Bringing news to life

User engagement with augmented reality news content

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ABSTRACT

The news industry is changing due to technological developments. Individuals have increasingly disengaged themselves from traditional outlets, as they rather engage with journalism via mobile devices. This results in increasing competition between news outlets, which caused that these news outlets have to innovate in order to attract and retain readership. Augmented reality (AR) offers the opportunity for journalism to innovate, as it offers new forms of storytelling. In order to understand whether AR news content is relevant for news outlets to adopt, it is important to study how users engage with augmented reality news coverage. To study this, in-depth interviews were conducted, which were analyzed by a thematic content analysis by which three main themes emerged. The findings give a detailed picture of the user perceptions, which show how users engage with augmented reality news content.

First, augmented reality news content is new for most users and therefore they have to learn how to use it. Second, the characteristics of the AR medium, including the interactivity, context and visual elements, are of high importance as it can give users the feeling they have control over the news content, it can make complicated news content more clear and it can bring the news content to life. This can give the content added value and relative advantage over other alternatives. Additionally, the findings show that low expectations related to the feeling of skepticism can contribute to a higher feeling of immersion than when having high expectations. Third, this study suggests that users can feel bothered when engaging with AR news content, due to their news consumption habits and social standards, as well as device and space constraints. Because of this, users would be most likely to consume AR news content at home. Additionally, these findings show that users prefer entertaining as well as in-depth augmented reality news articles since this fits their associations with augmented reality and their preferences.

KEYWORDS: *Augmented reality, news industry, user engagement, immersive content, digital transformation.*

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1. Introduction

In the last two decades, technological developments have disrupted traditional business models (Grueskin, Seave, & Graves, 2011). Within journalism, technology allowed for new opportunities for the creation, distribution and consumption (Van der Haak, Parks & Castells, 2012), where especially digital technology, mobile media and the Internet have had a great impact. These technological forces have resulted in a decrease in the impact of traditional news media, where audiences have detached themselves from these traditional forms of media (Pavlik & Bridges, 2013). Eight o'clock is no longer a sacred moment to watch the news, individuals are listening less to news radio and newspapers merge or cease to exist. Individuals mostly consult mobile devices in order to keep informed with current news throughout the day (NPO-organisatie, 2015), where online news on mobile devices is mostly free of charge, provided in real-time and abundant. Individuals who want to read the news are now just only a few clicks away from countless news articles offered in different ways. As a result of this, there is a growing competition for audiences, as news outlets have to grab the attention of audiences in an age of information overload (Van der Haak et al., 2012).

Faced with changing news production, distribution and consumption, news outlets have to deal with the question on how to attract and retain audiences in order keep existing. Especially traditional news outlets, such as newspapers and television channels, are faced with this challenge as individuals choose these outlets less frequently (Van der Haak et al., 2012). Furthermore, news outlets also face the question of how the media use of their audience will develop in the future, as technology is changing rapidly (NPO-organisatie, 2015). In general, news outlets are challenged to stay innovative and relevant in order to keep their audience (Mersey, 2010). According to Pavlik, innovation in the news industry is "the process of taking new approaches to media practices and forms while maintaining a commitment to quality and high ethical standards (2013, p .183)." Therefore, if a news outlet wants to stay innovative, they have to introduce and diffuse new products and techniques for production (Globerman, 2016), as new technologies can transform these outlets in profitable ways. Furthermore, innovation in news media is focused on several dimensions of which most are relating to users and technology (Pavlik, 2013). Among these dimensions are the need to engage individuals in interactive news content and the need for producing new forms of reporting which are made for the digital environment (Pavlik, 2013, p. 183).

The increasing penetration of mobile technologies allows for innovation opportunities for the news industry (Pavlik, 2013). Due to this rise of mobile devices, augmented reality is emerging for the public and this technology serves new opportunities that can produce effective new forms of content (Pavlik, 2013). Augmented reality (AR) is a term that is used for technologies that overlay virtual elements onto the real physical world (Bai, 2014). According to Höllerer and Feiner (2004), "AR systems integrate virtual information into a person's physical environment so that he or she will

perceive that information as existing in their surroundings" (p. 221). According to Pavlik & Bridges (2013), augmented reality "may disrupt and transform traditional methods of storytelling in journalism" (p. 51). With augmented reality, content is interactive and immersive, which means that users can feel like they are present in a virtual world and can engage with the content. This means that audiences are not passive receivers of third-person news stories anymore, but rather active participants in a first-person story, where they can actually explore the news. This way of experiencing news is similar to actively experiencing a video game, rather than passively reading a newspaper or watching the news (Pavlik & Bridges, 2013).

Augmented reality is becoming more and more common as the possibilities of augmented reality are increasing nowadays. Popular applications such as Pokémon Go and Snapchat introduced augmented reality (AR) to the public and strengthened its position being a mainstream technology (Dirin & Laine, 2018). Furthermore, more and more businesses are investing in augmented reality. For instance, Apple and Google have the largest share in the mobile phone industry and are both seriously investing in augmented reality, which helps the technology reaching the mainstream. Apple's ARkit and Google's ARcore came into the market in 2017 and this software allows users to easily use it on their mobile devices (Van der Wel, 2017). This increase in possibilities and company interest might result in the fact that the public becomes more comfortable with using augmented reality applications as these companies are introducing the technology to a larger audience. Thus, adoption might continue to grow and the development of AR applications continues to drive up (Daniel, 2018). However, in the news industry, this technology is still emerging and thus news organizations do not know whether AR news content is relevant for their audience.

The technology of augmented reality offers an opportunity for journalism to innovate. However, research suggests that news organizations should not just innovate for the purpose of innovating, but they should consider this based on several factors. For instance, they need to make sure it meets the needs of the user through new experiences, it should fit the values of the intended user, it should be likely to be adopted by the user and it needs to be technically feasible. These considerations are user-based and focus both on innovations in the production of news as well as on innovations on the consumption of news (Diakopolous, 2012). In order to understand whether AR news content is relevant for news outlets to adopt, it is important to first understand how, where and through what users engage with augmented reality news coverage (Peters, 2012). Here, the concept of engagement highlights a person's interest or involvement in an experience its activity or content (Dow, Mehta, Harmon, MacIntyre & Matheas, 2007). Without timely and accurate data on news consumption and its changing features focusing on news consumption and augmented reality, news organizations associations might not be in line with the contemporary practices of the public (Peters, 2012).

1.1 Social and academic relevance

From a social point of view, this study explores how users engage with augmented reality news content. Digital developments changed the needs of individuals towards their news consumption. These digital changes created opportunities for the emergence of new technologies in the news industry, such as augmented reality. Hence, this thesis examines how users engage with this upcoming technology in the news industry. Moreover, technologies around augmented reality are rapidly developing and thus user experiences might change fast. Therefore, this research is relevant as applications are rapidly changing and thus user perceptions regarding engagement about these applications as well. Furthermore, this research is relevant for news outlets, as they are facing troubles with retaining their readership base. This research can give news outlets valuable data on users who engage with augmented reality news content, in order to define the best practices for information design for this medium as well as whether to incorporate it into their strategy.

Focusing on academic relevance, this study contributes to the understanding of user engagement within augmented reality news consumption, as this is still in its early stages. Despite the increasing amount of research on AR, user-based AR research remains limited, being less than 10% each year between 2005 and 2014 (Dey, Billinghurst, Lindeman & Swan, 2018). Additionally, media innovation has been studied mostly based on quantitative methods such as statistics, not taking qualitative research into account (García-Avilés, Carvajal-Prieto, Arias-Robles & De Lara-González, 2018). Furthermore, augmented reality has been studied substantially within several areas, such as the gaming or educational industry (Chatzopoulos, Bermejo, Huang & Hui, 2017), however, augmented reality within the news industry has been understudied (Diakopoulos, 2012). Therefore, this qualitative study aims to give more insights in research on augmented reality, particularly focusing on user engagement with AR news content.

1.2 Research questions

This research is focused on user engagement with augmented reality news content. The study is based on interviews with users about experiencing the augmented reality features of the *New York Times* app. The *New York Times* is a news organization that wants to expand the impact and reach of their journalism at a time when technology and user behavior are changing rapidly (The New York Times, 2014). This research will give a better understanding of how users are characterizing their user experiences with AR news content, what content users find most compelling and whether users will embrace AR news content into their daily news consumption. The following research question is posed:

RQ: *How do users engage with augmented reality news content?*

This main research question covers three sub-questions, which are the following:

SQ1: *How do users feel about adopting augmented reality news content into their news consumption routine?*

SQ2: *How do users characterize their user experience with augmented reality news content?*

SQ3: *What content elements find users most compelling in augmented reality news content?*

In order to answer these research questions, the following chapter will first discuss the main theoretical concepts. This chapter will not only include already existing scientific theories but will also introduce the line of reasoning. More specifically, news media and augmented reality are explained as well as technology adoption and user experience. In the next chapter, a detailed overview of the methodological choices will be given. This will include a thorough explanation of the sample and it will be argued why in-depth interviews were used within this research. Moreover, it discusses the analysis and interpretation procedure of the collected data, focusing on a thematic analysis. After this chapter, a rich overview of the results is given focusing on the main themes which emerged from the analysis. In detail, this section includes a discussion which will connect the findings to the literature. Finally, the conclusion is stated with the limitations and suggestions for further research. The goal of this research is to get a deep understanding of the user engagement with augmented reality news content, which contributes to existing scientific literature as well as that it has social relevance to the news industry.

2. Theoretical framework

This chapter discusses the main concepts and theories which are necessary to understand how users engage with augmented reality news content. First, the changing patterns in news media will be introduced, focusing on mobile news consumption. Then, augmented reality is introduced and an elaborate description of augmented reality is given, emphasizing its interactivity, engagement and the importance of immersive content. Next, in order to understand user adoption, two concepts will be discussed: the innovation diffusion theory and the technology acceptance model. Finally, user experience is argued. Within this section, emphasize is given to user expectations and a multi-layer conceptual framework which is focusing on different aspects of user experience.

2.1 Changing patterns in news media

News consumption, production, and distribution is changing due to technological developments (Van der Haak et al., 2012). Hence, news and media storytelling notions are challenged. Nowadays, individuals have the ability to engage with journalism, where they have increasingly disengaged themselves from traditional news and moved to mobile devices to get their news (Pavlik & Bridges, 2013). Individuals do so, because smartphones make accessing the news more easy for individuals. It has become easier for individuals and news outlets to share news online, making mobile news content more diversified, and because news content is more accessible on mobile devices, it has become easier for users to get their news based on their own preferences. Mobile users can now easily select news content anytime and anywhere just by visiting news website, going to mobile news apps or by logging in into social media (Shim, You, Lee, Go, 2014). Furthermore, mobile users who read their news online are more likely to access their news on multiple platforms. This means that users spread their attention to different news platforms across different media during the day (Molyneux, 2017). These news media can supplement each other in order to create a varied news routine for users (Molyneux, 2017). Furthermore, news consumption on mobile devices is usually characterized by terms like frequency, brevity, distraction and low attention (Molyneux, 2017, p. 11), as research reveals that users use their smartphones within their news consumption in order to read small amounts of news, filling the gaps within their day. Thus, individuals consume news on their smartphones more times a day, in shorter sessions and more spread out over the course of the day than on other platforms (Molyneux, 2017).

According to Teneja, Webster, Malthouse & Ksjazek, “place” is an important concept when addressing mobile news consumption (2012, p. 154). They reveal in their research that mobile media consumption is most common during commuting and when being at work. This is confirmed by a research showing that individuals usually consume mobile news while on the go and during gaps in the day (Dimmick, Feaster, & Hoplamazian, 2011). Other research reveals that individuals also consume their mobile news at other places such as home and at work (Schrøder, 2014). Moreover, research of Westlund suggests that “norms are emerging on where and when it is appropriate to use

one's smartphone, which may condition the places of use" (2015, p. 154). This means that although now the previous named places are common for mobile news consumption, this can still change due to changing norms of individuals. Thus, mobile news consumption is considered to have different times and locations, being less stable compared to other news media (Wolf & Schnauber, 2014; Westlund, 2015).

As discussed, the increasing use of mobile devices has changed the way in which individuals consume their news, however, it has also altered news content. For instance, news content in mobile devices mainly involves soft news, which is content focusing especially on entertainment news. This is because nowadays, users have more diverse content to select as well as that they have more control over their news selection, as they are presented with more news media choices (Kim, Chen, Gil de Zúñiga, 2013). Therefore, many users may swap their news content for more entertaining content, just because "the selection of entertainment content can maximize their comfort through the provision of pacifying information" (Kim et al., 2013, p. 2609). Furthermore, mobile news consumption has changed news production and consumption due to the devices its small touchscreen, ubiquitous information availability and limited data storage. For example, due to limited data storage and a small screen on mobile devices, users can prefer to consume short articles on these devices. Thus, news outlets can make content that is optimal for mobile devices by making shorter content, due to the limitations of these devices. Therefore, content in mobile apps usually focus more on news about sports and celebrity than on politics and current events news (Kim, 2011).

This section shows that users read more digital forms of news consumption, which serves for higher accessibility and selectivity for users. Smartphones are a significant part of users news consumption, where individuals consume news on their smartphones more times a day, on different locations compared to other news media. These developments allow for more competition between news outlets. This research suggests that a form of mobile news content that may provide relative advantage for a news outlet can be augmented reality news content. In the next section, this concept will be discussed in order to give an understanding of what augmented reality entails.

2.2 Augmented reality

Augmented reality can be defined with the help of the "virtuality continuum" (Milgram & Kishino, 1994, p. 3) (see figure 2.1). Milgram et al. defined this continuum as a real-to-virtual world, where augmented reality is part of mixed reality (Azuma, Baillot, Behringer, Feiner, Julier & MacIntyre, 2001). The real objects are on one side of the continuum and the virtual objects are at the other side. The virtual environment (virtual reality) engages users in a totally virtual world without actually seeing the real environment. Virtual reality is the media that is most immersive as it produces surroundings in which individuals can actually be "present" in an artificial environment. According to Dow et al. (2007), immersion is about the qualities of technology based on media that produces

sensory impact for the user. Media is more immersive when it actually surrounds a user (Dow et al, 2007). In augmented virtuality, real items are added to virtual ones, while AR gives a sense of reality by placing virtual objects in the real environment, in real time (Alkhamisi & Monowar, 2013; Azuma et al., 2001). Augmented reality imposes virtual objects in the real world (Doye, Gelman & Gill, 2016), which means that it can give users digital information within their real environments. The purpose of AR is to produce a seamless integration between virtual and real items in order to enhance the user's experience (Heim, 2007).

