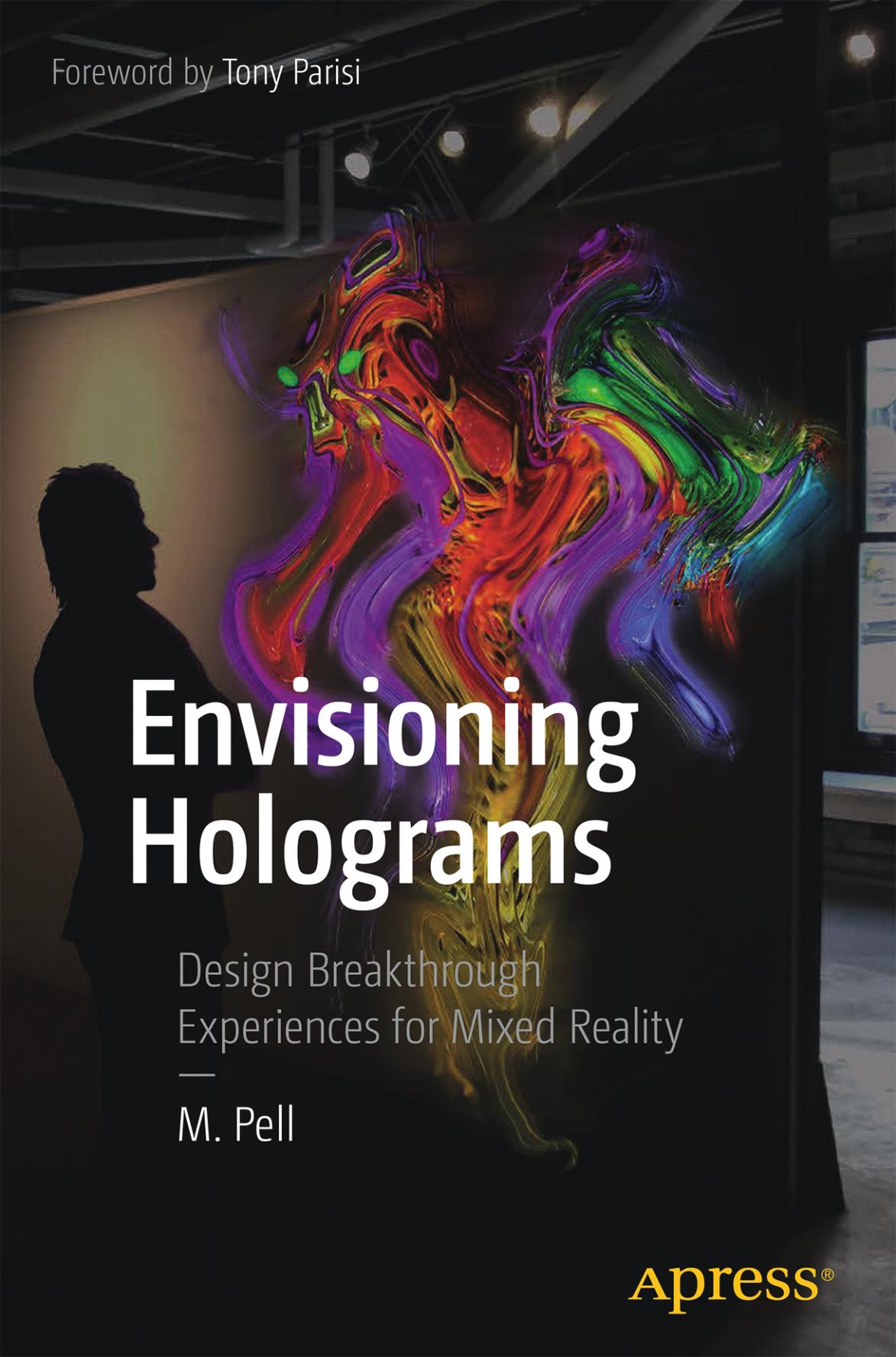


Foreword by Tony Parisi

A photograph of a person's silhouette from the side, facing a large, vibrant, abstract projection of swirling colors (purple, red, orange, yellow, green) on a wall. The projection appears to be a 3D hologram. The background shows a modern interior space with recessed lighting.

