

FROM YOUR PHONE TO YOUR HOME: AN AUGMENTED REALITY
BRAND EXPERIENCE FOR HIGH-END FURNITURE

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ABSTRACT

Augmented reality (AR) is a developing technology that provides an opportunistic platform for advertising and company branding. AR provides a captivating user experience that can be leveraged for brand placement as well as additional product information. This thesis focuses on a smartphone-based AR usage model where users can view their actual surroundings on their smartphone display, viewed through the smartphones' camera, upon which virtual content is overlaid, augmenting the surroundings viewed on the display. This technology is not yet widely implemented for advertising or branding and opportunities exist for a retail company to be the first in its market to implement it. No such AR experiences are yet implemented within the high-end furniture market, therefore, an AR experience in this market would allow such company to stand out from its competitors. For this project, an AR smartphone brand experience application was prototyped for the modern furniture company, Knoll, that allows targeted customers to view and customize virtual furniture in their home, as well as enable users to make furniture purchases directly from the application.

CHAPTER 1: INTRODUCTION

Augmented reality (AR) is a growing technology with implementation opportunities in many different markets. AR has been a successful marketing tool in retail, by providing an augmented experience for viewers either through their own smartphone, or on a large AR television display (Javorik, 2016, section 2.1).

Estimates for the developing AR industry's revenue range from approximately \$60 billion to \$120 billion by 2020 (Javornik, 2016, Introduction). The range of predicted revenue is wide, and reports point to the continual growth of AR.

Thesis Objective

This thesis has two objectives. The first is to examine the success of AR within the context of brand experience through research and case studies of previous AR implementation. The second objective is to create a prototype of a branded AR experience in a market with an absence of AR solutions. This thesis's proposed AR experience focuses on the high-end furniture market, and the prototype enables a user to shop for high-end furniture by using an AR application allowing for the placement and customization of a digital furniture item in a home.

Thesis Organization

This thesis is organized into five chapters. The first chapter is to introduce the concept of AR and the proposed application. Chapter 2 examines the importance of branding, defines AR with research on its current usage in other markets, and discusses the uses of AR as a brand experience. Chapter 3 introduces the problem statement and the

high-end furniture company that this thesis will use as a client for the AR experience. Chapter 4 contains the creative methods for this project, including the process of developing the prototype. Chapter 5 presents the final deliverables for the entire AR brand experience. Chapter 6 concludes the thesis by discussing the potential of future research, and summarizing the findings and results of the project.

CHAPTER 2: PRELIMINARY RESEARCH

Understanding the Brand Experience

From the perspective of a customer or prospective customer, a company's brand is defined as person's gut feeling about the company. Since companies cannot directly tell people how to feel about their company or product, branding implements strategies to encourage a trusting relationship between the company and their customer, and to foster an existing relationship for an already loyal customer (Neumeier, 2006). These strategies are often accomplished through a brand experience. When successful, brand experiences can boost customer loyalty and attract new customers. Successful brand experiences are memorable and people feel compelled to share them with others (Wheeler, 2013, p. 18).

According to Brakus, Schmitt, and Zarantonello (2009), brand experiences occur for consumers when they search for a product, when they shop and receive services, and when they consume the product. A consumer can experience a product directly by viewing or interacting with the product in person, or indirectly, by viewing a product online or seeing it in an advertisement. A consumer's shopping experience can also be influenced by the retail store, and the store personnel they interact with. The consumption of the product influences the consumer experience when the consumer purchases or uses a product. Consumer experience can vary depending on whether the product is a physical object, or a non-physical object. An example of a non-physical product is a visit to a museum, in which the entire experience is the product.

Brakus, Schmitt, and Zarantonello's (2009) study on brand experiences involved interviewing consumers on a brand of their choice, and asking participants to briefly

describe how their chosen brands made them feel. The consumers gave some companies positive descriptions, and other companies negative descriptions. For instance, a participant's response to his or her experience with the luxury car brand BMW was overwhelmingly positive, stating: "I feel young; I feel stylish. It's great to drive. A BMW is the symbol of my success." Another positive example claimed the television brand HBO was "discussion inducing" and made the viewer "want to discuss the shows with others." Customers' positive feelings towards Nike, the athletic gear brand, claimed that the brand "inspired [them] to start working out," and made them "feel like an athlete" (Brakus, Schmitt, & Zarantonello, 2009, Table 1). Positive feelings towards a brand encourage loyalty and trust—an important link between a company and consumer.

Defining Human-Centered Design Experiences

As the world becomes increasingly integrated with technology, digital product designers must consider the people who are using technological devices in their day-to-day lives. This is where experience-centered design comes in, which can be defined as "designing for the richness of human experience" (Wright & McCarthy, 2010, p. 2). If the experience does not meet the expectations of the users, or fails to encompass experience-driven design, the subpar experience could harm brand image, or set future experiences on a similar platform up for failure (Scholz & Smith, 2016, section 5.1.).

The Emerging Role of Augmented Reality as a Consumer Brand Experience

Advancements in high technology are changing consumer experience, both online and in physical settings. AR has a growing role in marketing and branding by incorporating easily accessible virtual experiences on a user's smartphone. Companies

are already implementing smartphone AR technology to reach their consumers on a new level. Some examples of AR marketing implementation are the Tokyo Aquarium providing visitors with virtual penguins to lead the guests to certain exhibits, a Cadbury candy bar with an augmented game appearing on the packaging, and a Pepsi Max Monster Mirror campaign that transforms viewer's faces into monsters by peering into an augmented mirror (Scholz & Smith, 2016, sections 1 and 2).

Defining Augmented Reality

Augmented reality is virtual information perceived by a viewer through a digital device, such as a smartphone or large AR television display (Scholz & Smith, 2016, section 2). AR incorporates virtual imagery into the viewer's real world. The virtual information is "registered" to the physical environment, allowing it to appear as though it is part of the viewer's real experience. The AR system tracks the viewer's perspective and aligns the virtual information with what it sees in the real world (Schmalstieg & Höllerer, 2016, p. 3-4).

According to Schmalstieg and Höllerer (2016, chapter 2), AR isn't limited to augmenting the visual human sense. Smell, touch, and audio senses can also be augmented. An example of an olfactory AR experience was a device called the "Smelling Screen," that blew scents at the viewer while viewing a 2D screen. Incorporating other senses into an AR device does provide the user a heightened level of sensory experience, however such methods contain additional complications to control the user's perceived environment. 70% of sensory information delivered to the human brain is from the visual sense alone, therefore AR has primarily focused on augmenting visual information.

Hsieh and Lee's (2015) definition of augmented reality divides AR into three necessary components. The first is that AR must combine virtual objects with the real world. The second is that the virtual elements of AR act in real time. The third is that the virtual content aligns to real world content visually, typically from the perspective of the viewer. With these components working together, the viewer sees virtual content in her real surroundings. While the devices on which AR is viewed upon can vary, these three components must be present to be a true visual AR experience.

AR devices come in a variety of hardware display formats. According to Schmalstieg and Höllerer (2016, chapter 2), developments in AR technology provide augmented visuals on several formats of displays, including: stationary displays, desktop displays, projector-based displays, head mounted displays (HMDs), and handheld displays. These displays are categorized by their proximity to the eyes of the viewer. One of the most common types of AR display is a "near-eye display," which is most often in the form of an HMD.

Virtual reality relies on HMD devices to fully immerse the viewer. Examples of VR HMDs include the HTC Vive (see Figure 1) and Oculus Rift. The HMD device straps to the user's head to allow a full range of movement, and tracks the wearers head movements to realign the virtual content accordingly. The HMD contains two optical displays that the user wears close to their eyes (see Figure 2).



Figure 1. An HTC Vive Virtual Reality Headset



Figure 2. View of HTC Vive Optical Displays

Examples of near-eye AR displays are Google Glass, Microsoft Hololens, and Google Cardboard. Some near-eye devices, such as the Google Cardboard, and Samsung VR use a smartphone as the display, utilizing the smartphone's camera to combine the real world with the digital content.

AR applications on smartphones typically fall within two categories: location based, and vision based. Location based applications rely on the smartphone's Global Positioning System (GPS) coordinates, and add augmented content based on the user's location. When AR content is added to the user's real location, it can create a sense of connection to the digital content. In vision-based AR applications, a visual queue such as

a Quick Response (QR) code provides the AR information to the smartphone, and shows the augmented content using the phone's camera (Markouzis & Fessakis, 2016, p. 32, section 3). QR codes are typically blocky black and white patterns within a square that the phone recognizes as a visual queue for the virtual information (see Figure 3).



