



o r a
organic reality augmentation



Ora is a gesture controlled virtual and augmented reality operating system that utilizes haptic holography to create interfaces you can touch and feel. Embedded behind your ear, ora connects with your visual cortex to create realistic interfaces in your vision without the need for additional hardware. Along with natural gestures, ora can also be controlled via voice, thought, and sight.

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Disclosure: In this book I write a lot about virtual reality technology without referencing augmented or mixed reality. I fully believe that augmented and mixed reality will blend with virtual reality in 20 or so years and we may not need the three differentiation. I also intentionally left out augmented and mixed reality in relation to the history since, as of 2016, we as humans, are just barely able to create virtual reality devices let alone the aforementioned.

PREFACE

WHAT IS ORA?

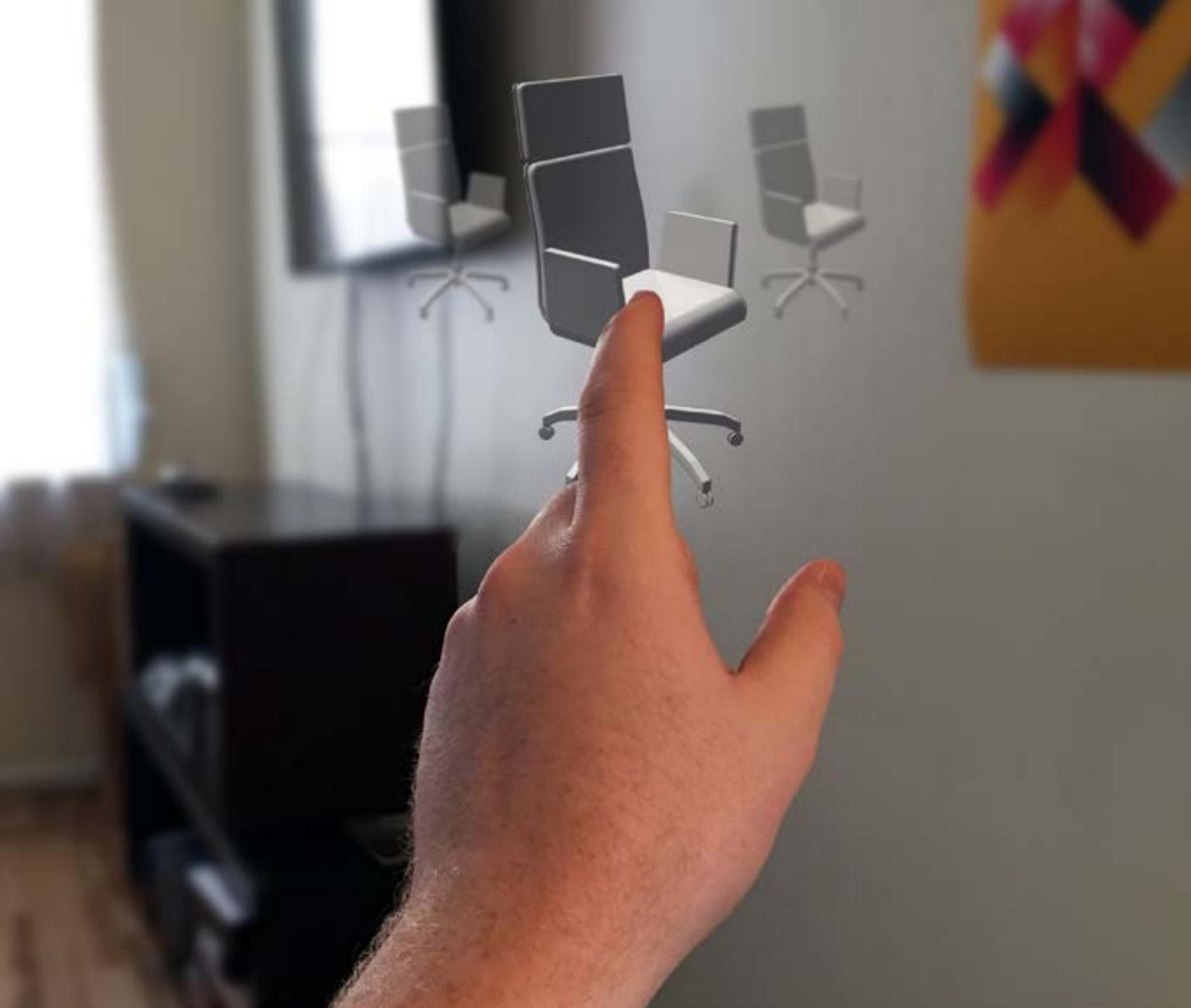
Ora is a gesture controlled virtual and augmented reality operating system that utilizes haptic holography to create interfaces you can touch and feel. Embedded behind your ear, ora connects with your visual cortex to create realistic interfaces in your vision without the need for additional hardware. Along with natural gestures, ora can also be controlled via voice, thought, and sight.

LOUISA LIU EXPERIENCING A VIRTUAL REALITY EXPERIENCE CREATED USING A-FRAME AND GOOGLE CARDBOARD.



TOUCH

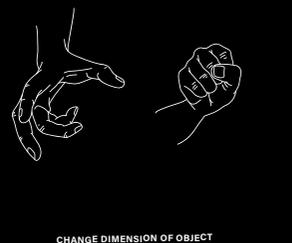
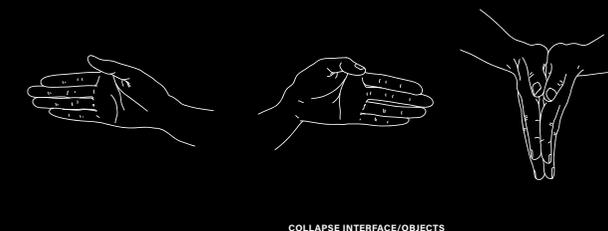
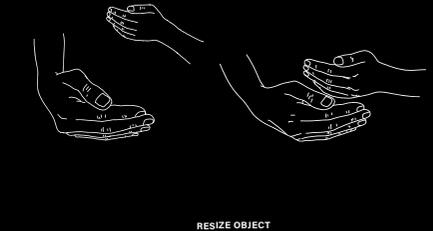
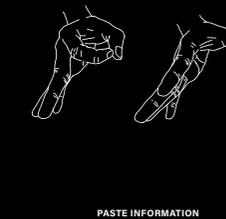
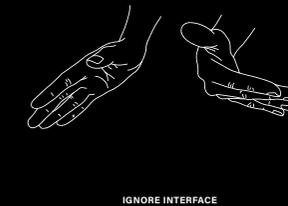
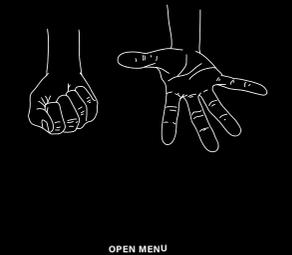
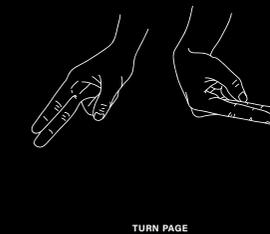
For Ora, touch is integral to the technology. Haptic holography allows you to touch and feel all of the interfaces that you come in contact with. The integration of haptic simulation allows for a multitude of uses such as being able to pet a virtual reality animal, feel the hug from a friend in a virtual reality conversation, or grab and feel virtual objects. Being able to feel what you are manipulating in virtual space helps to more accurately portray reality.



GESTURE

Being able to communicate with technology is important to the success of virtual reality.

Through gesture controls we can work with more accuracy and have a more natural experience when interacting with interface. Ora provides basic gesture controls to operate, and can easily be tailored/adjusted for individual needs.



SIGHT

Ora connects with your visual cortex creating stunning high fidelity imagery. Quality is incredibly important to virtual reality and leaves little room for error. With Ora, you can enjoy the complete feeling of presence of everything you come in contact with in your virtual reality world.



HISTORY

A MAN STANDS AT THE EDGE OF THE WATER LOOKING UP TOWARDS SPACE. WITH VR, YOU CAN GO ANYWHERE, ANYTIME, EVEN TO OUTER SPACE.

A VIRTUAL CONUNDRUM

Virtual Reality (VR) technology is breaking into the consumer world in droves. Understanding the terminology and history associated with this new technology is important as it gets developed and refined over time. Already, an array of delineations are being crammed into the term 'virtual reality' which it simply is not equipped to handle. As VR evolves, new words will have to be created. Language from other fields, such as the video game industry, will also have to be borrowed to create a spectrum that can handle the emerging technology. Check out the lexicon at the end of this book for a breakdown of key words.



Virtual Reality, by definition, is computer-generated simulations of a three-dimensional images or environments that can be interacted with in a seemingly real or physical way by a person. For some reason, people have skipped over 'computer-generated' and are applying the term to anything that utilizes a head mounted display. The most recent abusers of the term are due to the influx of 360-Degree video that is subsequently being called 'virtual reality,' which it is not. Wired published an excellent article "Stop Calling Google Cardboard's 360-Degree Videos 'VR'" which elaborates more on the differentiations between VR and 360-Degree video. A friend of mine jokingly—but kind of seriously—referred to 360-degree video as "globospectral visualization." A mouthful, but distinguishable for sure.

