becomes important to establish a framework of previous research on information as a scientific discipline. It also becomes important to understand what constitutes information needs and information behavior, as well as how different information needs and information behaviors manifest in people. In this chapter we also discuss MMORPGs as information systems. This is important to more easily understand what the players' information behavior looks like in relation to *Warframe*. Lastly, we present previous research regarding how information behavior manifests in virtual worlds and MMORPGs as information systems.

4.1 Information need and information behavior

An information need is when a person realizes that the knowledge one possesses is inadequate in some manner, and that more information is required to fill this knowledge gap (Case & Given, 2016). However, in this explanation, there is room to elaborate further. Weijts et al. (1993) specifies that information needs can take the form of three different categories: need for new information, request for clarification or request for confirmation. A need for new information usually takes the form of a question that needs to be answered in some manner. A request for clarification takes the form of the individual needing more information, or clearer information, for understanding; a request for confirmation relates to an individual confirming that they have understood the information. Chew (1994), when discussing information needs, cites Carter and explains that there are three modes of questioning behaviors whilst actively searching for information: orientation, reorientation and construction. Orientation relates to discovering what is happening, reorientation means that an individual will confirm if they are on the right track, and construction relates to questions of solving a problem or forming an opinion. Wilson (1981) explains that information needs results in inquiries that take different forms - the individual has the perception that they have a need for information in some manner.

An individual can make demands of an information system to fulfill their information need, or an individual may seek information from another person. An individual may also seek information from a source that typically does not have information as its primary function but may, nevertheless, have the information the individual is looking for. Searching for information in this manner is what Wilson (1997) refers to as active search. In this mode of searching, an individual has an established framework of knowledge, beliefs, ideas or values, and seeks to update this framework. Since this is a direct method of searching for information, the individual has at least a basic understanding of the nature of their information need and takes steps to satisfy it.

As can be seen from the research presented, an information need constitutes a need to search for information. Information seeking is the conscious act of seeking information. Apart from individuals seeking information by themselves, human beings also interact and work in groups. In such contexts, the act of information sharing takes place (Case & Given, 2016) - what Wilson (1981) calls information exchange. Information sharing mostly takes place amongst two individuals, but can also happen frequently in groups, especially if a group of people are working towards the same or similar goals (Case & Given, 2016). However, searching for information does not need to be as goal oriented as this, individuals may not always know what they are looking for and, thus, need to browse for information. Bates (2007) explains that browsing as an information seeking behavior constitutes many different techniques, the conditions for browsing may vary greatly and it can be a more direct form of browsing or lean towards more undirected methods. She summarizes that browsing consists of different stages: glimpsing, selecting, examining and acquiring. Glimpsing information transforms into selecting information, which results in an individual examining the information and, finally,

acquiring the information. During this process, however, an individual may abort at any stage and continue to browse. An information behavior that is connected to the idea of browsing is the concept of serendipitous discovery of information. Serendipity in the context of information behavior, and information browsing, is the act of an individual stumbling upon useful or interesting information whilst not actively searching for that particular information (Foster & Ford, 2003). This is an important part of everyday information behavior, as individuals are not always aware of the types of information they need. Serendipitous discoveries of information are common amongst individuals, especially while searching for information online (Case & Given, 2016).

In today's society information is everywhere, and individuals deal with the constant flow of information on a daily basis (Webster, 2014). McKenzie (2003) developed a model for how individuals go about searching for information in everyday life. The researcher found that individuals search for information in accordance with four general themes: active seeking, active scanning, non-directed monitoring, and by proxy. Active seeking is the most direct way of searching for information. This is similar to what Wilson (1997) calls active search, where an individual makes formal inquiries to satisfy an information need. More undirected methods of looking for information include active scanning and non-directed monitoring. Active scanning is where an individual scans locations for interesting information where it is likely to appear. Non-directed monitoring is where an individual is not actively searching for information, but stumbles upon interesting information (McKenzie, 2003). This is similar to what Bates (2007) explains as information browsing, which is a less goal oriented way of searching for information. The act of accidentally stumbling upon interesting information is what Foster and Ford (2003) call serendipitous discovery of information. Information by proxy is when an individual identifies an information source through another agent (McKenzie, 2003). This is somewhat related to the concept of information exchange discussed by Wilson (1997). Though it should be noted that the agent that makes the individual aware of the information source need not be another individual, and these by proxy information interactions can vary a great deal in nature (McKenzie, 2003).

In relation to information needs in virtual worlds and MMORPGs, Harviainen and Savolainen (2014) notes that information within a virtual world is always incomplete. This is partially due to information being hidden within the virtual world and, as such, people engaging with the virtual world are reliant on conventions brought from outside the virtual world to fill knowledge gaps. There are several reasons for MMORPGs wanting to hide information from their players. Harviainen (2012) explains that information uncertainty functions to engage the player and keep them immersed in the experience. The player is constantly seeking new information because knowledge gaps are made to appear, often by design. Because of this, players often rely on other players, cognitive authorities, and several external sources to fill these knowledge gaps.

4.2 Information systems in MMORPGs

The theory that virtual worlds such as MMORPGs consist of several intermingling information systems is developed by Harviainen and Savolainen (2014) in their paper,

Information as Capability for Action and Capital in Synthetic Worlds, where they review key studies about the topic of the role that information plays in synthetic worlds. This concept is further expanded upon by both Harviainen and Rapp (2018) and Harviainen and Vesa (2016). They establish that there exists at least three, sometimes more, information systems that intermingle to become one large information system. The three information systems in question are first, the retrieval core: an information system that exists within the confines of the game, where its algorithms take the form of obstacles or goals for the players to overcome and complete. These can be monsters, quests, NPCs and so on. The player uses the virtual worlds' different commands and actions to interact with the system, and the system then interprets these commands and actions to retrieve information based upon them. The second information system is the social system that exists both within the confines of the game, as well as outside the game. Within the confines of the MMORPG, the system takes the form of text and voice chat functions for players to communicate while playing. Meanwhile, outside of the MMORPG, there exist several websites and platforms for the players to interact and communicate with one another, and also to create, share and exchange information. The last information system is the external information sources. These information sources function as an extension of the social system, wherein they overlap and contribute to the websites and platforms where players can already communicate with each other. External information sources can therefore both be a source of communication for the players, as well as a source of information where players themselves share and create information about the MMORPG in question. Worthy of note is that these external information sources, and the information on them, are managed by the players themselves. The players upload, update, share and exchange information on these sources by their own accord, without the influence of the developers of the game. These three information systems work in triplet, and players can constantly move between them, and/or utilize them simultaneously while playing (Harviainen & Savolainen, 2014; Harviainen & Vesa, 2016; Harviainen & Rapp, 2018). The way that the different information systems intermingle can be seen in the model (figure 1) based upon Harviainen and Savolainen's (2014) theory of MMORPGs as information systems. The intersection between the retrieval core and the social system symbolizes every interaction between players inside the MMORPG, while the intersection between the external sources and the social system symbolizes every interaction between players on the external sources.

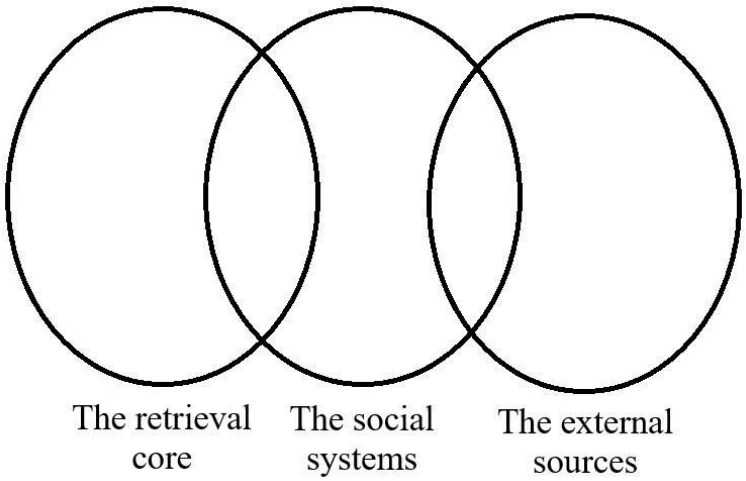

Figure 1. MMORPGs as information systems (based upon Harviainen and Savolainen's (2014) theory of information systems in virtual worlds)

4.3 Information and information behavior in Virtual Worlds and MMORPGs

Harviainen and Savolainen (2014) establish the idea that virtual worlds and MMORPGs function as information systems, but also study the role of information within virtual worlds. They posit that information is important in virtual worlds for several reasons. Their research presents the idea of information-based capability for action within virtual worlds, meaning that the more information that the player possesses, the more the player will be capable of acting within the virtual worlds. Information in this context, and in the context of an MMORPG, can take many forms. For example, if the player is not aware of their avatar's health within the game, or the current level of their character, their capability of acting within the game is severely restricted. The player is reliant on information given to them by the game, however, information can take other forms as well. The best strategy for defeating a certain enemy will not be revealed by the game, instead, the player can acquire this information either by experimenting with different strategies while encountering the enemy, or possibly by searching for this information, either through the social system (by asking other players), or by visiting external information sources. If this information is known by the player, the task of defeating this particular enemy becomes easier to manage, and the player's capability to succeed in the game world is increased. Since information dictates in many cases how well a player can perform within the game, it becomes important to the players, in this manner, information also plays the role of currency within a virtual world (Harviainen & Savolainen, 2014). Players can choose to share or withhold information from players, the act of sharing information plays an important role for the social aspect of play. Engaging in this form of information trade is common within the game, i.e., players can "purchase" information with information. Information can also contribute to increasing a player's status within the virtual world, since information is important for action, as well as for sharing and trading with other players. A player possessing a great deal of information can be awarded higher status, in some cases even the status of cognitive

authority within the game (Harviainen & Savolainen, 2014). Cognitive authority refers to an entity that has demonstrated training, experience, knowledge and expertise about a given subject. To attain the status of cognitive authority is an iterative process, whereby individuals assess the information output by the cognitive authority (Rieh, 2009). In virtual worlds and MMORPGs, a cognitive authority usually takes the form of some experienced players (Harviainen & Savolainen, 2014; Harviainen, 2012).