Figure 3. QR Code on an AR Promotion by IBM (Wiley 2017)

Differentiating Augmented Reality and Virtual Reality

Augmented reality and virtual reality share similar qualities but they result in different user experiences. VR completely replaces the user's perception of the real world

with the virtual world. In AR, the user is still aware of her surroundings because the user is still able to see the real world (Hsieh & Lee, 2015).

Virtual reality's full immersion is accomplished by the user wearing an HMD. An increasingly popular implementation for VR devices involves the use of a smartphone as the display inside of the HMD, such as with a Google Cardboard. An alternative is a HMD with dedicated, embedded, micro-displays tethered to a computer or game console, within an enclosure that blocks out the user's vision of the real world, as seen on the HTC Vive (Seunghun & Jinmo, 2017).

There is some overlap between hardware devices for AR and VR. A smartphone device can be used in either an AR and VR implementation, depending on the smartphone application. An AR experience will use the phone's camera, while a smartphone VR experience limits the user's vision to only the phone display.

Augmented and Virtual Reality in Entertainment

While AR and VR have had not yet been widely used for branding, the technologies of both reality-altering concepts are not new. Over the past several years the most prominent usage of AR and VR has been in the entertainment and gaming industries. One of the first games to implement AR was a location based smartphone game called *Ingress*, developed by Niantic. The game required players to walk around through neighborhoods and cities to access in-game functions (Mind Commerce, 2013, section 3.1). This game was one of the first examples of a game augmenting content into locations in the physical world.

Pokémon Go, Niantic's second and most popular smartphone AR game, used the same technology as *Ingress*, but relied on the established "Pokémon" brand. This game augments a Pokémon character into the player's environment by using the smartphone's camera, and overlaying the creature on top of the camera view (see Figure 4). The app also uses the phone's GPS to recognize the user's real-world location, and makes Pokémon characters and game elements appear in the user's field of view, in which the user must physically walk to. The phone's gyroscope and accelerometer track where the user is facing, and orients the Pokémon accordingly, as though the user has turned away from the creature (Batchelor, 2016).

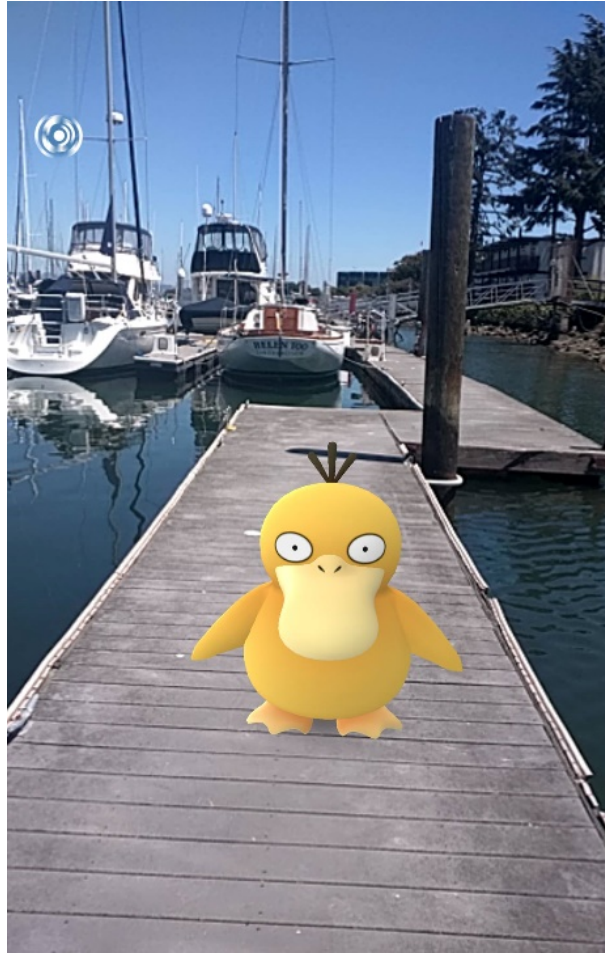


Figure 4. (Screenshot) A Pokémon Augmented into the Real-World Environment in the Pokémon Go Smartphone Game (Wiley, 2016)

Pokémon Go introduced augmented reality to a wide audience of users who were previously unfamiliar with the concept of AR, and it broke mobile game records for its growth in popularity. *Pokémon Go* became the fastest growing smartphone app soon after its release. Nintendo, the company in ownership of the Pokémon franchise, experienced a \$7.5 billion market value growth within two days after the game's release (Vella, 2016). Part of this game's success can be attributed to Nintendo's previously established Pokémon brand, which already had a large consumer base.

Storytelling in AR

An interactive “story structure” consists of a series of events that lead to a certain result, based on choices made by the user along the way. Through storytelling, people find meaning in an experience (Markouzis & Fessakis, 2016, p. 31, section 2). Many games and entertainment platforms employ storytelling methods to engage the user, and it can be used to further the level of immersion.

An example of storytelling in an AR game is seen with Niantic’s *Ingress*. The fictional narrative of the game introduces the concept of “exotic matter,” abbreviated as XM, which is trans-dimensional energy on Earth that has attracted an unknown alien force known as “Shapers.” Players, referred to as “Agents,” must choose one of two teams: *The Enlightened*, or *The Resistance*. Players compete against the opposing team by gathering XM and competing over “control portals,” which are real-world geographical locations such as local buildings or landmarks that the game augments to appear as though an alien-esque device is present. The color of the portal is determined by whichever team has taken control over it; green for *The Enlightened* and blue for *The Resistance* (Chess, 2014, 1106). In this story structure, players can cooperate to claim certain geographical locations, and the game provides users with a backstory to provide a more engaging objective.

Augmented Reality as a Successful Advertising Tool

AR has proven its effectiveness in marketing. In a study described by Liao (2015, p. 316), 74% of customers presented with an advertisement in AR said they would consider buying the advertised product. In a two-dimensional, non-AR version of the

advertisement, only 45% of the viewers said they would consider buying the product. In addition, viewers spent 1 minute and 23 seconds engaged with the AR experience, compared to 12 seconds of engagement with the two-dimensional advertisement.

AR advertising campaigns can be much cheaper than traditional print advertisements. Mind Commerce (2013, Section 4.0) reported that in 2011, a single full page advertisement in Sports Illustrated's Swimsuit Issue cost over \$400,00, while a simple AR campaign could be as low as \$5,000. AR can be a more economical marketing choice, depending on the level of complexity for the AR application compared to the print medium.

In addition, AR experiences can engage the viewer to venture beyond a single page of content (Mind Commerce, 2013, Section 4.0). A Heinz Ketchup AR app allowed users to "flip" through different recipes on the digitally altered label on their bottle of ketchup; not only did this provide the users the ability to interact with the product, it also allowed for more information to be displayed on a small amount of space (Scholz & Smith, 2016, Section 4.1.1). IBM's *Hidden Figures* mobile AR application gives users an extensive list of important women of the science, technology, engineering, and mathematics (STEM) fields. Digital bronze "sculptures" of these women appear over the provided QR code, and the application provides historical information on the figure appearing on the user's screen (see Figure 5).