To get a better grasp on the emerging technology and why new terminology is appropriate, is to know, in brief, the history. Virtual Reality is not a new concept. The development of VR began in the middle of the 20th century, but technological limitations and crude graphics prevented the boom we are seeing today. Imagine trying to carry around a 50 pound tube monitor on your head. Not impossible, but far from ergonomic.

The military continued to develop VR over the next few decades for war simulations, but the technology and consumer demand were both still lackluster. In the 90s, whispers of VR became loud and excited chatter that was quelled, almost as soon as it started, by the birth of the internet. The glittery constantly connected digital heartthrob became so intertwined in our lives that we forgot about everything else.

Throughout the 90s and early 2000s, connected devices stole the show as screens got thinner and bigger while pixels got smaller and denser. Concurrently, Computer Generated Imagery (CGI) advanced from blocky low-polygonal representations of objects and characters to near lifelike in appearance. The never-ending "showroom allure" kept most people pleasantly distracted.

Not everyone was hypnotized though, as Palmer Luckey, Oculus' founder and CEO, was busy dreaming about a VR filled world. In 2012, after years of prototyping, Luckey launched the Oculus Kickstarter, a VR headset designed as a personal project but unintentionally changed the world. By the end of the Kickstarter, Oculus had raised over 2million dollars and grabbed the attention of millions more.

The insurmountable press and allure surrounding Oculus put the idea of VR becoming a feasible household technology back in the minds of the masses. Still, the adventure was just beginning to unfold as Oculus' road to release a consumer product continued over the next four years with Development Kit 1 and 2.

In 2014, Facebook acquired Oculus for \$2billion. A purchase that rocked the tech world. See "Why Oculus's \$2bn sale to Facebook sparks fury from Kickstarter funders" by Leo Benedictus on theguardian.com for further reading. The future and potential of VR was no longer being taken lightly. Tech giants started to see the promise and hype of virtual reality. Meanwhile, other large tech companies such as Microsoft, HTC and Sony revealed that they were also developing their own hardware, Hololens, Vive, and

Playstation VR respectively. No surprise there.

In 2016, the consumer version of the Oculus Rift was finally ready to go on the market and preorders for the device began at the start of the year. As the world proved ready for true virtual reality experiences, pre-orders flooded in. True virtual reality was finally here.

Now, as Oculus leads the way, the market is about to be saturated with companies ready to release their own version of VR. Both high and low-end products will hit the shelves, and, with any low end product, problems can arise.

Google Cardboard is the lowest possible entry point into the world of virtual reality. Cardboard is a bare bones, no-frills device and is, quite literally, a headset made out of cardboard and plastic magnifying

lenses with a space to insert your smartphone. The device is incredibly limited in interaction and riddled with unfixable problems such as motion sickness since phones are not meant for virtual reality. The Cardboard conundrum if you will.

High-end devices such as Oculus Rift and HTC Vive have taken these issues into account to create consumer hardware free from issues such as motion sickness, however, they are currently incredibly expensive for the general consumer who does not own a high-end PC.

Though, positively, Google Cardboard has placed an inexpensive form of virtual reality into the hands of just about everyone. Getting VR, in any form, into the hands as many people as possible is incredibly important for its success.



PEOPLE

PIONEERING THE VIRTUAL WORLD

Virtual Reality is a completely new medium. There are no set rules related to VR and anything is possible. Taking the reigns to define good experiences in virtual reality, Josh Carpenter, Jody Medich, Bret Victor, and Mike Alger are a few, but incredibly important individuals, at the forefront of the VR movement we are seeing today.

LEFT TO RIGHT: JOSH CARPENTER, JODY MEDICH, BRET VICTOR, MIKE ALGER



JOSH CARPENTER

Josh Carpenter is the founder of Mozilla's VR team and was the UX Lead on Firefox OS. He helped make A-Frame, a virtual reality coding language for the web, a reality. He is also a user interface and a user experience designer who is heavily invested in designing and coming up with best practices for the world of virtual reality. He has crafted unique solutions to working in virtual space with current technologies and grids.



“ How do we design for [virtual reality]? New medium, new rules. Everything you know about designing for mobile or desktop, does not apply, none of it applies.

If you want to **make your career** and **be a pioneer**, you go into vr.

JOSH CARPENTER

JODY MEDICH

Jody Medich is one of the leading researchers in realm of Virtual Reality and has worked for companies such as Leap Motion and Microsoft. She seeks to create a relationship with human beings and virtual reality while discussing the benefits and incredible potential of the technology. In her article titled "What would a truly 3D operating system look like?" she discusses the problem of current 2D computing for it's lack of dimension. Humans have evolved to function in a 3D world. Jody states that "Without thinking, we can immediately tell the difference between two objects based on dimension and other cues." We can't do that on a computer, something VR can help solve.



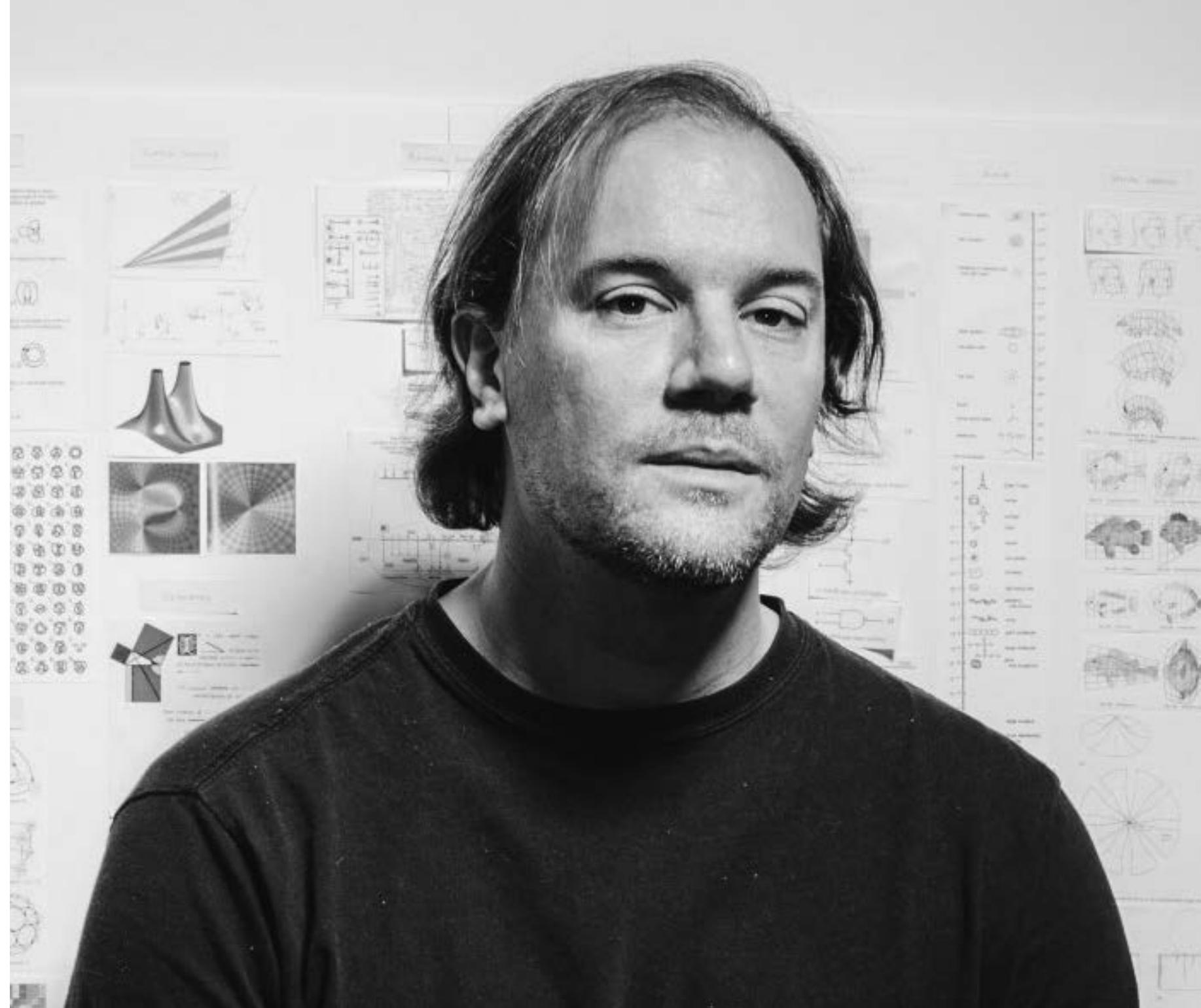
“AR/VR is inherently spatial, offering a much larger and richer surface for the spatial arrangement of tasks. And spatial memory is free - even in virtual worlds.