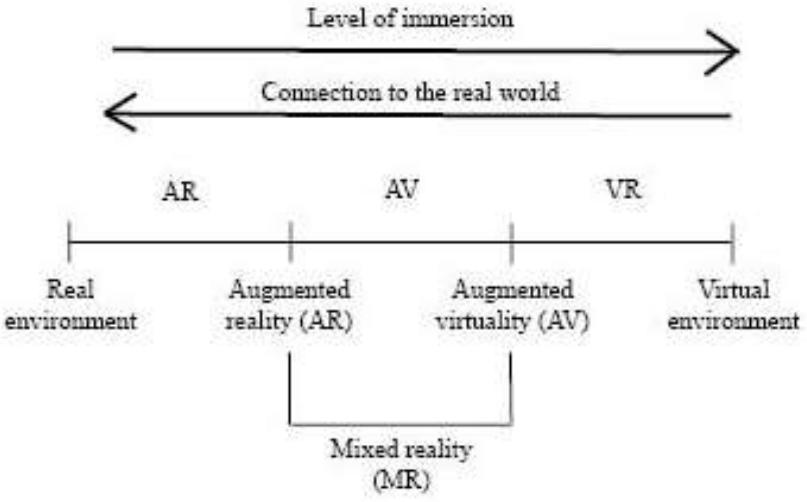

Figure 2.1 Virtuality continuum with examples (Kamenov, 2017)

Augmented reality is based on a relatively new technology of which the technical aspects are relevant to indicate in order to understand its usage. Within augmented reality, the camera blends physical things with digital sources of information, presenting this to the user in a composite view and executing it in real time (Azuma, 2015). AR is closely linked to the real environment as it is based on context-aware technology (Martinez, 2014). Context-aware technology is a necessary function of AR as it needs to be able to extract data "about a user's location, posture, intentions as well as environmental features" as this "has direct consequences to how synthetic information is utilized and 'placed' spatially and temporally" (Ritsos, Ritsos & Gougoulis, 2011, p. 5). Context includes more than the location of a user but also includes elements such as background noise, lightening, social circumstances and tethering (Ritsos et al., 2011). Communication technologies and sensors are developing nowadays, which allows mobile devices to become more context-aware, which means that the physical, task, technological and social context of users can be extracted as well as interpreted and utilized by AR apps (Abidin, Arshad & Shukri, 2017). Furthermore, AR services concentrate on several objects in the surroundings of a user and they need to recognize these objects and present information attached to it in a user friendly way. Thus, AR involves new storytelling forms "that

enable virtual content to be connected in meaningful ways to particular locations, whether those are places, people or objects" (Azuma, 2015, p. 259).

Mobile devices, including smartphones, tablets and smart glasses, have become an appropriate platform in which AR technologies can be applied (Olsson, Lagerstam, Kärkkäinen, & Väänänen-Vainio-Mattila, 2011). The increase in the features and capabilities of mobile devices, combined with accessible and affordable Internet rates made mobile augmented reality available for users. Mobile devices are more constrained than traditional computers on a computational level, however, mobile devices are better for the development of AR applications because of its multitude of sensors (Chatzopoulos et al., 2017). On these mobile devices, augmented reality can augment what a user sees through his or her device its camera with multimedia content. For instance, a user can direct his or her smartphone to the sky and learning the names of the sky, or the user can for example direct his or her camera to a film poster and watch its trailer (Hemamalini, Hema Priya, Vinston Raja & Poonkuzhali, 2017). With mobile augmented reality (MAR), augmented reality is generated and retrieved with mobile devices in mobile environments (Irshad & Rambli, 2014). Users can easily use augmented reality content whenever and wherever they want with their own mobile devices. Thus, the technical and mobile components of augmented reality make it easy for users to experience AR applications. Next to the technical and mobile component of augmented reality, interactivity and engagement are also components that are necessary to indicate when studying augmented reality from a user perspective.

2.2.1 Interactivity and engagement

Next to the technical and mobile component of augmented reality, interactivity and engagement are also components that are necessary to indicate when studying augmented reality from a user perspective. AR applications allow users to interact with the experience. In general, interaction is the shared impact of one thing on another. Within an augmented reality experience, there is interaction with the virtual as well as with the physical world. As the virtual and real world are combined in augmented reality, there are multiple ways to interact. In general, examples of interactivity in AR are interactions based on speech or gesture, including motion and eye tracking methods as well (Craig, 2013).

Multiple researcher have tried to define interactivity more in detail. For instance, Kristof and Satran (1995) debate that interactivity gives users self-directed control, where interactivity being high or low can impact engagement. Laurel describes interactivity as a "system's provisions for enabling a user to "act within a representation" and she defines this with three aspects, including frequency, range and significance (1993, p20). Frequency is based on how often someone can interact, range refers to how many choices there are existing and significance is about how much the choices actually matter (Laurel, 1993).

Interactivity is understood as a key component of the concept of engagement. This is because engagement is about involvement of the user in producing, consuming or distributing information, where this involvement is often expressed as interactivity (Ksiazek, Peer & Lessard, 2014). Not only involvement is a component of engagement, but being retained, occupied and intrinsically interested in something are also considered as fundamental components (Kim, Kim & Wachter, 2013). Within the context of a certain medium, such as newspaper, TV or augmented reality, engagement can be defined as a group of qualitative experiences with the medium. In fact, research shows that the rate of engagement user have, depends on their experiences with it, including how they feel about it, react to it and think about it (Pagani & Mirabello, 2011). Previous research has connected engagement with AR. For instance, a research of Scholz and Smith (2016) to AR engagement within the field of marketing focused on how AR components could facilitate engagement. Additionally, Singh and Pandey (2014) also studied the augmented reality in relation to marketing, focusing on the changes in media consumption and how augmented reality could useful to get engaging consumers. These studies focus mainly on marketing practices, where user engagement of augmented reality in the journalism is limited.

2.2.2 Immersive content

As augmented reality is based on interactivity and engagement, its content is also concerned with these concepts. In this context, the form of storytelling has moved from a linear form to a non-linear form. Traditionally, stories show facts in a linear manner, which is usually from the beginning to the end. Typically, these stories have media forms that are based on a single or dual modality, such as only text or text together with an image or video. In this form, story is fixed and distributed in time. However, shifts in technology allows audiences to engage more actively with news rather than listening, reading or watching news content passively (Pavlik & Bridges, 2013). This form of storytelling is nonlinear and within this form, individuals can explore content in different ways, "perhaps beginning in the middle, moving across time, or space, or by topic" (Pavlik & Bridges, 2013, p. 22). This idea of a nonlinear media form is related to the concept of immersive storytelling. Immersive storytelling is a form in which content is presented by immersive media and it gives individuals the opportunity to experience content in first person. The main idea of immersive storytelling is that individuals are allowed to enter a recreated virtual situation which represents the story and in which they can get a feeling of presence through the experience (de la Peña, Weil, Llobera, Giannopoulos, Pomés, Spanlang, Friedman, Sanchez-Vives & Slater, 2010). The purpose of using immersion is to create a deeper connection between audience and story (Doyle, Gelman & Gill, 2016).

With interactive and immersive stories, users can have the feeling that they are being in the story, which refers to presence, as well as that they have the feeling that they have control over events within the story, referring to agency. This is both connected to the concept of embodied narrative

engagement. This form of engagement gets created through the medium and the content, where it varies per individual. In this context, presence relates to the feeling of being in a world, whether this is physical, virtual or a mix of it. The concepts of presence and immersion are frequently used synonymously (Dow, 2008). Immersion is the feeling of being surrounded by another reality (Murray, 1997), as well as that is applies to any "absorbing activity" (Ryan, 2001, p. 14). In fact, active engagement is necessary with immersion and it also refers to a "corporeal experience" (Ryan, 2001, p. 21). Research of Gorini et al. (2011) suggests that emotional content within a virtual experience are expected to give a higher degree of presence, as well as that it contributes to a better interaction with the surroundings than neutral content. Moreover, agency is based on an empowerment feeling which individuals can get over events within a medium, in which they want to take action. In this research, three forms of agency are discussed; movement agency, object agency and narrative agency. Movement agency refers to "the ability to navigate a world", object agency focuses on " the ability to modify the world" and narrative agency is about "the ability to effect the course of unfolding plot events and the outcome of a story" (Dow, 2008, p. 4). Agency is based on the feeling of action, where a user has to feel that his or her action influence events in that particular environment (Dow, 2008).

As discussed, immersion requires active engagement, where interactive content actually has impact on the recall of content. Research has shown that physical action can aid with remembering information. For instance, research suggests that children can remember information better when first reading this information and then acting it out by using physical props compared to children who only read it (Glenberg, Brown, & Levin, 2007). Other research on specifically AR showed that students had a better recall when interacting physically with a story, compared to non-interactive content (Hornecker & Dünser, 2009).

Compelling content can enhance engagement (Kaplan & Haenlein, 2010), however, within the context of augmented reality, its content should be made based on the affordances of the medium. When creating content for AR experiences, it is not optimal to just transfer content from a medium such as TV to a AR medium (Craig, 2013). According to Craig, "there are aesthetics, communicative and technical aspects of AR content and all must be addressed fully to achieve a compelling application" (2013, p. 182). Additionally, the interaction, the content, the sensors, the displays and other relevant aspects of AR applications have to work together in order to show the desired content to the user (Craig, 2013). Furthermore, when the core of the story solely comes from reality, with little contribution of augmented technology, then it does not make sense to use AR. On the contrary, if the story is only based on virtual content, then the augmentation is not used optimally (Azuma, 2015). Thus, finding a good middle ground is essential.

This section provided an overview of augmented reality as being part of the virtuality continuum, focusing on augmented reality as well as on interactivity and immersion, which are all

linked to engagement. In order to focus more on engagement within augmented reality, it is important to take technology adoption into consideration, which will be discussed in the following section.

2.3 Technology adoption

Research suggests that technology acceptance is "a starting point of technology engagement" (Kim, Kim & Wachter, 2013, p. 361). In general, acceptance is based on the selection of an individual to use something (Kim et al., 2013). Engagement is determined by mobile technology's offer of diverse activities as well as user choices to access what is offered (Wachter, Kim & Kim, 2012). This research discusses augmented reality as a mobile technology that can engage users, where the adoption and acceptance decision still has to be made by the users, so it is based on an anticipated adoption perceptions.

From the user perspective, there are multiple innovation acceptance and adoption models. Among all, both the innovation diffusion theory (IDT) as well as the technology acceptance model (TAM) have been regarded as reliable frameworks for studying technology adoption and diffusion (Chan-Olmsted, Rim & Zerba, 2012). Within the IDT, an individual goes from gaining knowledge about an innovation to developing an opinion about an innovation. When an opinion is developed, a person decides to reject or accept an innovation (Rogers, 2003). While IDT proposes these different stages a person goes through when deciding on whether to adopt an innovation or not, TAM suggests that perceived ease of use and perceived usefulness are factors of importance when predicting "one's behavioral intention toward a specific information technology" (Chan-Olmsted, et al., 2012, p. 127).

2.3.1 Innovation diffusion theory

As discussed, user adoption relate to the theory of Rogers focusing on diffusion of innovations (Olsson, Kärkkäinen, Lagerstam & Ventä-Olkkonen, 2012). In this theory, "diffusion is the process by which an innovation is communicated through certain channels over time among the members of a social system" (Rogers, 2003, p. 5). Diffusion relates to communication, where communication is defined as a process in which individuals are producing and sharing information with someone else to create a shared understanding. As diffusion is based on new ideas, it also involves the concept of uncertainty. Uncertainty relates to the "degree to which a number of alternatives are perceived with respect to the occurrence of an event and the relative probability of these alternatives" (Rogers, 2003, p. 6). The lack of structure, information and/or predictability is suggested by uncertainty (Rogers, 2003).

Individuals can retrieve information by information-seeking and information-processing activities in the innovation-decision process in order to decrease the degree of uncertainty. This process can result in either adoption or rejection, which is decided on by an individual while passing several stages. These main stages are defined by Rogers (2003) as the following: (1) knowledge, (2) persuasion, (3) decision, (4) implementation, and (5) confirmation (p. 20). Within this research,

knowledge and persuasion are of great importance as it only focuses on the first moment of usage with AR technology. In detail, knowledge relates to when an individual is introduced to the existence of a new technology and gets some ideas about how it works. Here, individuals want to know what the innovation exactly is, how it works and why they should use it. The next stage is, persuasion which relates to individuals who form a positive or negative attitude towards the new technology.

Next to the stages of the innovation decision process, it is also important to note the different factors of an innovation which could clarify the rate of adoption, such as relative advantage, compatibility, complexity, trialability, and observability (Rogers, 2003, p. 15). All these factors impact the rate of adoption. Relative advantage is based on how much better the innovation is than its competition. Compatibility is about whether the innovation is in line with existing ideas, the needs of the adopter and their earlier experiences. Complexity shows the level of difficulty when a user wants to adopt an innovation. Trialability represents the ability to experiment with a technology before fully adopting it. And lastly, observability refers to the availability of the innovation, such as how much it can be seen in use. When an innovation is more used and thus more visible, individuals have more chance to observe its advantages (Rogers, 2003).

As Rogers describes (2003), there are different factors that influence the decision process of adopting new technologies, these factors include "socioeconomic status, personality variables and communication behavior" (p. 251). Accordingly, the process of new technology adoption passes several stages which have different user group types. Individuals can be categorized by five adopter categories, which are innovators, early adopters, early majority, late majority, and laggards. These categories are groupings "of members of a social system on the basis of innovativeness", which is related to whether someone is relatively faster in adopting a new technology than members of another system (Rogers, 2003, p. 22). The distribution of adopters usually is a s-shaped curve over time, which is because of the diffusion effect. This effect is described as "the cumulatively increasing degree of influence upon an individual to adopt or reject an innovation", which results from the usage of the innovation in peer networks (Rogers, 2003, p. 234). This influence comes from the growing amount of knowledge and rejection or adoption of the innovation in the social system (Rogers, 2003).

2.3.2 Technology acceptance model

One other frequently used theory within research of user adoption is the technology acceptance model (TAM). TAM serves flexibility and is a robust model, thus many studies have included this model in different areas of research (Rauschnabel & Ro, 2016). TAM is also used in research areas such as mobile news consumption (Chan-Olmsted et al., 2012), and augmented reality (Leue, Dieck & Jung, 2014; Spreer & Kallweit, 2014), however, there are limited studies on the AR user acceptance within news consumption.