Envisioning Holograms

Design Breakthrough
Experiences for Mixed Reality

—
M. Pell

Apress®

Envisioning Holograms

**Design Breakthrough
Experiences for Mixed Reality**

M. Pell

Foreword by Tony Parisi

Apress®

Envisioning Holograms

M. Pell

Woodinville, Washington, USA

ISBN-13 (pbk): 978-1-4842-2748-0

<https://doi.org/10.1007/978-1-4842-2749-7>

ISBN-13 (electronic): 978-1-4842-2749-7

Library of Congress Control Number: 2017959386

Copyright © 2017 by Mike Pell

This work is subject to copyright. All rights are reserved by the Publisher, whether the whole or part of the material is concerned, specifically the rights of translation, reprinting, reuse of illustrations, recitation, broadcasting, reproduction on microfilms or in any other physical way, and transmission or information storage and retrieval, electronic adaptation, computer software, or by similar or dissimilar methodology now known or hereafter developed.

Trademarked names, logos, and images may appear in this book. Rather than use a trademark symbol with every occurrence of a trademarked name, logo, or image we use the names, logos, and images only in an editorial fashion and to the benefit of the trademark owner, with no intention of infringement of the trademark.

The use in this publication of trade names, trademarks, service marks, and similar terms, even if they are not identified as such, is not to be taken as an expression of opinion as to whether or not they are subject to proprietary rights.

While the advice and information in this book are believed to be true and accurate at the date of publication, neither the authors nor the editors nor the publisher can accept any legal responsibility for any errors or omissions that may be made. The publisher makes no warranty, express or implied, with respect to the material contained herein.

Managing Director: Welmoed Spahr

Editorial Director: Todd Green

Acquisitions Editor: Jonathan Gennick

Development Editor: Jonathan Gennick

Coordinating Editor: Jill Balzano

Copy Editor: Lori Lynn Cavanaugh

Compositor: SPi Global

Indexer: SPi Global

Artist: M. Pell

Distributed to the book trade worldwide by Springer Science+Business Media New York, 233 Spring Street, 6th Floor, New York, NY 10013. Phone 1-800-SPRINGER, fax (201) 348-4505, e-mail orders-ny@springer-sbm.com, or visit www.springeronline.com. Apress Media, LLC is a California LLC and the sole member (owner) is Springer Science + Business Media Finance Inc (SSBM Finance Inc). SSBM Finance Inc is a **Delaware** corporation.

For information on translations, please e-mail rights@apress.com, or visit <http://www.apress.com/rights-permissions>.

Apress titles may be purchased in bulk for academic, corporate, or promotional use. eBook versions and licenses are also available for most titles. For more information, reference our Print and eBook Bulk Sales web page at <http://www.apress.com/bulk-sales>.

Printed on acid-free paper

This one is for me.

Table of Contents

About the Author	vii
Acknowledgments	ix
Foreword	xi
Introduction	xv
Part I: A New Frontier	1
Chapter 1: What's So Special About Holograms?	3
Chapter 2: Why is Hographic Design So Challenging?	17
Chapter 3: How Can Envisioning Help?	31
Chapter 4: When Should I Use Envisioning?	41
Chapter 5: Where Do We Start?	51
Part II: Envisioning Holograms	63
Chapter 6: Shifting Your Mindset	65
Chapter 7: Choosing a Technique	87
Chapter 8: Breakthrough Examples	119
Part III: The Envisioning Process	137
Chapter 9: Flow	139
Chapter 10: Frame	151

TABLE OF CONTENTS

Chapter 11: Prototype	171
Chapter 12: Test, Refine, Restart	189
Chapter 13: Invaluable Tools	201
Part IV: Holographic Designs	223
Chapter 14: HoloScenes	225
Chapter 15: Datascrapers	249
Chapter 16: HoloArt Gallery	275
Chapter 17: Design Insights	301
Closing Thoughts	311
Index	313

About the Author



Bold, insightful, and uncompromising, **M. Pell** is recognized as a thought leader in the fields of Holographic Envisioning and Smart Information.

Pell currently leads Design for The Microsoft Garage, the company's outlet for experimental projects and curiosity-fueled explorations, worldwide.

As a lifelong Designer/Coder, he has consistently been on the leading edge of design and innovation over his thirty years in high-technology.

Career highlights include creating the first stylized Font menu at the dawn of the Macintosh (*MenuFonts*), working with Pixar to pioneer 3D type generation with RenderMan (*TextMan*), co-inventing electronic document interchange (*Adobe Acrobat*), conceptualizing dynamic 3D information (*InfoSpaces*), developing a rapid design method (*Fast Design*), and being the inventor on over a dozen U.S. Patents.

Besides his writing, M. Pell is a dynamic presenter who delivers entertaining talks on a wide variety of design topics. His evolution from intrepid entrepreneur, to VC-backed startup veteran, to corporate man for Adobe and Microsoft has given him a unique perspective to draw on when discussing how to combine business, experience, and technology to create experience breakthroughs.

You can discover more about M. Pell and see his current work at **futuristic.com**.

Acknowledgments

Who knew?