Every **interaction** with the [modern] OS is an **interruption**.

JODY MEDICH

BRET VICTOR

In 2011 Bret Victor already had his mind on the future of interaction when he published "A Brief Rant on the Future of Interaction Design." In this article, he talked about the importance of hands and their ignorant uses in current future projections. He states that "Our hands feel things, and our hands manipulate things. Why aim for anything less than a dynamic medium that we can see, feel, and manipulate?" With companies such as Disney having breakthroughs with haptic holograms, VR is the perfect realm to break free of the 'Pictures Under Glass' relationship we currently have with technology and develop something truly innovative.



“ Hands do two things. They are two utterly amazing things, and you rely on them every moment of the day, and most Future Interaction Concepts completely ignore both of them.

Hands **feel** things, and hands **manipulate** things.

BRET VICTOR

MIKE ALGER

Mike Alger's has poured tons of research into Virtual Reality especially related to interface design in space. He has several videos where he discusses the placement of virtual interfaces as well as 'safe-zones' for where interface should go. He has distilled the research of individuals such as Jody Medich into understandable bites through expressive visuals and clear breakdowns of sometimes complicated topics. Currently, Mike Alger works as a VR Designer for Google and is a person to watch in the realm of VR.



“ People who were web designer before will need to learn to be environment designers and really will have to find out about what architects and interior designers have already learned.

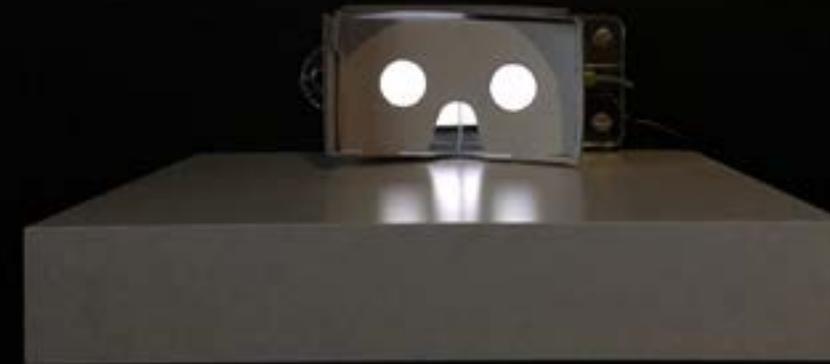
There [will still] need to be **backwards compatibility** for 2D content.

MIKE ALGER

PROCESSES

WAYFINDING THE FUTURE

After years of contemplating Bret Victor's essay from 2011 titled "A Brief Rant on the Future of Interaction Design" I decided to pursue his argument that in order to make a more natural relationship between humans and computers, we should look at the primary function of our hands; to feel and to manipulate objects. His main criticism is in reflection to the abundance of, what he calls "pictures under glass," a phenomenon relating to many projected visions of our future.



My project serves as a midway point between his perfect future and the one we are presently experiencing. I was looking at the manipulation of interface and less so the feeling portion due to technological constraints. In the end, Victor served as the primary inspiration for my thesis project and I started to think about gestural communication with technology. Through that I decided that I wanted to create a gestural language that would serve as a way to interact with virtual and augmented reality technologies.

Movies like the Minority Report, with broad and taxing gestures, instantly came to the minds of my peers when I began talking about this project. However, this was not the kind of future I had in mind. In 2013, Fjord wrote an article on "Why the Human Body Will Be the Next Computer Interface" where they extrapolated on the idea of micro-

gestures being a part of our future. Micro-gestures, paired with virtual/augmented reality technology was exactly what I wanted my thesis to explore.

Of course, nothing was as simple as it sounds!

Toward the beginning when I was framing my project, I wanted to explore both touch and manipulation related to our virtual futures. Unfortunately, tactility through technology is currently impossible to simulate on an affordable scale. However, I still strongly believe our future is tactile. I believe feedback through stimulation of all of our sense through technology will become the primary way of interaction. A natural integration, if you will.

A common representation of our future involves broad and elaborate gestures to manipulate interface complete

minimal tasks, again think Minority Report. I disregard the notion that we will have to interact with the technology around us in overexerting and tasking performances. Rather, I see the future utilizing minute "micro-gestures" to run commands and have it fit seamlessly within our daily lives. Saving a memory could be as simple as bringing your hand to your heart. Sharing with others could be as simple as tapping their sternum. Our hands can express a complex array of movements which are finite in nature. Technology will be able to recognize those expressions. We will learn the gestures through immersion much like how we learn to talk or display emotions.

Once I had a general understanding of virtual reality and gestural communication, the question I posed was: How might we visualize a gestural and tactile interface of the future?

Within that question, I had to create my own parameters for the project and assumptions to design under such as virtual reality already being real, that it is deviceless and seamlessly integrated into your life, and haptic holography was capable and easily replicated. From an initial thesis presentation: "I am designing based on the assumption that AR/VR can be projected into your retinas...let's say by a contact lens. I also am assuming that haptic holography is real...holograms that you can see feel and touch to interact." These parameters helped create a framing device for my project.

The first portion of the project that I investigated was potential gestural interactions. I started the project by coming up with a set of instructions that one would typically perform on a traditional 2D interface. From that data, I then recreated what I

thought would be good gestures for performing tasks. The tasks ranged from saving, down to simple copy and paste commands. Once I had my preferred gestural interactions, I had others perform the same gestures in a multitude of combinations. What became apparent from those exercises was the gestures I had come up with were not as easy for other people to perform. Afterwards I worked with quite a few people to perfect some of the interactions and they can be seen throughout the three videos that I created for my thesis.

With the gestures set, I needed something to begin experimentation in virtual reality. The Oculus DK2 was decommissioned and I was left in a predicament on how to proceed to have an interactive component in my exhibition. Luckily, late in my fall semester during my thesis year,

A-Frame was released to the public which helped me create the virtual interactive experiences I had within my exhibition. A-Frame, is a coding language similar to HTML and CSS. A-Frame allows you to develop virtual reality experiences in the browser and run them on your phone to use with Google Cardboard. With A-Frame I was able to create four virtual reality experiences, three of which were displayed in the exhibition.

Along with gestures, and VR people could experience, I created videos where I explored three different scenarios relating to my conceptual prototype. In the first video I investigated what the potential shopping experience could be like in early models of Mixed Reality. In the second video I looked at what working and writing content might be like in the future and in the third video

I explored what the future of making might be like, specifically related to 3D artists. All of these incorporated the gesture controls developed for working in VR.

In the next phase of my research beyond the MFA, I will be exploring how virtual and augmented reality worlds will start to function similar to how a mind palace works. Instead of digging around on your computer trying to find the exact file that you need in the folder that you saved it in, you'll be able to use spacial/external memory instead of working memory.

I've already started to redefine the computer systems archaic office analogy, and I have devised some new vocabulary:

mem - a full memory (i.e. all experiences/knowledge/etc) – similar to a hard drive

(mem) block - a collection of mem fragments - multiple units acting as one piece of memory (i.e. a photo album) – similar to folders

(mem) fragment - a distillation of a whole - one unit (i.e. a picture) – similar to files

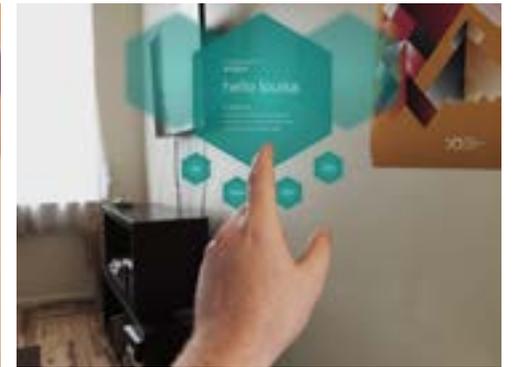
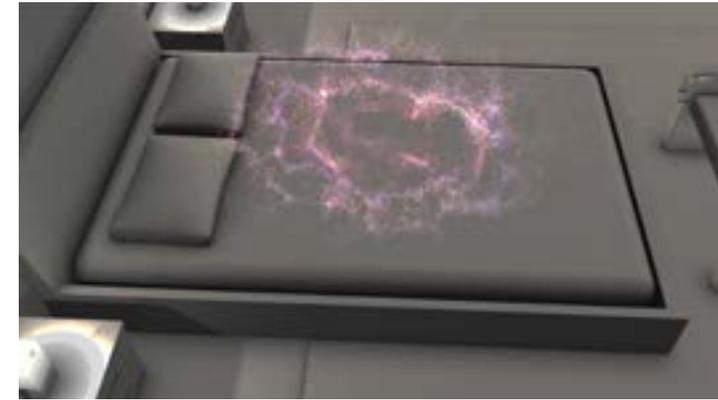
Before I close, I must say the future for designers is incredibly exciting for this new medium. As VR/AR/MR develop, some questions I have moving forward are: Will we go back to a skeuomorphic approach to design? What kind of programs will be created to collaborate with designers and developers in VR/AR/MR? Will virtual reality succeed or fall to augmented and mixed reality? The list goes on, but food for thought!