TAM proposes that there are important determinants, such as the perceived ease of use and the perceived usefulness, which can forecast someone's behavioral intention towards a particular technology (Chan-Olmsted et al., 2012). Davis (1989, p. 320) suggests that these factors are of theoretical importance because it is indicated by several different researchers. Davis (1989, p. 320) states that individuals are likely to use an innovation when they believe it can perform their task better, which refers to perceived usefulness. Users' perceived usefulness is based on their attitude toward the ability to easily deliver their preferred end state when engaged. This preferred end state is based on their activity and goal. The value that users derive from certain engagement should enhance their satisfaction during and after the actions done (Kim et al., 2013). Moreover, the perceived ease of use refers to the belief that an innovation is useful in combination with the belief that it is not too hard to use and free of effort (Davis, 1989). In relation to engagement, actions that entail limited effort increase the chance that someone will engage (Kim et al., 2013).

As discussed, TAM have been applied to study augmented reality technologies before. These studies show that the TAM is an appropriate model for AR research. However, some of the AR research added extra variables to the TAM. This is done since in TAM research it is important to use context specific variables to make sure that it is applicable to different contexts (Ayeh, Au & Law, 2012). For instance, Leue et al. (2014) include personal innovativeness within AR TAM research. Personal innovativeness origins from the DIT theory of Rogers (2003) and relates to the willingness of a user to try out new products and services (Morosan, 2012). According to Yussof, Ibrahim, Zaman, Ahmad, & Suhaifi (2011) personal innovativeness has a positive effect on whether a user wants to use AR applications, where this variable also has a significant role in the context of engagement (Guo & Chan-Olmsted, 2015).

This section discussed two user adoption models which are relevant for this study. As mentioned, user adoption is of importance as it is the starting point of user engagement. Knowing when and how users adopt a new technology, it is more clear how and why they engage with a technology. In order to study engagement, it is also important to know how users characterize their experience with AR news content, of which its relevance is discussed by the next section.

2.4 User experience

Earlier research states that user experience is linked to engagement (Kim et al., 2013), as numerous studies regarding engagement are based on the subjective experiences that individuals felt who are engaged (Peters, Castellano & Freitas, 2009). Hence, experiences of individuals play a part in the overall engagement level. In fact, engagement can be described as "the sum of the motivational experiences consumers have with the media product". The main part in understanding engagement is user experience, where it is important to understand the different experiences a user has regarding a

media product (Pagani & Mirabello, 2011). Thus, it is crucial to understand how user perceive experiences individually, in order to discuss how users engage with them (Olsson et al., 2011).

According to International Organization for Standardization (ISO), user experience is "a person's perceptions and responses resulting from the use and/or anticipated use of a product, system or service" (2009). Within user experience research, user experience especially emphasizes on the emotional relationship between the product and the user, which moves beyond usability (Olsson & Väänänen-Vainio-Mattila, 2011). According to Olsson and Väänänen-Vainio-Mattila (2011), user experience is "subjective, depends on the context, and develops over time" (p. 2). Furthermore, anticipated usage is also an important attribute to user experience. In his study, Olsson (2013) emphasizes this attribute, focusing on expectations, as he discusses that the expectations of the possible user are of great importance for new technologies. The expectations of a user can influence their opinion of the experience its quality and capabilities. When a technology meets the expectations of a user, he or she is likely to be satisfied with the experience, while when it does not meet the expectations of the user, the user will be dissatisfied. Additionally, anticipated use of an experience is an essential aspect of user experience, since the expectations of a user are reflecting the anticipated behavior, thus this has an influence on the formation of the actual user experience (Olsson et al., 2011). The expectations of users before they have done an experience can have a key role in assessing the overall feeling of the new service. Thus, it is necessary to understand possible users their expectations of an innovation and its implementation (Heikkinen, Olsson, Väänänen-Vainio-Mattila, 2009).

Furthermore, user experiences based on engagement are often related to the concept of immersion. For instance, when engaging with a computer game, experiences based on engagement usually relate to the feeling of losing oneself in the virtual world of that game (Peters, et al., 2009). Another important concept within user experiences is flow. Flow is described by Csíkszentmihályi (1990) as an "optimal experience", defined as "the state in which people are so involved in an activity nothing else seems to matter" (p. 4). When wanting to keep individuals in a flow, it is key to maintain "optimal arousal, where curiosity is maintained through complexity and variety, by a mix of perceived challenge (difficulty) and user ability (skill)" (Hart, 2014 p. 50). Thus, user experiences focus on immersion and flow, which provides users with an optimal user experience.

2.4.1 Multi-layered conceptual framework on MAR user experiences

In order to study user experience and to see whether users have an optimal experience with augmented reality news content, the multi-layered conceptual framework of Irshad an Rambli is used (2016). This framework focuses on mobile augmented reality and user experiences. It includes several dimensions that are important for user experiences, including MAR service features, time and context, which are necessary in order to ensure a complete experience. Irshad and Rambli (2016) have made

this framework based on their own research regarding user experience evaluation of MAR technology and other studies related to MAR and user experience.

Within Irshad and Rambli (2016) their framework, there are several MAR service features that are of great importance, including presentation, information content, service functionality, interaction, augmentation and mobility. The first feature is presentation, as "the look and feel of a product have a great impact on the user experience (Irshad & Rambli, 2016, p. 23). The presentation of virtual and real content, images, colors and other media impacts emotional user experiences. This impact varies from user to user as this depends on the context of use. The second feature is information content. Visual content is one of the most important elements of MAR (Irshad & Rambli, 2016). Visual information can vary from just a simple informational representation to challenging 3D modelling (Irshad & Rambli, 2014). Third, the service functionality is depending on the momentary needs of a user. The experience should provide the user with information based on their personal relevance within the context. MAR apps provide a functionality which is unique as it both has real and virtual elements, thus arousing new experiences for the user. Fourth, as mentioned above, interactivity is of importance within an immersive user experience. AR experiences that focus on mobile devices are expected to execute a task while the user is on the go. Interactivity for MAR should be therefore be made for precise and instant interaction. Fifth, another important feature applications based on MAR are the ability to put information in the real world, focusing on augmentation. Users will have control over their surroundings due to augmentation. "Streamlining background information and customize augmented content" in applications regarding MAR can improve the user experience (Irshad & Rambli, 2016, p. 24). If the information that is based on augmentation is context specific, is using visual and audible cues and if it has accurate viewpoints, it can help to enrich the user experience. Finally, mobility is another important MAR service feature, which relates to whether the technology is usable in activities and in mobile contexts, always allowing interaction (Irshad & Rambli, 2016). All these six features "can vary according to the requirements of the domain for which the application is designed because of the multifaceted nature of MAR" (Irshad & Rambli, 2016, p. 23). For instance, the requirements and design are different for a MAR educational application than for a MAR advertising campaign. Therefore, these features may not specifically apply to all MAR applications (Irshad & Rambli, 2016).

Besides the MAR service features, time is also an important attribute within a MAR user experience. It depends on time what kind of experience a user has when experiencing a MAR service. Four different timespans are relevant here in order to estimate the whole user experience. According to Irshad and Rambli (2016, p. 24), "the temporal nature and time span of UX are important concepts in understanding user experience characterization." Roto, Law, Vermeeren and Hoonhout (2011) studied the user experience based on time. They grouped these experiences based on time, naming them anticipated user experience, which is before usage, momentary user experience, which is during usage,

episodic user experience, which is after usage and cumulative user experience, which is over time. Clarifying the time span of the study is important when discussing user experience. Within this research it is chosen to focus on a moment of usage, which can give more details on a user their emotional responses. When a study focuses on a longer period, it may show the impact of moments in the experience on a cumulative user experience. For instance, according to Roto et al. (2011, p. 9), "the importance of a strong negative reaction during use may diminish after successful outcomes, and the reaction may be remembered differently". Thus, a focus on experiences within one moment gives different values on evaluation than focus on a longer time span of user experience (Roto et al., 2011). Furthermore, specific context is also considered when studying MAR user experiences. Within this research, context includes physical aspects such as the surroundings, the temperature and the weather. It also contains related tasks such as task importance, time and meaningfulness and it includes a cultural and social aspects, such as language, religion, time pressure and social requirements. Therefore, taking in account different factors which are affecting the user experience is important when studying an engaging experience.

Taken everything together, this chapter has given an overview on different theoretical concepts. It showed that user adoption, user experiences and content are important components of user engagement within augmented reality news content. Augmented reality offers new forms of content to news outlets, such as immersive storytelling (Pavlik, 2013), which gives individuals the opportunity to experience content in first person, where they can have the feeling that they are actually present in a recreated virtual situation (de la Peña et al., 2010). Content is an important aspect of immersive storytelling, as when the content is not addressing the communicative, aesthetics and technical aspects of AR content, it will not give a compelling experience. Additionally, research indicates that the starting point of technology engagement is technology acceptance (Kim, Kim & Wachter, 2013). This refers to the user adoption, since acceptance is based on the selection of an individual to use something (Kim et al., 2013). Furthermore, user experience is an important attribute in this study to user engagement as earlier research stated that user experience is linked to engagement (Kim et al., 2013). Various research to engagement are related to the experiences that individuals felt who are engaged (Peters et al., 2009), where experiences of individuals are a significant part of the overall engagement rate. Moreover, the key part of understanding engagement is user experience, where it is important to understand how users perceive experiences individually (Pagani & Mirabello, 2011; Olsson et al., 2011). In the context of this study, user experience is linked to immersion and flow, which can provide users with an optimal user experience. Besides this, research suggest that expectations should also be taken into account when researching user experiences, as expectations can influence the satisfaction of users (Olsson et al., 2011).

3. Method

This research examines how users engage with augmented reality news content within news consumption. This chapter discusses the methodological aspects of this research. First, the research design is discussed, elaborating on why the qualitative method of interviews is appropriate for this study. Next, the case of this research is explained which is used during the interviews to give the participants a sense of what augmented reality in news content is. Afterward, sampling is discussed followed by the operationalization. Lastly, the data collection process and analysis is described focusing on thematic analysis.

3.1 Research design

This research focuses on how users engage with augmented reality news content. To gain more understanding into this topic and to eventually answer the research question, it is insightful to examine users' experiences, views and opinions on augmented news content and their news consumption. Therefore, the appropriate type of research method is qualitative data collection. Qualitative research emphasizes on gathering participants' experiences, their views and thoughts and highlights the participants their unique responses. Understanding the participants' thoughts on a topic is not standardized as it collects in-depth information from the participants (Ormston, Spencer, Bernard, & Snape, 2014). Thus, this study aims to gain insight and understanding in how users engage with augmented reality news content, by employing a qualitative research method.

This study focuses on users, specifically individuals who are familiar with the *New York Times*, and on how they engage with augmented reality news content, focusing on user adoption, user experience and content. Therefore, in-depth semi-structured interviews were done in order to gain more insights from the participants on these topics. Semi-structured interviews offer flexibility, due to two reasons. Firstly, the interviewer can change the order of questions every time and secondly, the interviewer can ask follow-up questions to get more insights in some mentioned topics, in order to clarify the interviewees' answers. This flexibility offers the participants the chance to reveal their views as well as that it gives the interviewer the opportunity to explore the answers of the participants (Brennen, 2013, p. 28). Furthermore, semi-structured interviews enable the interviewer to be interactive. With interaction between the interviewee and the interviewer, information is co-constructed, which provides a more clear understanding of the participants' perceptions (Legard, Keegan & Ward, 2003).

In order to make the participants familiar with augmented reality within news content, the interviews were based on one AR article of the *New York Times* mobile app. The case that was used is about the Winter Olympics of 2018. The case will be explained more elaborate in the next section. This case is used in the interviews to give the participants a sense of what it is like to engage with

augmented reality news. This case will guide the interviews, as interviews questions were asked based on this case.

3.1.1 Case – The *New York Times*

The American newspaper the *New York Times* is concerned with the changing news industry and therefore puts emphasis on innovations within their business. They produced an Innovation Report (2014) of which the goal was to find ways "to expand the reach and impact of our journalism at a time when technology, user behavior and our competitors are evolving more rapidly than ever" (p. 1). To stay up to date with new technologies, the *New York Times* started to experiment with innovations. For instance, the *New York Times* started to implement personalization technologies in their app and they experimented with different kind of forms of content, such as virtual reality and snowfall articles. From the beginning of 2018, the *New York Times* started to experiment with augmented reality in their practices, also offering consumers new forms of news content within their app. Other newspapers, such as the Washington Post or the USA Today have also applied immersive media features to their news stories, however, the *New York Times* has shown a dedication to the integration of augmented reality features in their storytelling as a regular element, having multiple articles covering this (Palladino, 2018). Therefore, this app is a relevant case to research user engagement with augmented reality within the news industry.

Within their app, the New York Times offers several augmented reality articles. These articles allow users to have virtual three-dimensional items placed in their own real environment, where readers can interact with the news. For instance, users can step inside the Thai cave, which came into the news in July 2018, to experience the real scale of the obstacles the rescuers faced. Within this article, users can see the size of the cave in their own environment and they can interact with it by actually stepping through the cave. Other AR articles are about David Bowies costumes, a mission of the NASA to Mars and the Winter Olympic its athletes (Harrison, 2018). The latter article named is used in this research, in order to give the participants a sense of what augmented reality in news can be. The article chosen is about the Winter Olympics of 2018, which was published on February 5, 2018 (Branch, 2018). This news item was a large collaboration between the newsroom and the product and design staff of the *New York Times*, and it shows the benefit of augmented reality which is that it emphasizes "the explanatory value of visual journalism" (Roberts, 2018).

The abovementioned article can be found in the menu of the *New York Times* app under the tab 'Immersive AR/VR' (figure 3A). Here, more articles based on immersive media can be found (Figure 3B). This specific article is chosen since it focuses on augmented reality and it includes enough storytelling and interaction elements on which could be elaborated in the interviews. The article focuses on several athletes of the Winter Olympics, such as an ice skater, a skier and a snowboarder. With every athlete, an introduction is given in text, following by an AR experience in

which the user can walk around the athlete, seeing his pose and body as well as getting more information with it. Within this research, only the first part about the ice skater is used by the participants. During the interview, they had to read the introduction text about this Olympic ice skater, Nathan Chen, followed by using the AR experience of him.

