THE AR IN ARCHITECTURE

by Dieu An Vu
Acknowledgements

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Abstract

A common method within architectural visualization today is the production of still images made with 3D-modeling software. With such advanced technology, it is made easy and efficient to control and manipulate what is shown on those still images, increasing the salability of architectural projects. But what if we take it a step further, using alternative reality technologies? AR, or Augmented Reality can be another useful visualization method, but what implications does it come with, especially for the non-professional users? If we do not consider the impacts it might have, similarly to still images, it will just turn into another tool to increase the salability of architectural projects. This study will therefore seek to answer the question of “How do we implement AR within architectural visualization in a way that is beneficial for the non-professional users?”

The central concepts to consider when talking about architectural visualization are autonomy, time, early involvement of citizens, ocularcentrism and the concept of reality. As architecture has to depend on the contexts of our daily lives, the visualization should not shut out the world to create a pretty ideal that only serves as false advertisement. Shutting out the voices of the citizens also serves to create a metaphorical wall between the people within the field and the people outside of it, causing a loss of exchange of insights and perspectives. One of the voices that speak strongly against the autonomous view is Jeremy Till, his words from the book *Architecture Depends* will therefore play a central role in the theoretical perspective of this study.

To answer the questions of this study, the observation lens will be turned to both the professional side and the non-professional side regarding the subject of alternative reality usage within architecture. This is done via the method of cyber-ethnography, in which the Internet will be the open field to observe. The potentials of AR that are expressed by the professionals will be taken to compare to the perspectives and worries of the non-professionals. The results of the observations will be of use towards a proposal of an AR application, which is this study’s contribution to the discussion of which ways AR can be implemented for the sake of the non-professional users.
Sammanfattning


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Introduction

Within the architectural visualization field today, the most commonly used method to publicize or to sell a project remains still images made from graphical 3D-models. With the help of computer software such as SketchUp, Revit, 3DS Max and AutoCAD, three dimensional models can be created and then exported to an image editing software such as Adobe Photoshop. These software programs make it increasingly easy to polish or manipulate images. The products produced by these methods are still images, which are often heavily composed. Moreover, these images have very carefully chosen angles that help increase the salability of the project.

While the methods of still images can create beautiful visualizations, they do have many shortcomings. You can see the buildings in these images, but you cannot experience them. Things such as scale and spatial perception gets lost or misrepresented. Depending on the honesty of the ones in charge of the project, the images shown to the public can turn out to be false advertisement, and a cause for disappointment when people see the physical building in real life. Because the technology is so advanced nowadays, it becomes increasingly easy to hide flaws of projects, flaws that could make a major difference in deciding whether or not a project should be accepted and finalized as planned.

But what if instead of just seeing the image, you could enter it? What if you could experience those 3D-models as if they were in real life scales, surrounding you? What if you could see your upcoming house in its dedicated location and with decorations of your choice before you decide to build it? That is where alternative reality technologies enter the picture. They allow the users to move in a space that is not physically there, but that is convincing enough to become a memorable experience. They are convincing to the point of starting debates surrounding what constitutes reality.

The most well-known alternative reality technologies available for consumers today are Virtual Reality, Augmented Reality and Mixed Reality, usually
referred to as VR, AR and MR. They each incorporate graphical data to your surroundings on different levels. VR completely surrounds your sight with graphical data, taking you to a virtual world mentally but not physically. AR incorporates graphical aspects to your current physical surroundings, allowing you to view graphical objects in all angles as if they were real objects, or simply overlaying graphical data over glasses that gives you ease of access to information such as navigation. MR does the same as AR but in a more immersive way by sensing and anchoring the graphical data to real physical objects to make them interactable together.

With these currently being new and exciting technologies, there are often positive outlooks on the possibilities these can bring to the field of architectural visualization. Could they change the way we see and do visualizations, or do they just offer another way to sell a project, similarly to still images? If we study ways to use it strategically to shift the current imbalanced power balance between the professionals and the non-professionals, we can address issues within the field, such as the autonomous view on architecture. Imagine a scenario where alternative reality technologies could not only visualize, but also help the citizens with early involvement in new architectural projects, letting everybody share their knowledge and perspectives. Imagine being able to encourage even the uninterested youth to be involved in discussions about the plans of their city. Imagine visualizing the future together.

The aim of this study

The goal of this study is to seek out the potentials to change the current imbalanced power between the professionals and the users within architectural visualization. My primary research question is: “How do we implement AR within architectural visualization in a way that is beneficial for the non-professional users?”
The topic of AR and alternative reality technology is relevant within architectural visualization because it is a method that is currently developing and spreading fast, which can lead to both potentials and consequences. As with a lot of new technologies, it is often associated with advancement and improvement. But these new technologies can leave the users feeling left out if they are only being seen from a positive lens that focuses on the cutting-edge aspects, forcefully pulling the users along simply for the sake of unexplained advancement. It risks to be just another visualization method that the users do not fully understand, but have to accept because it is what they are being offered. But in other ways, this new technology has potentials to change the current relationship we have with visualizations to something more inclusive, something that does not shut out the voices of the users. The users are after all the most important because they are the ones who will have to live with the consequences of architectural projects. It can affect the built environment around them, and also the relationship they have with the professionals within the architectural fields.

While this study brings up alternative reality technology in general to compare and differentiate them, the focus is on AR. As the first intention of this study was to focus on the currently more popular alternative reality technology that is VR, the background research has lead it to prioritize AR as it has the potential of easier avoiding the autonomous view on architecture. AR also lacks the amount of attention and discussion that VR currently has, this study will therefore hopefully be able to contribute to that discussion, so that we can further understand this new visualization method. MR on the other hand will be less discussed, because it is in its current state not widely available for consumer friendly usage compared to VR and AR.

My hypothesis is that AR will be able to challenge the status quo and offer new ways to involve the people outside the architectural fields. But in order to bring that change, we need to be aware of the current situation and problems within architectural visualization. We need to know in what ways the autonomous view on architecture is dividing us. To
answer these questions, architectural visualization will be looked at from different critics’ points of views as a background literature study. Following that, because the non-professional users’ views on this topic is important, the trends and opinions that are openly expressed on the Internet are to be observed and compared to the opinions of the professionals within the architectural fields. A form of cyber-ethnography is therefore the main method of this study, especially to be able to observe the opinions of the non-professional users in a space where those opinions can be expressed without any major censorship. From the theories and findings, a proposal of an AR application for the city of Malmo will be made, showing ways AR can be used to involve the non-professional users early in the planning stages and increase interest for urban exploration.

Personal background

For the sake of context, I find it important to state my personal background and prior experiences to be clear about the perspective from which this study is done. In this case, my background and reason for the chosen topic of this study has to do with both educational and personal interests.

As a student of the program Architecture, visualization and communication of Malmö University from 2016 to 2019, I see alternative reality technology as a way that can address a lot of the issues and debates regarding the autonomy of architecture that we have read about and encountered through our previous studies. Alternative reality is something we have yet to explore during our whole program, as it is not yet a commonly used method within the architectural field in Sweden, or specifically in Malmö. During the courses of the university program, I have been taught to use software such as SketchUp, 3DS Max, AutoCAD and Adobe Photoshop, all of
which can work towards the creation of still image visualizations. While some of these software, such as 3DS Max nowadays have workflow options that can work towards producing materials for alternative reality usage, these were not introduced during my time in the university program.