I thought writing and illustrating a book would be relatively easy. Writing was fun for me, it came pretty easy, and I had endless things to say. How hard could it be?

Turns out that writing a book for the first time is quite the endeavor. Holy crap. So, it's no surprise that I could not have done this particular book without the help of a ton of people and decades of experience.

First and foremost, the team at **Apress** took my initial concept and helped me shape it into what you see before you. Jonathan Gennick led me through the book writing and editing process like the pro that he is, Jill Balzano found innovative ways to accommodate my experiments, and Welmoed Spahr had the vision to expand the publisher's view of itself. Many thanks for your support and hard work.

Next, there's no question I continue to learn and grow every single day of my life because of my amazing team in **The Microsoft Garage** around the world. You all bring out the best in me and provide the right environment to do epic work. Thank you for crushing it every day.

And finally, for the hundreds of people who have inspired me over a lifetime of adventures (and expect to see your name listed here), you know who you are, and already know how much I appreciate you. Thank you.

Until next time,

M. Pell

Foreword

A Postcard from the Bleeding Edge

In the summer of 1977, I was one of millions of American nerd boys who flocked to see Star Wars: Episode IV – A New Hope. Of its many iconic scenes, one that really stuck with me was the scene where Princess Leia delivered Obi-Wan Kenobi a message of vital importance to the resistance – via a tabletop video hologram. Though George Lucas was telling a story that happened long ago and far, far away to other people, he was really envisioning our future. And as it turned out, it wouldn't take that long to become a reality.

Looking back, I think that scene from Star Wars is in no small way responsible for drawing me to immersive computer interfaces. I eventually became a professional software programmer, working on random boring stuff for a few years, but at every job I would find excuses to work on 3D graphics. 3D charts rendered to inkjet printers. Real-time wireframe models to visualize data on workstation computers. Nothing fancy back then; the tech to make the really cool stuff wouldn't land on laptops for another decade, and mobile phones for another decade after that. All this 3D tinkering eventually led me to an absurdly ambitious project to build the Metaverse: virtual people in 3D-rendered environments, communicating in real time, transcending time and space. That project, which came to be known as the Virtual Reality Markup Language, or VRML, was ultimately too early by twenty years.

It was back then that I met Mike Pell. Since I've known him, Mike has been on a quest to create software designs that put people at the center. Mike was early with 3D as well, working through a series of startup

FOREWORD

companies exploring how far he could push the boundaries of human-computer interface. These days, years might go by between our face to face encounters, but Mike is the kind of guy where when you do see each other again, you pick up right where you left off. Our most recent reunion came about a year ago, with Mike firmly ensconced at Microsoft and me with a new job at Unity Technologies. Two old soldiers, with gray hair but the same sparkle in our eyes, and the same mission: to make computers work for us.

Forty years have gone by since the premiere of Star Wars, and computers have come a long way. We appear to be at the cusp of a next great wave of breakthroughs, including mixed reality, voice recognition, artificial intelligence, and the Internet of Things. Combined with genetic engineering and advances in materials science, the possibilities are magical and limitless, and without a doubt will shape the next several decades of human endeavor.

3D interface is no longer a theoretical possibility; it's the new reality. And with all this new potential comes the need for a new approach to design. To create mixed reality applications, the software designer must transform, becoming parts and alternately architect, interior designer, information designer, storyteller, filmmaker, game designer, and social engineer. But most importantly, we need to learn to envision.

Can you envision what a 3D Wikipedia will be like? How 3D maps, with elevation and physical features, operate when displayed as holograms on your tabletop? Speaking with 3D video holograms of your loved ones in some future version of FaceTime? Or a 3D PowerPoint, with persuasive presentation graphics rendered all around you?

You can? That's great! But sorry; pretty much anybody can do that. Now, really challenge yourself: for any of these scenarios, imagine where and when they are used, by whom, and for exactly what. Go even further: how

will these experiences not just be cool, more facile and more intuitive, but really change our lives? I don't think that, a decade ago, most of us imagined the extent to which a phone-turned-computer would upend the world the way it has. I think we could have predicted Yelp. Maybe even Tinder. But Uber? AirBnB? Snapchat?

What are the holographic analogs to those wildly disruptive, life-changing applications? And how will we make them? That's what this book is all about. It defines the conceptual framework, and shows the processes, techniques, and production tools to make them real. A lot of the material in here isn't really specific to designing for holographic interfaces; it's useful for many other endeavors. But to design for holograms, you'll need all these and more.

Someday they may teach courses based on this book. I envision a future — probably after I have shuffled off this mortal coil — where the information in this book has become part of a canon on how to design and build the interfaces that save the planet, monitor and control automation, take us into outer space, and store and present the world's information. Holograms will, without a doubt, be an integral part of that future civilization, in many more ways than George Lucas ever dreamed of.