Within this article, first text is presented which introduces an ice skating athlete, Nathan Chen (figure 3C). When scrolling down another screen appears into the article. First, this screen asks the user to allow camera access (figure 3D). This is asked only the first time of usage and is necessary to accept, otherwise the AR experience cannot be used. If accepted, the experience starts and instructs the user to aim the camera at the floor, or another flat surface, and move in a circle (figure 3E). Next, small yellow dots pop up in order for the experience scan the environment and when aiming at a flat surface, the 3D visualization of the athlete appears. This visualization is static and does not move. Then the experience instructs the user to pinpoint this visualization and tap to place the athlete where he or she would like to have it (figure 3F). When placed, the user is able to walk around the 3D visualization. This way, they can see the posture of the athlete, as well as that they can get more information about that specific athlete (figure 3G). There are three grey lines presented around the athlete. When aiming the camera on one of the three grey lines, more information will appear highlighting the line blue (figure 3H). Enough space is needed to walk around the 3D visualization, as the visualization is quite large and users still need to activate all the information lines by walking around the visualization. There is an opportunity to make the visualization small with clicking on the icon in the right upper corner (Figure 3I). Furthermore, if the athlete is not placed in a right place, users are able to place the visualization again by clicking on the icon in the upper left corner (Figure 3I). In this study, the app refers to the app of the *New York Times*, including all the articles. The text refers to the actual text in the article used for this case, which is the introduction to Nathan Chen. The experience refers to the AR experience, in which the users actually have to walk around in order to interact with it. The article refers to both the text and the AR experience, focusing on the case of this study.

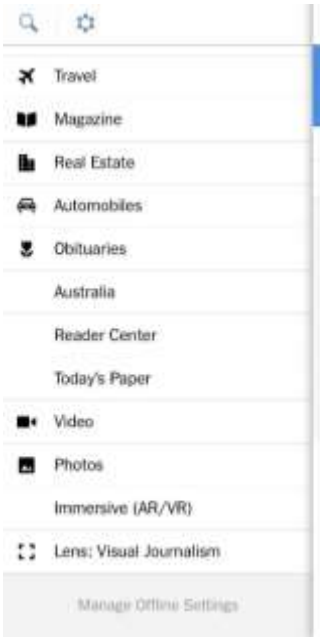

Figure 3A.

Figure 3B.

Figure 3C.

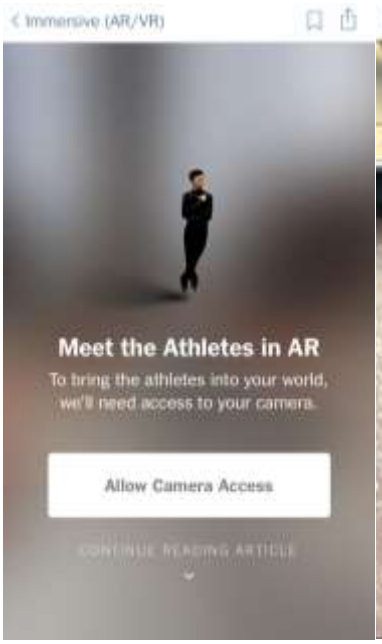

Figure 3D.

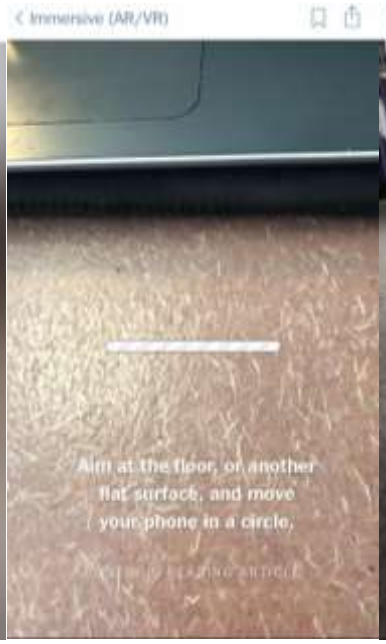

Figure 3E.

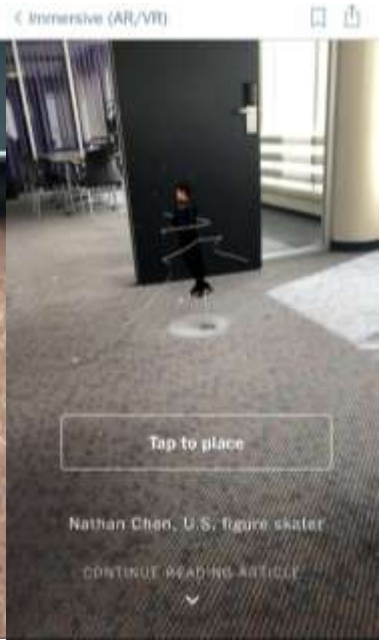

Figure 3F.

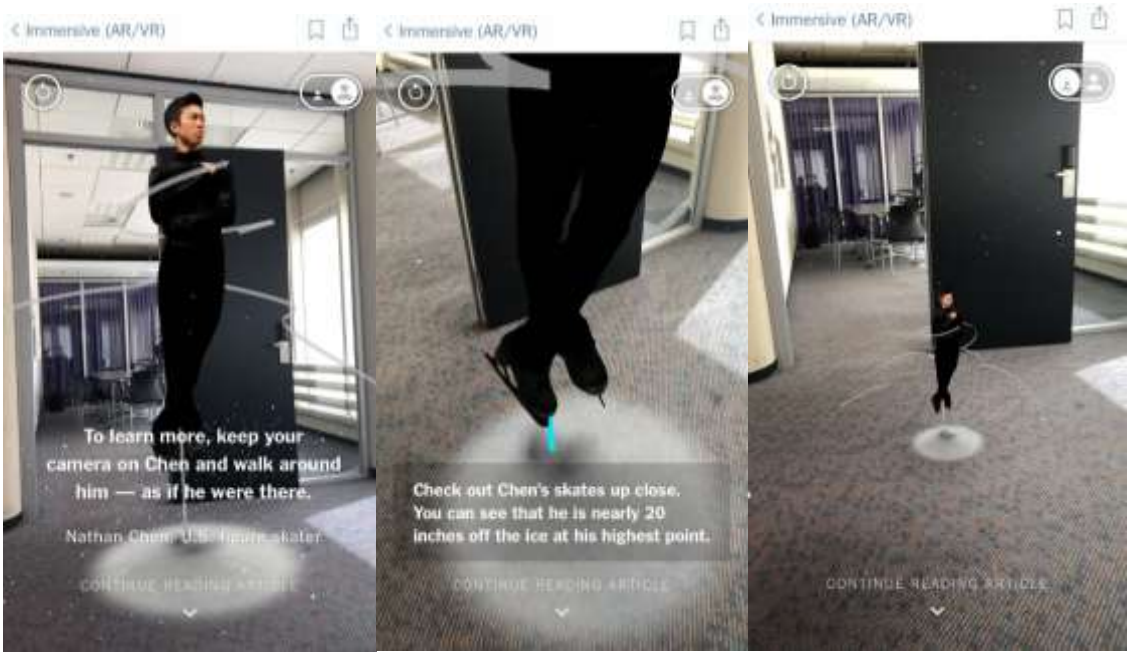

Figure 3G. *Figure 3H.* *Figure 3I.*

3.2 Sampling

This research focuses on individuals who are familiar with the *New York Times*, as this is the newspaper that is used as a case. This way the participants were able to answer interview questions based on the newspaper itself and it also enabled them to give answers to interview questions about news consumption as their familiarity with the *New York Times* content showed a general interest in news. Familiarity with the content of New York Times meant in this study that they had to be subscripted to the *New York Times*, have been subscribed to it before, or read articles on the website, social media or app of the *New York Times*. As discussed already, the particular AR features in the mobile app were used within the interview, so it was not necessary that the participants had already used the immersive media elements in the app. All participants had to be willing to download the *New York Times* app, as doing the AR experience on their own smartphone could give them the most real experience. In case the AR experience did not work on their own phones, the participants could use the smartphone of the researcher.

All participants interviewed were between the age of 18 and 34. This age range is chosen as this user group is most likely to get news from their smartphone according to the research of ComScore (2016). Therefore, these user group is most likely to actually engage with AR news content. Furthermore, Broom, Hand and Tovey (2009) suggest that it is of high importance to pay attention to gender, biographical, psycho-social and environmental aspects in qualitative data analysis. Therefore, it is made sure that the participants recruited have a variety in their backgrounds. For instance, variety in gender is achieved, as five participants are female and seven participants are male. Also, it is tried to

have a diverse range based on things such as their profession. In the interviews, all participants were able to show their opinions on augmented reality within news.

In total, twelve participants were recruited and interviewed. The participants were recruited via the social media channel Facebook, as well as through word-of-mouth recruiting. All participants, including the names, ages, profession and date of interviews can be found in an overview in Appendix A. Within this research, all participants have been given pseudonyms, in some cases, details such as the profession has been changed, in order to guarantee their privacy.

3.3 Operationalization

For this study, an interview guide was made based on the research questions and the theoretical framework, in order to guide the interviews (see Appendix B). Interview questions were made before, to ensure that all significant aspects of the study were covered. It is made sure all questions are open-ended, as this allows the interviewee to give in-depth answers (Harvey, 2011). Moreover, the order of the questions was based on each interview's situation. In addition, when a question needed context in order for the participant to understand it, the interviewer provided this.

Each interview started with some introductory questions, based on the participant their background, their readership of the *New York Times* and their knowledge of augmented reality. The definition of AR is explained when the participants did not know what AR is. This not only gave clarity to the participant, enabling them to answer the questions, it also gave the interviewer the change to see the initial reactions of the participants on this technology. After this, the AR news case of this study was used by the participants. During the usage of the case, questions were asked about the participants' experiences. This was done to see whether the participants were able to navigate easily through the case. After the case was used by the participant, the interview continued with questions relating to technology adoption, user experience, content elements, which are all topics relating to the research questions.

The first topic stated in the interview guide is about user adoption. These questions focus mainly on whether the users would adopt augmented reality news content within their news consumption. First, general questions regarding the participants' current news consumption are stated as well as questions referring to augmented reality news content in relation to their current news consumption. Next, the concepts of perceived ease of use and perceived usefulness were included, as these are important concepts within user adoption according to literature (Davis, 1989). Within the interviews, perceived usefulness is particularly discussed according to whether the content came across better through the augmented reality elements. Perceived ease of use is discussed according to the amount of effort the participants had to put into the usage of the application and on the instructions. Diffusion is discussed in this topic as well (Rogers, 2003), which focuses on the

communication aspect of new technologies, thus, questioning whether the participants would talk with others about their experience.

The second topic refers to user experience. This part emphasizes on how the users felt when doing the immersive experience and on the MAR service features. Attributes such as content quality, representativeness, augmentation, interactivity and mobility were discussed since literature suggests that these contribute to a complete experience (Irshad & Rambli, 2016). In this topic, the questions especially focused on the opinions of an immersive experience. Lastly, user expectations were discussed here, as literature suggests that this is an important part of user experiences (Olsson et al., 2011). Before using the case, the participants were asked what they expected from it. After using the case, it was asked if these expectations were met or not and how they felt about this.

Lastly, the third topic deals with content elements. Participants were asked to come up with content elements which they thought were compelling within AR news content. When the participants did not have an idea about this yet, first more questions were asked about augmented reality in general. This was done in order for the participants to create an opinion about augmented reality, which helped to answer questions about the content. Furthermore, questions focused on elements such as genre and news. With genre, it was asked what users thought of the news genre they thought augmented reality fitted, such as lifestyle articles, political articles, sports articles or financial articles. With the questions related to content and news, an emphasis was given on the characteristics of journalism, as it was asked whether it was ethical and whether the participants thought it fitted news in general.

3.4 Data collection and analysis

In total twelve interviews were conducted. During the interviews, notes were made in order to keep the interview structured and all interviews were recorded in order to transcribe all interviews. Before starting the interview, the interviewee and interviewer had an informal talk, in order to ensure a pleasant and comfortable atmosphere. Besides this, the topic of the research was introduced. It was explained to the participants what the research is about and for what purposes the findings will be used. After this, the interview started according to description in the operationalization section. In three interviews, the AR experience did not work on the smartphone of the participant, so in these cases, the case was used on the smartphone of the researcher. In total, an average of 56 minutes of audio recording of each interview was collected, which gave enough data to understand the user engagement of AR news content. Four interviews were conducted in English and eight were conducted in Dutch, due to language preferences or constraints of the participants. The sections of the Dutch interviews which are used in the result section were translated into English.

A qualitative content analysis was done on the interview transcripts, which provides a rich understanding and interpretation of the data (Hsiu-Fang & Shannon, 2005). To be more specific, a

thematic analysis was done on the transcripts to analyze and interpret the data. Thematic analysis fits most with this research as it is able to identify meanings from the data set, focusing mainly on the content, as well as on the aforementioned theoretical concepts (Riessman, 2008). Specifically, a thematic analysis focuses on categorizing data and showing patterns in order to examine the data (Braun & Clarke, 2006, p. 81). It can "usefully summarize key features" of a great amount of research data and it "can highlight similarities and differences across the data set" (Braun & Clarke, 2006, p. 97). Additionally, thematic analysis is based on an iterative process, in which themes are constantly improved and revised in order to create clear and structured themes (Braun & Clarke, 2006). This thematic analysis was conducted by using open, axial and selective coding, which allows the refinement of large amounts of data, creating structure and finally describe the data (Boeije, 2010).

Within this thematic analysis, it was first of importance to read the transcripts and to make notes when doing this. This way, the researcher familiarized herself with the data. Then, the analysis started with open coding, which included coding the entire data set (Braun & Clarke, 2006). Open coding focused on the first categorization of the data, giving it short descriptions (Strauss & Corbin, 1990). The goal of open coding is to explore the answers, familiarization with the data, as well as the creation of initial codes to manage the data (Boeije, 2010, p. 107). Then axial and selective coding was done, merging similar and relevant codes, categorizing them into less groups resulting in the final themes (Braun & Clarke, 2006). To be more specific, axial coding was mostly focused on describing and aligning categories, while determining the relevance of each category (Boeije, 2010, p. 114). Selective coding was based on shaping the definite findings. Moreover, the goal of selective coding was "determining important categories and possibly a core category, formulating the theoretical model, reassembling of the data in the order to answer the research question and realize the research aim" (Boeije, 2010, p. 118). All of the coding was done in an Excel sheet. Statements from the transcriptions were categorized in a coding sheet, as this provided a clear overview of the data and it could easily be structured by selecting relevant themes per topic. Within this process of coding, it was of high importance that no relevant data was missed. The themes that came out of this analysis will be discussed in the results chapter of this study.