DURING THE PROCESS I WORKED THROUGH WHAT I WANTED MY PRODUCT TO BE AND ALL THE WORDS ASSOCIATED AS WELL AS WHAT POTENTIAL NAMES COULD BE.



AFTER DEVELOPING WHAT THE GESTURES WERE, I ILLUSTRATED THEM AND CUT THEM OUT IN VINYL FOR THE GALLERY WALLS. THESE TESTS WERE TO SEE VARIOUS LINE THICKNESS.

HERE ARE SOME PROCESS SHOTS FOR THE INTERFACE DESIGN THAT I WORKED ON FOR ORA. I STARTED BY LOOKING AT TRADITIONAL 2D INTERFACES AND APPLIED THEM IN A 3D SPACE.







GESTURES

SPEAKING TO COMPUTERS

In the world of virtual and augmented reality, new languages will have to be developed to communicate with the operating system. Some of the most natural forms of communication will be through voice and gesture control. In order to provide better user experiences, gestures will have to accommodate for a range of types from broad to micro in scale. Over the year, I have developed a set of gestures to perform potentially common tasks with virtual reality systems.

A SHOT OF THE GALLERY AND THE GESTURES THAT I CREATED. I CONSIDER THEM A SIGN LANGUAGE FOR VR.



VARIOUS STILLS FROM MY THESIS VIDEO
WHERE THE USER IS INTERACTING
WITH A SHOPPING INTERFACE IN ORDER
TO PURCHASE A PRODUCT SHE WAS
PREVIOUSLY LOOKING AT.

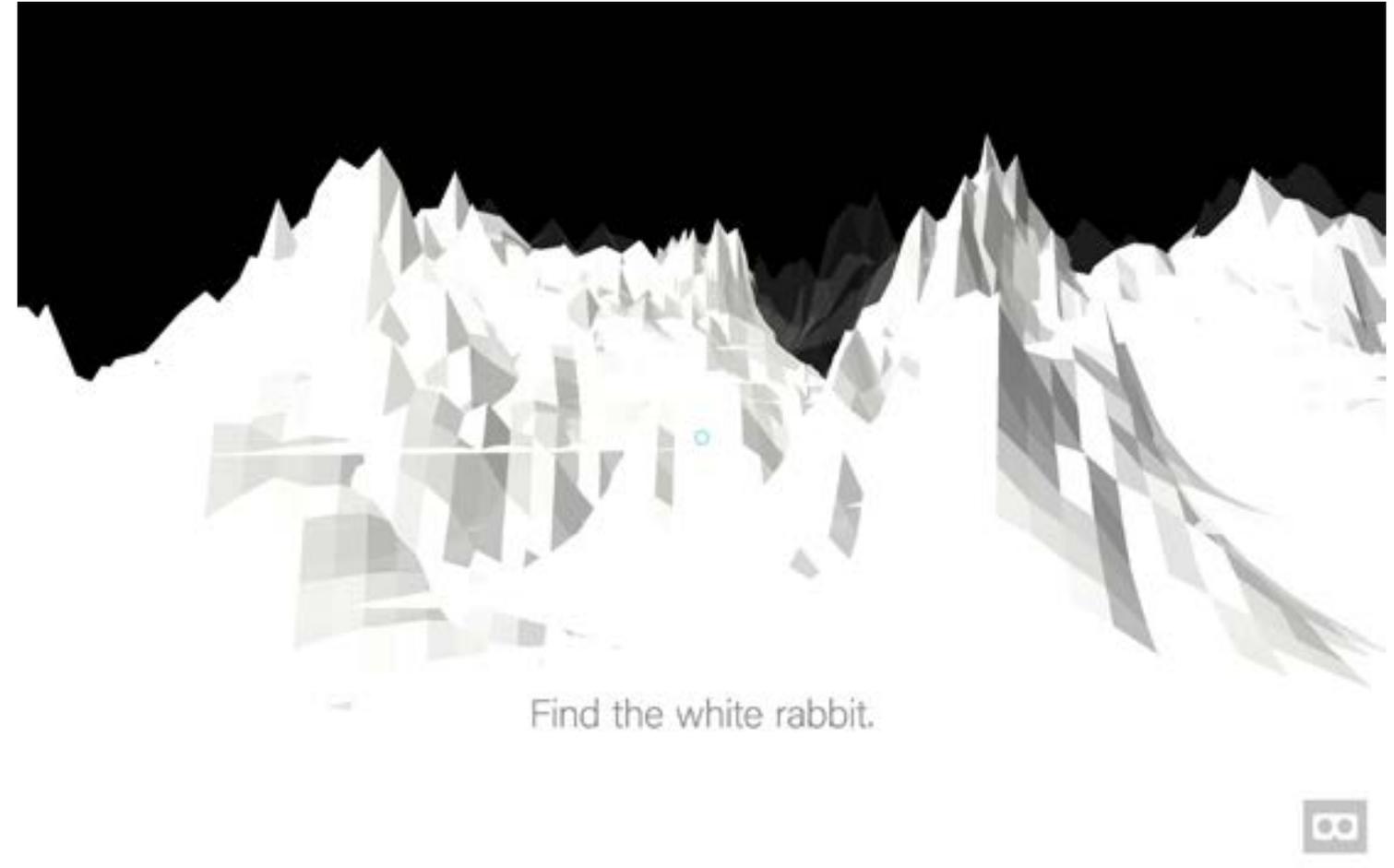


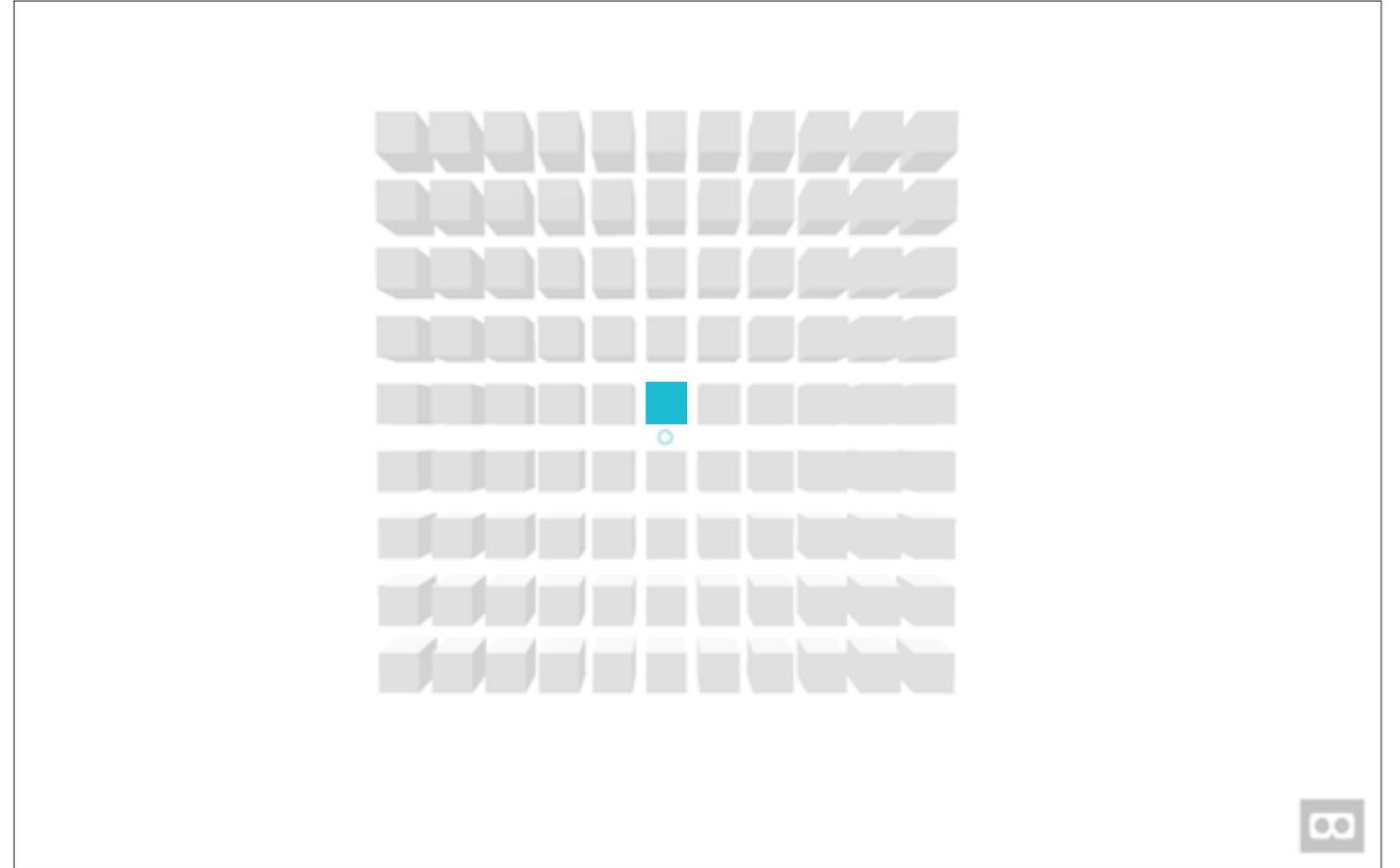
A-FRAME

LEVERAGING A-FRAME

A-Frame is an open-source framework for easily creating WebVR experiences with HTML. It is designed and maintained by the Mozilla VR team (MozVR). A-Frame wraps three.js and WebGL in HTML custom elements. This enables web developers, designers, and artists to create 3D/VR scenes without having to learn WebGL's complex low-level API. Because WebGL is ubiquitous in modern browsers on desktop and mobile, A-Frame experiences work across desktop, iOS, Android, and Oculus Rift headsets.