Ostrander (2008) finds, while studying information seeking in a virtual world (that acts only as a virtual space), that users' information seeking behaviors fall into different themes. The themes, which are mentioned in their study, which are relevant for this thesis are "social information seeking", "serendipitous discovery", "use of the virtual worlds search utility", and "visual and experiential information seeking". According to Ostrander, social information seeking was the most common way for users to search for information in the virtual world. This mode of information seeking means that users seek information during communication with other users: either by asking directly, users accidentally mentioning useful information in a social interaction, or by getting recommendations about information sources from other players. It was also common that users engaged in social information seeking whilst simultaneously utilizing other information sources. This method for information seeking is similar to active search, explained by Wilson (1997), and active seeking, established by McKenzie (2003). The fact that information seeking through interactions with other users was the most common way to search for information makes sense in relation to Harviaien and Savolainen's (2014) theory of the social information system that are built into every aspect of virtual worlds and MMORPGs. Serendipitous discovery of information (Foster & Ford, 2003) was also common amongst the users in Ostrander's (2008) study. Another common information search practice amongst the users was through the search tool (Ostrander, 2008). The virtual world offers the ability for a user to search for information whilst inside the virtual world. Whilst this is the most straightforward way of searching for information, its effectiveness as an information source depends on the type of information required. Lastly, users of virtual worlds reported utilizing visual and experiential information seeking. This method of searching for information contains interactions, and engagement, with the virtual world to gain information about something that has caused a knowledge gap. The act of solving problems by experimenting with the virtual world, in the virtual world, is something users of virtual worlds can do by themselves or in groups. Ostrander (2008) points out that this method of information seeking is also common in *massively multiplayer online games* (MMOGs).

Harviainen et al. (2012) discusses the role of social media in relation to digital games and information. An important aspect to note is that players often use social media simultaneously while playing a digital game, and digital games often have an online database dedicated to the game which contains almost everything one would need to know about the game. This means that players can decide how much information they want during their play. Harviainen et al. (2012) go on to explain that social media plays an important role in players information needs in MMORPGs, and players stated in interviews that they can simply look up information about a particular topic on social media instead of trying to discover it in the game. This was a quicker method for

gaining required information, but players also noted that it was not as satisfying. What can be noted is that social media and forums refers to how players use external information sources and the external information system (Harviainen & Savolainen, 2014; Harviainen & Vesa, 2016; Harviainen & Rapp, 2018) to satisfy their information needs. Furthermore, Harviainen et al. (2012) discusses that social media was also commonly used to monitor new information about digital games, such as updates and new releases. This behavior can be seen as a more direct mode of information browsing, as explained by Bates (2007). However, it turns out that players browse for more information than just news. Harviainen et al. (2012) explains that players also reported a more undirected mode of browsing to learn more about the digital game and its mechanics. Using information browsing to discover a game's lore and story tidbits was a particularly common subject.

5. Theoretical framework

To study players' information utilization, and reasons for their utilization, two models will be applied: one model used on top of another. Firstly, we apply the "MMORPGs as information systems" model based upon Harviainen and Savolainen's (2014) research. This means that *Warframe* will be studied from the viewpoint of an information system consisting of three intermingling information systems. To study MMORPGs with this theoretical framework, it is also required to apply a model that is suited to identifying information behavior within information systems. To do this, we will apply the "nested model for information-seeking and information search behaviour" (Wilson, 1999). Wilson's model describes three different levels of information behavior that an individual moves through whilst retrieving information. The three levels are: information behavior, information seeking as a subset to information behavior, and information search behavior as a subset to information seeking behavior. Information behavior relates to a broader context of behaviors an individual engages in while identifying an information need and searching for information. Information seeking relates to the discovery and accessing of information resources, meaning that an individual discovers that a particular information resource is relevant, and then accesses the resource. Lastly, information search refers to how an individual interacts with an information system after having accessed it. With this model it is possible to identify different modes of information seeking an individual utilizes while seeking information, as will be presented in chapter 6.2. *Method of analysis*.

When studying MMORPGs from the viewpoint of information systems, this model is able to identify the different levels of information behavior a player moves through, and how they discover, access and interact with the different information systems that constitute an MMORPG.

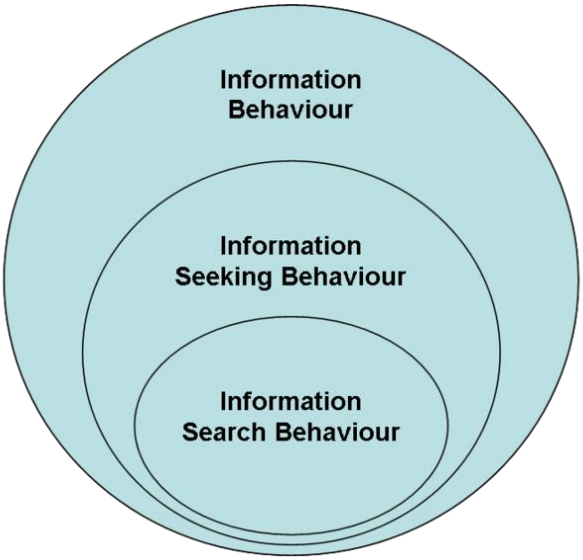

Figure 2. Wilson's nested model of information-seeking and information search behaviour (1999) with permission

6. Method

Semi-structured interviews (Luo & Wildemuth, 2017) were conducted to gather data and study the phenomenon of external information sources, and the reason for their utilization by players. The study used Wilson's (1999) model as a theoretical base to understand how information behavior develops in MMORPGs as information systems (Harviainen & Savolainen, 2014). The interviews focused on how players explain their information behavior as it relates to external information sources. Specifically, how players' information needs affected their information seeking behavior, and if or why players felt the need to retrieve information from external information sources.

The interview participants were categorized based on their experience with the MMORPG *Warframe*. Taking the experience of players into account when studying MMORPGs from the viewpoint of information was necessary, because depending on how much a player had progressed in the game, the player will have had access to different amounts of information. How much experience a particular player had with playing *Warframe* was tied to how far a player had progressed within the game. Players who had progressed very far within the game had generally played the game for long periods of time. Harviainen and Rapp (2018) explains that users of information systems who are more experienced in their use of an information system, tend to demonstrate more effective information search behavior, as well as being more effective in applying the information retrieved from the information system. This meant that experience had a possibility of not only dictating how much information a player had access to, based upon progression, but also how competent they were at searching for, and applying information within *Warframe*. Because of this, different amounts of experience with an MMORPG might have affected a player's information behavior, which needed to be taken into account.

As stated before, interview participants were categorized into different groups based upon their experience with *Warframe*. In *Warframe*, there exists a function that allows players to see their total amount of time spent playing. Two different groups of players were able to participate in the study: players who had 500 hours, or less, total amount of time played, and players who had 2000 hours, or more, total amount of time played. Choosing the amount of time to base the selection process on was a hard balance to strike - it was based on the average amount of time it takes players to play through different aspects of the game. There are several websites which track the average amount of time for player progression in digital games; the website *howlongtobeat.com* was used to learn how much time, on average, a player spent on different activities in *Warframe* (https://howlongtobeat.com/game/11037). A total playtime of 500 hours or lower was suitable because, at this point, a player had likely experienced many of the activities within the game, but was not yet familiar with everything that *Warframe* had to offer, making them less experienced players. A total playtime of 2000 hours or more likely meant that a player had, at some point, done every activity the game offered, probably more than once, making them experienced players. It would have been ideal to include players between these two groups, who had more than 500 hours, but less than 2000 hours of total playtime, for a broader spectrum of comparison. However, because of time constraints, this aspect of the thesis had to be dismissed. Because we only had time to study two groups of experience levels, we made the decision to look at the most experienced and the least experienced, our hypothesis being that the possible similarities and differences between the groups would be more clearly identified.

An interview guide was developed, along with a pilot test (Larsen, 2018), to try out the interview questions, and revise them after feedback. After the revision, the number of interviews needed to fulfill the data became clear, and recruitment for the interviews could begin. Respondents were recruited from several social media sites, specifically, from communities on external information sources dedicated to *Warframe*.

When the interviews were completed, they were fully transcribed. To more accurately and easily identify different themes in the interviews' transcriptions, we used content analysis. By using content analysis, we were able to find and highlight segments of the different interviewees statements that had similarities and differences (Bryman, 2018; Zhang & Wildemuth, 2017). To find what information would be relevant for analysis in the transcriptions, Wilson's (1999) model for information behavior was used as a lens to discern the possible relevancy.