4. Results and Discussion

The goal of this research is to find out how users engage with augmented reality news content. Due to the changing patterns news industry, news outlets are having a hard time to retain their audiences. Therefore, it is insightful to see how users engage with augmented reality news consumption, including whether users would adopt this new type of medium within their news consumption, how users characterize their user experience with AR news content and what they believe is compelling AR news content. However, until now, limited academic research is done on users engagement with augmented news consumption. Therefore, the following results show how users engage with augmented reality news. In-depth interviews were done and the collected data was analyzed and interpreted by a thematic analysis, trying to find reoccurring patterns. Three main themes emerged from the analysis and interpretation, which enables answering the research question. These themes are the following: "The learning curve of using AR content", "Importance of medium characteristic on immersive experiences", "Being active in news consumption". The following sections show the clashes as well as the similarities between the data.

First, the theme "The learning curve of using AR content" is presented, which emphasizes the perceived ease of use of the case. These findings highlight how businesses start to innovate with augmented reality, which is therefore rather new for users. As it is new the participants to use, they have to get familiar to AR experiences, as now they still perceive some barriers to the usage. These findings shed light on what aspects made the experience hard, however, it also emphasized on what made the experience easy. Moreover, privacy issues will be elaborated in this section, which shows that the participants do not see privacy consent as a barrier to the adoption of AR news content into their news consumption. In the end, the findings emphasize on the newness of AR experiences, where it indicates that especially the first time is hard users to user augmented reality since it is not clear what to do or where to look.

The second theme is "Importance of medium characteristic on immersive experiences", which highlights that medium characteristics such as interactivity and context awareness are important attributes to an immersive experience. Concepts such as added value, alternatives and perceived usefulness are discussed in this section. It states which content gives added value as well as that it highlights what the advantages of this content. Lastly, this section emphasizes the importance of expectations in user experiences and what impact these expectations can have on the level of immersion.

The third theme, "Being active in news consumption", shows that most individuals read their news on different platforms, throughout the day and across different media. This sections indicates that users have to be physically active when using augmented reality news content, however, it also shows that the participants do not want to be active every time when reading their news, as they can

feel uncomfortable when using it. This section indicates why this is the case and in which place the participants do feel comfortable when engaging with AR news content. Furthermore, the findings end by highlighting the preference of entertaining and in-depth news articles.

4.1 The learning curve of using AR content

The news industry is changing to more digital forms and the interest of individuals in newspapers is decreasing due to technological developments. Individuals are increasingly interested in mobile news, with which they can actively engage. Individuals now have access to multiple online news platforms, which increases the competition among news outlets. Therefore, news outlets need to find innovative ways to attract or retain readers (Pavlik & Bridges, 2013). In the interviews, participants named the shift from paper to online. For instance, Paulien (22, student) says that news media have a hard time with the digitalization and individuals do not buy actual newspapers anymore: "I think especially news media have a hard time with the digitalization and people do not actually buy newspapers, they just go to Google". Also Daniela (26, startup analyst) has an opinion about this and mentions that newspapers are trying to save their businesses with innovations: "Well, we all know that newspapers are not making a lot of money at the moment and probably they are just trying to save their business by implementing these new innovative features." Furthermore, most participants believe it is good that the *New York Times* is innovating with augmented reality content, since it can attract more readers and the *New York Times* can differentiate themselves from their competition. Max (24, student) says the following about this:

> "I think it is new and exciting and it is good to go with the flow, as a newspaper or a news outlet because of the changing times and stuff. And I think it is good to be one of the first to do stuff like this. It gives you a distinctive advantage of these early adopters."

Also, Raoul (24, communication manager) mentions user groups, as he named in the interview that the *New York Times* could attract more younger and more technology interested individuals into their database. Thus, participants believe it is good for news outlets to innovate, as this way they can try to retain their business.

Most businesses are just starting to innovate with augmented reality and it is not very known yet by the public. The majority of the participants were not very familiar with augmented reality before their interview. For instance, when asked what augmented reality was, most of them had a hard time explaining this, as they did not know exactly what it was. For instance, when it was asked to Iris (25, student) whether she knew what augmented reality is, she answers the following: "Uhm, not really. I think maybe I know what it is but could you explain it to me?" A reason for this is that augmented reality is rather new for users as it is still in it its developing phase. Furthermore, most users had used augmented reality apps, such as Pokémon Go and Snapchat. However, some of them were not aware of the fact that these were AR applications, as they did not know what AR content

was. Thus, initially they did not perceive this as an AR application. Additionally, some of the participants named applications they had used before such as museum tours with augmented reality or game apps with augmented reality. For instance, Femke (30, event manager) did a tour through a city with augmented reality before: “I have done such a tour once. We had to walk around in the city and could see how the city looked in history.” Furthermore, within the interviews, only two participants knew about news in relation to augmented reality. Both of them have a media and journalistic background, so this could be the reason for their interest in this. Furthermore, in the interviews AR got linked to VR by the participants. For instance, some participants mention news in relation to VR, as this is more common for them. Also, some participants confuse virtual reality with augmented reality. For them, it is not clear what the difference was for augmented reality and virtual reality, as they do not have enough knowledge about this. “I was thinking, the differences exactly between augmented reality and virtual reality, I might confuse them,” says Wessel (27, engineer) about this. The knowledge users have about an experience is linked to how users eventually use an experience. The introduction of individuals to a new technology is related to knowledge, as well as the formation of ideas about how the technology works (Rogers, 2003). Thus, the knowledge users have of augmented reality is of high importance, as it forms the ideas about this technology which can impact the usage.

Three participants cannot open the AR experience on their smartphone, which means that they can read the text of the article, but not experience the AR elements. For Wessel, it is not clear why he cannot open the experience, while with the other two there is a clear reason. Paulien cannot open the experience as she cannot download the Google ARcore app, assuming that the app is not automatically installed on her relatively old Android phone. “I honestly think it is not because of the *New York Times* I think it is because of the Google AR app. I think that might be just faulty or maybe my phone is not adapted to that. ... I think the newer one [phone] really worked well,” she says about this. The experience does not work on Teun (26, engineer) his smartphone as well, due to the fact that he did not accept the privacy terms. Since the AR news article does not work on their smartphones, they are not able use it on their own phones, thus having this as a large barrier to adopt it into their news consumption.

For the other participants, the experience did work during the interview and some highlighted that they like that the article works smoothly. They emphasize on the integration of the AR experience in an actual text article. When opening the article, first text was presented where after the AR experience opened automatically. Thus, when users opened the article, they first had to read some text, which introduced the athletes as well as the augmented reality. Next, a screen appeared which opened the AR experience. For instance, Iris says:

> “I did indeed expect that it would be more difficult. Because sometimes you also have to download special apps for these things or other things, but this was pretty clear. The only thing

> you actually did was scroll down. And give access to your camera. And that was actually easy to use."

Both Joost (25, journalist) and Thimo (27, innovation consultant) say almost the same and added that they liked it that the loading time of the experience was very low. Thimo mentions the following:

> "I think it is important that it is right in the middle of the story and that you do not have to open a new screen first, which would first load half an hour. You also do not have to go to YouTube first or something."

Thus, users did not have to download another app to experience augmented reality in the interview, which they perceive as easy. Moreover, ten participants emphasize that it was good that the AR news article also included text. As mentioned, the experience was integrated in an article. By including this text to the AR experience, the experience became part of the story. Also, the text introduces the augmented reality before the AR experience itself, which is necessary as AR news content is new for most users. Without the text, the participants might have felt lost, while now the text prepares them for the experience. Also, the text fits with the *New York Times* as they mostly have text articles in their mobile app. Iris says, "It was no different than a normal article. Which is also nice. So indeed... it fits within the rest of the *New York Times*. So that is indeed user-friendly." Within this context, it is easy to use and the participants do not have to put much effort into it for the experience to work.

The users were asked to accept the privacy terms when the AR experience came into the screen after reading the text in the article. This screen asked if they agreed on opening their camera in order to use the AR experience in the article. The majority of participants is okay with accepting the privacy terms, thus accepting that the *New York Times* can open their smartphone camera. Reasons for this are that otherwise they are not able to use the experience and that there are much more other apps that already have access to their phones which means they are used to this.

> "Almost all apps have this. ... If you do not give permission to use your camera, how do you want to use that app? ... I want to use that app. Then I have to do something to give permission," Hamid (34, IT employee) says.

When accepting the terms, some participants did not even think about the fact that there are privacy issues connected to it. For instance, Beau (22, student) did not think about the consequences of accepting the privacy terms before doing it:

> "No, not at all. Because you have to do this for so many apps. And I personally do not even think about it anymore. I just click on allow. But now that you say this, I think oh, maybe I should think about what happens next, after I have done this. But I did not think about it at the time I accepted it."

Therefore, since most participants just accepted the privacy terms, it is assumed that privacy is not a large barrier for users to use an experience.

According to literature, perceived ease of use is an important aspect for user adoption. This means that when the experience is easy to use according to a user, he or she would adopt it faster into his or her news consumption. In total, eight participants emphasize that the AR experience was easy to use. For instance, most of the participants were able to easily pinpoint the athlete in their room and the athlete just stayed at his place, making it easier for the participants to walk around him. For instance, Hamid mentions that the experience was easy to use: “It is easy. And that eventually matters to everyone. Everyone wants convenience.” Also Max mentions that it is ease: “I think when you get there it is definitely easy to use.” However, some interactions did not work for some participants, as some participants could not get to see all the information. When trying to pinpoint their camera to the athletes body, more information did not always appear. Joost ran into this problem during the interview. He says, “I found it hard to see everything. I do not quite understand how it works yet. As in, I know it contains information, but I can't get it all out yet.” Thus, the majority believes the experience is easy to use, however, there are still some barriers as some participants could not activate all interactions during the AR experience.

Although the article, including the text and the AR experience, works smoothly and is easy to use in general, most participants have a hard time experiencing the AR experience due to their surroundings. In the AR experience, the users could interact by walking around the experience and they could get more information about the athlete by directing their camera to different body parts focusing on the information lines. This type of interaction is based on motion interaction as they have to move for it. For this, the users actually need enough space in the room where they were experiencing the article, in order to walk around the athlete. Furthermore, the visualization of the athlete was quite large, so the users had to distance themselves from the 3D visualization in order to see the whole athlete on their screen, instead of small parts of it. Most users could not walk around since their room was too small or that there was furniture in the way. Therefore, they had to put themselves in uncomfortable postures to make the experience work. For instance, while using the experience, at one point, Wessel was in his garden pointing his smartphone to inside the house to distance himself from the 3D visualization of the athlete, in order to see the whole figure. Also Max almost walked into his closet and Raoul had a hard time to move around his table. Daniela indicates that the athlete was first in her window, then he was in the middle of her room but that the room was small and that she could not walk around him: “This character [3D visualization of athlete] was first on my window, then in the middle of the room, I could not walk around it. So it was quite inconvenient in a way.” Teun indicates that he did not have enough space to see the 3D visualization of the athlete and that if he wanted to see it, he actually had to walk around:

> "He did not fit my screen completely. I do not know how far people normally project from themselves, but here I do not have a lot of space. .... Then you have to walk a lot. That has not been easy."

Additionally, Iris indicates that her room was also too small to get all the interactive information: "But because I have a small room, I only see about one image [information line] of him." She mentions that it would probably be easier to use if there was an instructions beforehand saying that she should go to a larger room. Then she would be able to experience the AR news content more smoothly. She also indicates that if she would do it more often, she would initially know that she has to go to a larger space, such as her garden. Thus, as the experience is new for most participants, they do not know they have to have enough space to interact, however, it is assumed that when they are using it more often that they will know to go to a larger space.

Within the interviews, there were some comments on the instructions of the article. There were some instructions at the beginning of the article, written down in text. Here, a small description is given with a link to more detailed instructions. None of the participants clicked on this link when reading the text. Within the AR experience itself, some other instructions were given. For instance, it states how the users should pin the 3D visualization in their surroundings and it indicates that users should walk around and point their camera to the athlete in order to get more information. Some participants say that everything they had to do was in the instructions and they just had to follow these. Beau says about this that everything was clear, "If you just read what it says then it is clear what to do and then the instructions are easy to follow." Some other participants have comments on the instructions, as they would have liked to have more instructions, which is based on the fact that for some users it is still too complex without instructions, referring to Rogers´ concept complexity (2003). Complexity refers to the difficulty level when a user wants to adopt an innovation. For instance, Joost says he wanted to know how to activate certain things before the experience started: "I would have liked to know in the beginning how I could activate certain things. For instance the [yellow] information dots and what the lines meant." Also Thimo indicates he had a hard time to pinpoint the athlete as his table was not flat enough and he would have liked more instructions on this. Furthermore, some participants were trying to swipe the screen in order to move the 3D visualization, while the experience was not able to do this. As users are used to using the screen to swipe and click, they were not used to walk around and get more information by directing the camera to the 3D character and thus were confused by this. Moreover, the majority of users did not use the button on the left and right corner to make the 3D visualization smaller and to pinpoint it again, probably because they did not know these options were available. More instructions here would have helped them with finding the right way to interact with the AR experience.

Participants had a hard time experiencing the augmented reality news article, because for most participants augmented reality is quite new and because of the lack of information. Nine participants talked in their interview about the fact that they had to get used to the experience as it was a bit overwhelming at the beginning, since they had never experienced something like it. “I do not know, it is a different form I think. It is a different way to experience it. So, I think it is a bit overwhelming at first,” Max states. Also Paulien mentions she was distracted at the beginning since she was overwhelmed with what she saw: “I was looking more at the athlete in the first beginning and I was like OMG.” However, some participants mention in the interview that if they would do it more often, they would get used to it more and it would be easier to use. For instance, Max says the following about this: “Yeah, think it takes a bit of a learning curve. You have to do it at least twice to really get the hang of it.” Participants also find it hard to use the AR experience due to the lack of information or instructions. As the results discuss, some participants did not know how to interact with the experience or did not know how much space it needed, thus lacking this information. Furthermore, some participants mention that they did not look at the instructions very well when doing the experience. For instance, Thimo says he just started to try the experience and would look at instructions later if he needed it. “And at the very beginning the instructions that ... I thought that would be okay to read later if needed. I just tried and see if it worked.” Thus, although some users had a hard time experiencing the AR experience, they indicate that this feeling is connected to the concept of novelty. They believe that when using AR experience more often, it will become more clear what to do, as they learn from the previous used experiences.