The information in this book can make magicians of us all.

Envision that.

*Tony Parisi
San Francisco, California*

Introduction

“Reality is what you want it to be.” – M. Pell

One thing you notice right away when talking with people in the high-tech industry – they are very particular about terminology.

Complete strangers will correct you immediately, with disdain, if you use a term they care about incorrectly. Call it a geek power trip, lack of social graces, I don't know. Whatever the reason, it's uncomfortable to be called out for using a term incorrectly. That said, there's often sufficient grey area in what these terms refer to that we're often redefining things to fit our perspective. At the end of the day, it's just people splitting hairs with semantics to make their position known. Which leads me to make a terminology assertion here before you even start reading this book.

What is Mixed Reality?

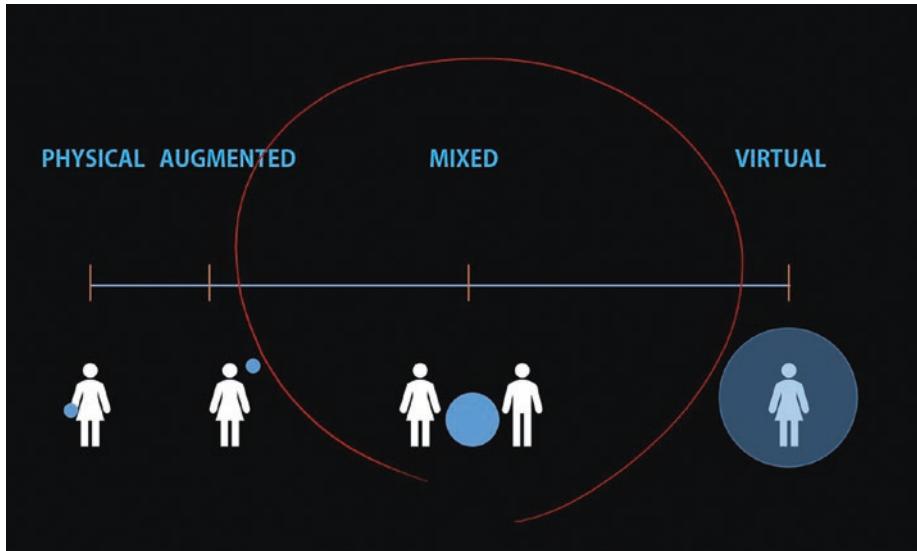
Because of the rapid pace of innovation and almost daily product introductions, the definition of “mixed reality” will continue to shift and evolve until it's almost inconsequential. We'll know it when we experience it, and it will most certainly be part of a much larger continuum of next generation computing interactions.

For the purposes of this book, I will define “mixed reality” in this way.

Mixed reality is the blending of digital content seamlessly into the physical world which appears realistic or natural.

INTRODUCTION

These digital “holograms” appear integrated within our physical spaces and react to several environmental factors in addition to human interaction. Today, experiencing mixed reality is achieved by using a device or special optics. Tomorrow, we may not be able to separate our notion of normal from mixed reality.



Where mixed reality lands on the reality continuum

Mixed reality exists on a continuum that many people have defined as having physical reality on the far left and completely digital environments on the far right. My take on where mixed reality exists on this line is close to where Microsoft currently positions it and defines the other stops on the line.

Also for the purposes of this book, I will define PR, AR, MR, and VR in these ways...

Physical Reality

(PR) is what we are used to and experience every day. It's what most people consider the "real world." Digital content is generally contained within devices and behind glass screens.

Augmented Reality

(AR) is layering digital content over (and recently within) the physical world. There's less difference between AR and mixed reality than there used to be. The key differentiator still seems to be the notion that AR content *overlays* the real world, rather than integrate deeply within. Again, that's dissolving quickly through regular advancements.

Mixed Reality

(MR) blends holograms (digital actors) seamlessly into the physical world in a way that appears natural. The key aspect of mixed reality is the ability to stay grounded to the real world, as opposed to being completely immersed in a digital space. Currently, special devices and optics are used to experience MR.

Virtual Reality

(VR) transports you to a completely digital space where you are immersed within an experience. The immersion effect is amplified by having no sights or sounds from your current physical space. VR requires headsets, motion controllers, and headphones to experience the immersion.