6.1 Method of selection

The selection method used for the participants of this study was self-selection, along with snowball sampling (Bryman, 2018; Patel & Davidson, 2019). The social media platforms *Discord* and *Reddit* were used as recruitment tools. These social media platforms have particular forums dedicated to *Warframe*. On these forums, individuals can read, ask questions, and discuss *Warframe*. Along with text communication, *Discord* possesses the functionality of voice communication, where individuals can call each other directly on the platform or access voice channels and talk to one or multiple

people simultaneously. Comparatively, *Reddit* is a website purely for text and media communication. We made posts on the forums dedicated to *Warframe* on both *Discord* and *Reddit*, where the players could see the purpose of the thesis, and determine for themselves if they wanted to be included in the interview study or not. The players who saw the recruitment posts were encouraged to share them on other sites, or to other players they were aware of, which they deemed could be of interest for the study. The only variable included in the selection process was the total amount of time the players had been playing the game *Warframe*. They could choose to join the study if they had played the game for no more than 500 hours in total, or if they had played the game for 2000 hours or more in total. Personal details, such as gender, age and education level, were non-important to this study, and were not included as variables. We aimed to conduct six separate interviews, three of each experience level, to gain an even distribution of players in our data. Ultimately, five total interviews were conducted - two with less experience and three with more experience.

It is worth mentioning that utilizing social media platforms in the selection process introduced a problem with our data collection. Namely, that every participant in the study used at least one external information source during the time of the recruitment: the platform from which the participant was recruited. This does not necessarily mean that these platforms were made use of as an external information source by the participant for the purpose of information retrieval, however, it is likely that a participant has, at some point, come across useful information about *Warframe* while utilizing these platforms, either from posts, or from communicating with other players. The intended original method for selecting participants was to ask players inside the game. Unfortunately, the developers of *Warframe* forbade this so as to not disturb players in their play. Therefore, we chose the social media approach as an alternative method, while knowing that there were risks for bias in the data.

6.2 Method of analysis

We utilized the model (figure 1) based on Harviainen and Savolainen's (2014) research to identify *Warframe* as the three intermingling information systems: the retrieval core, the social system and the external information system. Looking at utterances during the interviews it was possible to identify which of the different information systems the players were accessing when they were seeking information about *Warframe*, or if they were accessing multiple information systems at the same time. Wilson's (1999) nested model was applied as a framework for each separate information system to help us identify the players information behavior, information seeking behavior, and information search behavior within the three different information systems, i.e., the retrieval core, the social system and the external information system.

Qualitative content analysis (Larsen, 2018) was used to analyze the data gathered from the interviews. When applying this method for data analysis, a common approach is to identify themes as units for analysis (Zhang & Wildemuth, 2017). Coding data after themes fits together with Wilson's (1999) nested model as it illustrates the different levels an individual moves through while seeking information. These three levels

(information behavior, information seeking behavior, and information search behavior) were used as individual themes in the analysis of the data. Wilson (1999) explains that information behavior as shown in the model is a complex process where every level intermingles and affects each other. In a similar vein, Harviainen and Savolainen (2014) explain that there exists overlap between each information system that makes up an MMORPG. Because of the complex nature of information behavior and how individuals search for information, when analyzing data from interviews, a paragraph of text or statement could fall into several themes simultaneously. Therefore, a method for data analysis was required that was flexible and could be adapted to the nature of the data. Zhang and Wildemuth (2017) explain that this is one of the strengths of qualitative content analysis; its ability to be applied both deductively and inductively.

To identify different modes of seeking within Wilson's (1999) model, the information need and information behavior concepts presented in 4.1 *Information need and information behavior* were applied. Information needs were described using the three forms of information need; need for new information, request for clarification and request for confirmation (Weijts et al., 1993). Different modes of seeking were described using active search (Wilson, 1997), information sharing (Case and Given, 2016; Wilson, 1981), information browsing (Bates, 2007), active scanning and information by proxy (McKenzie, 2003), and serendipitous discovery of information (Foster and Ford, 2003). Finally, Harviainen and Savolainen (2014) along with Harviainen et al. (2012) explains that cognitive authorities have an important role to play when players seek information in virtual worlds and digital games. Because of this, cognitive authorities were taken into account as a separate theme during analysis.

6.3. Ethics

While conducting the interviews, there were a number of ethical obligations that needed to be considered. The first thing to note is that no personal information was gathered for the interviews. The interview participants were informed and fully aware of the purpose of the study, how the interview material gathered would be applied within said study (Luo & Wildemuth, 2017), and that the data gathered would only be used for this study and not applied to any other research (Bryman, 2018). A consent form was developed and presented to the interview participants for signing before every interview. This consent form informed the participants that their participation within the study was strictly voluntary, and that they could retract their participation at any time, and if so, all the data gathered from the interview would be deleted. The interview participants were anonymous within the study, meaning that synonyms were used to reduce the risk of identification. Confidentiality is of the utmost importance when conducting interviews (Vetenskapsrådet, 2017; Patel & Davidson, 2019) and when interviewing players of an MMORPG there is a risk that the interviewed players might be identified by other players they play with regularly. The players which the participants interact with regularly within the game may be aware of their play habits and, thus, have an easier way of identifying the participants. Taking this risk into account, if the participants' utterances contained any type of revealing information, e.g., names, places, or

nicknames in the game, this information was either anonymized, where possible, or not cited at all, where impossible.

We, the writers of this thesis, also brought with us prior knowledge about MMORPGs, having personal experience of playing digital games of this genre. Knowledge such as this can be an asset, but also presents a problem. One of the factors that needed to be considered when applying content analysis was the influence of bias on the analytical process (Larsen, 2018; Wallén, 1996). Because of prior experience with MMORPGs, we had a personal understanding of how a player could search for information on external sources while playing. Every researcher has bias in some manner, and this bias will, arguably, always impact the analytical process in some manner (Wallén, 1996). It was necessary to take this into consideration and attempt to reduce the influence of prior knowledge and personal bias where it was possible.

7. Results and analysis

In this chapter we will present the findings of our study. A total of five interviews were conducted with five different players of *Warframe*. Two of the interviewed players had less than 500 hours of playtime, these players will be referred to as less experienced 1 and 2. The other three players had over 2000 hours of playtime and will be referred to as experienced 1, 2 and 3.

First the general findings will be presented in the form of a diagram we have constructed. After presenting the overarching findings of the study, this chapter is separated into three subchapters where the findings will be discussed in detail. The first subchapter is information seeking behavior, the second is information behavior and lastly information search behavior. The information seeking behavior subchapter will present which information sources the interviewed players utilized, the information behavior subchapter will present the reasons for their utilization, and the information search behavior subchapter will present the strategies employed by the interviewed players to find information on particular information sources. Although Wilson's (1999) nested model is structured by information behavior as the overarching type of behavior, information seeking behavior being nested into information behavior, and information searching behavior being nested into information seeking behavior; we find that presenting information seeking behavior and which information sources the players utilized, followed by presenting information behavior and the reasons for their utilization, and concluding with specific information search strategies, is the most effective structure for presenting the findings in a comprehensible way.

Presented below is figure 3, an overview of the analyzed empirical data. The figure demonstrates how the players interviewed moved through information behavior, information seeking behavior, and information search behavior, while interacting with information regarding *Warframe*. The diagram's layout was based on the nested model (figure 2) for information-seeking and information search behaviour (Wilson, 1999). Figure 3 also illustrates the differences and similarities between the experienced and less experienced players' information behavior. Under information behavior, we see

which factors influenced players' information behavior. Under information seeking behavior we see how convenience, information need, and the mode of seeking affected the players' information seeking behavior. The three different types of information needs were included during analysis of the data, in the information need section of the figure. However, as the needs varied and changed during the course of a player's information seeking state, we decided to exclude these from the figure for easier comprehension. Under information search behavior, we see the specific search strategies players employed on external information sources.

	Information behavior	Information seeking behavior		Information searching behavior
	Information need and convenience affects information seeking behavior	Accesses different information sources depending on information need, convenience and trust		The search strategies empoyed depends on the source
Experienced players	Time spent playing Developed understanding for sources	Information need	Convenience	Mode of seeking	Search strategies
		The wiki for statistics	Sources they know, or have developed an understanding of using, through experience	Information need affects if player employs: Information sharing Active search Active scanning Information browsing	YouTube search bar Google search bar The wiki search bar Excel sheets Reddit or Discord Asking other players through chats on external information sources or in the game
		YouTube and Reddit for entertainment			
		YouTube for builds, strategies and visual presentation			
Less experienced players	Plays the game with others Already inside the game If information need is not satisfied -> external informaiton sources	Ask other players or seek information inside the game first If information need is not satisfied -> the wiki	Already in the game Other players are easy to access because they are already playing with them	Information need affects if player employs: Information sharing Active search Active scanning Information browsing	YouTube search bar The wiki search bar Google search bar Asking other players through chats on external information sources or in the game

Figure 3. Analysis of empirical evidence

7.1 Information seeking behavior

In this subchapter we will present our data about what information sources the players utilized while playing *Warframe*, followed by how players gained knowledge of specific external information sources, and when to utilize them. Lastly, this subchapter will present the differences in the utilization of external information sources while online and actively playing, compared to not actively playing while being offline or online.