I also have no prior formal education in alternative reality technologies outside of university, as I am only equipped with my interest for it and the experience of non-professional VR gaming. My first introduction to VR was via the VR-headset Oculus Go. It is a simpler version of the well-known Oculus Rift, which is currently one of the leading headsets in the alternative reality industry for consumers. The Oculus Go provides a more graphically simple experiences at the same time as it is more portable, without requirements of being connected to a computer that has very high specifications. The only thing you need to start your VR experience is the headset and its handheld controller. Even with the Oculus Go being marketed as a simpler experience, it is still incredibly immersive for me.

As a desensitized fan of the horror genre, VR made a huge difference in comparison to the normal computer or TV screen. The first horror experiences I got through in VR are still pleasantly stuck in my head, similarly to the memories of visiting haunted houses in theme parks. It was also an interesting sight to see my family members trying VR for the first time, seeing them trying to keep themselves from falling as they experience the virtual simulation of standing on a thin ledge sticking out of a skyscraper. The nervous feelings of having butterflies in your stomach are very present, as if you really are standing on a thin ledge, even if your physical body is actually standing on stable flooring in your own living room. These realistic experiences were what caused me to consider VR as a topic for my study.

When I later came to the conclusion that AR was a better choice to focus on, I had to try some architectural AR applications for the smartphone since I had no proper prior experience of AR. The only AR I had personally tried up until that point was
on less advance applications that were not focused on architecture. An example is a small add-on mechanic for a postal service, where you could see the size of the package you would pick up with the help of AR, which could be very useful in case you need to decide on bringing help to pick up heavier packages. Another example is the application that the furniture and houseware store IKEA made, which lets the users place out and edit AR furniture in their own house to visualize how it might look like in context with the surrounding. Applications like these prove that there are many useful functions for AR technology, and that gives me the drive to further explore it in the context of architectural visualization.

Limitations of the thesis

With the limitations set by my educational background and personal experiences with alternative reality, this study will not be able to go deeper into topics such as the technical aspects and the professional usage. While I can study them from the point of view of an interested outsider, I do not claim to be a professional of any sort. Statements regarding the technicalities and professional usage will therefore be sourced to the professionals with experience of working within the fields.

With both alternative reality technologies and architecture being developed and advanced in a fast pace, there is the limitation of time to be taken into consideration. Because this study have a duration span of three months, it cannot cover beyond that or collect enough data to predict the patterns of future developments within these fields. None of my statements and conclusions within this study will claim to be irrefutable predictions either.

As for my proposal of an AR application, it is to be seen as a descriptive work of an idea, not a normative statement. It is not an actual application that will be produced by me during the study, nor do I think Malmö must follow its directions. It is instead to start a discussion about the possibilities of using AR in a way that favors the citizens.
There are also limitations methodically, as methods such as interviews did not come to fruition when met with disinterest from local studios and sections of Malmö city that work with alternative reality. With more time or continued studies, the method of interviews could be pushed further to get a better insider view, especially regarding the plans and intentions from the professionals’ side.

Because this study is presented in English, a minor language barrier might occur as it is not my native language. I am however able to express myself on a fluent level of a university student in Sweden, although it is levels below the academic English of native speakers. This means the language in this study should be understandable enough without any significant needs for clarifications, but there are limitations of how eloquently I am able to express myself. The reason I am writing in English instead of Swedish is because most of the references and findings are in English. The topic of alternative reality in general is not as relevant in Sweden as it is in English speaking countries such as the USA.

Discussions within the topic on the Internet are also usually done in English, to be understandable for a bigger crowd. In this situation, if I would have written in Swedish instead, most of the allowed time for this study would be spent on translating from English to Swedish.
Definitions of alternative reality technologies

As alternative reality technologies are still relatively new when it comes to consumer friendly usage, many people might not know exactly what VR, AR and MR stands for. It is therefore appropriate to first have a short explanation of each of them, so that the latter less technical parts of the study become more comprehensible.
VR

When talking about alternative reality technologies, VR, or Virtual Reality, is the term that usually comes up in conversation, as it currently is the most popular one. It takes you to a virtual world, which is usually done with headsets that gives 360° angle views by sensing the head movements and position of the user. It blocks out real surroundings completely, allowing the user to focus only on the virtual world. Depending on the activity within the headset, handheld controllers can be used to add a sense of mobility and navigation with hand movements. There are also many other varying controllers to emulate different tasks.

It is a technology that can be useful in many fields, such as the medical, recruitment and entertainment fields. For architecture, it is relatively newly introduced as it first started to become sensational with the release of consumer friendly gadgets such as the VR-headsets Oculus Rift and HTC Vive, which were released in 2016 (Design Build Network, 2018). It can currently help address some of the restrictions with still image visualizations, such as restrictions on real scale and depth perceptions. But it also suffers a lot of the same problems and limitations such as false advertisement and autonomy, which we will dive further into when comparing VR to other alternative reality technologies in a less technical discussion.

AR

AR is the acronym for Augmented Reality. Unlike VR, it keeps aspects of reality such as the user's real location and surroundings, while adding a layer of virtual data over it. This can be done in many different ways. One of the more simple ways is to have AR glass devices, also called smart glasses, which are usually lightweight and shaped like regular glasses. They allow the users to see through the screen to the real world but with an overlay of graphics projected from the glasses. Because of the current lightweight and simplicity of this technology, the glasses are at this point not cut out for any heavy data 3D-models, they are instead for daily tasks and
efficiencies like showing the time, weather, e-mails, calls and GPS directions. For handling of more data, devices with more power such as smartphones and tablets have the ability through some applications to make use of their camera and sensors, to pivot and overlay graphics over the footage you see on your screen. While these devices can handle large amounts of data, the immersiveness is limited to a small screen. A more advance way for AR is to use a headset. These look and work similarly to the VR-headsets, but they have cameras and sensors that capture the user's surrounding, to use it when overlaying graphical data in a way that feels more immersive as it is not being restricted to a small screen like the smartphones and tablets.

For the users in the context of architectural visualization, the fact that it involves the physical locations and surroundings means it has less of a risk of portraying buildings as autonomous works without real background and contexts. It can also include more senses, instead of only focusing on the optical which is a big risk with VR.

MR

MR, or Mixed Reality, is similar to AR but even more immersive as it allows the user to anchor virtual objects with real life objects, making them both interactable together. MR is currently under development for more consumer friendly entertainment, but the technology is not there yet as of today, although because of the rapid developments of technology and short time span of trends, it is possible for MR to take over and become more mainstream in the near future.

There are currently consumer friendly headsets on the market that has both VR and AR capacities, these are sometimes named Mixed Reality headsets, though that term in this marketing context is not the same as the technical term of MR.
Figure 1: Examples of VR, AR and MR.
Theory

This chapter will address the issues and central concepts that are necessary to know before discussing AR as an architectural visualization method. Because if we do not take them into consideration when introducing yet another visualization method, we risk running into the same problems all over again and not changing anything. With alternative reality being more immersive and convincing, we could even risk using a more powerful tool of trickery compared to today’s methods.