4.2 Importance of medium characteristics on immersive experiences

In order to have a complete user experience of AR news content, users should feel immersed in the story. Experiences related to immersion are based on losing oneself in the virtual world (Peters et al., 2009). With this optimal experience, flow is also an important concept, focusing on “the state in which people are so involved in an activity nothing else seems to matter” (Csíkszentmihályi, 1990, p. 4). Within the interviews, the features regarding visualization, interaction, augmentation, and mobility were discussed, which are all related to the characteristics of the medium. All these features, can attribute to an immersive experience that adds value. In general, AR news content should have added value in order for individuals to adopt it, otherwise they can easily go to other news media such as print, television, radio or other online articles. If AR news is not perceived as better than its competition, it does not have a relative advantage and individuals will not use it. Therefore, in order for AR news content to be perceived useful, it needs to take advantage of its characteristics.

Within immersive media, realistic images are key, as it can give users the feeling that something is actually happening in their own room. In this case, the users saw an 3D visualization of Nathan Chen, an ice skater who participated in the Winter Olympics. He was hanging in the air in the rooms of the users in one of his most signature poses. Some participants argue that the quality of the

visuals is high, in total five participants. For instance, “His skates are nice. The more you zoom in on it, the more detailed. So that is nice,” Hamid mentions. Others agree with this by saying the visualization looked realistic and that it used realistic colors. However, some disagree and say that the visuals were not totally convincing. For instance, Daniela highlights the darkness: “In general I think it was good quality, but as I said, it was too dark. So you could not actually see much detail.” Furthermore, some participants indicate that the content was not shown smoothly, as it faltered sometimes when walking around it. Femke mentions that it was not a smooth visualization: “It is also a bit of a stuttering or something. And the beauty of such a jump is the fluency and ease that someone does.” Some users indicate the experience is not detailed enough, and therefore believe the experience was not immersive enough. Concerning the representativeness of the visuals, most participants do not feel like the experience was representative, as the visualization of the athlete was rather large. “In terms of size, I think this guy [3d visualization of athlete] was not at true size,” Joost says about this. Also, they argue that the athlete was not representative as the 3D visualization does not have enough details to come across as “real”, having a negative impact on the level of immersion.

An interesting finding is that some of those participants who thought the quality of the content was not convincing, did not mind the fact that it was not convincing. This is because it is still a new technology and because they see potential in the growth of this technology. For instance, Joost emphasizes that the graphics could be better, however he says that it is already very nice that this experience is so easily accessible in just an app on his phone. Additionally, in several other interviews the potential got emphasized as well. For instance, Iris says that the quality did not matter to her that much as she compares it to animations in films: “That if you now look back at a film from 20 years ago that you also think of, oh, how could we have watched this. But 20 years ago this was all excellent quality.” She says that because augmented reality is new, the quality does not matter to her. Also Wessel compares augmented reality with colored television and black and white television in his interview. He argues that there is still a large step to be made with augmented reality, however he sees the potential in this. Other users also emphasize its potential, in total seven participants mention it explicitly.

Next to the visualization, other features do have an influence on the immersive user experience, such as augmentation. Some participants say that they did not feel like the 3D visualization fitted their environment and thus the immersive experience was not optimal. The concept of context-awareness technology is of importance here as this technology needs to recognize the objects around a user’s and interpret this, by providing virtual data (Azuma, 2015). Femke says that it was weird that there was an ice skater in her room as he did not fit there. For instance, she mentions the following about the experience: “The component of walking around it and that the athlete is suddenly hanging in the air here is not true for me, and does not add much.” Thus, according to her, AR news content should fit with the location, as she explains that then it is clear why journalists chose

to use augmented reality for the users. However, she says that when there is just a 3D visualization of something that does not fit in the room, it is harder to recognize the added value. Therefore, she mentions that it is more interesting to see something that is connected to the world around her. Additionally, Wessel says that because there was an ice skater in his room, he felt like it was further removed from reality, since it did not fit there. He highlights that other topics could be better utilized within augmented reality. This demonstrates that the 3D visualization should fit the place in which the users experience the AR experience.

Regarding mobility, eleven participants argue that a smartphone is the best device to experience AR news content, comparing it to other mobile devices such as laptops or tablets. Reasons for this are that smartphones are portable, everyone has one, they almost always have it with them, the camera has a good quality and that it is easy to use. One participant highlights that a tablet is a better option for this experience, as it has a larger screen. Other participants also indicate that a tablet could be a good option since it has a larger screen, but then they said a smartphone would be better since it is more portable and accessible. For instance, Hamid says, “I am not going to walk around with my tablet. ... It is too large for that. And telephones are useful for that. ... You already have it in your hands all day long.” Although the smartphone is named as the most suitable device, on some older smartphones AR experiences do not work, as they are not updated with the newest technologies, so this could be a downside of it.

Furthermore, interactivity is also an important part of augmented reality as well when giving users an immersive experience. Within this experience the participants had to direct their camera to a 3D visualization of an athlete by walking around it, in order to get more information about the athlete. In total, there were three information points in the AR experience with which the user can interact. These were the grey lines, which users could activate by directing their camera towards it when using the experience in the interview. Three participants indicate that audio could be a good additional interaction to the experience. “I think this is a very cool opportunity for you to feel like he was talking to you and telling you something while him not being there”, says Paulien, as she believes this way it would be even more immersive. Wessel says that it depends on the platform whether news should have audio. When transferring content from television to augmented reality, he states that it should include audio. “That you can see the eight-hour news with augmented reality, that someone in your room is telling you”, he says. However, when transferring content from written form, it is not necessarily needed according to him. Moreover, participants mention in the interviews that with sports, it would be best if the content would be moving as dynamics is an important aspect of sport. “If they made him come by like sjoeeefff. Like slow motion on your own floor, that would have been a cool idea. But now he is standing still and I have not seen how fast it went,” Thimo says. As video can show this more dynamic visuals, participants viewed video as a better platform for that kind of

content than MAR. This shows that depending on the combination of the type of news content and interactivity, AR news experiences will have added value to news content.

According to the participants, AR elements can give added value to news content. For instance, AR elements bring news content to life and it brings news close to the user. Beau mentions that augmented reality gives you the opportunity to get really close to the news and watch it from several sides. She says the following about this: “Especially since you can now get really close and view it from all sides, it makes it a lot more personal. Instead of just an image that you see from TV.” Furthermore, AR news content is rather new for users to experience, so the interviewees were still impressed by it and believe it is cool. According to Teun it is futuristic and it is something not much news outlets are doing: “And it is futuristic. They do something that others do not do yet.” Also Wessel agrees with this as he says that since it is new, it triggers him to read the article. “It is new and it is something that triggers you to continue. ... It catches your attention very quickly,” Wessel says. Additionally, it is fun, because users can interact with the content. Hamid says that interacting with the content, walking around it and actually putting a bit of effort into it, made it nice for him to experience news. Here, participants also say that nowadays with the shorter attention spans of individuals, that with this experience users would be more engaged and would be more inclined to linger. “To really get more engagement. Uhm, especially with the attention spans from today, where everything is like quick quick quick,” Max says. Because of the visuals, users will also be more likely to keep the attention, as Teun says:

> “Well, I think anyway that people nowadays have a shorter tension, so they would rather watch documentaries than read a book and watch a two-minute film than read a one-minute article. So, graphically [augmented reality] it is very strong, to keep the attention.”

Also Wessel names this in his interview:

> “You can convey things much better visually and that is exactly the same as why news has moved more and more towards photos and videos. Visualization have a greater impact and it is easier for people to consume. And I think that augmented reality is the next step in this.”

Moreover, users have the feeling they have control when experiencing AR news content. This control makes it also more personalized. Max indicates that reading a news article is very standardized, but with this AR experience, users can experience it in different ways according by how they want it themselves.

> “I think because it is very personalized. Reading a news article is a very standardized and everybody reads the same words, but this figure skater, you can experience it very different... even walking around the dude in very different angles or different rotations and stuff,” Max explains.

Thus, agency is given to the user, as they have their own choice on where to go within the experience. All these AR elements are connected to Rogers' (2003) concept of relative advantage, as it serves advantages to the users over other alternatives. The values named in the interviews are all based on the advantages of AR content, which can help when individuals have to choose a medium over another medium.

Several participants mention that augmented reality news content has added value as it can be more memorable or more informative than other news content. Interviewees say that they think that it can have a stronger recall due to the visual aspect as it came more alive with this and that they could really engage with it. Also, it can give more information than just a visualizations or just text as it is a combination of it. Raoul mentions that he could remember news content better with the use of augmented reality, as he believes that it is an interesting way to provide information. He says he thinks that he would probably not have remembered the content if it was not with in a immersive way. However, some participants disagree with the fact that augmented reality would have influence on the recall of information. For instance, Thimo believes it does not have any added value as it is only memorable because of the novelty of it. Thimo says:

> "But that is just because it is a new technology, that it therefore lingers a little longer. Especially now. I do not think I will have forgotten this again in two weeks or so. So I am sure it will stick. In the long term, on the other hand, if you have a lot of these kind of news articles, then this will be less. Now it is still special."

Thus, he indicates that when this novelty will wear off, that users will not perceive this content better than media such as video. Joost also believes that it does not have added value because of the novel technology that he was more distracted from the content than that it added value.

> "Well, I was now mainly looking at cool technology, I can watch it [the 3D visualization], I can go above it, I can go below it and I can also control it myself. The content, no idea really. ... This technology is much more interesting here than the information," Joost explains.

Therefore, there is a tension in this research. On one side, it is believed that augmented reality serves for a higher recall of information, while one the other side, participants say that this would wear off soon, when users get more used to this new technology. Literature confirms the perceptions of the users about the recall of information, as it suggests that physical active engagement actually aids the recall of information (Glenberg et al., 2007; Hornecker et al., 2009). Thus, having stronger evidence for the recall of information when actively engaged.

4.2.1 Contextual 3D visualizations

The majority of participants indicate that the augmented reality characteristics, such as context awareness and visual elements, are important aspects within compelling content. Literature (Craig,

2013; Scholz & Smith 2016) and these results suggest that augmented reality content should fit the affordances of the medium and the participants mostly mention examples of content that are also based on these characteristics. The results show that news content should fit these characteristics, otherwise it will not have enough added value and users can easily consume their news via other options such as video, image or text. Within this section, the immersive experience and the perceived usefulness are important concepts. When the content is right and fits the AR characteristics, the user will feel immersed in the content and will see that the content has added value and thus will perceive it as useful.

3D visualization is a significant component of augmented reality and seven out of twelve participants say that augmented reality news content should include elements in which the visualization is important. Participants propose that visualization is a good way to make abstract things more clear and that it is easier to comprehend complicated content instead of just reading it. Daniela says that it makes content more tangible and that when she has the materialization in front of her, it makes news more understandable for her. Joost emphasizes this in his interview as well and gives an example with this about Mozambique. He says that in Mozambique there is something happening that feels far away, from which we hear very little. He believes that with augmented reality it can get much closer to individuals. Furthermore, Teun says that things that are removed from him fit best with augmented reality content:

> "If you have to convey things where image is much stronger than written text. When it comes to telling what a situation is like. For instance, things that are far removed from my personal life, design, or visual things that are hard to describe."

Thus, users believe that augmented reality fits with content that shows abstract things, which are hard to imagine or things that are hard to comprehend, as augmented reality can make those topics more clear by visualizing it. Furthermore, as augmented reality visualizes content, Femke also says that it fits content that emphasizes design, such as fashion shows or art. "Well for example at a fashion show or things like that I can imagine. So things that are very visual. Just like art," she says. Furthermore, AR news visualizations add a third dimension, which distinguishes AR news visualizations from just a video or an image. According to Femke, this third dimension is very useful as it can make content more insightful. She gives the example of a graph, where next to the x-axis and the y-axis, another axis can be inserted, in order to make the information more clear. This third dimension can also bring things to life. For instance, Teun proposes that this third dimension makes content more alive and thus the content should fit this liveliness, by showing persons or things that individuals normally would not see from up-close. He mentions: "In particular things [content] that needs to come alive. So where a video would be even less than AR. So with 3D. So yes, I think such a car is a good example that you can walk around it." Thus, the visual element within AR news content is of great importance for

compelling content as it makes topics more clear as well as that it gives more impact by bringing the news closer to the user and making it come to life.

Next to visualization, context awareness is an important part of augmented reality content as well, as it distinguishes it from just a video or image. Augmented reality content both can recognize a user his or her surroundings or it can see where he or she is with GPS locations (Ritsos et al., 2011). AR news content that users find compelling is content that interacts and recognizes the surroundings. For instance, Wessel says that when news is brought to someone's house, it can have much impact. He gives an example of seeing an earthquake in his own house: "That you can see that in your own house, then I think the news has much more value because it is personal and comes closer." Femke says that with augmented reality news content users can come in contact with the lives and stories of individuals all over the world. She gives an example in which she says that it would be cool if she can stand in her own kitchen and see the kitchen of someone of India. Furthermore, compelling content could also be content that is based on a user's GPS location. For instance, Iris gives the example of the Twin Towers, as she says that it would be interesting if she could see the Twin Towers on the place they originally were in New York within an AR news article. Thus, according to the users, compelling AR news content is content that is connected to the characteristics of AR. This includes AR elements of 3D visualization and context-awareness particularly.

4.2.2 Influence of expectations on immersion

Not all participants believe the interactions were immersive enough, because they did not have the feeling they were actually present in another new world when using the AR experience. In fact, seven participants expected the 3D visualization to move and thus missed this interaction when experiencing the content, resulting into the fact they did not have a immersive experience. For instance, Daniela says the following: "Yeah, but to be honest, I was expecting that this character would move. But it was just like one pose of him." These expectations were there due to two reasons. Firstly, the topic of the AR news article is about sports, which is related to dynamics in the minds of most participants. Femke mentions that with an earlier AR experience, it was about static objects in which it was okay they did not move. But sports are all about movement, according to her. "Because that was about buildings, so static objects that are just there. And this is about something, in the foundation it is about movement, so an athlete and a certain kind of jump. So the expectations are different," Femke explains. Secondly, the text in the article before the actual AR experience is focusing on how fast the ice skater can turn and thus the participants expected to see this happening. Thimo mentions that the article really hypes the fact that ice skating goes fast and thus gave him certain expectations. "They [the *New York Times*] hype it very well, like, wow this went really fast. And then you just expect that we will see it moving on my floor. But that did not happen," Thimo states. Also Daniela confirms this in her interview: "Because in the article they talk about him being as uh, ice skater and making pirouettes and then it is kind of underwhelming when you just see him

standing there." This shows that expectations are crucial within an AR experience. According to literature, expectations are related to the satisfaction of a user after an experience. When a technology meets or exceeds the expectations of a user, he or she is likely to be satisfied with the experience, while when it does not meet the expectations of the user, the user will be dissatisfied (Olsson et al., 2011). This is confirmed by these findings, as users expected the visualization to move, but when it did not, they were disappointed by this. Not only the expectations of the interactivity disappointed the users. The fact that users did not use AR much before and saw it as something new and futuristic, heightened their expectations. Therefore, these are harder to be met. In all these cases, expectations management is key, as when participants have expectations which are closer to the actual experience, they are more likely to be satisfied with the whole experience.