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17   </a-entity>
18
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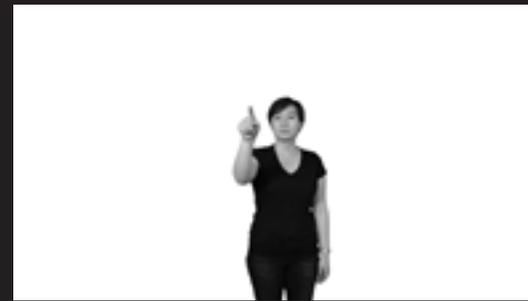
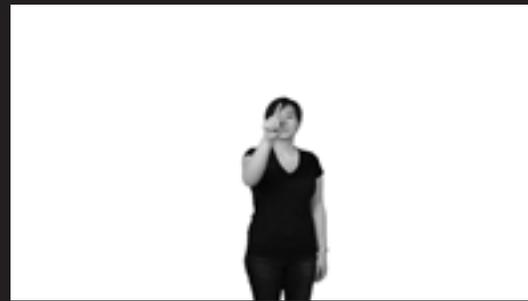
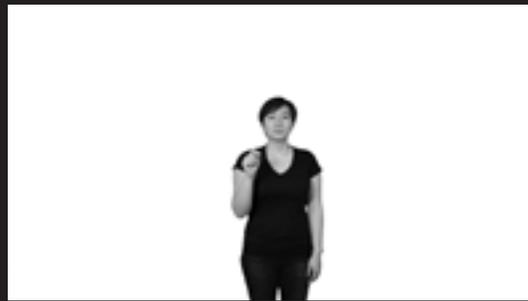
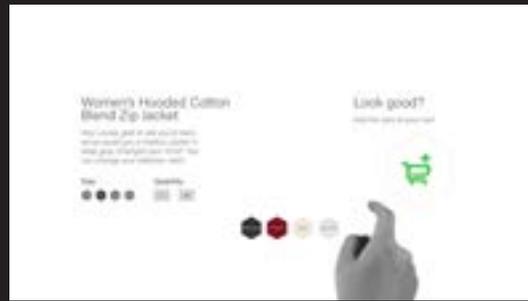
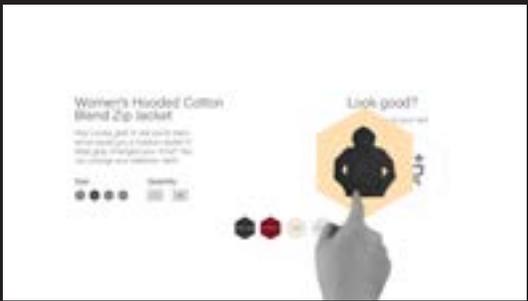
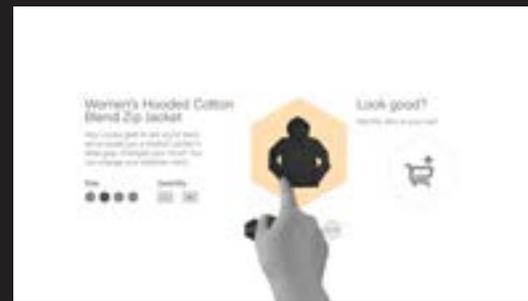
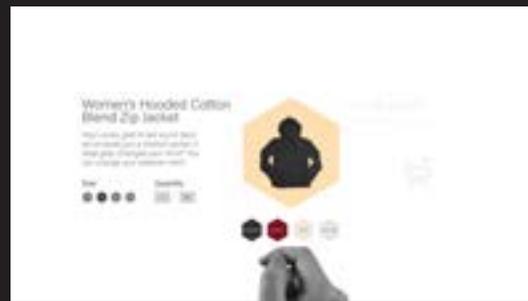


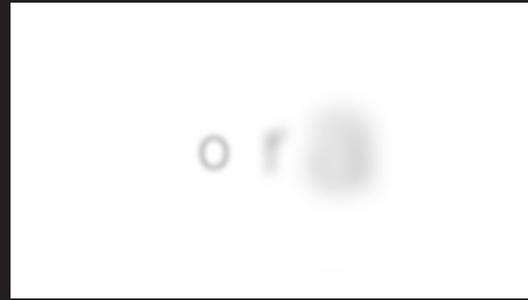
VIDEOS

THE SHOPPING EXPERIENCE

For this video I investigated a potential scenario involving interaction between a menu and a user. The video begins with the user selecting an item within the interface they were shopping for in a previous experience. Once selected, the user swipes away a coupon advertisement and is taken to her product for final selection. Once added to the cart the user is presented with a series of choices to determine which shipping option she would like. Adding the item to her pocket purchases the item and she is on her way.





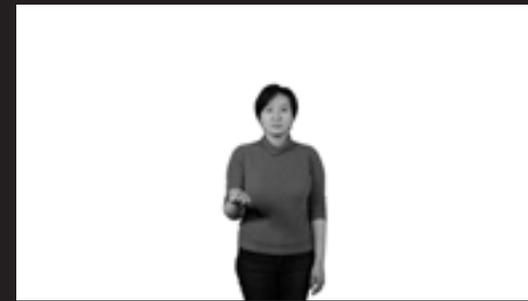
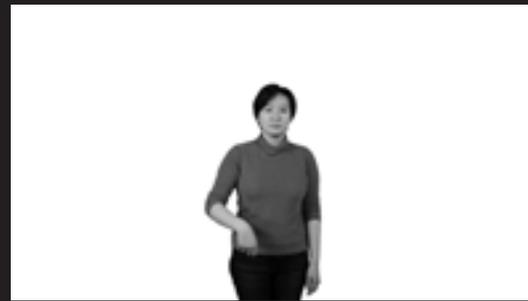
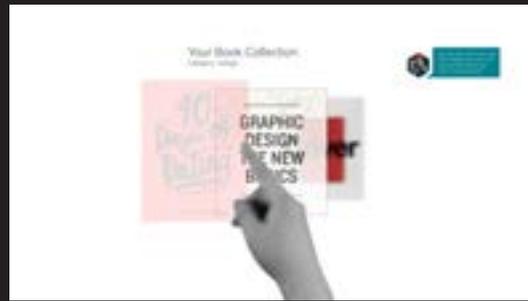
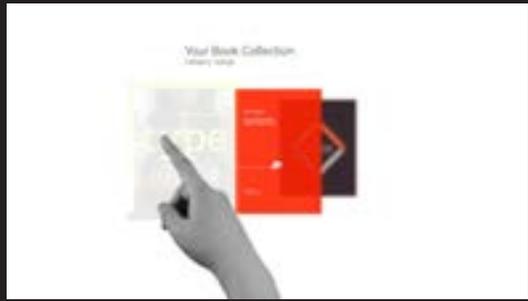
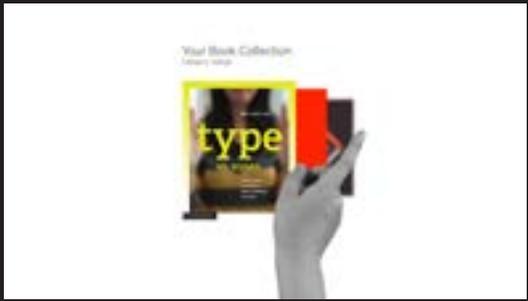