7.1.1 Players' utilization of information sources

When searching for information about *Warframe* on external information sources, players explained that there are a multitude of different sources available. For example, they could utilize *Reddit* or *Discord* for discussions about *Warframe*, and *YouTube* could be used to search for how to complete tasks in the game, or to see how a weapon functions. However, our data showed that there were two information sources players utilized in particular: other players, and the *Warframe Wikipedia page* (referred to as "the wiki" from now on). Which source was preferred, and in what manner the sources were used, also varied between players. While other external sources were mentioned, they varied in their utilization between players. Experienced players stated that even though they used external websites as their first option in general, if they go to websites or other players depended upon what type of information they were looking for. Every experienced player mentioned having specific criteria of where they went to look for information. Experienced 2 exemplified this while talking about information sources:

> *It's a very entwined sort of web of relationships that I use to get to know the game, so I primarily use the wiki. [...] if I want to talk about lore, or if I just want to complain about the game or find particular strategies… Then I would go to Reddit or I would go to any Discord server. [...] I guess hard, cold numbers; I go to the wiki. [...] and then for builds specifically, I used to use Overframe, which is a website where people are allowed to submit their own builds for both weapons and warframes, and I found that relatively helpful. So I guess that's it. I only have a couple of places that I really go to for information. - Experienced 2*

The data showed that the players moved through different information seeking behaviors depending on how their information needs manifested. Need for new information was the most common nature of the information need. The experienced players described the mode of seeking active search, which demonstrated that they understood their information need and accessed an information source they judged to be suitable to fulfill the information need.

For less experienced players, the preferred information seeking behavior differed from experienced players. Less experienced 1 exemplified this process when asked how the player decided which information sources to use:

> *I don't know. Well, most often when I play it, I don't play the game alone. I play it with friends, so I ask them automatically since I'm already playing with them and it goes a bit faster, but if they're not entirely sure about it, then I'll use the Wikipedia as a secondary source. - Less experienced 1*

Less experienced players tended to utilize other players through information sharing as their first option when in need of information. It should be noted that the nature of the information need did not seem to affect the social information system as the primarily chosen information source. However, if the information provided through information sharing proved unsatisfactory, less experienced players would change their information seeking behavior and perform an active search on an external source instead, most commonly the wiki, to fulfill their information need.

7.1.2 Players knowledge of external information sources

The data showed that players typically used different external information sources depending on the type of information they were looking for. When asked how they knew which source to visit for information, all players gave similar answers: that it was mostly a question of experience, and trial and error, to develop an understanding for which source to utilize for certain purposes. Some of the experienced players, who had played the game for over 2000 hours in total, reminisced during the interviews about how they developed the understanding for the uses of different external information sources:

> *I think it's just a side effect of spending a lot of time doing something. You get really good at navigating the systems, and also really good at finding what you need. - Experienced 2*

What can be observed in our data is that the external information system played an important role in experienced players' everyday information seeking. At the point of the interviews, these players had been active *Warframe* players for several years, and had developed an intuitive understanding for which external information source to access depending on their information need.

Experienced 2 explained that they first learned about the wiki from a friend, through information sharing and information by proxy. At that point, their friend was more experienced with *Warframe* compared to them. Less experienced 1 also noted that they either learned about the wiki through a friend, or discovered it by themself, but had trouble remembering. We interpreted this statement as suggesting that, at least the habit of learning to search for information on the wiki was developed through information sharing, and information by proxy, with the help of friends who were more experienced with the game.

7.1.3 Differences in players' utilization while actively playing and not actively playing

What can be observed from the data in general is that the nature of the players' information seeking behavior changed depending on if they were actively playing the game or not. All players expressed that, while online and actively playing the game, the information seeking tended to take a reactive approach. Some kind of knowledge gap appeared that they identified, and they then proceeded to seek information that affected the way they played the game.

Experienced players all had similar information seeking habits while online and actively playing. They looked for "hard data", which could be drop rates, loot tables, damage numbers or other statistics. Experienced 2 explained that, to them, *Warframe* was a game that needed a lot of prerequisites to be experienced to the fullest:

> *Warframe needs to be experienced with at least three screens open, one screen being the game, the other screen being a wiki, and the third screen being a friend who has already played the game for at least 1000 hours. So what you do is you go into the game and you see something you're unfamiliar with. You can either try and figure it out by yourself, and if all else fails, then you go to the wiki. If the wiki is unhelpful or it's like… not giving you the amount of information you need, at that point you go to your friend. - Experienced 2*

While offline, or online and not actively playing the game, the experienced players spoke about seeking information about *Warframe* in a more relaxed manner, i.e., information that did not necessarily affect the way they played the game. They usually consumed different forms of fan generated content about *Warframe* on external websites via information browsing. This could be looking at art, watching lore videos on *YouTube*, watching live streams of *Warframe* on *Twitch*, or partaking in relaxed information sharing via discussions about the game. Consuming content that did not necessarily improve the player's performance in *Warframe* could also cancel an ongoing active search for information that affected the way the game was played.

> *I just go into this rabbit hole, like, I want to find out about the frame. Where does the frame come from? The story behind the frame. Well, that is usually how it ends up. I'm just sitting on Warframe AFK and just watching lore videos. - Experienced 1*

Experienced 1 would sometimes, while in the process of seeking information to satisfy an information need, make a serendipitous discovery of information, which would then result in them browsing different external websites for this new information. While in a "rabbit hole", experienced 1 seemed to have an information behavior that circulated between information browsing and serendipitous discovery, where they discovered new information while browsing to begin the browsing cycle again.

Similarly to the experienced players, less experienced players also showed a reactive type of information seeking while online and actively playing, where they identified a need for new information and actively sought to fulfill their information need. However, these players more seldom sought information about Warframe while offline, or not actively playing.

> *Yeah, it's not very often I search for Warframe stuff outside the game when I'm not playing. It's mostly while I'm playing and I've noticed something interesting and I then search for it. So, it's not very much outside of playing. - Less experienced 1*

Less experienced 2 noted that there are periods of time where they did look for information outside the game, mostly this was for a preparational purpose:

> *Or when I think about, like, oh, what could I farm for next? I can look up something on the wiki and then just randomly try to find something that's, maybe, approachable to do, that wouldn't take too much time, but it could be fun if the missions are fun or something like that… - Less experienced 2*

Less experienced 2 expanded upon this by discussing how to prevent being burned out by *Warframe*. They preferred switching tasks within the game on a regular basis to keep themselves engaged while playing, and would do this by seeking information about tasks to do in the game before a play-session, through a combination of active scanning and information browsing on external websites. This could also be done on a more reactive basis during a play-session, if a certain task became too repetitive or less experienced 2 lost interest in the task.

7.2 Information behavior

In this subchapter we will present what different factors affect a player's information behavior. Firstly, we present players' opinions on the information provided by *Warframe,* followed by how cognitive authorities are meaningful for players when seeking information. This will also include different reasons players have come to trust external information sources. Lastly, this subchapter will present how the nature of the players' information needs, as well as convenience, affects the players' information behavior.

7.2.1 Player opinions on information inside *Warframe*

All players repeatedly explained that they needed to visit external information sources for certain types of information that was not available inside the game.

> *[...]there is, like, limits to how much the game itself can provide before you obtain said weapon or warframe. And so, it's much better to, with the notion of pursuing it, go outside of the game, inquire across the wiki, YouTube, among friends, or whoever else, to discern how said warframe*

> *or weapon functions, or how it performs, before you invest your time and/or money into anything there. - Experienced 3*

Not only were some types of information not available in the game, but players also repeatedly pointed out that external websites presented information in a more structured manner, and was more convenient to use whilst searching for information. This notion was something that experienced 2 exemplified here:

> *[...]Even if every single bit of information was in the game and accessible, I would still use the wiki, because the wiki is easier to search, better laid out, and just more convenient. - Experienced 2*

Experienced 2 shared their screen with us during the interview, and showed the various menus where players can learn about the game, and repeatedly stated that these were "useless", and that "nobody uses them". When asked specifically what the problem with the presentation of information inside the game was, they clarified that it was a problem with the complexity of the game, and that it could provide general information for new players, but at a certain point, the players needed more complex information that the retrieval core did not provide. Less experienced 2 also stated that they had this issue with the retrieval core, but further explained that information sharing, and utilization of external information sources, added to their experience:

> *I prefer searching for my information manually, and not have everything presented, just easily digestible and just having everything instantly in front of me. I think it's part of the charm of the game to search for information and to engage with the community about it. [...] I think it adds some kind of intrinsic value. A bit of, yeah, something that maybe connects the community as well. - Less experienced 2*

The data showed that the players' information needs, regardless of experience, at some point required information that the retrieval core was either incapable of providing, or provided in an ineffective manner. Because of this, players were required to utilize either the social system in the form of information sharing, or access external information sources to fulfill their information needs. However, as presented in 7.1.1 *Players' utilization of information sources*, experienced players and less experienced players had different preferences for which information system to access first, where experienced players more often directly accessed external information sources, and less experienced players tended to lean on more experienced players, through the social system, to provide them with the information needed.

7.2.2 Cognitive authorities and trusting information

The data showed the prevalent use of cognitive authorities for all players when searching for information. However, these cognitive authorities manifested in different forms related to *Warframe*. Less experienced players preferred utilizing information sharing, particularly with experienced players, as their first option when looking for information. Less experienced 1 explains:

> *Well, mainly I ask the friends that are experts in the game. Otherwise, I'll use [Warframe's] Wikipedia page to search for information. - Less experienced 1*

Less experienced 2 makes a similar statement:

> *If I'm playing with teammates, I would ask the teammates first if I see that they're a higher level than me, because I would assume that they might have the information I'm looking for. - Less experienced 2*

What can be seen through these quotes is that for less experienced players, certain experienced players acted as cognitive authorities and, therefore, the information provided by these experienced players was implicitly trusted. That some experienced players assumed the role of cognitive authorities can be exemplified by experienced 2, who stated that they are themselves a cognitive authority, because they had become a higher leveled player compared to their friend, who they used to use as an information source:

> *And at this point, she was MR (masterrank) maybe 8? So she wasn't super far along. She was far enough along that I would like, trust her with things. As you saw, I am now like MR Legendary 2, which is pretty much as high as you can get. I am now the source of information. - Experienced 2*

Experienced 2 went on to explain that they were mentoring a newer, less experienced player. The less experienced player would, when a problem arose, contact experienced 2 to ask questions about the game, e.g., how to defeat a certain boss. Experienced 2 would then look at the less experienced player's equipment and assess what might be less effective and give recommendations about changes to the equipment, or experienced 2 would send links to external information sources with the information needed to the player.