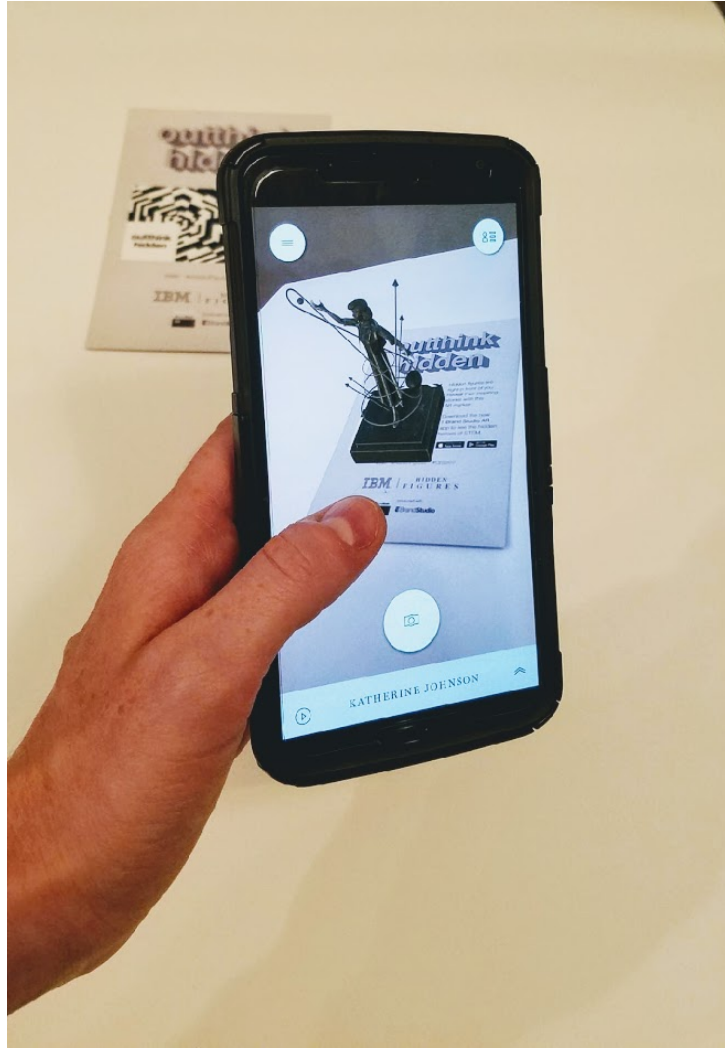


Figure 5. The Hidden Figures AR Application Augmenting a Virtual Sculpture over the QR Code (Wiley, 2017)

An AR experience can provide a level of emotional connection to the viewer. Scholz and Smith (2016, Section 4.0) claims viewers feel more personally connected to the product when they see it appear in their world through augmented technology. In 2013, General Mills launched an AR campaign that enabled an NFL football player to appear on the user's smartphone. He "appeared" by ripping out of the particular cereal box that enabled the AR experience, and users could play a simple phone game with him

or take a picture next to him (Mininni, 2017, p. 20). This application of AR provided users with a fun and memorable brand experience.

The Growth of Web-Based and AR Advertising and Branding

AR campaigns can adhere to the brand's image, like most branded campaigns. What sets AR apart from traditional media is the new level of experience these AR strategies can employ. The "Walking Dead," a zombie television show, set up a single-location AR campaign in Vienna, Austria, that tricked viewers into believing there were zombies approaching them at a bus stop by making zombies appear through a "Magic Mirror" screen in the bus station's glass side (see Figure 6). The screen shows the street view as though it were a regular window, then augments a virtual zombie character onto the screen to create the illusion of a zombie approaching the viewer in real life. The campaign remained consistent with the intended shock value brand image of the show, and garnered approval from fans worldwide after the campaign went viral on social media (Scholtz & Smith, 2016, Section 5.7).



Figure 6. The AR Walking Dead Campaign in Vienna.

Note: Image accessed from www.researchgate.net on 4/17/17

Overview of Historic Furniture Branding Methods

Furniture branding methods employ traditional and digital mediums. For furniture, print catalogs, websites, and advertisements in printed or online formats are common. Companies also promote their brand by setting up physical showrooms of their collections, and applying their visual identities to an assortment of items such as calendars, notebooks, and writing utensils.

The proposed AR experience would provide the user with a virtual and unique brand experience that would strengthen the user's tie with the brand by creating a positive interaction with the company through the branded AR system.

Knoll Furniture

Knoll is a high-end furniture company that was founded in 1938. Knoll's aim is to create furniture that compliments the architecture of the space it is in, rather than compete with it. The company makes efforts to produce furniture in an environmentally friendly manner, and strives for the customer to keep a Knoll furniture piece for multiple generations ("Discover Knoll," 2017, accessed 4/18/17, knoll.com/discover-knoll/our-story).

CHAPTER 3: STATEMENT OF THE PROBLEM

There are currently no AR brand solutions in the high-end furniture market. If Knoll were to launch an interactive AR application for furniture browsing in a user's own home, Knoll will be the first in the high-end furniture market to utilize AR technology.

The Potential of AR in Marketing High-End Furniture

Through examining various AR marketing methods in branding campaigns and statistics on the success of AR advertisements, AR has proven to work as a powerful branding tool. High-end furniture brands employ traditional advertising and branding methods, and have not utilized AR technology.

AR is currently present in the non-luxury furniture market. In 2013, IKEA launched an AR campaign that allowed users to view IKEA furniture in their home using an app and IKEA catalog combination (Grushka, 2013, page 31). However, this application did not allow the user to customize the furniture, nor did it allow the user to make a purchase within the AR application, therefore a user would have needed to take an additional step of finding the virtual furniture from the app on the online store, or visiting the store in person.

The Knoll AR experience would be the first of its kind to allow a customer to customize augmented furniture while viewing it, and place an order from the application. The user could order the desired furniture item, or an upholstery sample to ensure that the customer is happy with the colors and materials before ordering the item.

The Client

For this thesis, Knoll is the client company for the AR brand experience. Knoll specializes in high-end modern furniture, and has been renowned for their modern furniture items since 1938 (“Discover Knoll,” 2017, accessed 3/26/17, www.knoll.com/discover-knoll/our-story). Knoll’s market is substantial; net sales during the third quarter of 2015 were a record \$292.1 million (Salamone, 2016).

Target Audience Profile

The target audience can determine the approach of the campaign (Golsefid, 2010, p. 447). Understanding the target market can help a campaign gain initial traction and reach as much of its intended audience as possible.

Consumers who are loyal to a brand are considered to have joined a “tribe.” This makes the consumer feel more connected to others who are loyal to the same brands. Tribes are a non-official measurement of a customer’s devotion towards a certain brand based on their purchases (Loureiro, S. C, and Kaufmann, 2016, section 2.4).

Luxury brands gain loyal customers through branding and the emotional desire of their audience, according to Loureiro, S. C, and Kaufmann (2016) in a study on luxury car tribes. The consumers of the luxury products feel hedonistic towards their high-end items, and the products they own give them a sense of identity. In studies pertaining to the income level of luxury item consumers, brands target customers within a high-income group.

Knoll’s target audience for this AR application falls under the high-income demographic of consumers who are comfortable with technology. This AR experience

appeals to Knoll's tribe, especially those who have already decided to purchase Knoll furniture.

CHAPTER 4: PROTOTYPING AND CREATIVE METHODS

Competitive Audit

No AR brand experience currently exists within the high-end furniture market. By examining Knoll's competing high-end modern furniture, there are similarities between branding and advertising solutions. With the proposed AR brand experience, Knoll would stand out amongst its competitors, by providing the first AR experience in its market (see Table 1).

Company Brand	Print Media	Online Ads	In-Store Experiences	Augmented Reality
Knoll	X	X	X	X
Interstuhl	X	X	X	
Herman Miller	X	X	X	
Hni Corp	X	X	X	
Steelcase	X	X	X	

Table 1. Competing high-end furniture brands and their current marketing platforms

Knoll's SWOT Analysis

A SWOT analysis focuses on the company's strengths, weaknesses, opportunities, and threats. This analysis examines the company's current marketing strategies (see Table 2). One of Knoll's listed opportunities is within growing e-commerce sales. By examining the success of AR brand experiences towards sales, the proposed AR Knoll experience offers a solution to this opportunity.

Strengths <ul style="list-style-type: none">• Extensive product portfolio• Partnerships with designers• Acquisitions to strengthen the high design, high margin specialty business	Weaknesses <ul style="list-style-type: none">• High dependence on the US market• Dependence on few customers
Opportunities <ul style="list-style-type: none">• Growing e-commerce sales• Reviving office furniture market in the US	Threats <ul style="list-style-type: none">• Highly competitive office furniture market• Risk of currency fluctuations• Environmental laws and regulations

Table 2. SWOT Analysis (Knoll, 2016, p. 4)

Summation and Creative Strategy

In examining the recent popularity of AR and VR in the consumer market, the idea to implement AR technology towards a more utilitarian approach arose. A dominant

portion of AR implementations in advertising and branding do not allow the user to engage with the brand beyond a few minutes of entertainment.

Many products require a consumer to interact with it before a purchase decision can be made. Online shopping does not allow this in-person interaction for consumers. The idea of combining a AR tool with high-end furniture shopping solves a potential issue of the furniture customers in removing the need of visiting a store to view the furniture items in person.