Hope that makes things crystal clear (more like mud, I'm sure). The fact is, this is all very messy, overlapping, and confusing at the moment due to the incredible pace of innovation and creativity. Judging by the

INTRODUCTION

speed of convergence, there will soon be a consolidation of technology we use for each stop into a single experience vehicle. We'll no longer have to use separate apparatus for each stop, but rather rely on a single, elegant solution that scales all the way from PR to AR to MR to VR, seamlessly, on demand, in a socially acceptable way. On the way to that eventuality, we'll coin and a new term that captures the essence of combining all of the current stops along the reality continuum.

In the meantime, let's use *mixed reality* to refer to the most exciting design space to explore.

What We'll Cover

If you wanted to know more about designing captivating *holograms* for mixed reality experiences, you came to the right place. Let's jump right in...

By sharing what I have learned through experimenting with mixed reality, my hope is you can move your own ideas in this space forward. For me, holographic design all starts with a process called *envisioning* – the act of visualizing what could be. By rapidly depicting a desired experience and experimenting with real-world interactions, you can quickly turn an initial vision into a tangible example of truly remarkable mixed reality experience.

This book, *Envisioning Holograms*, introduces a mental framework and design process to conceptualize and create holographic experiences that have impact, are memorable, and will delight those taking part in them.

- **Part 1** – Breaks down why mixed reality is a challenging design space, even for experts
- **Part 2** – Dives into the fresh thinking needed for holographic design

- **Part 3** – Introduces easy-to-master envisioning techniques to bring your ideas to life
- **Part 4** – Takes you through holographic examples and design insights

We stay focused on *designing* compelling holographic experiences, so it's not a general treatment of the space or a step-by-step recipe book for coding up your ideas for holographic experiences. This is a book about design.

Who This Book Is For

This book is designed to help people in three different situations.

- **Designers** who are new to mixed reality and want to quickly learn best practices
- **Developers** who need to do their own design work for mixed reality
- **Storytellers** who want to explore this exciting new medium for their narratives

Primarily aimed at those designing for *Microsoft HoloLens* and the *Windows Mixed Reality* platform, the techniques in the book are equally applicable to those targeting or working with augmented reality vehicles such as *Apple ARKit*, and the *Google ARCore* platforms.

What You Will Learn

We'll cover the design thinking and mindshift needed to master envisioning for this new realm.

This book will help you to:

- **Understand** what makes mixed reality a challenging design space
- **See** how envisioning quickly and persuasively brings ideas to life
- **Explore** several innovative rapid envisioning techniques
- **Identify** the key elements of your own holographic experience
- **Design** an engaging holographic experience start to finish

Not Covered Here

Holograms are part of very large shift in the computing landscape which encompasses everything from augmented reality to mixed reality to virtual reality. This book is focused on *designing* compelling holographic experiences, so it's not a general treatment of the space.

- **Coding** – this is not a programming book, so no mixed reality coding examples
- **Hardware** – we'll go through enough to set context, but hardware is not the focus

- **Augmented Reality** – is touched on, but this is not an in-depth discussion
- **Virtual Reality** – is discussed, but again is not the focus of this book

And finally, thank you for picking up this book. Can't wait to get started on this journey into mixed reality design with you. Regardless of your current role, I think you'll get something out of this read that can be applied to several areas of your work where quickly communicating your vision for how things could be is key.

Envision the possibilities.

*M. Pell
Seattle, Washington*

PART I

A New Frontier

CHAPTER 1

What's So Special About Holograms?

People are inherently dreamers.

We love to imagine what could be. It's part of who we are. And as natural storytellers, we feel compelled to share our thoughts with other people. Those aspirational dreams have long been communicated through gestures, drawings, conversations, books, films, games, and more recently as digital experiences. Thanks to breakthrough technologies, our dreams have finally escaped from behind the screen. They take the form of ultra-realistic digital additions to our physical world, vying for our attention, wanting to be shared.

Our dreams are now holograms.

Modern Magic

Holograms are digital representations of literally anything we can imagine blended into our physical spaces. They are unlike any other digital construct that we have ever created for people to interact with in the modern age, in large part because of their fantastical nature. Holograms defy logic. We innately know they aren't real, but still, we are surprised how

ENVISIONING HOLOGRAMS

convincingly they blend into the real world. Just like a master magician's finale, holograms hold us absolutely spellbound and believing they're real.



"Fragments" illustrates just how well holograms can blend into our surroundings (source: Microsoft)

People often refer to the feeling of interacting with holograms as magical. In large part, that's because they manage to suspend our disbelief just well enough for us to let go and be very present in the moment. We are transported. Transfixed. And even though it's not an entirely immersive transportation like with virtual reality, it is enough to evoke that childlike wonder we too often forget we're capable of.

The interesting part of this phenomenon is we know full well holograms are not real – just as most audience members realize the magician on stage has just tricked them through sleight of hand or misdirection. Yet momentarily, we are all fooled into believing an amazing feat has been accomplished right in front of our eyes.