Along with experienced 2 mentoring another player being an example for being a trusted source of information, and in turn making them a cognitive authority, they exemplified this in another story they shared. This was about showing a group of less experienced players an optional boss in the game that less experienced players usually do not know about. This specific boss is harder to defeat for the less experienced players, and usually ends up with them not knowing what to do and dying inside the game. This quote from experienced 2 shows the implicit trust given to experienced players when offering information or advice:

> *[...]it is very fun to ask them if they want to see something cool. Then spawn him on them and run while they're getting their asses kicked. This is not fun for them. It's very fun for me. - Experienced 2*

Our data showed that not only were experienced players attributed implicit trust in this manner, certain external sources were as well. When asked about the trustworthiness of the wiki, the consensus was that the website was automatically trusted. Either because the players' friends all used it and had had no issues with the information, or because they had never really thought to distrust the website in question, illustrated by both experienced 1 and less experienced 1:

> *Well… I don't check the facts really on the wiki, because I can't be bothered really to. [...] I don't really know if it's trustworthy other than hope I guess. - Experienced 1*

> *I just think it's correct. So, I don't really have any… How do you say it? I've never felt any reason to not trust it. - Less experienced 1*

The only player in our data who did not implicitly trust all the information provided by the wiki was less experienced 2, who utilized the comment section to discern the reliability of the information on the wiki. Under any *Warframe* wiki article, there is a comment section where players can make statements about if they find the information helpful, truthful, or in some way incorrect. Less experienced 2 explained that they would apply active scanning, and browse the comment section for information regarding the reliability of the information on the article. If enough players had commented, less experienced 2 could judge that piece of information for themselves and attempt to apply it inside the game. Similarly, experienced 1 utilized the strategy of active scanning and browsing the comment section to verify if a piece of information is reliable. However, they only did this after first implicitly trusting the information on the wiki, attempting to apply the information inside the game, and after that discovering it is incorrect, or unhelpful, in some manner.

Besides the wiki being implicitly trusted by most players, the data showed that it was an important source of information for all *Warframe* players, because it detailed the majority of information a player would need to know about the game. Similarly to certain experienced players, the wiki itself assumed the role of cognitive authority because of these factors. This quote from experienced 3 exemplified this:

> *The wiki is, as you might know, it's not an official Digital Extremes Warframe wiki, it is a fan site. I'm not sure about the entire statistics of Warframe, but there is a considerable fan base for them [...] it archives the entirety of Warframe, individual resources, individual warframes, individual weapons. It covers everything, it details lore, it details functionality, details statistics about everything that you might want to consider when you're playing Warframe. - Experienced 3*

7.2.3 Effects on players' information behavior

Each player spoke of different reasons as to why they utilized certain information sources. Although the specific reasons varied between players, what could be observed comprehensively was that the information needs of the players, and convenience of the

information sources, were major deciding factors for which information source they utilized.

For experienced players, this convenience was mostly because they had developed an understanding of specific information sources over time and gotten familiar with them. Meanwhile for less experienced players, the convenience lay in the fact that they were already in the game, and therefore they could easily access the retrieval core for information, or they were already talking to other players, and therefore they could easily ask the other players for the information they sought.

> *[...]The in-game one is the most approachable because I'm already in the game, probably on the ship, doing something, researching or whatever. So, I would go to the codex and I would look it up. If it's not there, I'm already in-game, I'm going to write it in the chat, see if anyone knows the answer. If no one knows the answer in the, I don't know, first five to ten minutes, then I would go and Google it. - Less experienced 2*

The quote of less experienced 2 illustrates that the convenience of already accessing the retrieval core, and the social system through the retrieval core, resulted in less experienced 2 choosing these information sources first. It also shows that if seeking information in the retrieval core and social system proved unfruitful, they would access less convenient sources, in this case external information sources, as their secondary option. This is similar to what less experienced 1 explained in 7.1.1 *Players' utilization of information sources*, where they most often played the game with friends and, because they were already accessing the social system, the most convenient way for them to search for information was by asking them. Less experienced 1 also used external information sources as a secondary option for information retrieval.

Experienced players, on the other hand, stated that they instead preferred utilizing external information sources. This was because the experienced players were in need of detailed information, such as "hard data" (detailed in 7.1.3 *Differences in players' utilization while actively playing and not actively playing*), when an information need appeared. Oftentimes the information they required was presented in the game itself in an unclear way, or not available at all (detailed in 7.2.1 *Player opinions on information inside Warframe*). To fulfill their information need, experienced players utilized external information sources instead, particularly the wiki, where the information was presented in a structured and convenient manner, as illustrated by experienced 1:

> ***Interviewer:*** *If I understand you correctly, it seems to be an aspect of convenience around the wiki. Is that fair?*
> ***Experienced 1:*** *Yeah, cause that info is not readily available in Warframe. So then I go to the wiki, then I get the full list of where to find it, how to find it, what's the best general option to find it.*

On top of convenience dictating the information behavior of the players, the data gathered also showed that for all players, the nature of the information need affected which information sources were utilized.

> *I'll look it up on the wiki to see the abilities to see, maybe, if the damage is good, maybe what the feedback is from the community and, if I'm interested by just reading about it, I might jump on YouTube to check if there's, like, a video explaining their abilities and how they look in the game, how the effects look, how it plays, if it's something that's up my alley. If it's something that would be interesting. So, when I'm looking for things like that, I start by looking at more sources than just the wiki, then I'm like, OK, let's check some videos. - Less experienced 2*

> *[...]what the wiki lacks the other sources do make up for, and that's the experience aspect of it, like, visual experience and veteran recollections of experience and so… To watch a YouTube video to fully see how a warframe functions, or how weapons function, or you watch a YouTube video to see how to partake in activities[...] - Experienced 3*

What is illustrated by less experienced 2 and experienced 3, is how the wiki is utilized when the information need manifested as need for new information, to gain understanding about a particular weapon, warframe, or other item in the game. After the initial information need was satisfied, the information need took the form of request for clarification, where players wanted to expand their understanding by visiting *YouTube* for a visual representation of the item or character in question. However, for less experienced players, there was another aspect that affected their information behavior that was not relevant for experienced players; certain activities, places and information were not accessible in the retrieval core based on their current progression in the game:

> *[...]sometimes it's four or five powers, and you have to know where to get it, and it's a lot of traveling in the game to find it, and since I haven't played that many hours, compared to my other friends, I might not have every place unlocked. So, I have to grind to get to that location. - Less experience 1*

The aspect of the game prohibiting what a player is able to do or have knowledge of in the game, applied a parameter to the available information for less experienced players. This did not affect experienced players, who had everything unlocked inside the game. This resulted in less experienced players' information need taking the form of need for new information more often, compared to experienced players. Less experienced players also tended to make serendipitous discoveries via information sharing while playing with other players, which then made their information need take the form of request for clarification, where they clarified this new information, either by asking other players via the social system, or searching on an external information source.

7.3 Information search behavior

In this subchapter we will present the strategies players had for organizing their information about *Warframe*. Specifically, how two out of three experienced players

organized, and modified, information to better suit their information needs. Finally, this subchapter will present the search strategies players employed to search for information on different external information sources.

7.3.1 Organizing Information

Two out of three experienced players interviewed had complex methods for organizing, and modifying, information acquired about *Warframe*, compared to the less experienced players. Experienced 2 preferred organizing their information through spreadsheets, utilizing either *Google Sheets* or *Microsoft Excel*. During the interview, experienced 2 shared their screen to show how these spreadsheets were organized:

> *[...]these are things I need. Here you can see the Relics. Gold means they are rare. Silver means they're uncommon. I don't have any bronzes, but bronze means that they're common. Greens means that I have a part, and then uncolored means that I don't. These are things that I'm going to sell for platinum, as you can see, there's the name, the value, and then how many I have. - Experienced 2*

They mainly organized information acquired by color coding, as can be seen by the quote. Experienced 2 explained further that they created this spreadsheet to keep track of "what I have, what I don't have, what I want, what I need." Experienced 2 mentioned that another reason they made spreadsheets of information was to personally correct, and keep track of, certain pieces of information they found on external information sources which were incorrect:

When they acquired information from the wiki, and attempted to apply it in the game, the information was sometimes wrong. An example that experienced 2 brought up was when they were trying to acquire a specific item, and the wiki said that the item would be acquired in a certain amount of tries, which the player found to be untrue in their experience:

> *I was absolutely convinced that the part I needed did not exist [...] I was tracking it down here. I was keeping my own information. Because, as you can see… On the wiki it says it has a 6% drop chance… And I was like, is this a lie? Are they lying to me? I'm not getting that. That is not my experience. I should have had it like 10 times ago. - Experienced 2*

Experienced 2 gathered data from the wiki and, when noticing that a piece of data is incorrect, performed their own calculations based on their gameplay, and cataloged this information in different spreadsheets. They then had the ability to perform an active search, or browse their different spreadsheets for information, when a knowledge gap appeared or an information need manifested during gameplay. What experienced 2 had created was their own, personalized, external information source that they curated and maintained by themselves.

