SHARP:

IMMERSIVE RETAIL EXPERIENCES THROUGH AUGMENTED REALITY

by

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B.A Media Production, Ryerson University, 2017

A Major Research Project

presented to Ryerson University

in partial fulfillment of the

requirements for the degree of

Master of Digital Media

in the

Yeates School of Graduate Studies

Toronto, Ontario, Canada, 2018

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ABSTRACT

Online shopping is becoming easier than ever with ecommerce sales steadily increasing year after year. Through recent technological advances, augmented reality has become widely available throughout consumer products such as the iPhone X and Samsung Galaxy S9. Using techniques such as object and image tracking, while using Apple's native software, ARKit, Sharp enhances online shopping by elevating the experience between consumers and the products they are assessing. Allowing users to have a heightened retail experience in the comfort of their own space, Sharp achieves a traditional retail environment through an innovative ecommerce process. With current solutions unable to mimic similar immersive online shopping experiences, Sharp plans to achieve new standards for ecommerce experiences.

ACKNOWLEDGEMENTS

I would like to acknowledge my supervisor Wojtek Kawczynski for his guidance throughout the project and my second reader Naimul Khan for his technical insight.

I would also like to acknowledge Ahmed Sagarwala for motivating me to step outside my comfort zone and learn

My friend Brendan Op 't Root for his countless time and commitment into helping me develop *Sharp* into a project more than I could have ever imagined.

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INTRODUCTION

It is clear that over the last 10 years the world has drastically changed in the realm of digital media. Whereas using technology to do everyday tasks was once a luxury, it is now an expectation for our everyday lives. The way we communicate our memories through social media, commute around the city, and order groceries has all seen a dramatic shift. Throughout this shift we have seen many technologies emerge. One in particular which is on the rise, Augmented Reality, is creating new horizons as to what can be done when interacting with everyday objects. The full potential within this technology is still unknown, with corporations beginning to experiment how to implement this technology in their products. By exploring the potential of Augmented Reality, I plan on discovering and focusing on the lack of technological advances specifically within the retail space. This paper will outline the process of my major project, *Sharp*, while exploring current trends, products, and research towards the advancement of Augmented Reality within the consumer space.

HISTORY OF AUGMENTED REALITY

We have seen multiple advances in Augmented Reality throughout the last couple of years. Augmented Reality has dated back to the 1960s it has only recently seen an upward trend due to the advancements in technology. Because of the recent emergence of this trend, there is still unknown potential to what AR can be applied to and the effects it may have on consumers. With Augmented Reality currently in early stage developments, it is inevitable that the technology experiences hiccups and is far from being flawless. First, one might ask what is Augmented Reality and why is such technology seeing such a dramatic increase. Augmented Reality "is the real-time use of information in the form of text, graphics, audio and other virtual

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enhancements integrated with real-world objects" (Augmented Reality, 2017). There are multiple ways one can view Augmented Reality content, whether that be with their smartphone, tablet or AR glasses. Even though experiencing AR is currently more common with smartphones and tablets, it is worth mentioning glasses are being developed for consumer markets. In 1965, a man by the name of Ivan Sutherland had the first idea of AR when he predicted in his essay, "The ultimate display would, of course, be a room within which the computer can control the existence of matter. A chair displayed in such a room would be good enough to sit in" (Schmalstieg, 2016). Because of his invention in 1968 of the world's first headset mounted display, this projected research into what we now know as Augmented Reality. In 1992, "this term first appeared in the work of Caudell and Mizell [1992] at Boeing, which sought to assist workers in an airplane factory by displaying wire bundle assembly schematics in a see-through HMD" (Schmalstieg, 2016). Since then, many have tried to mimic and create seamless AR experiences – and while none have fully succeeded yet, there have been many great advancements. Companies such as Google, Apple, Facebook, Snapchat and more are all tapping into Augmented Reality, hoping to create heightened user experiences within their platform.