By viewing a digital version of a piece of furniture in their home, a consumer might feel more confident with making a purchase, because they will know exactly what the product looks like in their home. The option to request a sample of the upholstery for the sake of color-matching is included in the app idea.

The Google Cardboard utilizes the smartphone's accelerometer as a means of head-tracking, however the device only has one button function while in VR mode. This limitation is considered during the construction of the user interface, as every selection has to be made by the viewer pointing the center of the device—often a crosshair, or a simple dot in the middle of the screen—at a menu option, and using the single button to select it (see Figure 7).

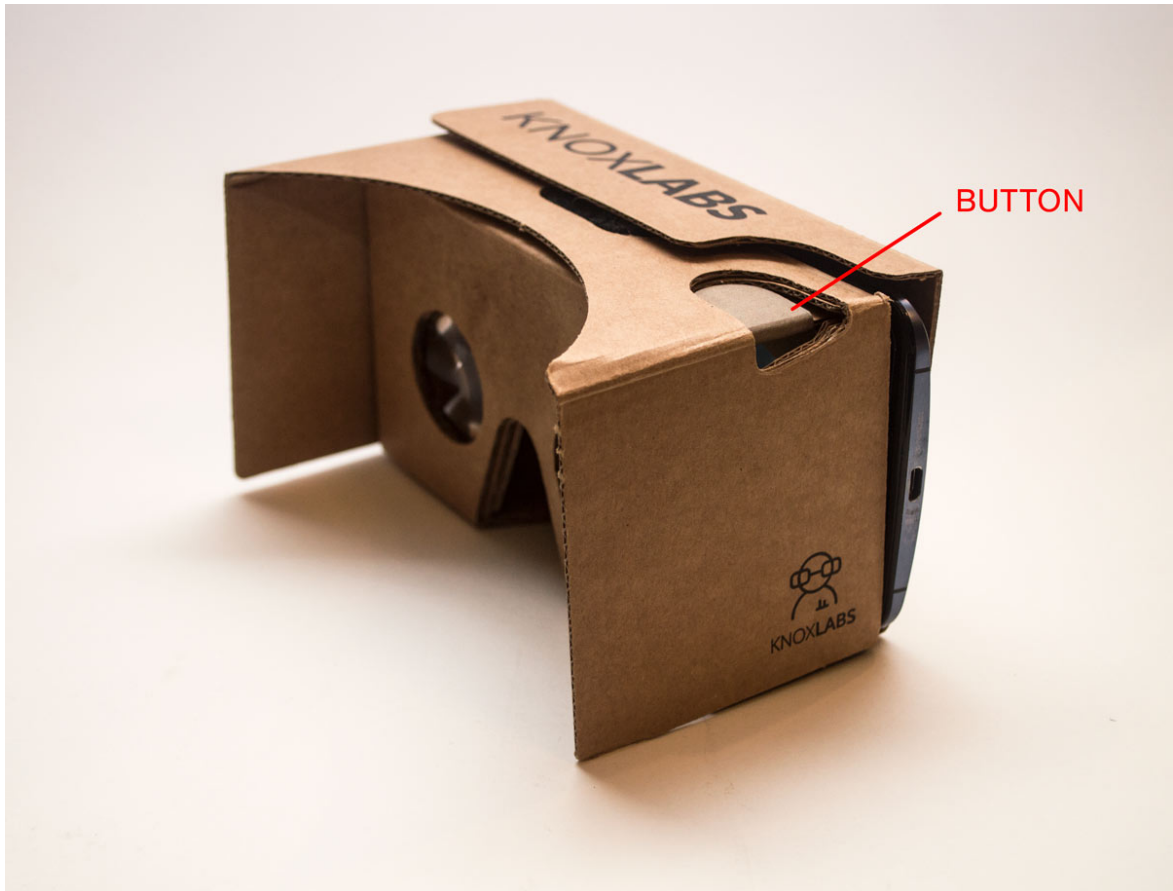


Figure 7. Google Cardboard Device and Hardware Button (Wiley, 2017)

Design Process and Documentation

Digital and hand-rendered diagramming was employed during the ideation phase of developing the AR program. The refined ideas were narrowed down into the best possible solutions for the Knoll brand and AR experience, keeping Knoll's visual identity in mind, as well as the limitations of the mediums for which the deliverables were intended. The finalized deliverables were created using Adobe Photoshop and Adobe Illustrator. There were several stages during the process of building the brand experience prototype. The initial ideas began as rough sketches on paper and user maps.

Knoll's audience needed a way to learn about the AR experience. To understand how a Knoll customer might go from knowing nothing about the Knoll AR experience, to purchasing furniture through the app, a User Flow map of possible user journeys was created (see Figure 8). Sticky notes applied to a large sheet of paper was used as a method to quickly arrange ideas.

The aim of the user map was to establish the steps of execution beginning with the user wanting to purchase Knoll furniture—to the actual furniture order placement. The ideal persona of the AR experience was already loyal to the brand; this map therefore began with the user already intending to purchase from Knoll.

This map also presented three possible avenues that a consumer might learn about the AR app: hearing about it from store personnel at a Knoll showroom or furniture store, seeing it in an advertisement, or reading about it on the Knoll website.

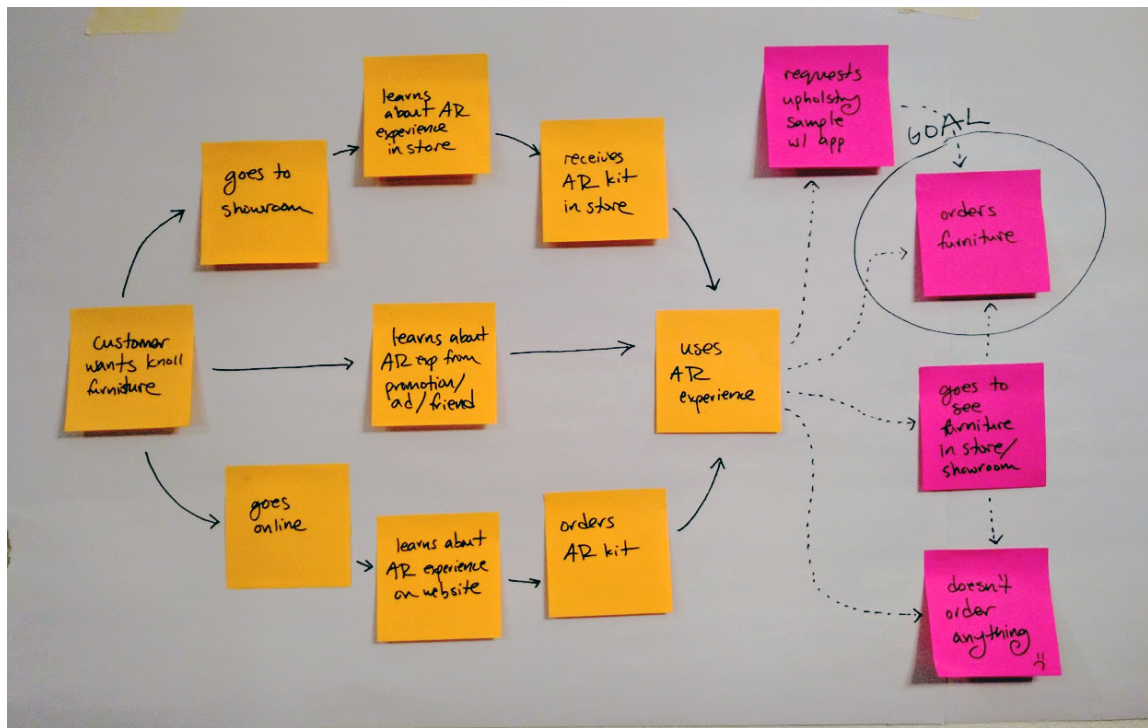


Figure 8. Sticky Note User Flow Map

A second sticky note map was created (see Figure 9), starting from the moment a user receives her Knoll AR kit. This map was used to determine how many steps were needed by the user to get to the point of placing an order—either for upholstery samples, or for the final customized furniture product. Unlike more traditional campaigns such as print media or website, an AR experience requires the user to proceed through a few steps before having the ability to view the virtual content.