Some users were skeptical about the experience before using the AR experience, as they were not sure if it would have an added value. For instance, Raoul mentions that he had done virtual reality before and that this promising medium never came off the ground, expecting AR to also have this. He says:

> "Augmented reality is supposed to be an immersive experience but then less of an invasive experience than virtual reality. The way I see it, virtual reality had so much promise and not a lot came out of it and because of that I think I am a little skeptical about what has come from it, which is augmented reality."

Usually these participants had low expectations since they already have experienced some immersive situations which disappointed them and thus they were more skeptical beforehand. Although these users were skeptical, they perceived the experience more immersive afterwards, in comparison to users who did not feel this skepticism. Four participants that were skeptical initially, had a positive view on the level of immersion. During the experience, they felt that the athlete was really in the room, where the users felt they were present in a new world. For instance, Joost says that he realized that he could not have his hand behind the athlete, since he was not really there. He says: "I only realized afterwards that if I put my hand in front of him [the camera], that I could not make him [the visualization of the athlete] behind it." Beau also mentions something similar, as she says that she really had the idea that the visualization of the athlete was standing in her room: "You really have the idea that he is there, you really walk around it with a bow than you really walk through him or something. Yes, so it really looks like it is there." Raoul says he really had to look away from his phone to see whether the athlete was really in his room and Max believes that the quality is really good and therefore he could really immersive himself in the experience because of this. Other participants who were not expressing this skepticism before doing the experience, do not think the AR experience was that immersive, as they did not think the athlete was actually in their room. Thus, participants their expectations determine the level of immersion.

4.3 Being active in news consumption

Daily news consumption is an important part of user adoption, as it shows how users already consume their news and whether new practices fit their consumption. According to the interviews, most of the participants read their news online, usually on their smartphone or on their laptop. This is also confirmed by literature, as it suggests that individuals are more likely to read their news on their smartphones rather than using another source (Shim, You, Lee, Go, 2014). Moreover, participants indicate they now consume their news in different places. Places that came back several times in the interviews are at home, in public transport, at work and at school. Participants also frequently read their news in the morning, for instance in their bed. These places are confirmed by literature (Westlund, 2015), as well as that it this mentions that mobile news consumption is considered to have different locations as well as times, usually filling gaps in the day (Wolf & Schnauber, 2014; Westlund, 2015).

The majority of the participants say that they would not like to experience AR news content in every news article they read. When experiencing AR news content, usually users have to interact with the content, meaning they have to have an active stance. However, some interviewees say that they are used to reading their news passively concerning their physics, so experiencing news with an active stance is new for them. For instance, Femke mentions she really has to get used to it, as she is used to reading news physically passive. Paulien agrees with this and mentions that when she does not want to move, she probably would not read the AR news article: "I did not mind that much but let's say if I felt really lazy and just want to lay in bed and read the news then probably would have just skipped it." Similarly, Daniela says that if she is sitting down to read an article, she is not necessarily interested to interact with it. She says that once in a while it could be nice for a change, but not every time when she consumes the news. Furthermore, as discussed participants like to read their news when they wake up in the morning and then they do not feel like being active yet.

Most participants indicate they expect that they would feel uncomfortable to use AR news content in public places. However, literature and these findings indicate that public places, such as public transport, are a common place for users to read their news. This means that AR news content does not go hand in hand with the places individuals read their news. For instance, Thimo indicates that at home he would read AR news articles, but in the train he would not. He says that he does not want to stand up to use the AR news experience as this would disturb other persons around him. Also Teun has an opinion on using AR news content in public places:

> "Because it's a public place, so it just feels a little weird to walk around there because you do not know what people think. They might think that I am filming them. And uhm, and you should just watch where you walk. Because you are doing other things. So I can imagine that if you walk at a tram stop or something that it is not so nice."

Thus, Teun says that he would not feel comfortable when using it in public as other persons might think he is filming them since users have to hold up their camera when using the experience. Individuals who are not familiar with this might not know what he is doing. He also says that doing it in public can be dangerous, as users are not paying attention to the environment anymore. Thus, these findings indicate that users rather do not use augmented reality news content in public.

Participants indicate they cannot use AR news content anywhere and anytime. In some places individuals do not use their smartphone, but read their news in paper or on their laptop. For instance, some participants state that in school they usually use their laptop to consume news as they are not allowed to use their smartphone here. In these instances, users are not able to experience the AR news content, as the content does not work on platforms like a laptop. "And also like for example if I use my laptop for school stuff then I also maybe have read my news there on the laptop it does not quite work the same as with your phone," Paulien says about this. Additionally, to use AR news content, users need to have enough space. However, users do not always have the space around them when consuming news, so then they are not able to optimally experience the AR news content. For instance, Raoul indicates that users do not have enough space in a great amount of situations, such as in the office, at school, in the library or at home. Thus, space constraints can impact the usage of augmented reality news content.

Currently, the participants perceive using AR news content in public as uncomfortable. However, in her interview, Beau indicates that reading AR news content might become more "normal", just like what happened with Pokémon Go. She says that when everyone would use AR news content, it can become more socially accepted. Also Paulien says something similar: "Let's say ten-twenty year it will maybe a completely normal thing to do." Moreover, relating it to mobile phone usage, research suggests that norms are emerging on where and when it is appropriate to use one's smartphone, which may condition the places of use (Westlund, 2015). This relates to the concept of observability, which refers to the availability of an innovation. When an innovation is used more and thus more visible for the intended user, individuals have more chance to observe its advantages. Observing these advantages might result into actual adoption (Rogers, 2003). Thus, the norm about the usage of augmented reality can change. Furthermore, participants mention that news consumption habits might change due to AR news content. For instance, Femke mentions that does not fit the places where she now consumes her news. However, she believes that when users will see AR news content as something cool, it can take another moment in their schedule than "normal" news consumption. She mentions the following about this:

> "Then you would watch a series in the evening or read a book or something like that, then it would simply be added to that list. And then it becomes something you are going to do on the couch or from the couch and then you walk into space more easily."

Thus, Femke believes that AR news content will be added to the list of watching a series in the evening or reading a book. She says it will become something that users do on their couch in their room, a place where they walk around easily. Also Max states something in relation to this:

> "I think because you need a bit of commitment to really dive into it. And to really allow yourself to immerse into it. I do not think it has to be quiet like a library but I think if you really want to experience it, you should really need a moment to do it. And not be distracted by something around you."

His quote confirms the fact that for AR news content, users really need to have the time, which is not always the case. Thus, in general users need to have the time and place to use AR news content.

Within the interviews it became clear that all participants would talk about this experience to others. Based on the fact that users want to communicate about the experience to others, makes that the technology will diffuse faster. Here, users are sharing information and exchanging knowledge in order to produce a shared understanding about this innovation (Rogers, 2003). All of this is related to the observability factor named above. When more users are talking about AR news content in public, it can become more "normal" for users and the discomfort of usage can decrease. Reasons for sharing this experience are related to the novelty and coolness of the experience. "So it is special. I now assume that most individuals do not know that this exists and then it is nice to tell this," Teun mentions. Participants say they like it when they have discovered something new and then would show others this novelty. This motivation to share is mostly based on the augmented reality aspects within the article instead of the actual content of the article. Half of the participants would actually show the other individual they are telling it to. They believe this is the best way to introduce someone to articles like this, as only telling the other person might not give them a good impression of it as it is something so new.

Most of the participants agree with Femke, saying that they did not mind using the AR news articles at home as they usually have enough space here and there are no other persons who can judge them. On short term, participants mention that they would consume AR news articles more often since they are curious to what this new technology can offer more. For instance, Raoul says:

> "You have to move around quite a bit and it was not right up my alley in terms of my interests, but why I think it satisfied me is because it got me more curious about it, and I think that even if they were able to do that to me, I think that, that is kind of a win for them because I will now go on and have a look at more AR articles."

Thus, he would look more into the AR articles because he is curious to what AR news content can offer more. In the long term, participants say they would read more AR news articles when they are interested in the content of that particular article. For instance, Teun mentions he would read it more

often, when the topic is interesting to him. Thimo confirms this: “Yes [he would read more AR news articles], as I said, it still has to be an interesting article.” Additionally, the participants mention that they would read AR news articles more often as it would become more available and accessible. Now, users really have to search for it, while when the articles are presented on the home page of a newspapers, it is more easy to find and select them. Furthermore, when they are really interested in a AR news article but are not able to read that article due to the previous named arguments, then some participants indicate that they would read it later. Both Wessel and Iris say that they would save it for later and read it at a comfortable place, for instance their home. For example, Wessel states: “I always make to do lists. So if there really is an article that I would like to read, I will put it on my list for a while. And then I will read it back later.” However, not everyone would do this. For instance, Beau mentions that she would probably forget about the article since there is so much other choice for her to read something. Furthermore, Joost states that he thought it was unfair that when he was not able to read the AR news article that he did not have any alternatives for this. He argues that there should be an option for him to still consume the news but without having the augmented reality elements in it. Thus, some users save augmented reality articles to read when they are not home, however, not every user has to motivation to do so. Therefore, alternatives could be useful, in order for users to still engage with the content.

4.3.1 In-depth, entertaining news content

As mentioned above, participants recognize that they have to be active when using the AR application. Therefore, they do not see themselves engaging with AR news content when they are not in the occasion to move. They see themselves doing it when they have time, the motivation, the recourses and the space. Thus, they believe that most of the time they will use it when they are in a comfortable place, having the time to read something. At those times, the participants mention that they would like to read more in-depth articles instead of small web articles. “I am also more inclined to read a long-read or something in the evening. ... And in the morning in my bed I just want to know quickly,” says Femke about this. Additionally, participants recognize that the production of AR applications can be time consuming for the developers. However, they see that news usually is very fast-phased and should be updated fast. Thus, participants mention that fast-paced news is not suitable for AR news content. Instead, in-depth articles are more suitable. Joost says, “news articles are often background stories that are worked on for weeks and months, and it [augmented reality] fits very well with that.” He mentions that it fits best with background news stories, as more time is given to those stories and are not necessary to upload fast. Also Max mentions that AR news articles should be made with commitment, ensuring the quality. Thus, he also agrees that fast news is not suitable. In general, Iris agrees with this and said the following about this: “But more indeed, perhaps for in-depth subjects. For instance for interpretation or for explanation in an innovative way, or to reach a younger audience. I think this would work.” Although the participants believe it fits best with in-depth articles, literature

suggests that mobile news consumption is usually focused on short articles. For instance, Molyneux (2017) discusses that individuals like small amounts of news on their smartphones, filling the gaps within their day. Furthermore, Kim (2011) argues that news outlets make short content due to the limitations of smartphones. Thus, this finding is contradicting with research about mobile news consumption in general. For AR news content, users like to read more in-depth and longer articles.

Furthermore, nine participants relate augmented reality news to entertainment in the interviews. They state that it had some elements of entertainment in it, it is assumed that this is due to their associations with other augmented reality experiences such as Pokémon Go or Snapchat. Since there are not much other mainstream AR apps in other industries as gaming, it is hard for users to imagine other applications. Also the interactivity element makes it feel like a game, since they can "play" and walk around the ice skater, getting more information by directing their phone at particular parts. Beau mentions the following about this: "Yes, it is like a toy. Just a nice gadget. Instead of something I have to take seriously." Due to the perception of AR news content being related to a game, participants feel like "serious news" does not fit with this medium. Iris confirms this in her interview and because it feels like a game, she believes it does not fit with the more serious news topics. She says,

> "It is indeed that augmented reality, I still think it is a kind of novelty, a kind of game. And I do not think it fits, at least in the form that it is now, I do not really think it fits very serious subjects."

More participants emphasize this opinion. For instance, Wessel mentions the situation in Aleppo and believes this is too serious, as he would not like to interact with this situation in his room. Also because AR content is focused on visual elements, participants are a bit hesitant about serious news. Some mention that they would not like to see persons who are dead laying in their room or other dramatic happenings like an auto crash. For instance, Daniela says the following about this:

> "I am not sure if I participate in an accident or some of my relatives are part of an accident and then all of a sudden it is all over the news in augmented reality, that is not very pleasant I think. No, I do not see what the point of that would be. It is just like a sensation kind of thing."

Participants believe that here the responsibility of the journalist comes in. Most participants indicate it is a journalist their job to know what is ethical to show and what not. "I think this is ethical because I think the responsibility of the media is to provide information," Raoul says. Furthermore, some participants mention that news outlets should keep individuals informed and educated and that they should make sure that they do not make it too entertaining as then the news value diminishes.

Too serious news is not appreciated in AR content by most participant, thus they perceive , entertaining AR news content as more compelling. For instance, Max proposes that infotainment

content would be good to have, such as sports or lifestyle news. This is confirmed by literature, as literature says that individuals rather read soft news on their mobile phones than hard news, which is more entertaining. However, the reasons for soft news is different for mobile news and AR news. In mobile news consumption individuals rather want soft news due to the small screens of the smartphones and the selectivity of the user. Soft news can be put in short articles as well as that it is easier to consume and users feel more comfortable selecting this (Kim, 2011; Kim, Chen, Gil de Zúñiga, 2013). In AR news content, users rather have soft news due to the associations users already have about augmented reality, feeling like augmented reality is too entertaining for the seriousness of hard news. Furthermore, as users indicate that AR content is having elements of entertainment, they recognize that interesting content for augmented reality news could be based on things that are normally not fun to read. According to Raoul, AR elements can be useful in articles which are about things users are not known with yet in order to introduce information to them in a fun way, as he says: "So I think that at least for someone like me who, who has not been interested in winter sports, it was a very effective way to provide information ... When I saw it, I was amazed." Femke also says that augmented reality news content can give news a more positive vibe, due to the entertainment level. Thus, entertaining news is most appreciated when experiencing augmented reality news content.