Current disagreements surrounding the question of how real alternative realities truly are will also be addressed, as they are to be taken into consideration when discussing the concept of autonomous views on architecture. While we will not go too deep within the topic of reality in this specific study, it is worth to mention to prove how powerful alternative reality technologies are, and how they can have a very big impact on the users.
Critiques on different visualization methods

Drawings and communication difficulties

Traditional architectural drawings are generally difficult to read for people outside the architecture and construction fields. Since they present a 3D-world in 2D, with field specific signs for different functions and objects, they make it difficult to translate unless you have prior knowledge and experience of architectural drawings. CGarchitect (2012) even made a document to help people working with architectural visualization to understand the traditional drawings, while stating that “Understanding a set of architectural drawings is critical to efficient and accurate work in 3ds Max, and without knowing exactly how drawings are put together and what each component of a drawing indicates, a 3D artist is likely to spend a great deal of time trying to make sense of the madness that can be a set of architectural drawings.” Some of the simpler drawings shown to non-professional readers would attempt to explain their own signs in a list, allowing the reader to do the translation by themselves. But this is not an instant process, and is not ideal when trying to give a clear picture of how a building is supposed to look like in the head of the reader. Therefore, to communicate to people outside these fields, other methods are more popular today.

Figure 2: A typical architectural site drawing (CGarchitect, 2012).
Physical miniature models and scale perception

One of the widely appreciated methods is the use of physical miniature models. These models can help the non-professional viewers with the perception of lighting, situation and volume. They can for example be an interactive model of a city that provide different types of information in a way that is easy to understand for everybody. An example of such model can be found in the gallery of New London Architecture, in UK (NLA, n.d.) (figure 3). Using a light projector, different parts of the model light up depending on what information the users choose in an easy navigable touch panel. The model is the most popular attraction of the entire exhibition and can therefore help encourage more interest in the planning and development of the city. Other examples of using physical miniature models are those that represent the same building it is located in. These types of models help the visitors understand the forms of the building, and in turn understand how to navigate the building better with a clearer sense of which room is which, compared to a flat map of lines.

Physical miniature models effectively serve their purpose well, but they do not help with the scale and distance perception and you cannot experience moving within or around the buildings that they represent. You see them from above, like a bird in the sky rather than a human. As Frank H. Durgin (2014, pp. 253-260) states with his article on the journal *Psychology & Neuroscience* on misperception of egocentric distance, “relative to perceived eye-height, the perception of egocentric distance is
systematically compressed.” With his scientific study on angular scale expansions, he came to the conclusion that “there are clearly systematic biases in the human perceptual coding of locomotor space as revealed by multiple methodologies designed to examine perceived angular declination.” Because of this human misperception of distance, trying to translate an object that was scaled down to a realistic scale would prove difficult.

Still images and false advertisement

With still images of digital models, you can get eye level views into buildings and rooms. You can even get examples of different types of activities that can occur within different rooms. But these do not give a realistic perception of scale, space, volume and distance. Depending on the work ethics of the people in charge of the project and their views on producing false advertisement, these still images can be heavily altered to increase its salability or to be eye-catching rather than being informative.

False advertisement is currently one of the biggest issues within architectural visualization. Often, a building as shown on the visualization will create a positive expectation that does not match with the reality. The reveal of the real building can at times bring along a lot of disappointments from the people who are affected by it or simply witnessing it. In a post for the Swedish association Arkitekturupprororet, Peter Olsson (2018) writes about this issue as he lists many examples of projects that have gotten criticized for being misleading or deceptive because of their visualizations. A common pattern with these visualizations are the constant beautiful sunny weather with dreamy lighting, the abundance of happy lively people, the clean shiny materials, the lack of cars and trucks, and the addition of trees and greenery that do not exist there in real life. Figure 4 shows an obvious example of such visualization. As he states, the reason this is happening is because “In principle, you can create renderings that exactly match the final result. However, as the architectural offices are keen to sell their ideas to the client, there
is a tendency to use the technology’s possibilities to beautify the renderings to the extent that they are directly misleading.” (Olsson, 2018). In summary, the false advertisement is to increase a project’s salability.

This problem can also affect architectural competitions. Magnus Rönn is a Swedish architect and president of the Nordic Association of Architectural Research (NAF/NAAR), and he wrote in an article (2012, pp. 150-170) about the processes behind prequalification of architectural competitions in Sweden. He brings up how the quality of the competition proposals are based on design idea, but also on how well the proposals are visualized in drawings and illustrations. This information shows how even when a project is being judged by people within the field, the beautification of the visualization can still occur to make designs seem more attractive.
Central Concepts

Autonomy

An important concept to consider when looking at or working with architectural visualizations is *autonomy*. Visualizations can intentionally or unintentionally add to the perception of architecture being autonomous, independent from its surroundings and contexts. One of the running themes in Jeremy Till’s book, *Architecture Depends* (2009) is the impossible autonomy. Architecture in reality has to depend on many factors of our daily life, such as weather, location, history, culture, politics, context, involved parties and time. But a lot of projects tend to strive for autonomy or unconsciously forget about all the factors that architecture needs to depend on. Popular publications will often focus on buildings as if they are autonomous works of art to put on a pedestal. Some parts of the architecture field purposely do so to preserve the feeling of superiority or power over the users that are not professionals within the field. In the chapter *Deluded Detachment*, Till makes a strong statement about this phenomenon of autonomy when he compares it to the metaphorical picture of people standing in high towers:

We look down at the city below and, at this distance, command it as an abstraction. The voices of people are lost; we just observe their functions. Buildings are reduced to form, roads to flows of traffic. Noises are measured, not listened to. Shapes are classified by type, not sensuously enjoyed. “One’s body is no longer clasped by the streets,” as Michel de Certeau says, standing prophetically on top of the New York World Trade Center, “nor is it possessed by the rumble of so many differences.” And from below, the city looks back and sees us as remote figures of authority. The tower thus signifies a removal that allows specific rituals and values to be established at the earliest stages of the nascent architect’s education.

(Till, 2009, p. 7)
The consequence of this can lead to buildings that do not serve any real functions or create any possibilities in real life, and instead increases hardships and problems. Because without the insights of the actual people who are supposed to live with the results, the professionals’ knowledge base and understanding of the situation will stay limited.

Time

When talking about methods such as still images, time is an important concept to consider since the still image tends to leave it out. An issue within architectural visualizations specifically is the lack of consideration of time and processes. In his book, Till (2009, pp.77-80) points out time as one of the pillars that architecture depends on but that is often forgotten or purposely hidden. He criticizes idealized pictures that capture architecture in a perfect moment before time affects it, or without consideration of the process that came before it. The pictures show no signs of being lived in, signs such as dirt, ageing of materials, social drifts or any realistic human touches. As he explains, “this provides solace for architects who can dream for a moment that architecture is a stable power existing over and above the tides of time.” (Till, 2009, p. 77).