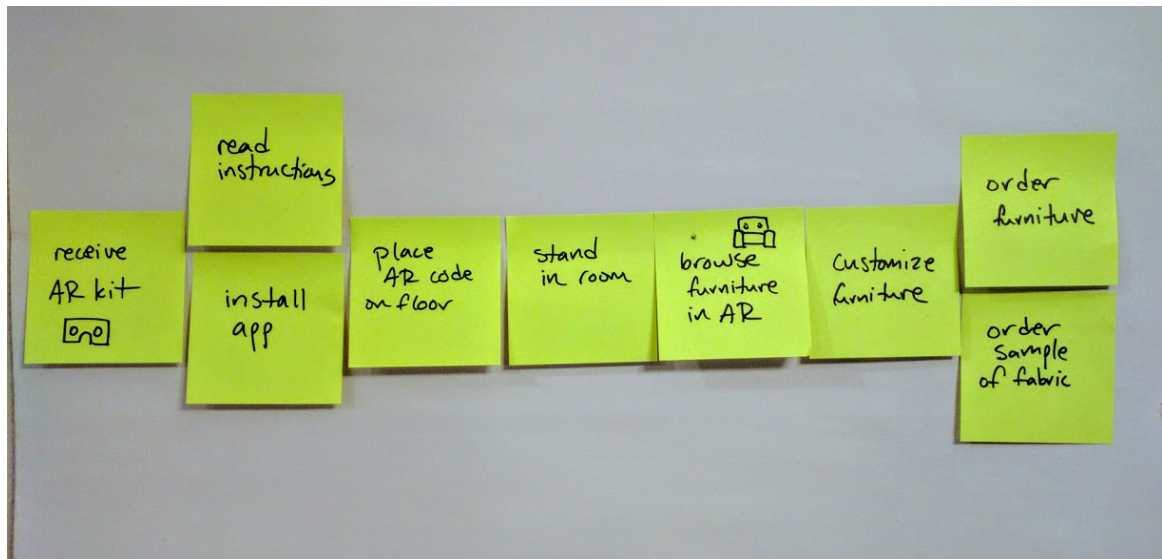


Figure 9. Sticky Note Process of User Journey

The process of creating both sticky note maps described helped determine what deliverables were necessary to produce a complete brand package for the full brand experience intended. The necessary deliverables included the Google Cardboard AR device, a QR code for the application, and the box that would contain the entire AR kit. The deliverables would need to fit the visual identity of the Knoll brand to encompass the entire experience.

Preliminary Deliverables Development

The Google Cardboard would need to include Knoll branding, and an opening for the phone's camera, to enable the AR. Various iterations of a Google Cardboard were created, while maintaining Knoll's visual identity (see Figures 10 and 11).

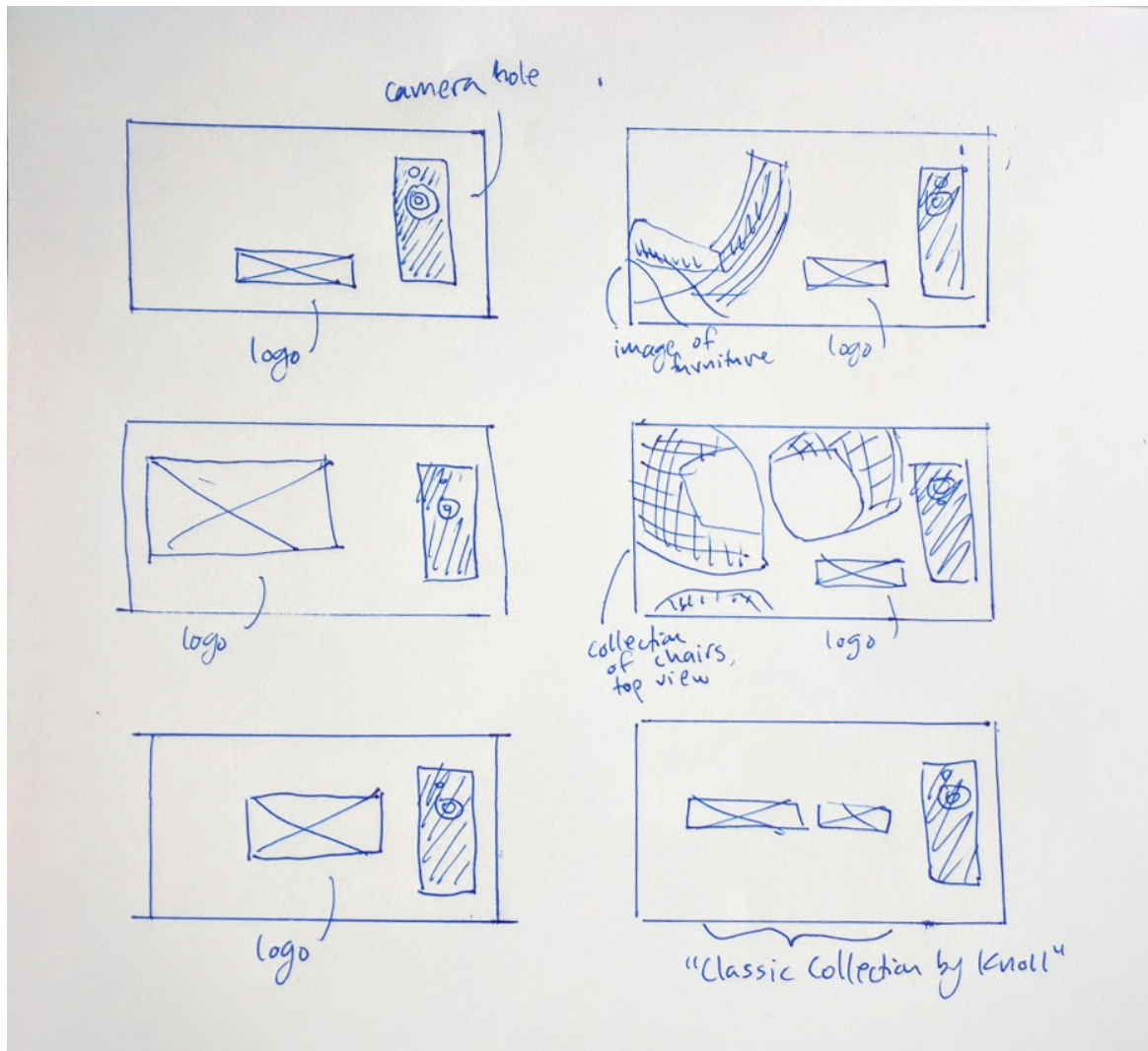


Figure 10. Preliminary Sketches on Paper of the Layout for the Knoll Cardboard Design

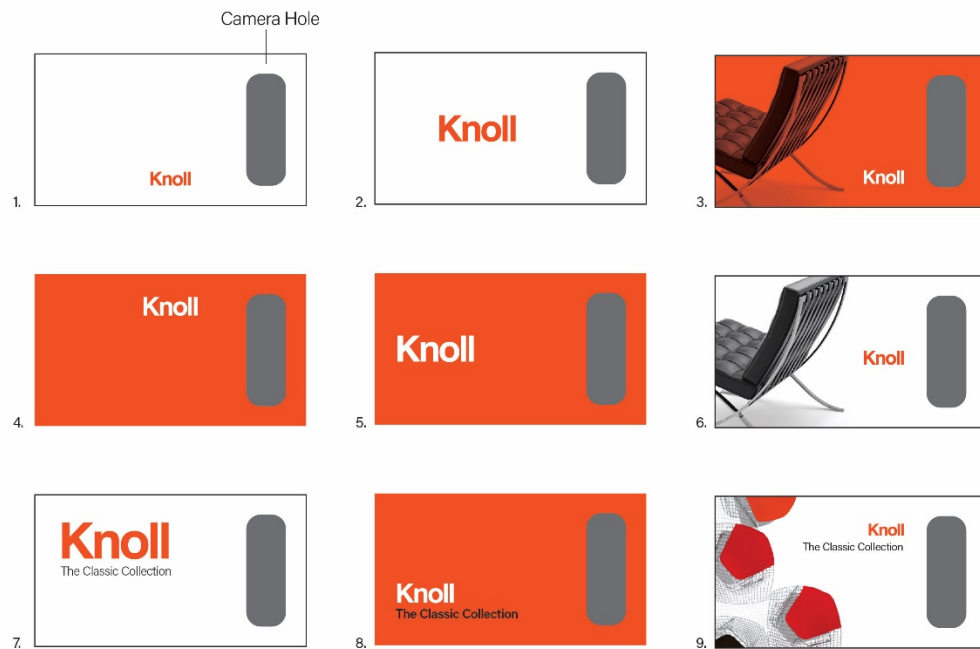


Figure 11. Design Iterations for Branded Cardboard

Note: Images access from knoll.com on 3/25/17.