Holograms are the embodiment of that grand illusion and willing belief in magic. And just like a magician's best trick, they leave us wanting more.

Profound Impact

Saying that holograms are completely mind blowing may not actually do them justice. Seeing and interacting with a hologram for the first time is truly memorable. For some, it is even profound. Holograms excite the mind with blinding speed. We see a universe of possibilities and new realities all in an instant. Everything suddenly seems possible. Nothing is out of bounds. We immediately recognize we're right on the edge of something truly transformative for us as dreamers and storytellers. And in that way, it's a spiritual awakening of sorts – a realization of how incredibly clever humans are and what we're capable of.

This is a bit hard to do, but I'll try to illustrate that first time feeling. See if you can imagine a cute dolphin appearing out of thin air right in front of you, squeaking a greeting, then tearing off to swim tight circles through the air around you so fast your head spins. Suddenly it stops, winks at you, squeaks a goodbye and disappears as quickly as it came. Did that work? Great. But, that's nothing like what interacting with a hologram feels like. Sorry. No one can really describe it. It's familiar and believable, exciting and fun, yet completely surreal. So, get out there and try it for yourself!

One thing you'll probably notice about holograms is they are fundamentally a contradiction. Clearly digital, but uncannily real at the same time; life sized, yet resizable. Responsive, but not alive. Within reach, but not touchable. They are right there, but elusive. Holograms are like unicorns in that way. This paradox is precisely why they have such an impact on people.

ENVISIONING HOLOGRAMS



Real enough to touch? Medical students learn anatomy holographically (source: Microsoft)

Not restricted to being just animated characters or everyday objects, holograms can take just about any shape and make any sound. They can be collections of abstract shapes and colors that react to music, or appear as incredibly realistic books, or tower over us like giant buildings. Their range is astounding.

Some holograms are even capable of warping space. You can create the appearance of entirely new spaces within existing physical ones. A breath-taking special effect used within holographic experiences is to punch out holes in floors or walls that seem to reveal entirely new worlds within. It is startlingly realistic and convincing. So much, you may not want to go too close.

The impact of holograms being so immensely flexible is that we can now express our dreams and aspirations in significantly new ways, some of which can't even be imagined right now. They hold that much potential for true resonance.

Emotional Response

Another fascinating aspect of holograms is they cannot help but elicit an emotional response in people. They appear to co-exist in our space and our minds simultaneously, which triggers an unexpectedly personal connection. It's as if we are hardwired to be fascinated and drawn in by their charms. This is a true experience goldmine if you are a Designer or Storyteller.

The most common advice given to creators of experiences is to make an emotional connection with the person engaged in the activity. We strive to leave people with a positive impression from the humanistic side. It's considered the mark of a truly successful design effort. Holographic computing delivers that without even trying.



A sense of wonder is a common reaction to seeing holograms

Given the kind of emotional reaction holograms evoke, you'd think trying to understand *why* people are so drawn to holographic experiences would be a key consideration for any new project. Sadly, that's often

ENVISIONING HOLOGRAMS

not the case. It's so natural to tackle projects from the technological viewpoint first, we often rush headlong into these new endeavors with little consideration for the human side of the equation.

That said, we can easily avoid taking such a technologically heavy view of holographic computing by consciously putting people first in our design work. That doesn't mean figuring out how to make the experience as efficient or fun as possible, or creating a cardboard cutout of the fictional customer. It does mean deeply understanding the entire holographic experience from another person's perspective and context. What's their emotional state? Is this so different from normal that it unintentionally causes anxiety or stress? How can we reinforce the fun aspects?

Digging into these questions with real people is just as important as understanding the mind-bending tech being used for holograms. Getting a solid foundation to make interaction decisions on will result in a huge leap forward from the experience design perspective.

Manageable Immersion

Unlike a *virtual reality* (VR) experience that completely immerses you in an encompassing digital world, *mixed reality* (MR) keeps you anchored to the real world by blending holograms in with the physical objects you naturally see around you. While VR acts as a transport mechanism to take us into self-contained worlds, mixed reality is an augmentation of the real spaces we reside in. It turns out that makes a tremendous difference in how someone will react to the immersion.

Many people report being motion sick or disoriented from VR experiences, due in part to a fairly common condition where our brains can't properly process the inputs of moving within an enclosing world

CHAPTER 1 WHAT'S SO SPECIAL ABOUT HOLOGRAMS?

that is somehow mismatched with our bodies in the real world. Better techniques and newer technology are reducing the occurrences of VR sickness, but it's more the nature of the complete immersion that triggers it.