5. Conclusion

The news industry is changing due to technological developments. Individuals have increasingly disengaged themselves from traditional outlets, as they rather engage with journalism via mobile devices (Pavlik & Bridges, 2013). This results in increasing competition between news outlets, which caused that these news outlets have to innovate in order to attract and retain readership (Van der Haak et al., 2012). Augmented reality (AR) offers the opportunity for journalism to innovate, as it offers new forms of storytelling. These new forms focus on first-person narratives, instead of third-person narratives which is common in most television, newspaper, radio and magazine journalism (Pavlik & Bridges, 2013). This first-person narrative is related to immersive storytelling, which means that individuals are allowed to enter a recreated virtual situation which represents the story and in which they can get a feeling of presence through the experience (de la Peña et al., 2010). In order to understand whether AR news content is relevant for news outlets to adopt, it is important to study how users engage with augmented reality news coverage. Therefore, this research focuses on users engagement with augmented reality in the news industry, as the following research question is posed "How do users engage with augmented reality news content?". This question is researched by conducting in-depth interviews with users about an augmented reality news article of the *New York Times*, where after the interviews were analyzed by a thematic analysis. In the article of the *New York Times*, the interviewees had to interact with augmented reality by walking around a 3D visualization of an Olympic athlete. They could direct their camera to specific points of the 3D visualization in order to get more information of this Olympic athlete. This research design gave the opportunity to gain insights and to find patterns on user engagement with augmented reality news content.

The findings that arose from this research revealed that the concept of novelty is a significant aspect of engagement with augmented reality news content. Augmented reality is rather new for individuals, as there are not many popular augmented reality applications available. Therefore, users still have a problem to define and recognize augmented reality. Especially augmented reality connected to news is new for most participants in this research, as they have never heard about this or used this. Therefore, it can be hard for users to engage with the AR news content since they have never used AR experiences like this within this context. In general, the participants in this study had a hard time with the interactivity aspects of the AR experience. As they are new to augmented reality news content, many interviewees expressed their lack of knowledge on the need for enough space. In order to make the experience work, users need to have enough space to be able to walk around the 3D visualization. However, most interviewees did not have enough space and had to put themselves in uncomfortable postures to make the experience work, facing some discomfort. Additionally, participants had to activate additional information by directing their camera to the 3D visualization, which they perceive as hard. The interviewees are not used to motion interaction, which relates to the movement users had to make when experiencing the AR news article, as they are used to clicking and

swiping when using interactive applications. Furthermore, not all interactions worked due to their lack of knowledge, as the interviewees did not know how to activate them. Therefore, more instructions on interactivity would have helped users with finding the right way to interact with the AR experience. Although these aspects were perceived as hard for the participants, overall they could use the experience easily. Furthermore, integration of the AR experience in a text article is appreciated. Integrating the AR experience in an regular article and introducing the AR experience with text, makes it easier for users to use augmented reality news content as it guides the user. All these perceptions are related to the perceived ease of use, which means that when something is too hard to use, the user is less likely to adopt it. In general, the negative comments on the perceived ease of use of the experience are concerned with first time errors, just because the users are not used to experiences like this. It is assumed that when doing AR experiences like this more often, users will get used to these experiences and will be able to easily navigate through the AR news content.

Furthermore, expectations are a significant part of the user experience with augmented reality. This research indicates that high expectations of users are less likely to be met than low expectations of users. This means that users who have high expectations, are likely to be less satisfied with the AR experience. Since users are new to augmented reality, they might not have accurate expectations before they experience it, which can result in disappointment. For instance, interviewees expected that the AR news content would be dynamic, however, it turned out that the AR experience did not move, where after the interviewees felt disappointed. Because of this, expectations management is of high important with AR news consumption. An attribute in expectation management is the text in an article that introduces an experience. When this text focuses on the aspects the AR experience entails, it can give users a better overview of what the users will experience and thus of what they can expect. Another interesting finding in this research is that the level of immersion is related to expectations. In this context, immersion refers to the feeling of being presence in a new world (Dow, 2008). The findings show that low expectations, can contribute to a higher level of immersion than when having high expectations. These low expectations are related to a feeling of skepticism, where users can feel skeptical about AR experiences as they do not think that AR has added value due to their AR knowledge and previous experiences with immersive media. For instance, when the interviewees felt skeptical about the AR experience before using it, they felt immersed during the experience due to their low expectations. Interviewees expressed this feeling of immersion by stating that they had the feeling the Olympic athlete was actually in their room. Interviewees who had higher expectations did not express this level of immersion, as they did not have the feeling the athlete was in their room.

The characteristics of the AR medium are of high importance to user engagement with AR news content. These medium characteristics include interactivity elements, context elements, as well as visual elements. If the medium does not use these characteristics in the content, the participants would rather use alternative media such as television, newspapers or radio to consume news. Thus, if

AR news content does not give more value to users than its competition, it does not have relative advantage and participants are likely to not fully adopt it into their news consumption routine. One of the medium characteristic of AR is the visual aspect, as AR content can visualize digital 3D objects in the users their real world. The findings of this research show that AR news content should take advantage of this visual element since augmented reality can make news topics more clear by visualizing it, as visualization is a way to make abstract things more clear. This visualization also makes it easier to comprehend complicated content as well that it can make more impact since it brings the news to users, making news more alive. The findings of this research also show that AR news content that users find compelling is context-aware and thus recognizes and interacts with the surroundings of a user. Location fit is essential, as the content presented should fit the surroundings, otherwise it is not perceived as real by the interviewees. This means that when a user is experiencing something in their living room, it should fit the location of the living room. When news interacts with users' surroundings effectively, it can have of impact on them, as it can bring news closer to the user. Furthermore, interactivity is also a key characteristic of the AR medium, thus AR news content should be based on the interactive elements. When actively interacting with content, it is found that content is better remembered by users. Therefore, having to interact with AR news content has advantages over alternatives as it aids the recall of information. Moreover, users have the feeling they have control when engaging with AR news content, which makes it a more personalized experience. This control offers users the agency to choose their own path in experiencing the information, which is advantage over other more traditional media. Thus, with these content elements focusing on the medium, AR news content is perceived as useful, having an advantage over other media. Although these medium characteristics are of high importance, it is interesting to note that the content quality of the medium is perceived as less important by the participants, as they see the potential of the technology. Participants of this study recognize that augmented reality is still developing and therefore do not mind if it has little content quality.

Participants of this study do not seem to be interested in engaging with AR news content at all the places and times where users usually would read the news, thus not adopting it in their regular news consumption routine. Interviewees in this research indicate that they mostly read their news at home, in public transport, at work and at school. However, with AR news content, users actually need to have the space and motivation to engage with this content actively. Therefore, the users indicate that they would not use AR news content anytime and anywhere, as they can feel bothered when engaging with AR news content, due to their news consumption habits, the their social standards, as well as device and space constraints. For instance, interviewees say they feel uncomfortable using AR news content when being in public spaces, since individuals around them might judge them. Additionally, users need to have enough space around them to use AR news content. However, they might not always have this space available when they want to consume news, thus not choosing to use AR news

content. Furthermore, users do not see themselves engaging with AR news content every time they consume news, since they perceive reading news as something passive. However, AR news content requires the user to be active. Interviewees indicate they are not always willing to actively engage with news, for instance, when being in bed. In these cases, users would rather get their information from a normal news article, by passively reading it. Moreover, users might not always have the device in order to engage with AR news content, as mobile devices such as a smartphone or tablet is needed. For instance, some mobile devices do not support AR applications as they are too old and do not have the newest technologies integrated. This way, users cannot engage with the AR applications and cannot adopt it into their news consumption. Although it is indicated that users would not use AR news content anywhere and anytime, they would use it at home. Here they feel most comfortable to use the AR news content, since they have the space, the resources and the time, and because they do not feel judged here.

In-depth and entertaining news fit best with augmented reality news content according to users. This is partly due to the place the participants would like to read their augmented reality news content; their home. When at home, users usually have the time to read news, thus users prefer in-depth articles instead of small web articles, which are usually distributed on mobile news platforms (Molyneux, 2017). Additionally, as AR news content takes time and recourses to make, fast-paced news is not suitable for AR news content according to the interviewees. Therefore, in-depth background stories would fit well with augmented reality news content. Furthermore, the findings of this research imply that users rather have entertaining news when experiencing augmented reality news content due to the associations they have about augmented reality and the interactive play element of it. Because of these associations, users believe AR content relates to entertainment, which does not fit the seriousness of hard news. Additionally, since AR content is based on its visuals, interviewees also indicate they are hesitant about too serious news. For instance, users would not like to see things such as dead bodies or an auto crash.

Norms about news consumption or about AR news consumption can change in the future, according to this research. As users expect to engage with AR news content mostly at home, focusing on in-depth and entertaining articles, it can take another moment in their schedule than “normal” news consumption. For instance, AR news content can be added to the list of watching a series in the evening or reading a book, as this can be a place where users relax when they have the time and can walk around. It can also be the case that experiencing AR news content in public will become more “normal” and users will not feel uncomfortable anymore when using it at another place than home. For instance, when more users are going to engage with it in public or talk about it with others, the more individuals get used to it and it can become more socially accepted.

Taken together, this research suggests that the participants do not just adopt augmented reality news content into their news consumption routine, as they have to learn how the AR experiences work and will mainly engage with it at home, due to due to their news consumption habits, their social standards, as well as device and space constraints. Also, it needs to have added value by utilizing the medium its characteristics, including the visual, context and interactivity elements, otherwise users will rather engage with alternative media. Referring to user experiences, this research shows that expectations and the characteristics of a medium are of great importance. In fact, it shows that the expectations can define the feeling of immersion. Based on the content elements, AR news content should incorporate these previous named medium characteristics as well, as it can complicated news content less complicated, it can make the content more personal and it can give more impact, according to the participants. Besides that, these findings show that users prefer entertaining as well as in-depth augmented reality news articles as this fit their associations with augmented reality, as well as that it fits the location and time of when they want to engage with AR news content. In conclusion, this research has contributed to the understanding of how users engage with augmented reality news content. It has insightful findings which can also be relevant for news outlets in the changing news industry.

5.1 Limitations and further research

This research revealed valuable answers to the main research question and its sub-questions, however, there are three limitations to this research that need to be addressed. First, as the researcher is the measurement instrument in the chosen method, subjectivity can arouse to a certain amount. This can challenge the validity of the results, because the study was conducted in an unique way. Thus, because it is a qualitative research, the generalizability of the results is challenged. In order to have a more reliable and valid report, further research can take a mixed method in order to analyze engagement within augmented reality news consumption. In fact, research based on a qualitative method can acquire in-depth and rich information where research based on a quantitative method provides more generalizable results, serving as an insightful combination.

A second limitation is that individuals are generally incapable of considering implications of the usage of a technology on the longer term. As augmented reality news content is new for most participants, the experiences discussed are mostly first-hand experiences from engaging with AR news content. For now, it is too soon to forecast whether the reported experiences are significant in the long run and how user engagement might change “as people appropriate the services to their own contexts and purposes” (Olsson et al., 2011, p. 302). Furthermore, as indicated above, social norms might change about augmented reality usage, where augmented reality can become more common for individuals to use. This might also change the perceptions of users about augmented reality news consumption. There is a lack of research on this change in perception, thus in order to research this topic more in-depth, additional research is needed. Especially a longitudinal research approach can be

insightful as it studies user perceptions over different periods of time (Menard, 1991). In the context of this study it can research researching whether the engagement with augmented reality news content changes over time.

The third limitation is based on the representativeness of the case and the sample used in this study. This research is now focused on one case, which is an augmented reality news article of the *New York Times* on the Winter Olympics. This provides little basis for generalization on a scientific level, as the perceptions and experiences of users might have been different when using another case Therefore, further research should focus on other AR cases within the news industry, studying whether users describe their experiences and perceptions differently when engaging with other AR news content. Additionally, the amount of interviewees is a limitation as only individuals who are familiar with the content of the New York Times, between the age of 18 and 34, are interviewed. Nevertheless, participants were chosen based on different socio-economic and gender background. This choice makes the data of the sample more diversified and rich. Another limitation concerning the sample is the sample size. With twelve participants in total, it is hard to generalize the findings of the research as they are only based on a small sample. Therefore, further research can emphasize different users from multiple age groups, focusing on a higher frequency of interviews, which allows for a more thorough analysis.

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Appendix A. Overview sample

Name of the interviewee	Age	Gender	Profession	Date of interview
Max	24	M	Student	March 29, 2019
Raoul	24	M	Communication manager	March 30, 2019
Daniela	26	F	Startup analyst	April 3, 2019
Hamid	34	M	IT employee	April 4, 2019
Joost	25	M	Journalist	April 6, 2019
Iris	25	F	Student	April 10, 2019
Beau	22	F	Student	April 10, 2019
Paulien	22	F	Student	April 17, 2019
Femke	30	F	Event manager	April 23, 2019
Wessel	27	M	Engineer	April 23, 2019
Teun	26	M	Engineer	April 24, 2019
Thimo	27	M	Innovation consultant	April 29, 2019

Appendix B. Interview guide

Demographic and factual questions	1. Can you shortly introduce yourself? 2. How do you perceive the *New York Times*? 3. Are you familiar with augmented reality already? 4. Do you know other apps that use augmented reality? In particular news apps? 5. What do you expect from the article? 6. Did you know the *New York Times* uses augmented reality within some articles? If yes, how did you know this?
User adoption	7. Would you read augmented reality articles like these more often? Why? 8. How do you normally consume your news? 9. Does augmented reality fit within your news consumption routines? Why? 10. Do you think the content of the article came across better through the augmented reality elements? 11. How do you feel about your privacy when using this AR experience? 12. How would you characterize the effort you had to put into the AR experience? 13. What do you think of the instructions of the AR experience? 14. Would you talk with others about this article? How would you tell them about it? 15. What do you think of the *New York Times* using AR in their articles?
User experience	16. What are your first impressions of the article? 17. Was the article like you expected? And why? 18. What kind of emotion(s) did you feel while using the experience? Can you explain these emotions? 19. What do you think of the augmented reality elements within the AR experience? • Presentation • Content • Interaction • Augmentation • Mobility • Immersion
Content elements	20. If you had other experiences with augmented reality, in what way can you compare this AR experience with your previous AR experiences?

	21. Do you think the augmented reality elements fit the content of the experience? Why? 22. In what kind of articles do you think augmented reality fits? (E.g. lifestyle articles, political articles, sports articles, financial articles etc.) 23. What kind of augmented reality news content would you like to use more? 24. What do you think are advantages and disadvantages of the augmented reality news content? 25. Do you think using augmented reality in news content is ethical? 26. Do you think augmented reality content fits with news in general?