The Knoll AR kit would need a QR code to activate the virtual furniture within the user's space. Many AR applications that require a QR code come with a small flyer or information card that is placed in view of the smartphone's camera. Since longevity and environmental friendliness are important to Knoll, the concept of a more versatile QR code delivery medium was developed. Instead of a single piece of paper with a QR code that the user might misplace or lose, the Knoll AR kit would include a calendar that contains a single page for the QR code information. When the user isn't interacting with the AR application, the Knoll branded calendar can be displayed in their home. Several

initial designs were created to capture the essence of the Knoll visual brand (see Figure 12).



Figure 12. Design Iterations for Branded Calendar

The AR kit would be delivered to the user in a box. Measurements of a Google Cardboard, and the dimensions of the calendar were arranged in a digital mockup (see Figure 13). This helped to visualize the contents that would go inside to box. In the second option, the extra space was filled with a Knoll business card, enabling the customer to easily contact a customer service representative or salesperson. The size of the calendar was adjusted depending on the box layouts.



Figure 13. Potential Dimensions of the Box

Developing the User Interface

The user experience (UX) flow of the AR application was built to allow a user to select furniture categories and customize items (see Figures 14–21). The user interface (UI) was designed using furniture images (accessed from knoll.com on 3/26/17). In these figures, a gray background is used, but when viewing the application through an AR device, the background imagery would be the user's environment captured through the phone's camera. These figures are placed in the order in which a user would navigate

through the menu, starting from the loading screen, to a final customized piece of furniture. Selected menu options appear with a highlighted orange border.



Figure 14. Loading Screen

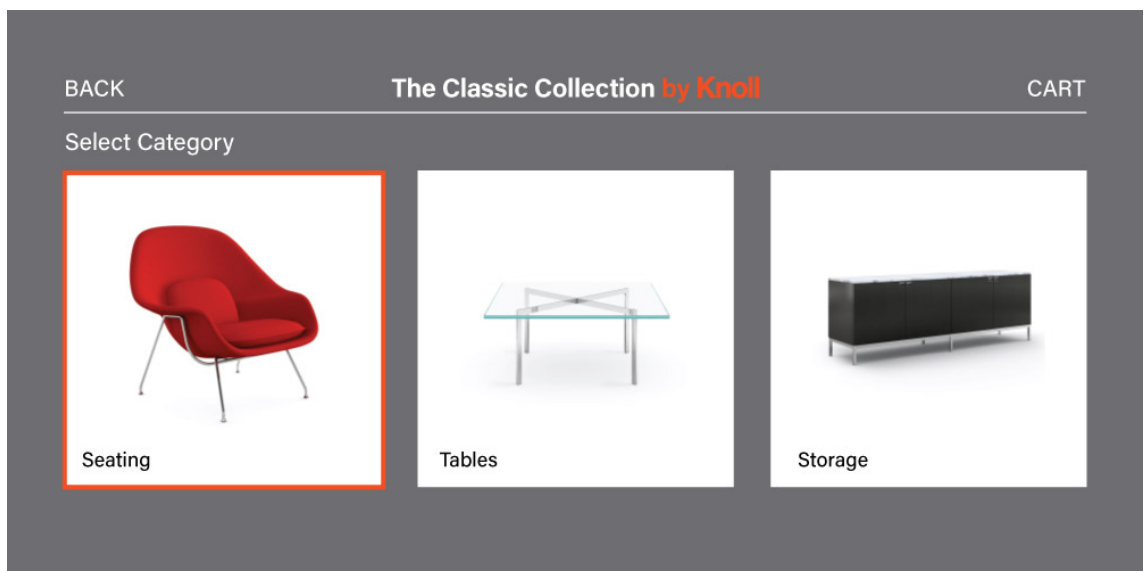


Figure 15. Select Furniture Category Screen

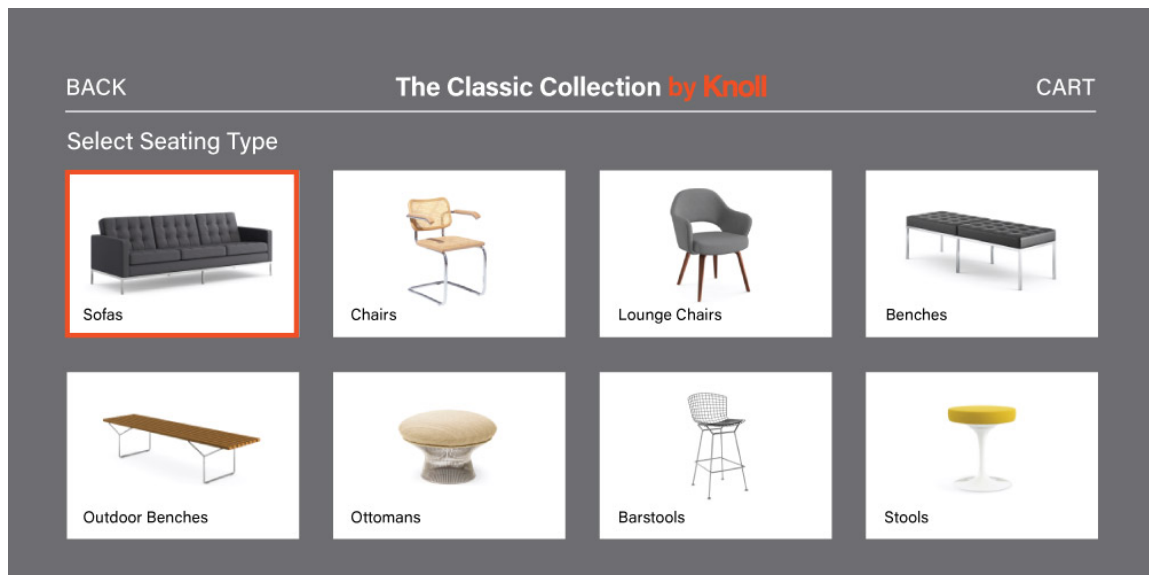


Figure 16. Select Seating Type Screen

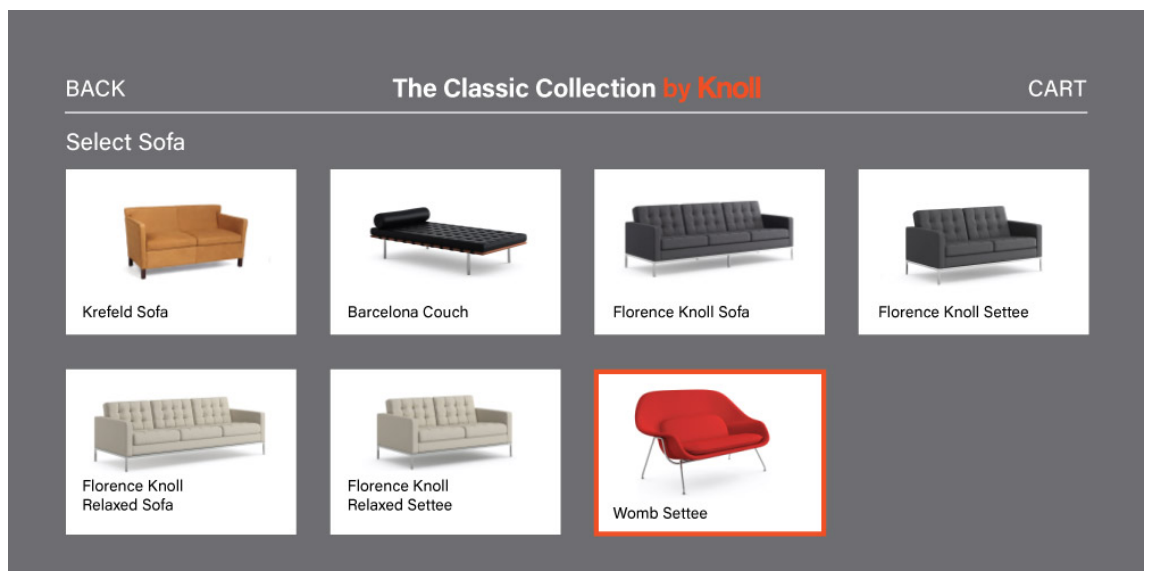


Figure 17. Select Sofa Screen



Figure 18. Womb Settee Selected, Color Customization Selected



Figure 19. New Color Selected, Womb Settee Changes to White Color Option



Figure 20. Add Customized Furniture Item to Cart



Figure 21. Customized Furniture Item is Now in Cart

Note: All imagery in Figures 14-21 is from knoll.com, accessed on 4/7/17.