CURRENT MARKET USAGE

In a report conducted by Tractica, AR is seeing a drastic increase within monthly active users due to emerging apps that showcase the many strengths AR has to offer. "From 342.8 million unique monthly active users (MAUs) globally in 2016 to nearly 1.9 billion MAUs by 2022", it is clear that AR is becoming welcomed among users (Mobile Augmented Reality, 2017). Corporations such as Apple, Facebook, Snapchat and Google are all entering the market through different paths. Platforms such as Snapchat and Facebook, are allowing users to interact with the real world by enhancing their "*selfies*". They are achieving this by allowing filters such

as animated dog ears to seamless attach to one's face. In this example, the ears follow the tracking of the subject from a three-dimensional perspective allowing for a hyperrealist effect. Even though using Augmented Reality to take your "selfie" with a dog filter may not seem important through a macro lens, it allows the average consumer to experience AR organically. This exposure is an important first step as it allows consumers to familiarize themselves with the technology. With 2.20 billion worldwide monthly active users for Q1 2018, Facebook is arguably the strongest social media to date (Number of Facebook Users Worldwide, 2018). By having a corporation like Facebook with such traction implementing Augmented Reality into the simplest form, it sets up the path for other organizations to follow suit. Individuals who use these filters may not realize they are using AR to apply these lenses to their "selfies". Snapchat is also leading in AR after inquiring Looskery, a Ukrainian tech company in 2015 (Constine, 2015). Both Facebook and Snapchat have launched their own tools allowing for individuals to create their own augmented lenses. "Snap already sees one-third of its 178 million daily users play with Lenses each day for an average of 3 minutes, which adds up to 500 years of playtime with AR each day" (Constine, 2017). Other markets such as mobile gaming are beginning to see a dramatic increase. One reason for this new trend is due to the fact that Apple, one of the leading smartphone providers, released an Augmented Reality platform for developers called ARKit. "Using the iPhone or iPad's camera and motion sensors, ARKit finds a bunch of points in the environment, then tracks them as you move the phone. It doesn't create a 3D model of a space, but it can "pin" objects to one point, realistically changing the scale and perspective" (Robertson, 2017). The use of Apple's ARKit was shown when the release of Pokémon GO for the iPhone took off. At launch in July 2016, Pokémon GO saw a peak in 45 million users, but since then, the number has dropped down to 30 million (Why Pokemon Go May Have Passed Its Peak, 2016).

With this data, we can see that AR has the potential to be accepted by a wide variety of individuals, but may lack engagement factors as shown with Pokémon GO, losing 15 million users since launch. Even though lack of engagement is apparent, the number of users who gave AR gaming a chance should not go unnoticed. While mobile gaming and taking selfies through Augmented Reality is becoming more common throughout the years, other markets such as ecommerce is lacking.

Ikea Place is innovating how consumers shop by allowing users to use Augmented Reality to place furniture, art and other products that Ikea carries through the user's phone. This application for interior design shows one of the many strengths AR is capable of. Ikea Place is one of the first apps for the iOS that exclusively uses ARKit and even though it is revolutionizing interior designing, many flaws are present during the experience. As an avid user of Augmented Reality, my project surrounding the implementation of such technology to enhance the relationship between consumers and products was created.

Online shopping is becoming the new norm – from household items to luxury goods. In 2017 alone, ecommerce reached \$2.3 trillion dollars in sales and accounts for 10% of retail sales total (Global Retail, 2018). It is no secret that ecommerce will become the new norm in the near future with brick and mortar stores closing while big corporations shift their attention to online sales. More than half of millennials represent purchases online while non-millennials numbers are steadily increasing. Even though there are many reasons why ecommerce has become increasingly popular over the years, there are still flaws that make it unappealing to consumers to use. When shopping online, you are not able to interact with the product you are assessing. Your limitations are within a 2D screen and you must only rely on the images and measurements that

is provide. While in a retail store, you are able to fully assess every detail of the product, from the size to the quality.