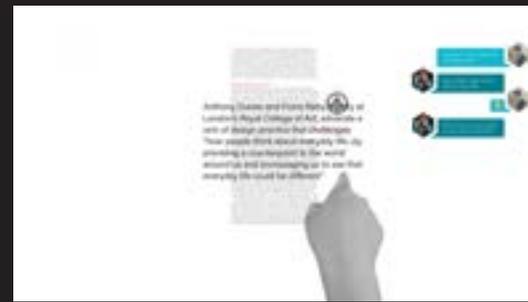
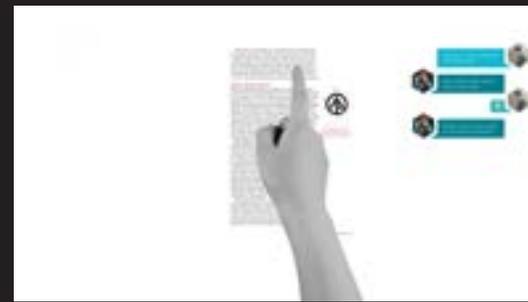
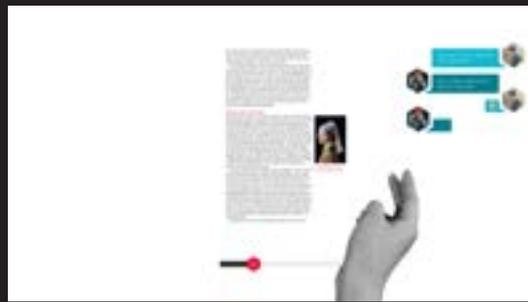
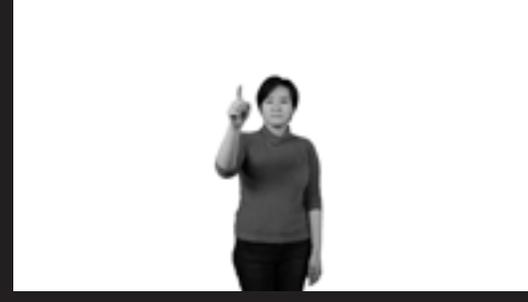
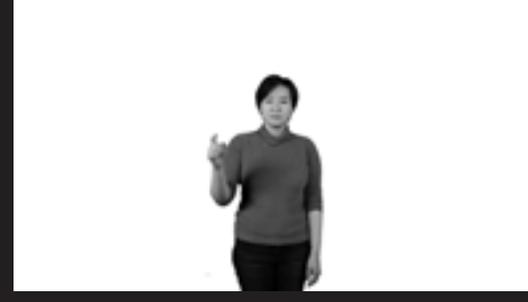
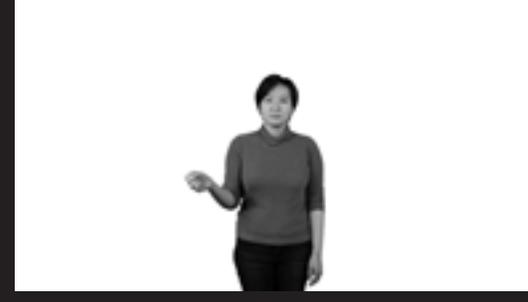
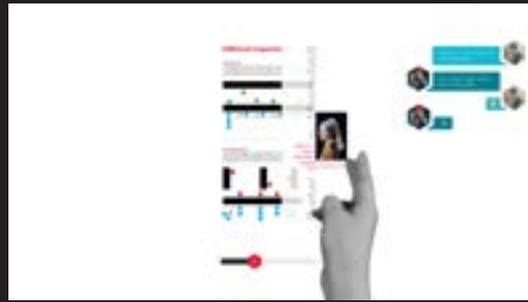
THE LITERARY EXPERIENCE

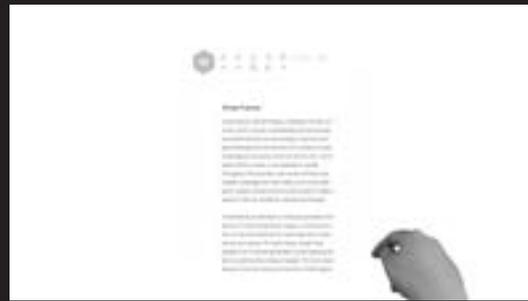
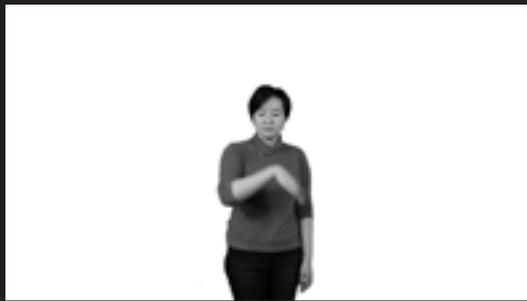
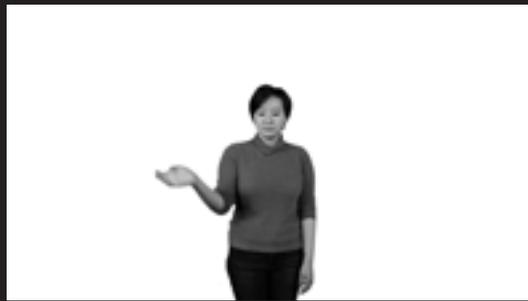
This video looks at the relationship between virtual and augmented reality as it pertains to a common use such as writing a paper. The journey begins with a user swiping through a series of books as she looks for one to pull a quote from. Once selected the flips through the pages of the book to find the content she is looking for and copies the text. She then closes the book interface and opens an editing software. Here she scans through her document and pinpoints where she wants the text to reside and pastes it inside. She then saves the document and continues with her day.

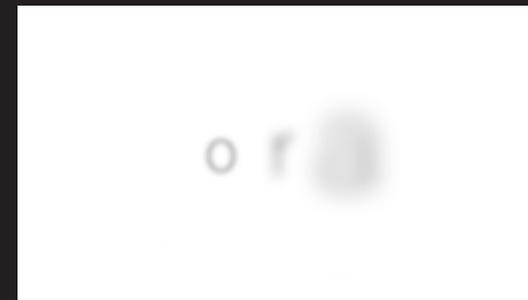
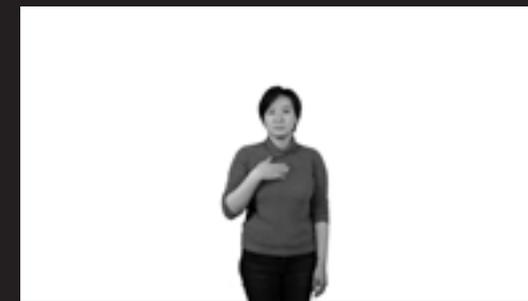
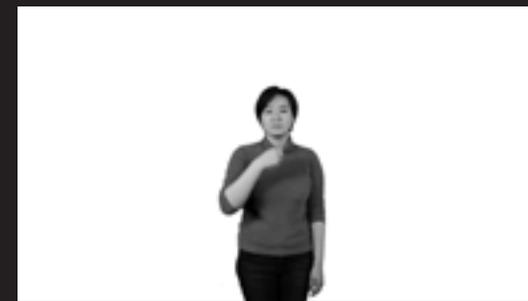
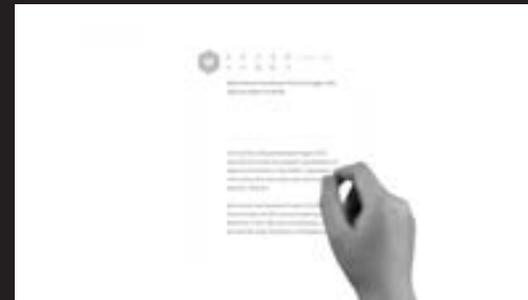
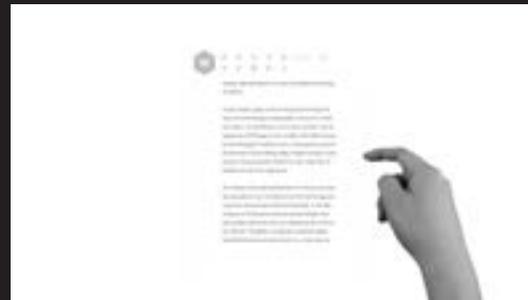
Your Book Collection
Category: Design