Till (2009, p. 79) strongly expresses that any tactics to separate time from architecture are doomed to fail, as time is unavoidable. This perspective is often brought up during the classes of the university program Architecture, visualization and communication. During our visualization projects, we are encouraged to go against the current trends of idealized commercial pictures. The view on this topic, which I have gotten from my three years in the program, is to either portray the buildings as realistic as possible including imperfections, or to be obvious about it being a loose representation like a sketch or a work in process. That way, we can help minimize the creation of false expectations that leads to disappointments in due time.
Planning stages

The lack of consideration of time and the autonomy problem can also be alleviated by involving the non-professional users early in the planning stages. Gunnar Sandin writes in the article *Democracy on the Margin: Architectural Means of Appropriation in Governmental Alteration of Space* (2013, pp. 234-250) about the problem of marginalization in architecture. He presents the renewal of a square as an example of where visualization has a role in the disappointments. Since the visualization can hide controversial elements or emphasize the selling points, Sandin argues that it risks misdirecting uninformed users towards an already decided final product which the professionals are already convinced about. As a solution to this problem, he recommends visualization that is more focused on processes and their participants. For this to happen, the users’ accessibility to information regarding early plans and drafts is important. As Sandin says, “A re-orientation of architectural competence could include extended public consultation and discussion about possible paths to be taken (and open-source design formats are already technically possible today). More vivid visualisation and more pro-active communication could embrace both place-specific actors and other interested/affected parties.” (2013, p. 247). It can also help create a more equal ground of communication, as the professionals will be more encouraged to explain the details behind their reasoning of certain creations or changes. Users outside the field can feel like they have an input on the changes around them, they do not need to feel like they should keep their opinions to themselves as the professionals “know better”.

Perceived exclusivity

The phenomenon where the user thinks the architect “knows better” can for example be observed in the documentary film *Koolhaas Houselife* (Bêka and Lemoine, 2013). It follows a housemaid in the well-known and admired Maison à Bordeaux, a house by the famous architect Rem Koolhaas. The house has regular tourist guides and has won many awards,
including those by TIME Magazine and The Wall Street Journal (OMA, 2011). As the viewer gets to follow the housemaid through her daily routines, a lot of the problems caused by the design get pointed out. Some of the bigger problems include water leakage because of visually pleasing choices, glass walls shattering, inefficient narrow walking spaces, the sun burning specific parts of the lawn and windows that are unusable because of their unnaturally high positions. During the panicked moments of discovering new problems while filming, the housemaid half-jokingly exclaims “It’s a live drama!” (Bêka and Lemoine, 2013, 00:40:00). She also talks about not understanding how the whole building is managing to stand up and her fear of it falling down, or why the walls are all gray. But even with all the time she has spent in and around the house, she is still not confident in explaining it to other people as she is afraid she would explain it wrong, as she perceives herself to not belong in the world of the architects (Bêka and Lemoine, 2013, 00:44:30). Even with all the knowledge she has to offer, the perceived autonomy of the architecture field has formed an exclusivity. It is therefore important to have better communication between the different parties, including the users, as early as possible in the planning stages to avoid this exclusivity.

Ocularcentrism

Visualization methods such as still images have been criticized for fetishizing the optical. As we experience architecture with more than just our eyes, visualizations have the risk of only informing us about a very small aspect of a project, leaving the rest to be unpredictable surprise factors for the citizens. In the book Architectural Representation and the Perspective Hinge, Alberto Pérez-Gómez and Louise Pelletier (1997, pp. 377-383) perceives the modern digital technologies as methods that makes composition and manipulation of viewpoints more efficient, making delusions created by the ones in charge of the project more believable:
“Indeed, the invisible perspectival hinge operating in nineteenth-century axonometric space is internalized and made even more “natural” by computer technology, resulting in a powerful tool of reduction and control.” (Pérez-Gómez and Pelletier, 1997, p. 378)

The fetishization of the optical sense is not a new phenomenon. Pérez-Gómez and Pelletier points out that the importance put on vision was already ingrained in the Western society since the Middle Ages, where it was viewed as a “vehicle of knowledge” by many scientists and philosophers (1997, p. 10). Through time, whether it be an empirical understanding in the sense of positivism or a subjective understanding with a cultural context, humans’ quest for knowledge through vision has always been present in various degrees (Pérez-Gómez and Pelletier, 1997, pp. 29-33).

Digitalization - what is real?

The debate regarding what constitutes reality is a big topic with today’s widespread use of digital spaces. It is a topic that can evoke a lot of passionate opinions from both sides, the side that is against digitalization and the side that welcomes it. Given that it is a complex and sensitive topic, this study will not have enough space to explore it sufficiently. It is however still important to be put into consideration when talking about alternative reality technologies, and is therefore necessary to be mentioned to show how they can have an impact on the users, making us question what is real.

Perspectives on reality within architecture

Can the experiences of architecture in alternative reality be considered real? There is currently no general shared consensus regarding this question. If we look at it from the point of view that wants to include more senses than the optical and auditory,
it is possible to argue that the current state of alternative reality leaves a lot to be desired. Within the architectural context where the alternative reality technology is used to visualize what is to become physical, one can argue that it is then only a temporary representation and therefore not real. Important factors such as material, weight and the effects of time which was pointed out by Till (2009, pp.77-80) are often excluded.

But from another point of view, many alternative reality technologies includes bodily movements to increase the control for the users, creating a more immersive feeling, which makes the experience feel realistic and memorable depending on how advanced the technology is. If it is remembered in your mind the same way as any other experiences, can it then be considered equal? Even if it is completely separate from our other daily life experiences, is it possible for it to also be real, like how different people’s perspective of reality can differ from each other depending on their backgrounds? For example, a visualized virtual building is not located in the same world as its physical counterpart, but for the visualizer who experience that visual world extensively, it is more memorable and recognizable than the physical one, making it their reality of that building. Meanwhile, the people living in the physical building sees the physical one as their reality, making both the virtual building and the physical building their own separate places. So despite the autonomy of the visualization, it still had a life. If architecture is viewed from the perspective that does not define it by merely physical objects, but also by social spaces and contexts, then it is all the more arguable that alternative realities can provide a real space.

A building has at least two lives – the one imagined by its maker and the life it lives afterward – and they are never the same.

(Koolhaas, 2012)
A study done by an online documentary and video essay channel on YouTube, tried to explore the question regarding reality with their video How Real is Virtual Reality? (The Good Stuff, 2017). With the help of a focus group in Chicago, which consisted of five people new to VR, including one of the producers, they tried experiencing VR for the first time to test its sense of realism. The response from the participants were surprised expressions of how real the virtual world felt: “The most interesting part to me was that, even though you’re fully aware that you’re experiencing a simulation, there’s a part of your brain that actually believes you’re somewhere else.” (The Good Stuff, 2017, 00:05:40).

They bring up two senses that are important factors to create that feeling of realism, the vestibular sense and proprioception (The Good Stuff, 2017, 00:06:15-00:11:17). The vestibular sense helps with our balance and spatial orientation, so when the VR world looks to move the same as what we are experiencing with the vestibular sense, it becomes believable. Proprioception is our perception of where our body is positioned and its movements.