INTRODUCING SHARP

The goal of my major project *Sharp* is to merge both ecommerce and physical retail experiences into one. By explaining the reasoning and process behind *Sharp*, I hope to bring more attention to an emerging industry and further expand my knowledge and passion within Augmented Reality. As a millennial who prefers online shopping majority of the time rather than a traditional retail experience, I've felt as if there is still a lack of technological advancements within the ecommerce space. On the other hand, with a passion for technology and innovating trends, the idea of merging Augmented Reality and ecommerce was born. Coming from a creative background with skills in graphic design, video production, and more, my initial plan was to create a concept video demonstrating how *Sharp* would be implemented into ecommerce. With multiple attempts, I was not satisfied with the outcome of the video despite advance camera movement, motion tracking, and many more post-production techniques. Without any knowledge in programming, I began studying and researching app development for iOS. Through countless hours of learning, *Sharp* is now an early development prototype with a working demo on multiple iPhones and iPads. When creating *Sharp*, my goal was to tackle the flaws of Augmented Reality while creating a new standard for online shopping. One major flaw in an AR experience is the ability to realistically mimic real life objects.

CURRENT MARKET FLAWS

As stated earlier, Ikea Place, one of the first AR exclusive apps to be available in the Apple App Store allows users to use AR to place furniture in their real life space. Even though

the idea is wonderful, the execution is subpar. To create a heightened experience, the real world and the overlaying objects should merge seamlessly. Objects found in Augmented Reality need to be 3D modeled, and while this may seem unproblematic, doing so incorrectly can lead to unsatisfying and unappealing experiences. An object's sizing is a factor that is often overlooked which is apparent in Ikea Place. In an article reviewing Ikea Place App from the Daily Dot, scaling seemed to be a problem with the user's experience, "First, it struggles with scale. Furniture ballooned from tiny to gigantic as I move them around our office space, making it impossible to determine how big they might look in person" (Tracy, 2017). Another problem occurred when wanting to see the furniture in more detail, "And while the app lets you rotate furniture, it doesn't let you inspect all of its pieces. For example, there was no way for me to see the inside of a desk's drawers or figure out if a couch's cushions are double-sided" (Tracy, 2017). It is worth mentioning that even though there are clear flaws within the app, it should not take away from the effort and innovation Ikea achieved. For being the first app of its kind, Ikea Place sets a new path for what the future of online shopping can become. While experimenting with the Ikea Place app myself, and looking further into other user's experiences, it is clear that app functionality and ability to be a useful resource overtook the flawed experience. By looking into the current market for AR apps similar to Ikea Place, the process to developing Sharp began.

When shopping online, the images shown can be deceiving or lack certain important details. Perfectly lit images showcase the products in the best way possible, but how do products such as watches look on the consumers wrist or the inside of bags and purses - questions that could be answered in a physical retail store, yet not while online shopping. The goal with *Sharp* is to merge the retail experience in the comfort of one's own space. Not only does this allow shopping online to become more convenient, it creates a heightened experience for consumers to

interact with the products on a greater scale. By bringing the products outside of a 2D screen, users are able to assess chosen products from all angels with multiple options. In the case of watch shopping, one big factor a consumer might consider is how the watch sits on their wrist. Currently such solutions are not available on the market which resorts in retailers using 360 degree photos and videos, and even thought are helpful, there is still a barrier between the products and customers. Even though a wide range of products can be applied to Augmented Reality, the first prototype of *Sharp* primarily focuses on watches.

DEVELOPMENT OF SHARP

With no prior knowledge of iOS and ARKit development, I used resources such as online courses and tutorials to begin the development of Sharp. To understand how these apps are created, one must first understand the software into creating them. There are many options available for developers when it comes to creating Augmented Reality apps. Unity, Vuforia, Xcode with ARKit, and more are common softwares for developers. In most cases, all three of these software's can be used to create functional AR app as they all offer different features. To achieve the goals of *Sharp*, using all three apps would be necessary since Xcode with ARKit, does not offer image tracking while Unity does. The reason image tracking is an essential feature to *Sharp* is because it allows for the correct products to appear when triggered by certain webpages. Until recently, Xcode, Apple's native development software was not able to track images which is why other third-party software is needed. With the release of ARKit 2 Beta, Apple has released many new features which allows for greater functionality for the development of Augmented Reality within iOS devices. The first step in creating objects for Augmented Reality for any platform is 3D modeling. With my limitations and lack of knowledge in 3D modeling, my options were to purchase these models from online stores. At first,

purchasing 3D models from artists seemed like the right approach until I began implementing it within Augmented Reality. Since these models were not originally intended for such an environment, they were displaying incorrectly which resorted me to learn the process of 3D modeling. The purchased 3D models were imported into Blender, an open source free modeling software which allowed me to make proper adjustments. These models are made up from thousands of polygons which create the overall structure of the object. Texture mapping is then needed to allow images, also known as the textures, to correctly wrap around the object. For a clearer understanding, the structure of the object could be compared to a vehicle frame while the texture is the paint job. Once the 3D models are correctly rendered in Blender, they are then exported to Xcode.