Experienced 3 explained that they had a particular process for gathering, and modifying,

information about different tasks, which they intended to do inside the game. During the interview, experienced 3 exemplified this process while talking about a specific task that they wanted to partake in. They watched a *YouTube* video about a strategy to approach the task, however, the video was tailored for players who intended to do the task in a group, which experienced 3 did not intend to do. Instead, they showed the video to their friends in the game, and modified the strategies to better suit experienced 3's playstyle:

> *I was able to take that video about solo Eidolon hunting, take it to my cohort, my peers, and was able to evaluate a slightly different approach that was a bit more tailored to my need. - Experienced 3*

The process that experienced 3 detailed, was acquiring information on an external information source, and modifying the information through information sharing with contacts in the game, to better suit their information need. Both experienced 2 and experienced 3 jokingly referred to playing *Warframe* as akin to a job due to the amount of research necessary to play the game in the way that they wanted, but noted that the research was a part of the entertainment as much as playing the actual game.

7.3.2 Search strategies

After having accessed an external information source, e.g., *Google*, the wiki, or *YouTube*, players expressed a multitude of different information search behaviors they employed to find what they needed. Experienced 2 specified that when searching for information on external information sources, they seldom searched on any particular website. Instead, they used *Google* and either started, or ended, their search query with "Warframe Wiki" or "Reddit" and accessed wiki pages or *Reddit* posts of their choice through *Google* search results. Less experienced 2, when explaining what their search process looked like step by step, utilized a similar strategy and said that they would go to *Google* and look for a solution to their problem. *Google* would, in the majority of cases, lead less experienced 2 to the wiki to look for information. Less experienced 2, much like experienced 2, also noted that they utilized *Google* while specifically wanting to look for information on the wiki by starting or ending their search query with "Warframe Wiki". Experienced 1, however, explained that they had the wiki as a saved bookmark in their browser, and when searching for information, would navigate to the website using the bookmark, and utilize the search bar on the wiki. Experienced 1 noted that they sometimes still used *Google* when searching for information.

After accessing *YouTube* to search for information about different aspects of items and weapons, the search strategies employed also differed amongst players. Players either applied active search, and looked for very specific videos, or they applied information browsing. Experienced 3 explained that they followed specific channels and visited these when looking for information on *YouTube*. Less experienced 1 explained that they instead typed a search query into the *YouTube* search bar, and applied information browsing on the results page in order to identify a video that might satisfy their information need. Less experienced 2 explained that they tended to cross reference their information sources, to make sure a certain type of information was correct. When

asked what they did if different information sources gave conflicting information, less experienced 2 explained that they applied information sharing via chats in the retrieval core. They would then believe what the majority of players stated was correct.

8. Discussion

In this chapter, we will discuss the findings of the analyzed data, and connect them to the two research questions presented in 2.1 *Research questions*. We will then summarize the study and its findings, along with giving recommendations for future research.

8.1. Research question 1

Which external information sources do players use, and how do players retrieve information from external information sources in relation to Warframe?

Our results show that our model, based upon Harviainen and Savolainen's (2014) research about MMORPGs as information systems, is useful for identifying different information sources within the retrieval core, the social system, and the external sources, and how players utilize them. The purpose this study focuses on, in part, is studying the role of external information sources for the players of *Warframe.* With the model, we are able to identify a multitude of external information sources that constitute the external information system. As detailed by Harviainen and Savolainen (2014), these three information systems intermingle, and players move through them seamlessly when seeking information. This can be seen in the data, where an information need manifests while accessing the retrieval core, and players then leave the game and utilize the social system and/or external sources to gather information, and then return to the retrieval core to apply the information. The data specifically indicates that there exists a great deal of overlap between the social system and the external sources. As is detailed in the model (figure 1), and as Harviainen and Savolainien (2014) explain, the external websites that constitute the external information system can often also be used for communicating with other players. This appears to be the case with all of the external information sources connected to *Warframe*. Players reported utilizing the *Warframe Wikipedia Page* (the wiki), *YouTube, Discord* and *Reddit* when seeking information on external sources. These external information sources also include the ability of communication, either through comments, or direct voice communication. Because this is the case, in *Warframe,* it becomes difficult to separate the social system from the external information system. Our data of how players use the external information system and the social information system in *Warframe* shows, just as Harviainen and Savolainen (2014) explains, that the external information system is an extension of the social information system.

Our data shows that the primary information sources utilized were the same for all players: either utilizing the external information sources, e.g., the wiki and *Youtube,* or utilizing the social system, by asking another player for information. Some players also mentioned that they utilized *Discord* or *Reddit* to seek information and/or communicate

with other players. That players utilize external websites to fulfill their information needs, is similar to what other researchers have found while studying MMORPGs from the viewpoint of information. Harviainen et al. (2012) notes that having access to social media while playing any digital game, enables a player to learn about every aspect of the game should they choose to, because, in some cases, everything a player would ever need to know about the game is cataloged on these sites. In the interviews conducted for this study, several players explained that the wiki has every aspect of *Warframe* cataloged, and if the information sought on the wiki is in some manner unsatisfactory, other external information sources, such as *YouTube*, can make up for it. This demonstrates that the external information system for *Warframe* is extensive and covers every aspect of the game. Our data suggests that this external information system plays an important role in all players' information seeking habits, because of their frequent use.

The search strategies players employed to search for information on external websites differed depending on the website in question, which is understandable, considering that each external website is structured differently. However, the strategies employed when seeking information on the same external information source differed somewhat between players. The strategies players employed for searching on the wiki were either to type a search query into *Google* and navigate to the wiki through the *Google* search results, or to visit the wiki and search by typing a query into the wiki search bar. This way of searching for information suggests the employment of active search (Wilson, 1997) or active seeking (McKenzie, 2003); the players seem to be aware of the nature of their information need and attempt to fill their knowledge gap. Meanwhile, on *YouTube*, active search (Wilson, 1997) or active seeking (McKenzie, 2003) also appeared to be employed. However, players reported that when utilizing *YouTube* while not actively playing, the search strategies differed compared to while actively playing. While not actively playing, players sought information of a more entertaining nature on *YouTube*; they reported search strategies that correspond to information browsing (Bates, 2007). The content players sought out for entertainment was often videos detailing the lore of the game, or other story elements. This corresponds to what Harviainen et al. (2012) explains, that information browsing is common when players want to learn about lore and other details about a game's story elements. Furthermore, our data shows that one particular player would seek information on *Youtube* through an active search (Wilson, 1997). This player then reported that they would make what constitutes a serendipitous discovery of information (Foster and Ford, 2003), and a new information need would materialize; the player would then start information browsing (Bates, 2007) for this new information. During the browsing, the player reported that they could, once again, make another serendipitous discovery of information, and the information browsing would change and focus on this new information need. The player concluded by explaining that this cycle could go on for some time. What is noteworthy about this behavior is firstly, as Case and Given (2016) point out, that serendipitous discovery of information is especially common while searching for information online. Secondly, as Ostrander (2008) explains, serendipitous discoveries of information are common while engaging with virtual worlds. Our data suggests that this also applies to *Warframe*. What is noteworthy about the cycle described by this player is that they reported being so

engaged in this behavior that they forgot to play the actual game they were learning about.

8.2 Research question 2

What differences in methods for retrieving information from, as well as reasons for utilization of, external information sources can be seen between players of different experience with Warframe?

All players interviewed utilized similar external information sources when looking for information. Harviainen et al. (2012) explains that a lack of information is utilized by digital games to keep players engaged. In a similar vein, Harviainen and Savolainen (2014) discuss that information in a virtual world is always incomplete due to information being hidden. The nature of hidden information to keep players engaged appears to be the case for *Warframe* as well. Harviainen et al. (2012), as well as Harviainen and Savolainen (2014), go on to explain that the knowledge gap that appears because of a lack of information, can result in players turning to other players, who act as cognitive authorities, or external websites to fill the knowledge gap. This can also be observed as one the main reasons why players seek information from other players, or external information sources, in our data. All players reported utilizing combinations of external information sources and other players, to fulfill their information needs. The difference between which of these information sources experienced and less experienced players utilize appears to be one of preference, and what the players consider to be most convenient. Experienced players interviewed preferred utilizing external information sources as their first option when seeking information. It appears that the reason experienced players prefer external information sources is because their information needs are more complex. This is also suggested by Harviainen and Rapp (2018), who notes that in *World of Warcraft*, third party modifications that give players access to more information are mandatory amongst serious players. Similarly, the experienced players in our data also seem to require complex and detailed information, as exemplified when two of the experienced players jokingly referred to playing *Warframe* as akin to a job, due to the amount of research that was required to play the game at a serious level. These two experienced players also explained that, because of the amount of complex information needed to play the game in a satisfying and enjoyable way, they needed to organize, structure, and modify the information they retrieved from external information sources. One of them created a network of contacts to help them understand and modify the information; the other created their own external information source in the form of *Microsoft Excel* or *Google Sheets* documents. What this exemplifies, is that certain experienced players demonstrate a serious commitment to *Warframe*, and develop strategies for organizing and modifying information to support the way they interact with *Warframe*, that suit their information habits, and the ways their information needs develop when interacting with the game at a serious level.