The human mind can start perceiving false limbs as our own when they are seen with the corresponding movements and interactions that we sense with our actual limbs. This is how the graphical hands placed in the VR world, which is located where we sense our placement of your own actual hands with the controllers, can trick us into believing it is real or an extension of our body. This can for example cause us to flinch or have other reflexive reactions when we see the false limbs being attacked.

Another important factor that the study brought up is that it is not only about realism, but also about emotional feelings (The Good Stuff, 2017, 00:11:17-00:13:11). Different VR worlds can evoke different emotional feelings for the users, feelings that are similar to the ones we can feel in similar settings outside of VR. With the participants of the study that are new to VR, the most common feelings they expressed were the sense of peacefulness and wonder, “like being a kid, learning for the first time what our bodies are capable of, and exploring this totally new world.” (The Good Stuff, 2017, 00:12:52).
Figure 5: Cover of the study by The Good Stuff (2017).
Methods

The previous section has been a literature review to show the theories that are central within this study, and give reasons to why they are important when talking about architectural visualization. As John W. Creswell explains in his book *Research design: Qualitative, quantitative and mixed methods approaches*, within studies such as ethnographies, setting the stage early is often necessary as it helps creating an “orienting framework” (2014, p. 61).

The method that provides the empirical data for this study is *cyber-ethnography*. As the name suggests, it is a form of ethnography, but the data is collected through various online spaces on the Internet. This method is also known as virtual ethnography or online ethnography. Similarly to other ethnographical studies, it is a qualitative approach (Creswell, 2014, p. 48). This study will therefore focus on finding different views and perspectives to analyze their patterns carefully, rather than on collecting as much data as possible to get an overall view as one does with quantitative studies. As Jörgen Skågeby (2011, pp. 410-428) puts it, “its aim is usually to look beyond amounts and distributions and try to unearth the deeper reasons for behaviours or sentiments (i.e. ‘why?’).”

To collect the data for this study, two different types of online spaces will be explored. One of them is the official websites or other controlled channels that contain the official statements of the professionals within the architectural or alternative reality fields. The other type of space is the more open one, where people outside the fields have equal opportunity to get their voices public. This range from YouTube videos, blogs and news articles on websites that do not cater to the mentioned fields. Information on the game Pokémon Go is also to be researched as it is a functioning example of an AR application. The feedback which Pokémon GO has will be put into consideration when forming answers to the questions of this study.

Skågeby (2011, pp. 410-428) points out a possible downside with this type of ethnography done on online spaces, because of the ease of access to incredibly high amounts of information on the
Internet, there is a risk of accumulating too much data which leaves too little time and space for the analyzation. To prevent this from happening, this study will focus on searching with terms related to the topic of alternative reality within architectural visualization, and terms related to the issues brought up with the theories. New issues that are brought up because of the findings will also be studied. For example, if the search terms starts at “AR architecture”, which leads to opinions about AR’s uses over VR, then the next search terms would be “AR VR architecture comparison”. When the observed opinions and views get too repetitive, further searching into the subject of matter will end, while they will be noted in this study of their prominence within their topic.

One of the reasons for the chosen method is because of the obstacles that occurred during the initial research attempts, and the lack of information available offline compared to online. The original intention was to interview local studios that work with alternative reality technologies. But because of my location, which is the city of Malmo in Sweden, there is a lack of activity in general regarding alternative reality technologies within architectural visualization. The studios that were found and contacted have shown a lack of interest in participating in an interview. An attempt was also made to contact the actual city of Malmo, to ask them regarding their rumored plans of using VR, and to find out whether its usage is meant to help the citizens. There was no reply from Malmo city, and an attempt to search for the information on the Internet has only shown a small presentation file in which short explanations of alternative reality technologies where presented, with MR being presented in its commercial context of being a combination of VR and AR rather than the technical meaning of it being more advance than AR. The information given was accidentally found by searching for a specific name of a person who works for Malmo city, it is not information made to be public. It is therefore a reason to conclude that Malmo city currently has no public plans of involving the citizens with their use of alternative reality technologies, or it could also be an issue with lack
of transparency for projects in their early stages. Because of all these obstacles, the observation lens was turned to the cyberspace, where a lot of international studios that work with alternative reality visualization methods already have their information available for public access.

Cyber-ethnography is also useful for this study because the focus is on the non-professional users. The online space allows the users to freely and openly express their views and concerns, which allows discussions to develop that would otherwise risk being stifled in the face of big corporations with commercial influences. The users also have more control over the trending topics, making it easier to observe what people deem as important. The more relaxed and dynamic character of the online spaces also provides with a big variety of different ways to express opinions and views, which can offer an interesting counterpart to the typical static academic texts.

From the data that is collected, a proposal of a way to use AR will be presented to give an example of one of the ways we can address the issues that are brought up through the theory and findings, especially regarding the issue of autonomous views on architecture. Pointers and inspirations taken from the game Pokémon GO will also be incorporated into the proposal, specifically with aspects that has been proven to work well. The proposal is not to be seen as a solution to all problems, but it is my contribution to the discussion of positive AR usage within architectural visualization.
Findings

These findings will present results from my research into the topic of alternative reality usage within architecture. They are all from online spaces. The first presented findings are from public information given by people and studios that work within the field. After that, the publicly addressed opinions and results from people who do not work within the field will also be presented. A working example of an AR application, which in this case is Pokémon GO, will be looked into, including both the positive and negative consequences it has shown.
The professionals' outlook on alternative reality

With alternative reality being new and exciting, it is mostly viewed in a positive light because of the new possibilities it can bring. Many studies currently present positive results when working with alternative reality technologies within the architectural fields.

Compared to other visualization methods, the pressure to be more eye-catching with misleading or beautified editing is less necessary, as it is already attention grabbing enough when a building is right in front of you in its real scale, or when you are situated inside of it. It makes creating “personal and emotional connection” to a building a quick process that causes the new users to be surprised (Gallagher, 2018). Especially with alternative reality being new technology, it has the appeal of looking “cool” and “futuristic”. It becomes almost impossible to ignore as it is still quite an uncommon experience for a lot of people, and can therefore increase the will to explore a project that could otherwise look plain and uninteresting to a person outside the field. There is also an additional sense of control for the user, as they can choose to see from all the possible angles for a human, rather than a specifically composed angle that was chosen with somebody else's motives behind it, making it more compelling to take a closer look at a project. As Gallagher (2018), who is a structural engineer illustrates, “They can look up and see how high the ceiling is. They can look left and right and get a feeling for how big a room is.” The news site Interesting Engineering (Fourtané, 2019) also writes about AR in very positive light, stating that AR “makes digital media feel physically present through interactive design and gesture”, which in turn can be “triggering faster decision making”.

With the real scales of buildings that alternative reality technologies can provide, it can change the way we study architectural projects. Gunita Kulikovska, who has a background in architecture, urbanism and urban strategies, spoke for TEDxRiga about her research (2016, 00:07:50). It was started in 2015 with a team of young architects and technicians to experiment with the meeting
of architecture and VR. They wanted to create a common method of communication for all involved parties within a construction project. They compared drawings on paper, physical 3D-models and VR. Those who got to experience buildings in VR got a deeper understanding of shapes and rooms in three-dimensional and real scales. She believes that VR is not only a form of presentation, but it can also contribute to the learning of architecture. Boaz Ashkenazy (2017) from Studio 216, a digital production agency, talked for the Congress for the New Urbanism about the possibilities of alternative realities. One of those possibilities is the ability to work with AR models in real scale, changing the way a designer could work when seeing their adjustments to the model in real scale and real time (Ashkenazy, 2017, 00:05:03).