Within Xcode is where *Sharp* comes to life. Due to the recent features Apple released with ARKit 2, Xcode 10 Beta and iOS 12 Beta are needed as well. Because all software used is currently in beta and not currently available to the public, it is expected to experience glitches and bugs during the process. Udemy, an online video platform which offers courses on various topics was used for the knowledge in creating and coding in Xcode and ARKit 2. To explain the process into creating *Sharp*, only main aspects will be mentioned as there are countless resources online that further dive into Augmented Reality coding. In Xcode, each 3D model is created into a scene. This scene is also known as SceneKit for ARKit 2. As stated in Apple's developer documentation, "SceneKit is a high-level 3D graphics framework that helps you create 3D animated scenes and effects in your apps. It incorporates a physics engine, a particle generator, and easy ways to script the actions of 3D objects so you can describe your scene in terms of its content — geometry, materials, lights, and cameras — then animate it by describing changes to those objects" (Apple, 2018). To create realistic objects within *Sharp*, SceneKit is needed to

apply texturing, lighting, camera, scale and more. There are many factors to consider when texturing a 3D model as it can drastically change the outcome when shown in Augmented Reality. Textures are flat images which achieve a greater look and feel. As shown in Figure 1, the Apple Watch 3D model, does not have any texture applied. When applying correct texturing and lighting, the results can be seen in Figure 2.



3D Object lighting and texture comparison

The way objects interact with the physical space is heightened by lighting. This is the second crucial component when creating 3D models in SceneKit. Figure 3 demonstrators when correct textures are applied to the model yet no lighting provided. Even though the model is displaying correctly, a sense of realism is taken away.



In app 3D model with no lighting

Within SceneKit there are multiple settings for applying textures, with each one serving an important purpose. For example, diffuse, specular, and normal all require different images for one object as they showcase the textures in different scenarios. Apple's documents give a clear explanation into these properties, "If you instead provide an image, SceneKit maps the image across the geometry's surface instead of shading with a uniform base color. If you instead provide a grayscale image, it determines the tendency of the material to reflect light directly toward the viewer—lighter pixels in the image make those areas of the material appear more shiny, and darker pixels make the material appear more matte. Instead, you can specify an image for this property that describes the contours of the surface. SceneKit uses this image (called a normal map) in lighting, creating the illusion of a complex, bumpy surface without increasing the complexity of the geometry" (SCNMaterialProperty). To create an innovating Augmented Reality experience, *Sharp* creates lifelike objects allowing for a seamless experience between the product and the user. Other applications on the market that have their objects look closer to animations than real products, takes away from the experience and overall goal of replicating products within Augmented Reality. This feature alone is what separates *Sharp* from other Augmented Reality apps.

CONCLUSION

Sharp is now in the beta stage with a fully functional prototype allowing users to interact with products such as shoes and watches. It is still unclear in which direction *Sharp* will grow. There are many different avenues *Sharp* can take such as primarily focusing on shoes and trying on watches, creating immersive marketing experience for products, implementing augmented reality within physical retail stores, and more. The key focus will be to create and implement a seamless workflow of bringing merchants products into augmented reality. While being in the

early stages of Augmented Reality can be exciting, the possibilities and adaptation are still unknown. The vision of *Sharp* is to change the way consumers interact with retailers - from ecommerce, in-store experiences, advertisements and more. Moving forward, *Sharp* will continue to work towards creating innovating Augmented Reality experiences that will be ready for market. In a matter of years, what seems to be an abnormality will become the norm. Augmented Reality as we know it, will be as instinctive as checking our email.

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