Less experienced players reported turning to the social system, and utilizing information sharing (Case & Given, 2016), as their preferred source of information, and turning to

external information sources if asking other players proved to be unsatisfactory. They specifically preferred asking other players who were perceived as being more experienced. Players utilizing other players to search for information is comparable to social information seeking, established by Ostrander (2009) when researching information seeking in virtual worlds. It is also analogous to the presence of experienced players who act as cognitive authorities within the game, detailed by Harviainen and Savolainen (2014); the authors go on to explain that experienced players "trade" information with less experienced players, and gain status within the game world in the exchange. This was exemplified by the less experienced players, who all explained that they prefer asking players they perceived to be experts, as well as by one of the experienced players, who explained that they are perceived as an expert because of their long experience with playing *Warframe*. This experienced player had assumed a role as mentor, and this illustrates that less experienced players recognize that an experienced player might possess detailed knowledge about *Warframe* that can be useful to them. Rieh (2009) explains that a cognitive authority within any given subject is awarded this role when they have demonstrated knowledge, and expertise, within a subject. In our data, the players who are perceived as cognitive authorities by less experienced players, also seem to be awarded a great deal of implicit trust. The nature of this implicit trust lends further support to the existence of experienced players who act as cognitive authorities within *Warframe*.

Harviainen and Savolainen (2014), as well as Harviainen et al. (2012), explain that players who act as cognitive authorities have an important role to play in the information infrastructure of digital games. However, their research only applies the role of cognitive authority to other players. Our data suggests the existence of another cognitive authority in the information infrastructure of *Warframe* that plays an important role: the *Warframe Wikipedia Page* (the wiki). The implicit trust awarded to certain experienced players also appears to be awarded to the wiki. Worthy of note is that when Rieh (2009) details the role of cognitive authority, the author specifies that it is awarded to *entities*, which does not limit the role to other people. All players in our data explained they utilized the wiki because all of their friends in the game also utilized this external information source, and because the wiki has every aspect of *Warframe* cataloged - according to the players. Some players in our data specified that one of the reasons they trust the wiki as an external information source is because it is regularly maintained, updated, and curated by expert players. This seems to be one of the main reasons players utilize the wiki, because of its status as a cognitive authority. Experienced players in particular prefer this external information source. Our data suggests that the flow of information in *Warframe* takes the form of a trickle-down effect; experienced players catalog information gathered from the retrieval core on the wiki, other experienced players then utilize the wiki, and then, in turn, employ information sharing (Case & Given, 2016) to less experienced players. This means that the wiki plays an important role as an information source, even for players who more seldom utilize it, because information from the wiki might nevertheless reach them, through information by proxy (McKenzie, 2003).

All players demonstrate that they implicitly trust information obtained from cognitive authorities. However, if the information obtained from a cognitive authority turns out to

be wrong, or a player has difficulty in applying the information in *Warframe* in some manner, the player's information need would manifest as a request for confirmation (Weijts et al., 1993). While investigating issues with information obtained from cognitive authorities, less experienced players and experienced players demonstrated different search strategies in their information behavior. Less experienced players tend to prefer utilizing information sharing (Case & Given, 2016) to investigate the truthfulness of the information obtained. As explained previously, this behavior corresponds to social information seeking (Ostrander, 2008). Furthermore, Harviainen and Savolainen (2014) explain that it is common for players to share information, and work in tandem to solve problems posed by the MMORPG. This also seems to be the case for *Warframe*. Experienced players, however, demonstrate a higher tendency to experiment within the game to find solutions to problems that arise. The strategy of experimenting in the game, reported by experienced players, corresponds to visual and experiential information seeking explained by Ostrander (2008), where a player experiments inside a virtual world to seek information. Ostrander (2008) points out that this mode of seeking is especially common in *massively multiplayer online games*. This also appears to be the case for the players of *Warframe*, however, in our data this behavior seems to be exclusive to experienced players. The fact that players tend to utilize social information seeking, or seeking and investigating information inside of the game itself by experiential and visual information seeking, lends further support to think about an MMORPG as an information system. This is relevant because of the fact that the players employ this particular information behavior to investigate if information retrieved from an external information source is correct. This illustrates how players utilize the three intermingling information systems, and move between them seamlessly, to investigate and/or confirm information.

As established by Harviainen et al. (2012), digital games restrict information as part of their inherent design to keep players engaged. One of the ways digital games accomplish this is based upon progression. This can be seen in our data as well and resulted in experienced players and less experienced players manifesting different information behaviors. Less experienced players had not progressed as far into *Warframe* as their experienced counterparts, resulting in less experienced players having to take their current level and progression in the game into account while seeking information. Restricting players' access to certain aspects of the game based upon progression is part of *Warframe's* inherent design. This is in accordance with what Harviainen and Savolainien (2014), as well as Harviainen and Rapp (2018), explain: when an MMORPG restricts information is where the social information system and the external information system can become relevant. Just like in *World of Warcraft*, players of *Warframe* can turn to other players and/or external websites to access information restricted by the MMORPG.

A major reason why players appear to be required to seek information on external sources is because, in some cases, the information required by the players simply does not exist inside *Warframe*. When players require information of this nature, they seem to be left with no other choice than to ask other players or visit an external information source. Furthermore, our data shows that experienced players in particular prefer utilizing external information sources, such as the wiki, because, even if the information

exists inside the game, the players prefer how the wiki presents the information. Previous research establishes that external information sources play an important role for players of MMORPGs (Harviainen & Savolainen, 2014; Harviainen & Rapp, 2018; Harviainen & Vesa, 2016; Sköld, 2015). This appears to be the case for both less experienced and experienced players of *Warframe*, however, experienced players seem to rely more heavily on external information sources than less experienced players.

8.3 Conclusion

The purpose of this study is to achieve a deeper understanding of players' information behavior in regard to MMORPGs' external information sources. To study this phenomenon, a model based upon Harviainen and Savolainien's (2014) theory of MMORPGs as an information system was developed and applied upon the MMORPG *Warframe*, along with Wilson's (1999) nested model for information-seeking and information search behaviour. It appears that external information sources play an important role in the information infrastructure of *Warframe*. Players report utilizing mainly the *Warframe Wikipedia Page*, *YouTube*, *Discord* and *Reddit* when seeking information on external information sources. The particular search strategies applied in their search are active search (Wilson, 1997), information browsing (Bates, 2007), information sharing (Case & Given, 2016), and serendipitous discovery of information (Foster & Ford, 2003). Players utilize different search strategies depending on which external information source they are using, where active search is more common on the wiki, and information browsing and serendipitous discovery of information are more common on *YouTube*.

In general, the reasons behind players' utilization of different external information sources are mostly dictated by convenience, habit, and the nature of the players' information need. However, what players consider convenient, and what their habits are when utilizing external information sources, differ between experienced and less experienced players. Experienced players prefer utilizing external information sources as their first option when seeking information about MMORPGs, so much so that they reported preferring utilizing an external information source, even if the same information is available inside the MMORPG. Less experienced players prefer asking other players as their first option when seeking information, regardless of their information need. If asking another player does not fulfill the less experienced player's information need, they turn to an external information source as their secondary option. When choosing to access an external information source, the nature of all players' information need influences which external information source is consulted first.

It is clear that players of *Warframe* share many of the information behaviors established in previous research on MMORPGs as information systems (Harviainen & Savolainen, 2014; Harviainen & Rapp, 2018; Harviainen & Vesa, 2016; Sköld, 2015), and that *Warframe* also can be understood as one large information system constituting three smaller intermingling information systems: the retrieval core, the social system, and the external information system. The information behavior of *Warframe* players differ depending on their experience, and external information sources play an important role

in the information infrastructure of *Warframe*. However, MMORPGs as information systems are still an understudied aspect of the LIS discipline, despite the popularity of MMORPGs as a recreational activity, and the players of games of this genre appearing to demonstrate information searching strategies while playing (Harviainen & Savolainen, 2014). As of today, there are a multitude of MMORPGs on the market any given individual can choose to play, and each individual MMORPG includes structures and mechanics that makes each of them unique, which in turn, might influence how players seek, and apply, information while engaging with them. Because of this, future research on unstudied MMORPGs is required to shed further light on this topic.

9. Bibliography

Adams, S. S. (2009). What Games Have to Offer: Information Behavior and Meaning-Making in Virtual Play Spaces. *Library Trends, 57*(4), 676–693. https://doi.org/10.1353/lib.0.0058

af Jochnick, E. & Toivola, W. (2023). Information behavior in digital worlds: A quantitative study about information systems and the players who use them. I D. Henriksen, M. Khosrowjerdi, J. Johnston, M. Liguziński, N. Z. Shuva & J. Skaug (Ed.), *Proceedings of the BOBCATSSS 2023 Conference. A New Era - Exploring the Possibilities and Expanding the Boundaries* (p. 60). Zenodo. doi.org/10.5281/zenodo.8136825

Bates, M. J. (2007). What is browsing-really? A model drawing from behavioural science research. *Information Research, 12*(4), Paper 330. http://InformationR.net/ir/124/paper330.html

Bryman, A. (2018). *Samhällsvetenskapliga metoder* (3rd ed.). Liber.

Case, D.O., & Given, L. M. (2016). *Looking for information: a survey of research on information seeking, needs, and behavior* (4th ed.). Emerald.