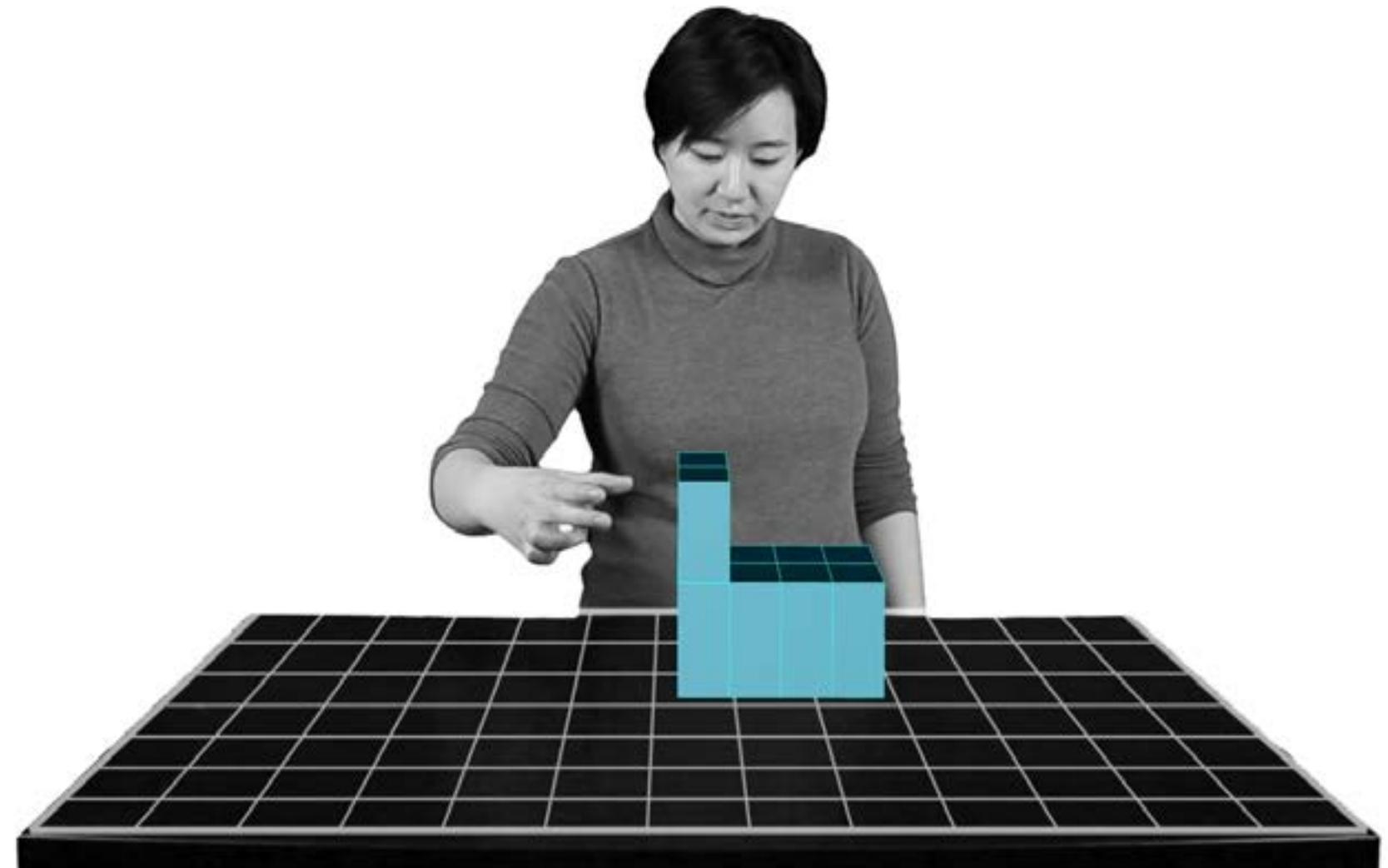


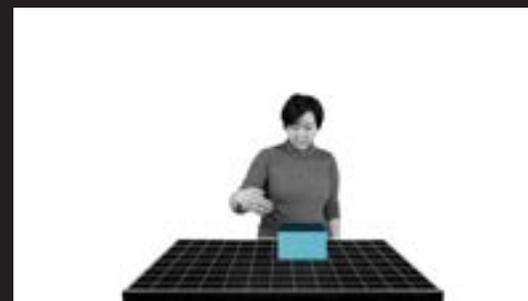
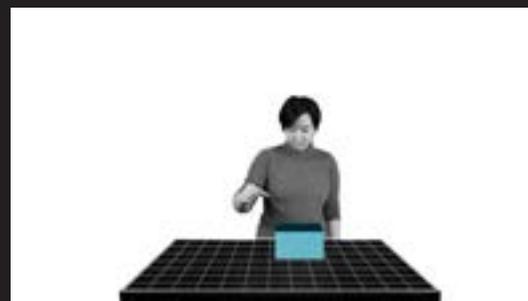
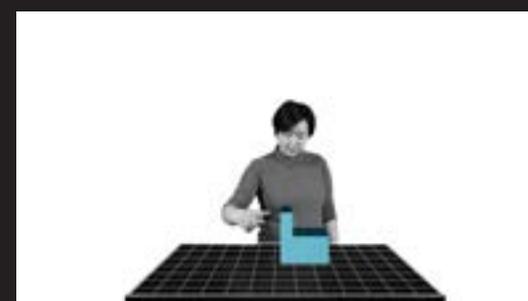
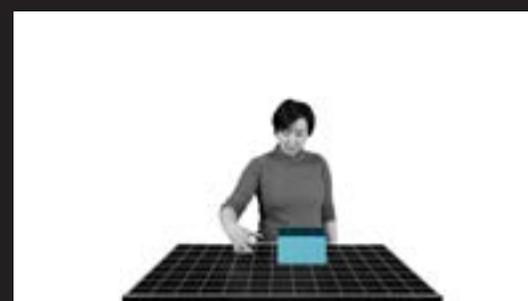
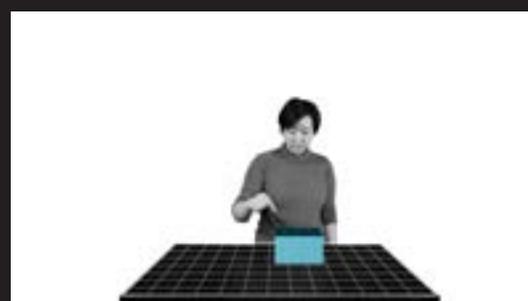
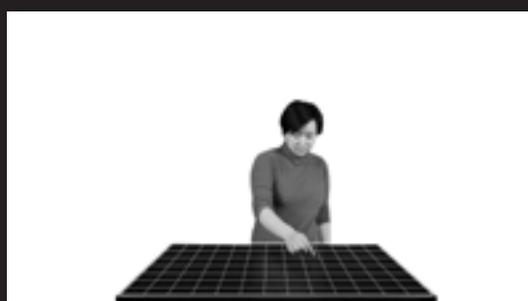
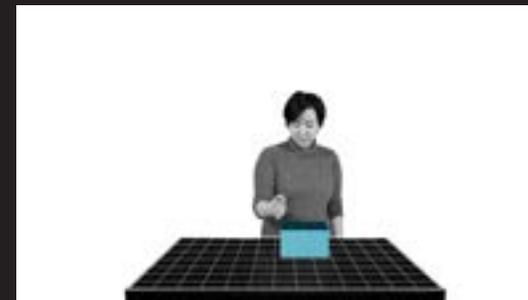
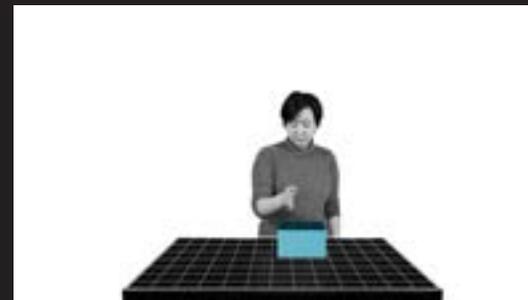
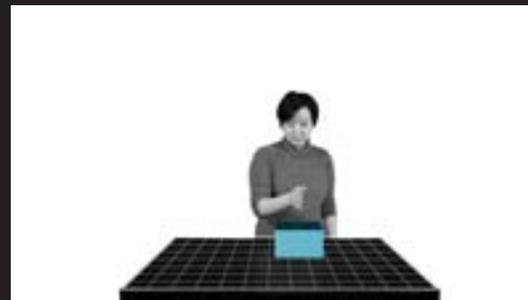
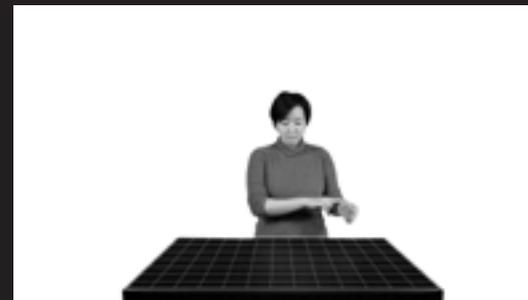