A similar possibility, but for the clients, is the ability to instantly create an AR 3D-model out of a traditional flat architectural drawing (Ashkenazy, 2017, 00:14:39). This could make it much easier for clients who are not used to reading architectural drawings, to understand the information that it is trying to communicate better, without the need of being able to do any 3D-modelling by themselves. Though something Ashkenazy did not bring up was the fact that this would require software that can read and translate traditional architectural drawings in a correct way that does not accidentally read the geometries wrongly, potentially causing misleading data to be communicated to the user in a way that looks more concrete. Since we are not quite there yet technology-wise, some studios that work with AR models today are instead using QR-codes that can lead the users to a premade AR 3D-model, rather than one created instantly by reading a drawing (SNOW Architects, 2011). However, the owners of the application Augment states that their technology can already do this direct translation of drawings to AR-models with the collaboration of a British real estate and construction company, LSI Architects (Augment, 2016) (figure 6). Whether these are cases where the application only can read their specific drawings or if it can read all general architectural drawings are not yet disclosed.
Another possibility is the use of different types of alternative realities together, as an example, Ashkenazy (2017, 00:06:06) showcase a situation in which a person is using AR, while getting guidance from another person who is not physically in the room, but connected through VR and seeing the same view that the first person is recording from their perspective (figure 7). This collaboration with different communication methods could be a possible future, which can be a subject to look further into when alternative reality technologies have become more advanced.
AR compared to VR

In an article that lists the usefulness of VR and AR for architects, Augment (2016) lists this “visualization in real environments” as one of the advancements AR has over VR. From the professionals’ perspective, they point out that AR is already being in use by the people in the field, and it has helped to make the workflow more efficient between the different parties, such as designers, engineers, and builders. Problems with buildings in development become more visible and can be addressed before the project is in its final stages, where it would lead to more time consuming rebuilds and renovations. “They can see the infrastructure of the BIM system through augmented reality - exactly where it'll exist - and catch any issues before it's too late.” (Augment, 2016).

From a more non-professional user-oriented perspective, using AR instead can also help alleviate the motion sickness that some users experience with VR, especially when they are not used to it. This is also known as cybersickness or virtual reality sickness, which is one of the challenges VR developers are currently working with to make VR usable for more people (University of Waterloo, 2018). The signs of this sickness are very similar to the motion sickness some people can experience when riding in cars or ships, such as nausea, headaches, vomiting, drowsiness, disorientation and other discomforts. Almar Suarez writes in the article How and why our experiments with virtual reality motion made us ill (2018) about this phenomenon. The motion sickness can occur when your external sensory information is not lining up with your internal sensors. Another cause is the lack of good enough graphical information, like low framerates or blurry views, causing our eyes to get fatigued or general disorientation. A too low field of view can also cause motion sickness, especially for women, who usually have better peripheral vision than men. In her conclusion, there are many different ways VR can cause motion sickness. Suarez (2018) mentions some solutions that can help limiting the effects, such as taking sea- or car-sickness pills, or having a fixed point of reference like a virtual nose within VR in the same position where our real nose should be seen. But overall, more research needs
to be done for VR to completely erase the problem of motion sickness, which is currently a hinder for some people to experience this technology. With AR technology, especially the ones that allow us to keep our real field of view, motion sickness has not been brought up or discussed widely as one of the problems that can occur.

Pokémon GO

When talking about AR, the popular smartphone gaming application Pokémon GO is usually mentioned since its release in 2016 (Pokémon, 2019). It is the easiest way to explain what AR is, as many people might not know what AR stands for, but are aware of Pokémon GO because of its huge popularity wave and controversies in mainstream media. It is also the first AR application to become well-known, introducing a lot of people to the technology.

Since Pokémon GO is an example of what AR in its current user-friendly state can do, we can directly observe the feedback the application received. During its release, the media reported a sudden surge of crowds of people exploring urban spaces that they would otherwise never visit, for the sake of advancing in the game. Even people who never played any earlier Pokémon games jumped on what the Internet calls “the hype train”, causing Nintendo, the company behind the game to soar in market value, passing even Sony (Lynley, 2016).

This popularity directly caused a massive increase in urban exploration, especially amongst the youth. In the article Pokémon GO Becomes an Unexpected Advocate for Urban Exploration, Giovanna Fabiano (2016) reported about what the game did for cities across the world. The game developers helped with the exploration of urban spaces by strategically placing out key locations for the game in interesting spaces while also giving the players history and information about those places. These locations can range from places near public art, unique
architecture or public gathering spaces. They were also not only limited to already well-known landmarks and could help people discover places that would otherwise lack visitors (Brady, 2016). Fabiano sees this strategy as a step in the right direction as he states: “As players capture more and more Pokémon, they are, perhaps ironically, forced to learn their city’s history, landmarks and local retailers, PokéStop by PokéStop. And it’s done using the oldest trick in the book—by making it fun.” (Fabiano, 2016).
Possible privacy issues

The Pokémon GO application was for some people a great way to meet new friends with similar interests. Because the application placed out non-physical data stations in specific real locations, also known as PokéStops, people would accidentally meet up with each other when they arrived. While this can be seen as a very joyful experience for many people and create a sense of community, it also comes with consequences.

One of those consequences is the safety issue, especially regarding the physical safety of the young players. Because the PokéStops are public information available for anybody with the application on their smartphone, there are risks of it being used by people with bad intentions. Those bad intentions can range from pedophilia to robbery. Daily Mail in UK even reported that there have been people charged with “first-degree robbery and armed criminal action for using Pokemon Go to allegedly rob people” (Davies, 2016).

The other consequence is the worries about privacy of data. The companies behind AR applications could be collecting data from the users without their knowledge, or in a discreet way such as hiding the information about data mining in a wordy “terms of service” document, similarly to other applications of today. With AR being very location based, users risks unknowingly sharing their own movements and locations. This collected data in turn can be used to help the AR companies further develop their application to be more advanced, but it can also be used for targeted advertisement or to be sold to third party companies. Targeted advertisement in this scenario means using the data collected from the user to tailor advertisement that fits the user’s specific history, traits, interests and preferences, which at times is causing unwanted invasion of privacy (GCF Global, n.d.). The more common AR usage will become, the bigger the amount of user data will be given to these companies. In a video report by the YouTube news channel of Philip DeFranco (2019), AR usage becoming extremely common is seen as an inevitable future, especially with massive companies such as Google already working on mapping the world for AR technology.
The reason privacy issues are relevant today is because of the data breach controversies in recent years that are causing users all over the world to be extra wary of it (figure 9). In 2018 the European Union even implemented a law to protect the users’ data and privacy, the General Data Protection Regulation, also known as GDPR 2018 or (EU) 2016/679 (EUR-Lex, 2016). In DeFranco’s video report, these recent controversies get highlighted with the biggest one being the recent high-profile data breach case by Facebook, in which the founder and CEO Mark Zuckerberg was under international scrutiny and forced into a court case (DeFranco, 2019, 00:06:30).
Analysis

Before giving the concrete answers and examples to the main question of this study, the findings will be analyzed to see how they address the issues and central concepts brought up in the theory. The patterns of the observations will also be analyzed to see who benefits from the claims. All this will be of use to give the concrete answers to the main question during my AR application proposal.
Why AR over VR?