Prototyping the Application

For the Knoll AR experience, an immersive prototype was necessary to understand how a finished product would look from the user's perspective. GoPro, a company known for their cameras popular with sport users, has a free VR video program that allows u to view a 360-degree video or image. This program allows viewers to “look” around the environment on their computer by clicking and dragging the viewpoint around with their mouse. GoPro VR is also compatible with PC-connected VR head mounted displays, such as Oculus Rift or HTC Vive, and uses the HMD's head tracking technology to let the user look around by turning their head while wearing the HMD to view an entire 360-degree environment.

The interface was added to a 360-degree photo of a living room (see Figures 22 and 23). Using Adobe Photoshop, the 360-degree photo was converted into a “spherical” format that was readable to the GoPro VR software. Unselected menu options appear at a lower opacity to be less obtrusive, as AR is not intended to block the viewer's view of her environment.



Figure 22. 360-Degree Image of a Living Room

Note: The 360-Degree image was accessed on 3/22/17 from Idealista.com.

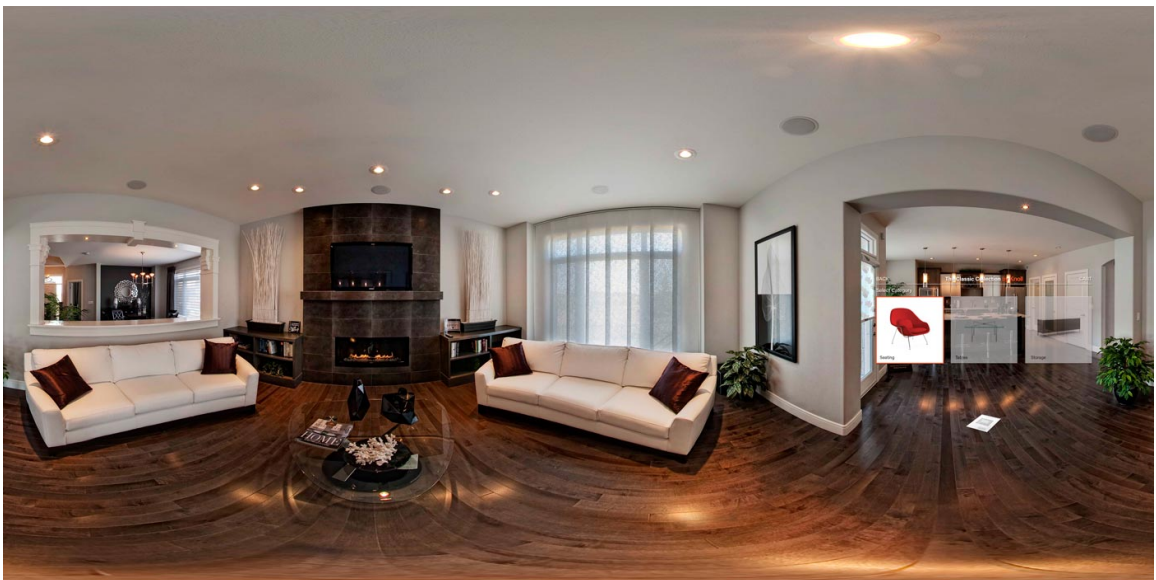


Figure 23. 360-Degree Image of a Living Room with AR Menu

To gain an understanding of the immersion of the experience, the GoPro VR program was viewed using an HTC Vive, which allows head tracking to determine where

the user is looking (see Figures 24-26). The distortion of the menus appearing slightly curved is a result of the display technology as seen on a computer monitor. To the user wearing the HMD, the interface is flat and floating within the three-dimensional environment.