Mixed reality doesn't have as much of that discord since the person's physical space is always visible and in sync with your senses. That natural connection to the real world keeps participants from getting sick as often, or often at all. Being anchored to the real world makes mixed reality much easier to stomach for many people (so to speak). It also allows you to see the people who may be watching you interacting with holograms, which alleviates to a degree the awkwardness and self-conscious feeling of being watched while fully immersed in VR.



Your physical environment is still visible when using mixed reality
(source: Microsoft)

ENVISIONING HOLOGRAMS

This more manageable type of immersion is why mixed reality is expected to be the dominant type of computing experience in the future. It remains to be seen if both approaches evolve to become more like each other over time, blurring the lines between complete versus manageable immersion.

Breakthrough Technology

You can count on one hand the number of truly breakthrough computing platforms that have come along in the last few decades—Desktop, Web, Mobile, Cloud. Each disrupted the status quo and set us on a new path into the future. Holographic is now without question one of those computing breakthroughs – and perhaps the most challenging platform for Designers and Developers to take full advantage of. We have once again leapt ahead into the future.

Holograms are currently only visible with the aid of ultra-high technology apparatus. Today, those are somewhat bulky and a bit heavy, but by the time you read this, who knows how miniaturized and lightweight they have become. Our sci-fi movies predict we'll eventually be able to project holograms anywhere, or use optical lenses and implants to enable innocuous continual use. Perhaps a ways off, those visions are the roadmap for innovation in this space that all started with the following examples of breakthrough holographic technology.

Microsoft HoloLens

At the time of its introduction in 2015, *Microsoft HoloLens* represented the absolute apex of holographic computing technology – the ability to see lifelike 3D holograms with an untethered headset. Resembling a pair of high-tech ski goggles, the first holographic computing device ran on a custom Holographic Processing Unit (HPU) chipset, included Wi-Fi

connectivity, built-in spatial sound, and rechargeable battery. A true technological marvel, the Microsoft HoloLens was just the first step on the journey to a rich holographic computing universe.



Microsoft HoloLens, the world's first self-contained holographic computer

Windows Mixed Reality

The world's first holographic operating system was originally introduced by Microsoft in 2015 to power the Microsoft HoloLens. Originally known as *Windows Holographic*, this variant of the Windows operating system provided a mixed reality platform for developers to experiment with, and featured the ability to integrate existing Windows Universal Apps into the mixed reality environment. Subsequently, Microsoft enabled compatible headsets to use a *Windows Mixed Reality* environment within Windows itself, mainstreaming some of the user experience that Microsoft HoloLens previously introduced.

ENVISIONING HOLOGRAMS



The Desktop becomes immersive through Windows Mixed Reality
(source: Microsoft)

Magic Leap

Not much is publicly known about this highly secretive, Florida-based startup company as of mid-2017, but Magic Leap has successfully raised over \$1 billion USD in venture capital to bring their vision of mixed reality computing to market.

Touted as being the most visually realistic solution in this space based on early prototypes of their light field technology, the Magic Leap product may indeed raise the experience bar and spur great competition in the mixed reality marketplace.

Apple ARKit

The much-anticipated entry of Apple into the world of augmented reality (AR) happened in June 2017, when the company introduced *Apple ARKit* – a developer's toolset and platform for creating digital objects that blend in with the real world. Viewed through the screen of an iPad or iPhone initially, the ARKit uses the device's camera, sensors, and custom software to match and integrate these AR objects quite realistically. Sound familiar? It is. And it does confuse things a bit when we talk about what mixed reality is versus augmented reality.

Historically, holograms were easy to spot because they're so striking – digital content rendered in the physical world. They could be projected and viewed with the naked eye or through devices with special optics such as headsets or glasses. Augmented reality content was almost always seen through the 2D glass screen of phones and tablets.

As evidenced by the rapid adoption of developers, Apple ARKit is clearly poised to become a mainstream medium for content that looks an awful lot like holograms through the glass screen. Add to that the new *Google ARCore* platform for Android devices, and it's clear to see an explosion of these types of experiences coming very quickly to a phone, tablet, or even glasses in the very near future.

The important part to understand from a design and envisioning perspective is that these new augmented reality platforms enable you to create the kinds of real-world experiences we all want to have access to. The semantics of AR versus MR are not important here. The fact that we will see an explosion of the creation and use of digital objects blended into the physical world on an unprecedented global scale is a game changer.

Key Innovations

There are several areas where we have combined hardware and software in unique ways to help pave the way for widespread use and adoption of holograms. Individually, each of these areas represent a significant step forward in how well our devices and interfaces work, but having all of these advancements combined into the same device has created a giant leap forward in capability and experience.