While a lot of focus and attention today lays on VR, mostly because it is more developed technology-wise out of the interests of the gaming and entertainment fields, there are still already architectural studios that are working with AR too. As shown in the findings, the ones that do work with AR expresses the usefulness is has over VR when it comes to architecture specifically. As Augment (2016) expressed, VR can be very useful in other fields, but when it comes to architectural visualization, AR makes a lot more sense in many ways.

As VR can bring you into an autonomous virtual world, there is a risk of it completely separating the visualization from real life, similar to still images but in a more immersive way. There are different options to address this problem or help alleviate it. One of the options is to place the 3D model in a realistic surrounding that the building is intended to be placed in afterwards. This can be done using 360° photographs and weather data of the real location, but all this requires more technical work.

Another easier option that furthermore adds to the exploration experience and includes more senses, is to simply use AR instead of VR.

When it comes to avoiding the ocularcentrism that Pérez-Gómez and Pelletier criticized (1997, pp. 377-383), AR is also shown to be the better option over VR. During VR usage, senses like touch of real life objects that are not also visualized within the graphical world, are to be avoided to not disorientate the user with mixed signals that does not line up with what they see, which could end up causing cyber-sickness as the studies of the findings have proven (Suarez, 2018). This heavy focus on the optical can, as the theory on ocularcentrism addressed, leave a lack of information regarding the physical experience of an architectural project, which can lead to unexpected results when witnessing the project in real life.

AR does however have a downside compared to VR. The user has to be situated at the correct location for projects that heavily relies on its context. If that is not possible for the user, they would have
to find a wide enough empty field to fit a whole project into it for proper viewing. It is in that sense less portable, but that is also what causes AR to be less autonomous than VR. Forcing a building to be placed where it is planned to be built will help to keep the project realistic with regards to the context and location that the final product is supposed to be. This would line up with Till’s (2009) argument about how architecture in real life has to depend on its contexts. If Ashkenazy’s suggestion (2017, 00:06:06) with collaboration between different alternative reality methods is possible in the future, it could also solve this problem of location access.

Similarities to still images

Alternative reality, if done correctly according to the positive results shown by the findings, can solve a lot of the disadvantages that the other methods have. But it can also suffer some of the same consequences of still image visualization. It is therefore necessary to consider the important issues and discussions about architectural visualization as a whole, specifically the issues that were brought up in the theory section regarding false advertisement, disregard of time and ocularcentrism in another degree compared to earlier comparison with VR.

Just like with still images, it is possible to manipulate the 3D-models of alternative realities to match an ideal instead of the physical reality or a process. The same pattern of manipulation can persist more or less even during architectural competitions unless there are rules set up to combat this issue. Although some aspects like scale and shadows will be difficult to alter to look better without it being immediately noticeable compared to still images, the more we get used to a method, the more we learn of ways to manipulate it, as discovered with still image visualizations of today.

Similarly to still images, the tendency to prioritize the optical instead of other senses could also be a problem that contributes to the ease of manipulation and the autonomous view on
architecture. VR specifically, as mentioned before, have more of a risk to run into this problem, as the outside world gets hidden to only show the virtual world, especially when trying to alleviate cybersickness. While AR projects that are placed in physical locations do not have the same risk of shutting out the physical world, if it is manipulated in a similar way as overly manipulated still images and VR-models, it could still suffer the same false advertisement and autonomy even if it is to a lesser extent. For example, a popular trend of still image visualizations today is dramatic foggy sceneries, this can easily be replicated in both VR and AR. With AR, the physical surroundings would be able to communicate a difference between itself and the weather of the AR visualization, so it becomes more obvious to the non-professional users how the AR visualization is attempting to manipulate. But depending on the skills and advancements of the visualizer and the technology, there is no guessing how easy it will become to convince the non-professional users that these manipulations are real in the future.

The patterns of information by different parties

As the findings have shown, there are certain patterns of opinions and perspectives that can be observed when looking at information provided by the professionals within alternative reality or architectural fields, compared to the non-professional users. The professionals provide a very positive outlook on what alternative reality can do currently, or what possibilities it can bring in the future. There are no mentions of downsides and risks beyond the technical aspects that are already being worked on to be improved. When alternative reality as a visualization method is being compared to other methods such as traditional architectural drawings or still images, there are no discussions about their similarities. Only their differences are being brought up to further elevate alternative reality as a more advance and improved method.
The non-professional users however tend to provide a wider variety of perspectives on alternative reality. On one hand, we have the expressed excitements on the new possibilities it can bring, such as challenging the definition of reality along with the increase of interest in urban exploration which it can generate. But on the other hand, there are also worries being expressed, worries that the professionals’ side tend to ignore until it becomes a controversy in the mainstream media. As the findings have shown, the current relevant worries are regarding privacy issues. With the recent controversies of big companies having data breaches, it is not a big leap to consider this issue with alternative reality also.

With these patterns being observed, one can ask why the professional side is not addressing the issues that the non-professionals are addressing. Is it not within their gain to discuss ways they can go about to avoid invasion of privacy? Is it perhaps not something that can be promised, as there are plans of collecting user data for their own gains, or to sell to third party companies? These are just assumptions, but until the professionals within the industry explain themselves clearly, the assumptions will remain in the heads of the non-professional users who are worried about their personal privacy.

Power shifts
With AR being capable of inviting earlier participation or information sharing between the non-professional users and the professionals, the power balance of architectural projects could shift. In its current state, regular citizens do not have much say in planned projects as they only get to see them in their already decided and advertisable form, as Sandin (2013) pointed out in his article about marginalization in architecture. This could change if the parties in power allows the sharing of AR-models in its draft stages. The easy accessibility to AR technology via smartphones mean projects in early stages can be viewed by most people, adults and children alike, and therefore start a
conversation around the project early, alleviating the surprise disappointments. This early access of information can also increase the ability for the citizens who participate in the conversations to sway the direction of the project towards a more suitable direction that the professionals might not have considered before.

But all this will only be possible if the people in charge of the projects allow the early drafts to be shared for the public to participate. As my research process and results have shown, companies and even the city of Malmö has not been very transparent with their intentions. It is therefore difficult to judge whether or not they deem the participation of non-professional users important. They could be looking from a perspective that prioritize their own financial gains only, where alternative reality’s usage is to look “cool” and “futuristic” to attract attention. If this was a bigger study with more resources, getting a better insight into these companies to study their real intentions would be an interesting way to get a better grasp of the actual situation.
Proposal of AR application for Malmö

As a strategy to increase urban exploration and involve the citizens early in the planning stages of architectural projects, I want to propose an example of an AR application. This example is to show the ways we can go about when using AR for the benefit of the citizens. It is not an actual application available currently, but descriptions of aspects I suggest should be included or taken into consideration in the future of AR applications.