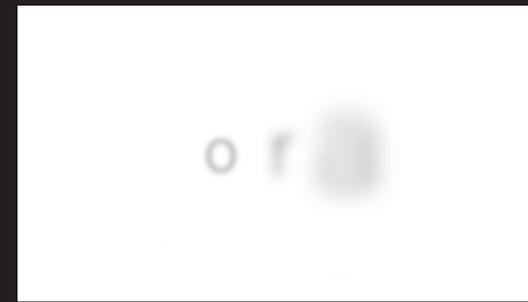
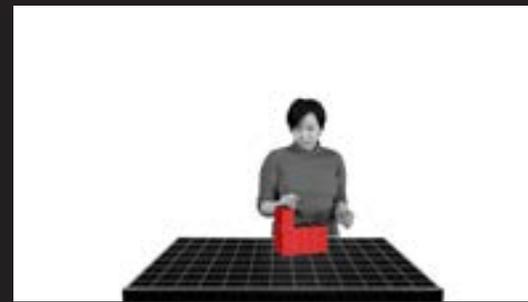
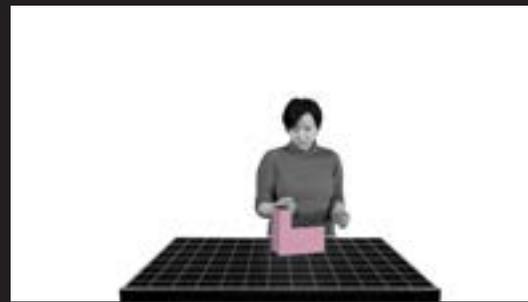
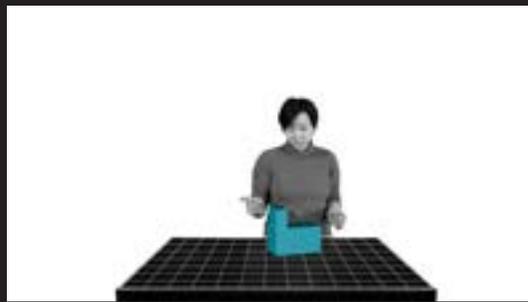
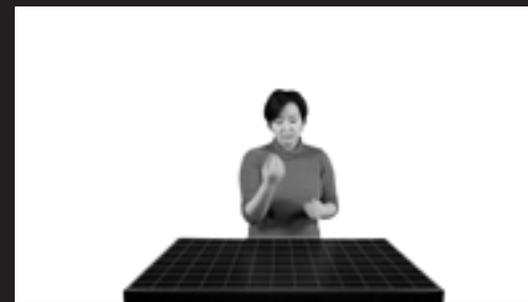
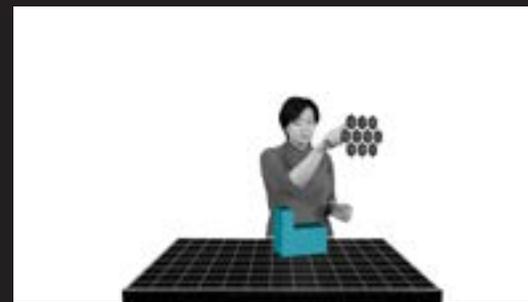
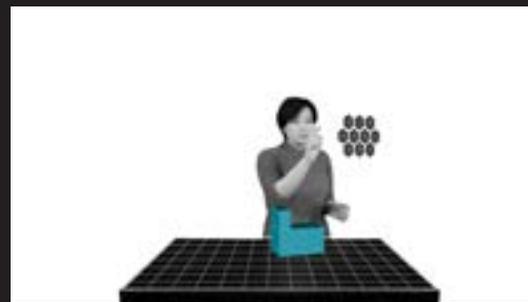
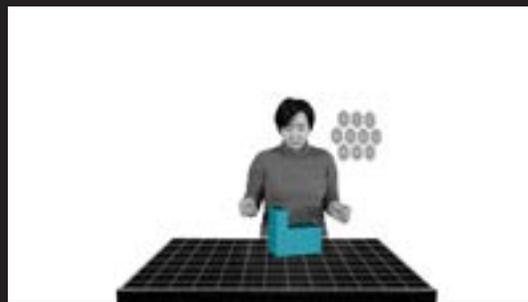
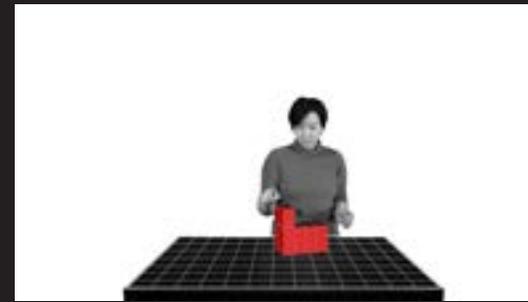
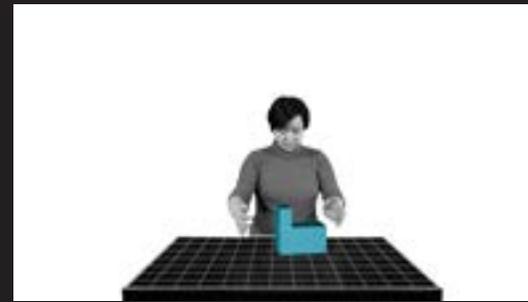
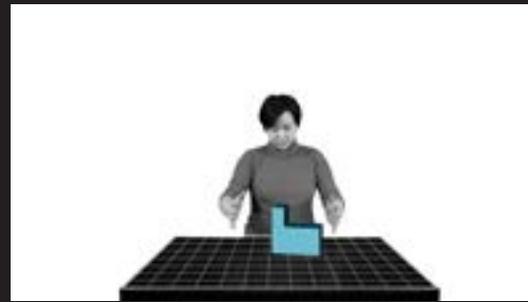
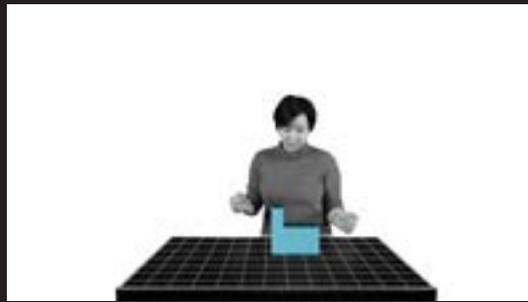


THE WORK EXPERIENCE

This last video takes place from a different vantage point with what a working experience might be like for someone such as a 3D artist. The user begins by placing her hand on her wrist to power the software on. She then begins by drawing a cube shape. Once the cube is formed she divides the shape into faces and extrudes it into dimension. After she begins to scale the object to a width she prefers. Once satisfied she turns the object to check other sides. The user decides to change the color of the object and a temporary interface appears. She turns the block red but is not satisfied with the result and deletes her work.







LEXICON

Augmented Reality – a technology that combines computer-generated images and user interface which then get superimposed on a user's actual environment in real time. This is different than virtual reality which generates a totally artificial environment.

Virtual Reality – a computer-generated simulation of an artificial three-dimensional image or environment that can be interacted with in a seemingly real or physical way by a person. The user suspends belief and accepts it as a real environment.

Mixed Reality – is the merging of real world and virtual worlds to produce a new environment where physical and digital objects can co-exist and interact. A mix of augmented reality and virtual reality.

Working Memory – the part of short-term memory that is concerned with immediate conscious perceptual and linguistic processing. Humans have a limited amount of working memory and thus utilize other forms of memory, such as external memory, to compensate.

External Memory – a form of memory that utilizes the real world environment to help remember.

Holography – an image, 2-D or 3-D, generated from light formed by the interference of light beams from a laser or other coherent light source.

Holophonic Sound – a binaural recording system created by Hugo Zuccarelli, that is based on the claim that the human auditory system acts as an interferometer. It relies on phase variance, just like stereophonic sound.

Vibrotactile – relating to or involving the perception of vibration through touch.

Haptic – of or relating to the sense of touch, in particular relating to the perception and manipulation of objects using the senses of touch and proprioception.

Natural User Interface – allow users to interact with a device through actions that are natural, intuitive and common to everyday human behavior.

Graphical User Interface – a visual way of interacting with a computer using items such as windows, icons, and menus, used by most modern operating systems.

Touch – come so close to (an object) as to be or come into contact with it.

Interruption Costs – the cost, in time, of interruption that a user receives when distracted from a task. Interruption costs can last anywhere from 3 seconds to 30 minutes.

Productivity – the effectiveness of productive effort, especially in industry, as measured in terms of the rate of output per unit of input.

Proprioception – The unconscious perception of movement and spatial orientation arising from stimuli within the body itself.

Parallax – the effect whereby the position or direction of an object appears to differ when viewed from different positions

Micro-gestures – a small, almost indiscernible movement of part of the body, especially a hand or the head, to express an idea or meaning.

Heads-Up-Display (HUD) – A head-up display or heads-up display—also known as a HUD—is any transparent display that presents data without requiring users to look away from their usual viewpoints.

Head Mounted Display (HMD) – a display device, worn on the head or as part of a helmet, that has a small display optic in front of one (monocular HMD) or each eye (binocular HMD).

Diegetic User Interface – Interface that is included in the game world -- i.e., it can be seen and heard by the game characters. Example: the holographic interface in *Dead Space*.

Non-diegetic User Interface – Interface that is rendered outside the game world, only visible and audible to the players in the real world. Example: most classic heads-up display (HUD) elements.

Spatial User Interface – UI elements presented in the game's 3D space with or without being an entity of the actual game world (diegetic or non-diegetic). The character outlines in *Left 4 Dead* are an example of non-diegetic spatial UI.

Meta User Interface – User Interface Representations can exist in the game world, but aren't necessarily visualized spatially for the player; these are meta representations. The most apparent example is effects rendered on the screen, such as blood spatter on the camera to indicate damage.



THANKS



AN INFINITE THANK YOU

I would like to thank my instructors and mentors who have made a great impact on my education and life

Ellen Lupton
Jennifer Cole Phillips
Jason Gottlieb
Abbott Miller

Andrew Losowsky
David Barringer
Elizabeth Dickinson
Jeremy Hoffman

Thanks to my colleagues for all their support, motivation, and understanding throughout the entire process

Louisa Liu
Connor Davenport
Mackenzie Schroeder
Jarrett Fuller

**MICA GDMFA Class of
2016 & 2017**

A huge thanks to those who helped me keep my sanity

Erica Remmele
Kelly Driver

And lastly, a special thanks to those who inspired me. Their research and communication helped immensely.

Jody Medich
Mike Alger
Josh Carpenter
Bret Victor