Chew, F. (1994). The Relationship of Information Needs to Issue Relevance and Media Use. *Journalism Quarterly, 71*(3), 676-688. doi.org/10.1177/107769909407100318

Foster, A., & Ford, N. (2003). Serendipity and information seeking: an empirical study. *Journal of Documentation, 59*(3), 321–340. doi.org/10.1108/00220410310472518

Harviainen, J. T. (2012). Ritualistic Games, Boundary Control, and Information Uncertainty. *Simulation & Gaming, 43*(4), 506–527. doi.org/10.1177/1046878111435395

Harviainen, J. T., Gough, R. D., & Sköld, O. (2012). Information Phenomena in Game-Related Social Media. In G. Widen & K. Holmberg (Ed.), *Social Information Research* (5th ed., p. 149-171). Emerald. doi.org/10.1108/S1876-0562(2012)5

Harviainen, J. T. & Hamari, J. (2015). Seek, share, or withhold: information trading in MMORPGs. *Journal of Documentation, 71*(6), 1119–1134. https://doi.org/10.1108/JD-09-2014-0135

Harviainen, J. T., & Rapp, A. (2018). Multiplayer online role-playing as information retrieval and system use: An ethnographic study. *Journal of Documentation, 74*(3), 624-640. doi.org/10.1108/JD-07-2017-0100

Harviainen, J. T., & Savolainen, R. (2014). Information as capability for action and capital in synthetic worlds. *Information research, 19*(4). https://informationr.net/ir/19-4/isic/isic12.html

Harviainen, J., & Vesa, M. (2016). Massively multiplayer online games as information systems: Implications for organizational learning. In T. Kaneda, H. Kanegae, Y. Toyoda, P. Rizzi (Ed.), *Simulation and Gaming in the Network Society* (p. 1-17). Springer Singapore. doi.org/10.1007/978-981-10-0575-6

Huizinga, J. (1949). *Homo ludens: A study of the play-element in culture*. Routledge & Kegan Paul Ltd.

Kovess-Masfety, V., Keyes, K., Hamilton, A., Hanson, G., Bitfoi, A., Golitz, D., Koç, C., Kuijpers, R., Lesinskiene, G., Mihova, Z., Otten, R., Fermanian, C., & Pez, O. (2016). Is time spent playing video games associated with mental health, cognitive and social skills in young children? *Social Psychiatry and Psychiatric Epidemiology, 51*, 349-357. doi.org/10.1007/s00127-016-1179-6

Larsen, A. K. (2018). *Metod helt enkelt: En introduktion till samhällsvetenskaplig metod* (2nd ed.). Gleerups.

Luo, L., & Wildemuth, B. M. (2017). Semistructured Interviews. In B. M. Wildemuth (Ed.), *Applications of Social Research Methods to Questions in Information and Library Science* (2nd ed., p. 248-257). Libraries Unlimited.

McKenzie, P. J. (2003). A model of information practices in accounts of everyday-life information seeking. *Journal of Documentation, 59*(1), 19–40. doi.org/10.1108/00220410310457993

Mao, W., Cui, Y., Chiu, M. M., & Lei, H. (2022). Effects of Game-Based Learning on Students' Critical Thinking: A Meta-Analysis. *Journal of Educational Computing Research, 59*(8), 1682-1708. doi.org/10.1177/07356331211007098

Ostrander, M. (2008). Talking, looking, flying, searching: information seeking behaviour in Second Life. *Library Hi Tech, 26*(4), 512–524. doi.org/10.1108/07378830810920860

Patel, R., & Davidson, B. (2019). *Forskningsmetodikens grunder : att planera, genomföra och rapportera en undersökning* (5th ed.). Studentlitteratur.

Rieh, S. Y. (2009). Credibility and cognitive authority of information. In J. D. McDonald & M. Levine-Clark (Ed.), *Encyclopedia of Library and*

Information Sciences (3rd ed., p. 1337-1344). CRC Press. doi-org.lib.costello.pub.hb.se/10.1081/E-ELIS4

Salen, K. & Zimmerman, E. (2004). *Rules of play: Game design fundamentals*. MIT Press.

Sköld, O. (2015). Documenting Virtual World Cultures: Memory-Making and Documentary Practices in the City of Heroes Community. *Journal of Documentation,71*(2), 294–316. doi.org/10.1108/JD-11-2013-0146

Sköld, O., Adams, S., Harviainen, J. T. & Huvila, I. (2015). Studying Games from the Viewpoint of Information. In P. Lankoski & S. Björk (Ed.), *Game Research Methods: An Overview* (p. 57-73). ETC Press.

Vetenskapsrådet. (2017). *God forskningssed*. https://www.vr.se/uppdrag/etik.html

Wallén, G. (1996). *Vetenskapsteori och forskningsmetodik* (2nd ed.). Studentlitteratur.

Wang, J., Huffaker, D. A., Treem, J. W., Fullerton, L., Ahmad, M. A., Williams, D., Poole, M. S., & Contractor, N. (2011). Focused on the prize: Characteristics of experts in massive multiplayer online games. *First Monday. 16*(8). doi.org/10.5210/fm.v16i8.3672

Webster, F. (2014). *Theories of the Information Society* (4th ed.). Routledge.

Weijts, W., Widdershoven, G., Kok, G., & Tomlow, P. (1993) Patients' Information-Seeking Actions and Physicians' Responses in Gynecological Consultations. *Qualitative Health Research, 3*(4) 398-429. doi.org/10.1177/104973239300300402

Wikipedia (5 October 2023). *Warframe*. https://en.wikipedia.org/wiki/Warframe

Wilson, T. D. (1981). On User Studies and Information Needs. *Journal of Documentation, 37*(1), 3-15. doi.org/ 10.1108/eb026702

Wilson, T. D. (1997). Information behaviour: An interdisciplinary perspective. *Information Processing and Management, 33(*4), 551–572. doi.org/10.1016/S0306-4573(97)00028-9

Wilson, T. D. (1999), Models in information behaviour research. *Journal of Documentation, 55*(3), 249-270. doi.org/10.1108/EUM0000000007145

Zhang, Y., & Wildemuth, B. M. (2017). Qualitative Analysis of Content. In B. M. Wildemuth (Ed.), *Applications of Social Research Methods to Questions in Information and Library Science* (2nd ed., p. 318-329). Libraries Unlimited.

10. Appendix

10.1 Interview guide

Introduction
Thank you for participating in this interview. You can choose to stop the interview at any time or to skip any question at any time. This interview will be recorded, and notes will be taken. You will be anonymous to the readers although the examiner might ask to review our audio recordings or our transcripts for examination of our paper and, thus, you will not be anonymous to the examiner. Is this acceptable? Great. Don't be afraid to take breaks or think about a question as long as you need or ask for elaboration from us as you see fit. If you think of something to add to a previous question, don't be afraid to tell us, we want to know as much as possible about your experience!

Icebreaker questions and questions regarding experience

Question 1
How many hours of playtime do you have in Warframe?

- How long have you been playing Warframe?

Question 2
What made you start playing Warframe?

Question 3
What are your main reasons for playing Warframe?

- What would you say are the aspects of Warframe you enjoy the most?

Questions regarding information behavior and utilization of external information sources

Question 1
If you find that you need some information about Warframe, how do you typically go about acquiring that information?
Clarifying example: Different websites, friends or in-game codex, in-game chat etc.
Clarifying example: Knowledge about stats, loot tables, strategies, and so on?

- Why do you use that source? Why this path? Why not some other source? and so on…
- Do you prefer sources outside or inside the game?

Question 2
Can you give us an example from when you looked up something about Warframe, either inside the game or outside of it?

Question 3
What factors, if any, influence when, why and how you search for information about Warframe?

Question 4
How do you know that the information from a particular source (friend/platform/website) is trustworthy?

Question 5
What are your opinions on the information inside the game and how it is presented?

Question 6
How do you know that different sources are suited for your different needs?

Question 7
What kind of Warframe content do you consume outside of the game?

- Why do you consume this content?

Question 8
Are there any differences between what type of information you are looking for when you are online in the game and actively playing, and what information you are looking for when you are logged out and not playing?

- Will you be using the same sources when you are playing the game and when you are logged out, or do you use different sources?

Outro
Thank you for your time! Do you have any final questions or comments?

If you have something more to add, or have any form of questions for us, feel free to email warframeinterviewstudy@gmail.com and we'll get back to you and answer to the best of our ability.

10.2 Consent form

HÖGSKOLAN I BORÅS
Academy of library, information, pedagogy and IT; section for library and information science

2023-03-28
Emil af Jochnick and Wilma Toivola

Consent to the collection and processing of data about you

As part of the bachelor thesis course at the University of Borås, we carry out a study with the purpose of studying why players of a massively multiplayer online roleplaying game (MMORPG) gather information from external sources and what the reasons are behind the usage of different external resources. The study will also examine if there are any differences in the reasons for utilization of external sources between players of varying experience with Warframe. We who conduct the study would like you to provide certain information about yourself, specifically your habits and reasons for searching information regarding the MMORPG Warframe, both inside the game and outside the game, as well as both while online and offline. The interview will also be voice recorded and saved by us for transcription.

The data will be used to identify patterns in the players reasons for utilizing external sources while playing Warframe and what differences and similarities that can be identified between players of different experience with the game.
The University of Borås is the personal data controller for the processing, which takes place with the support of Article 6.1 (a) of the General Data Protection Regulation, GDPR, (consent). The data will be used by us and be available to the teachers on the current course and central administrators at the university. However, the data are public documents that may be disclosed if someone requests it in accordance with the principle of public disclosure.
The personal data will be stored in the EU/EEA, or countries outside the EU/EEA that the EU Commission has determined to have an adequate level of protection, i.e. sufficiently high according to the GDPR. The data will be erased when it is no longer necessary.

The results of the study will be compiled in anonymized form and presented so that no data can be traced back to you.

You decide for yourself whether you want to participate in the study. Giving consent is completely voluntary, and you can withdraw a given consent at any time. Your data will then no longer be used. However, due to legal requirements, the university may be prevented from immediately removing the data.

I agree that data about me is collected and processed as above.

_____
Signature

_____
Name clarification

_____
Place and date