The reason I chose to aim this at Malmö is because it is a city which has enough financial and technological resources. Knowing about their plans on starting to work with alternative reality technologies, my proposal could be a relevant and timely option to take into consideration or to simply start a discussion. Although these ideas are not restricted to Malmö city only, as they could also work elsewhere.
Involving citizens early

For the sake of both the city and its citizens, it is more beneficial the earlier citizens are able to access the information and drafts of projects in the planning stages. As the research of this study has shown, only showcasing visualizations of projects that are almost in their final stages, with already set plans, can be a cause of surprise and disappointments for the citizens. This in turn can cause the projects to be heavily criticized as they do not function the way the people in charge predicted. Even if the citizens do not work within the fields of architecture, they still have insights and perspectives that can be very useful for architectural projects. One can even argue that it is precisely because they do not belong in the field, which means they can contribute from more points of views than one. Collective knowledge should not be unappreciated if we want to advance our cities.

Therefore, one of the main functions in this application should be the publication of early drafts. Imagine walking by an empty lot or a space under construction. You lift up your smartphone and look at it through the AR application, and in an instant, you are being shown an AR-model of a building that is going to be there physically in the future. You get curious and take a look at it from different angles, you can see what hangout spaces it will provide, what sceneries it will obscure or how well it will fit in with the rest of the surroundings. You find an interesting spot in the visualized building, snap a picture of it and discuss it with your friends.

Accessible information

Architecture is not only about how buildings look like, there are other important contextual information that are difficult to convey only via the visual methods. Informations such as history, background, reasons and involved parties are all important. The citizens deserves to know why there will be a new building replacing an old hangout spot, and who is behind the decision, with what intentions.
The AR application should therefore not only be restricted to the visual aspects. Imagine seeing the draft of an upcoming building in AR. It looks interesting, but you know nothing about it. You open up the information option in the application, and there it is, all the current publicly available information about the project. You find out whether it is backed by the city or a private company. You can also study the intended results for the project, comparing it to how they have designed the building. It says the building should be accessible for everybody, including people in wheelchairs or with strollers, but the size of those doors and the difference in ground heights are not suitable. Perhaps they did not consider that specific entrance to be for everybody, but why is that? Should the people in wheelchairs or with strollers enter from the back door? It is best you bring this to the attention of the people involved before it is too late, which could get costly for the project owners or be disappointing to the people who by then could feel left out.

Forum of feedback

Having a space where the citizens can openly and freely express their feedback on projects can serve as a useful forum of collective knowledge. The people in charge of projects can gain a lot from this. Because there can be oversights and mistakes in architectural projects, why not use the early feedback as help to cut it at the roots, preventing the problems from escalating? If left alone and discovered later when the physical building is already built, it could turn out to be very costly to make the changes. The ability to give the feedback early and being able to influence the project could also keep the citizens from surprise disappointments. It would instead increase the feeling of belonging and involvement in the city when the citizens can see their direct contributions.

To make this possible, the AR application should also have a section dedicated to feedback from the users. Imagine a continuation of previous scenario, where you discovered possible mistakes within
an upcoming project. Have anybody else thought about this before you? You enter the forum section of the application, specifically the discussion threads for this project. You look at other people’s posts, but cannot find anything about wheelchair and stroller accessibility. You go to the search bar to look up those terms within the forum, but find no matches. Since it looks like this issue has not been brought up yet, you decide to start the discussion for it. You make a new thread, and write about your discoveries. Soon enough, other people chime in with their own inputs on this discussion as well. It becomes a trending topic for this particular project, and gets noticed by the people in charge of it. They thank you for the feedback and promise to address the issue with their team.

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**Encouraging urban exploration**

As seen with the AR game Pokémon GO, is it highly effective to turn the experience of urban exploration into something fun. It is not to say that architectural AR applications need a gamification, but having some aspects inspired by it can be fun without taking away from the serious topic. Aspects such as the ability to collect personal statistics and graphical trophies that you can later browse through, could add a sense of satisfaction which can be an incentive to go out and explore. It creates a feeling of achievement, or can be reminders of the memories you have collected by visiting different places. In a more technical aspect, the graphical trophies can serve as direct links to profile pages of previously visited projects, making it easier for the users to check back on projects they personally find interesting.
Awareness of risks

To avoid controversies such as the big data breach cases of recent years, it is important for AR applications to be public and transparent about their ways of handling personal data from the users. Privacy issues should not be taken lightly, as it would only be procrastinated and forced to be dealt with on a later date.

The AR application can address this already on the first moment a user starts it or register for an account. The user should be well informed about what types of data the application is collecting, and for what reasons. With that information, the user can decide on whether or not they will allow specific types of data to be collected by the application. With this being about an AR application specifically, data such as location, movements, photos and video recordings would be amongst the options. This would also be in accordance to the General Data Protection Regulation, leaving less room for controversies and lawsuits in the future.
Figure 10: Visualization of AR application usage.
Conclusion

The main question of this study was “How do we implement AR within architectural visualization in a way that is beneficial for the non-professional users?”

The answers to this question have been provided in the study, through the theory which lists important concepts to consider, the findings that gave varied perspectives on the current situation, the analyzation that formed from those findings, and the proposal of the AR application which gave concrete examples of what exactly can be done. As they have shown, there are many ways to go about when implementing AR usage, ways which are realistic and has been done before, albeit in different contexts.

But for it all to be possible, the people in charge must first be aware and willing to consider it. That is where this study comes in, as it is a contribution to the discussion of AR usage within architectural visualization. As mentioned before, it is not a final solution. But any contribution to the discussion at this point is beneficial as we currently do not have enough of it. A lot is being focused on the “cool” and “futuristic” aspects of alternative reality technologies, leaving less room for other aspects. It is therefore my hope that I was able to contribute with useful information, from a perspective of an Architecture, visualization and communication student.

If this study will be continued, there are many possible ways to further pursue the questions surrounding alternative reality usage within architectural visualization. One of those ways would be a better and more daring attempt of contacting people within the field, to try digging deeper for insider information regarding their real intentions. By better and more daring, I mean in a way that would provide information that is not already openly available, information which they use to promote their services for monetary gains. There is of course nothing wrong with wanting to gain from the situation, but for the non-professional users to also gain from this, it is better to have transparency from the companies rather than repeating the same old marketable aspects.
Another very interesting way to take this study would be to study MR, which should be more advanced and interactive than AR. While it is currently not readily available for consumer-friendly usage, it could be so in the near future judging by the fast rate of alternative reality technology development. Could it provide even more options for the non-professional users to be involved in the early planning stages of architecture? More time and study will reveal its true potentials, and I am very excited to see what the future of alternative realities will bring to the table.
References


Figure references

Figure 1: Produced by author.


Figure 7: Ashkenazy, B. (2017). *Boaz Ashkenazy: Visualizing Place With VR, AR, & Mixed Reality* [video]. Available at https://www.youtube.com/watch?v=Zz1I_psENCg [Accessed 10 April 2019].


Figure 10: Produced by author.