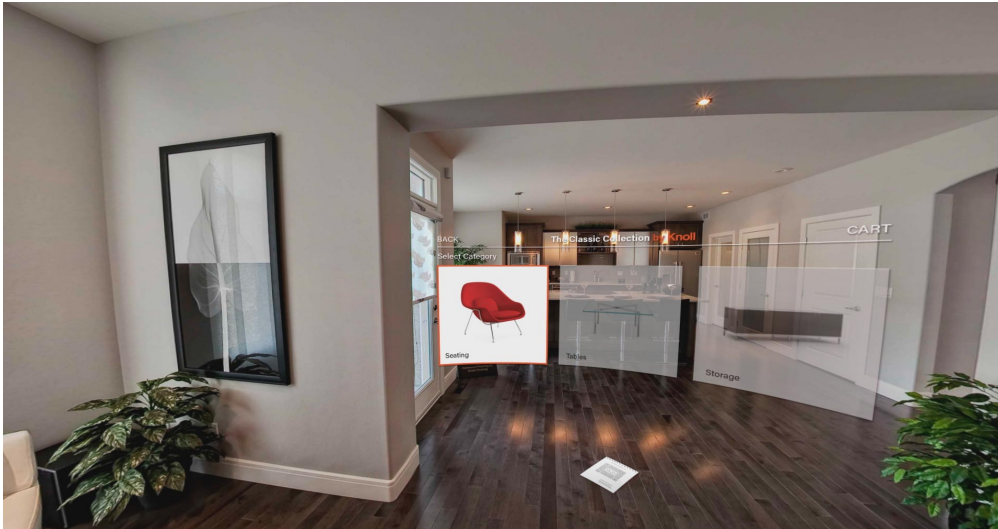


Figure 24. Looking to the Left of the AR Menu

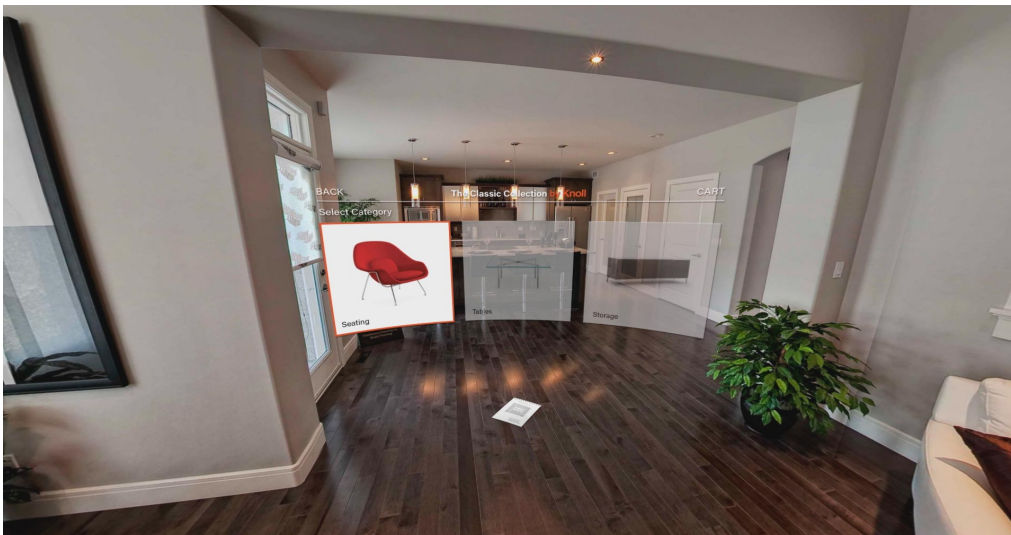


Figure 25. Looking Straight Towards the AR Menu

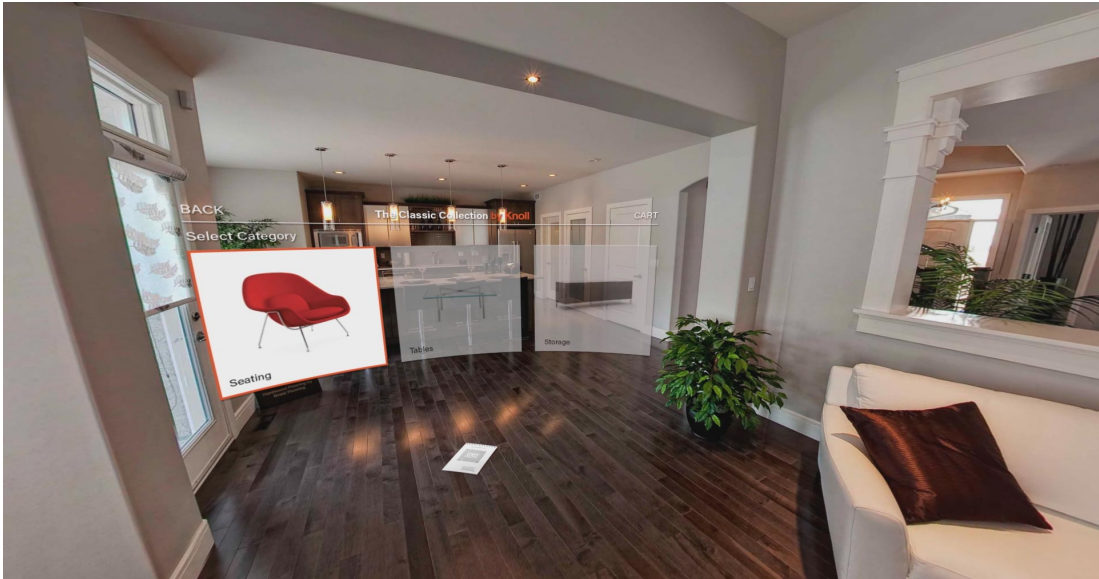


Figure 26. Looking to the Right of the AR Menu

CHAPTER 5: DELIVERABLES

Finalized deliverables include the physical objects a Knoll customer would receive, and the interface of the AR application.

Knoll Branded Items

The box in which the AR kit would arrive in (see Figure 27) follows the Knoll visual style, and features a Classic Collection furniture item on the top of the box. If Knoll were to release additional AR kits with other furniture lines, the images and names would change accordingly.

The final design of the Knoll Cardboard features Knoll's logo and "The Classic Collection" printed on the various sides of the device (see Figure 28). The Knoll Calendar (see Figure 29) comes inside of the box. An instructions page (see Figure 30) is included.



Figure 27. Knoll Branded AR Kit Box

Note: Imagery accessed on 3/22/17 from knoll.com, box mockup from www.mockupworld.co, accessed 3/22/17.



Figure 28. Knoll Branded Cardboard Device (Wiley, 2017)



Figure 29. Knoll Calendar with QR Code



Figure 30. QR Code and Instructions Page

The AR Experience User Interface

The final user interface of the prototype follows the visual brand of Knoll, and allows users to select any Knoll Classic Collection furniture item to view in their homes. Figure 31 shows the user's path in loading the application up to adding a customized Knoll furniture item to the cart.

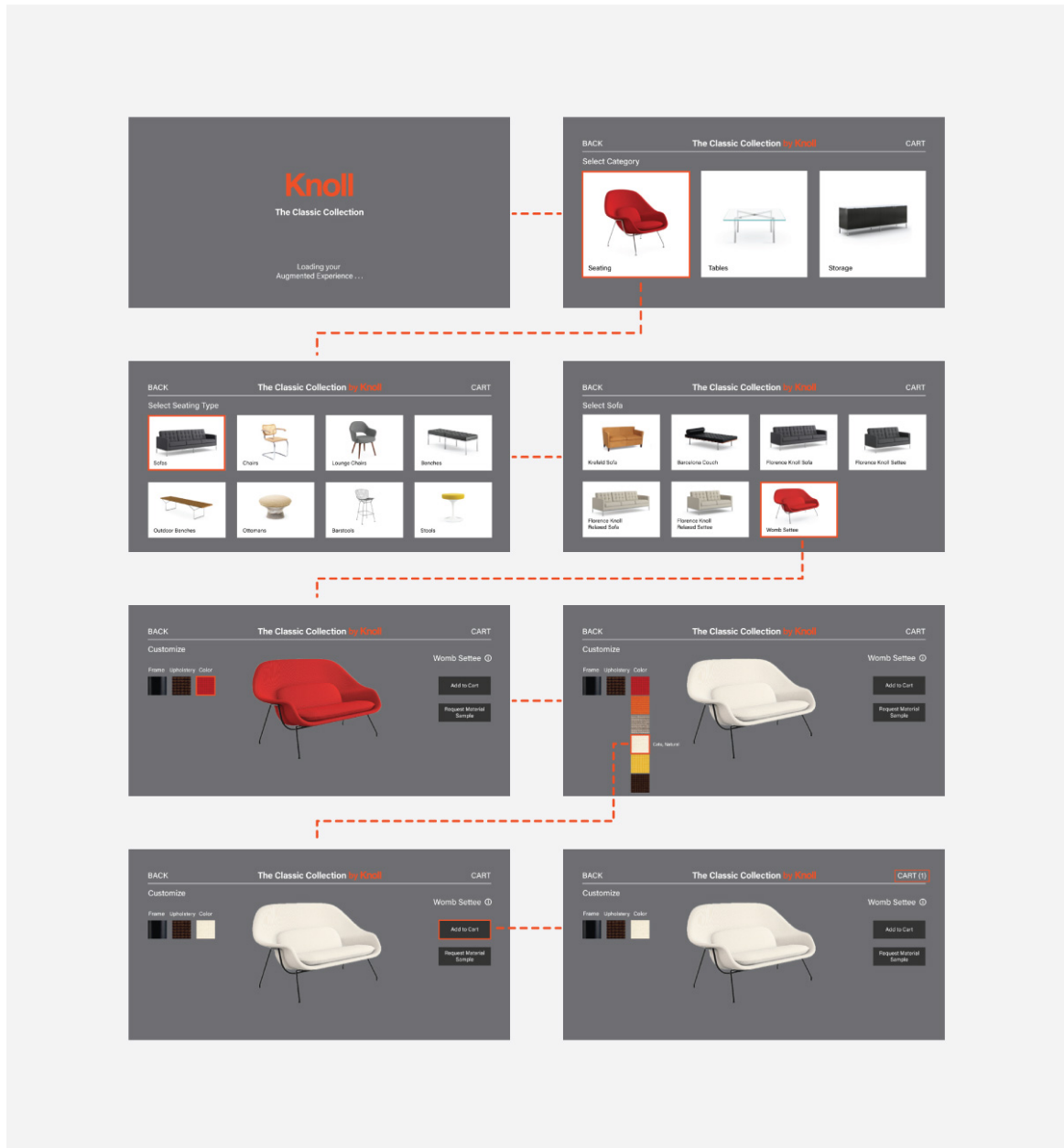


Figure 31. User Flow from Opening the App to Adding Customized Item to Cart (Wiley, 2017)

Note: Imagery is from knoll.com, accessed on 4/7/17.

CHAPTER 6: CONCLUSION

Future Research Potential

Continuing developments in AR could change how companies implement brand experiences and promote products or ideas. Future adoption estimates point to the ongoing growth of AR. Graphic rendering capability in mobile devices and AR display hardware will continue to improve, and even more AR experiences will continue to emerge, thus more possibilities may become available.

A high-end furniture company could continually evolve their AR application with such improvements in the AR ecosystem. With a more advanced AR system, a user might be able to “save” the furniture’s location in the physical house, and allow the user to view their furniture floorplan arrangement. This might be a useful tool for interior designers or recent home purchasers who want to view their floorplan as realistically as possible before making a furniture purchase.

Knoll, or another high-end furniture company, might consider expanding the single AR experience into a series of different furniture sets. Instead of a seasonal catalog, a company could send the latest furniture in a rebranded AR kit, depending on the furniture collection, and add virtual items to the app accordingly.

Discoveries and Results

AR is a powerful marketing tool for branding. In examining AR usage within various markets, it was found that AR will become an engaging platform for the customer brand experience. The AR industry is predicted to continue to grow over the next several

years, therefore companies should start considering AR to further engage customers and strengthen company branding.

The absence of an AR brand experience within the high-end furniture market provides a unique opportunity for a progressive company in this market to be an early adopter of an AR brand solution. The Knoll AR experience that this thesis prototyped could give Knoll an advantage over competing high-end furniture companies by providing consumers with an engaging, memorable experience.

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