Optics

The vast majority of time spent with holograms is indeed looking at them, so attaining a level of photorealism and believability is paramount. Through a remarkable process of projecting light into your line of sight in real-time, advanced hardware and software render holograms in such a way that our eyes treat them the same as any object we see normally. It's already astonishing, and getting better quickly. We can project from the steady increase in resolution and refresh rates of televisions and electronic screens there will eventually be digital imagery that is indistinguishable from reality.

Sensors and cameras

A hologram's natural environment is the real-world space that we inhabit, not the confines of a flat screen. That means the devices and operating systems needed to create and power holograms require collections of sensors and sophisticated software to scan physical spaces in real time to orient the holograms properly. Optical sensors, an accelerometer, a gyroscope, and a magnetometer all contribute key pieces of environmental data to be processed by the headset or glasses. Understanding the space

around the person utilizing holographic computing is critically important to the success of the immersion and ability to perform actions as expected in the real world.

Sound

This aspect of holographic computing is not touted nearly enough. As any fan of IMAX movies or surround sound theaters can tell you, spatially correct sound is an important cue in understanding your environment and making action believable. Holographic devices can sample the world around the participant with sensitive microphones and in turn render three-dimensional surround sound that simulates your current space accurately. This binaural sound capability deepens the immersion and believability of experiences immensely.

Input

The means for controlling interaction is made possible by sensor arrays detecting movements, gestures, and voice commands that serve as the primary means of controlling the experience. Initially constrained to simple hand gestures and a limited set of verbal commands, interaction models for holographic computing is an area of rapid innovation. Handheld controllers and a variety of other external sensors and cameras are being used to augment voice and gesture.

Limitless Possibilities

By now, it should be clear that holograms are only limited by our imaginations. They hold immense promise to deeply change the way we communicate and connect with each other.

ENVISIONING HOLOGRAMS

It's fun to think about all the new experiences and adventures that will be launched because of this transformational medium, which is still in its infancy. We cannot really begin to predict the actual impact holograms will have on social interactions, business, gaming, medicine, communication, entertainment, education, and science in the coming decades.

All we know for certain is that holographic computing is the new frontier we'll all be exploring to bring our dreams to life.

CHAPTER 2

Why is Holographic Design So Challenging?

We think holograms already exist.

They're in our favorite movies, television shows, books, and videos. They have conversations with us, respond to our commands, and provide insightful data without us even asking. We interact with them as if they were flesh and bone, yet they retain that ephemeral quality. Holograms are an expected part of our future. And that's precisely the problem.

Don't tell anyone, but holograms aren't real.

High Expectations

Given holograms are so prevalent throughout modern entertainment, we collectively hold a very high bar for what feels right when it comes to experiencing them in real life.

ENVISIONING HOLOGRAMS

Movie magic has done an amazing job of portraying how these digital stars should react to people. Special effects have come so far there's almost nothing we can't imagine holograms doing for and with us on screen. Directors and writers can dream up the most amazing situations for their characters to utilize holograms without worrying about whether it can be created or not. There seems to be no limit to what clever technical wizards can pull off convincingly in service of compelling narratives.

The *Iron Man* movie series is a great place to start if you want to fast forward to see and hear what holographic experiences will eventually be like. Those films offer a glimpse of what fluid interaction and seamless integration of holograms looks like. They are simply just another tool used by Tony Stark (*Iron Man*) to accomplish his goals—not a special environment or mode he enters to get work done. As depicted in the films, holograms are a very welcome replacement for the ridiculous movie interfaces of the past. They work for us, not against us. And because of that injection of intelligence, we love what they represent—the bright and shining future.

Sci-fi movies use projection, voice control, and gestural interaction as the primary ways to interact with holograms. Guess what? We caught up.

The holograms of Iron Man appear in both ambient environments and integrated directly into equipment, such as a helmet's heads-up-display. Voice is often the primary input mechanism for Tony Stark, supported by articulated gestures for manipulating the holograms. Meticulously designed sound is also an important supporting element for the interaction sequences. Taken all together, there's not much missing for what you'd want out of a next-gen computing interface (unless dealing with mechanical robots or androids is more your thing).

Now comes the hard part – translating all this convincing fiction into working software code that behaves as expected. As we turn our attention to bringing that amazing vision of holographic experiences to life via Windows Holographic, Microsoft HoloLens, or other mixed reality technologies, you quickly realize we’re still very much at the beginning of a long journey to discover how to make all this be as captivating as in film.

It's harder than it seems, I assure you.

Paradigm Shift

Do you remember the first time you ever saw an IMAX movie with 3D glasses on?

I do. The IMAX movie *Hubble 3D* was so intensely beautiful, and so riveting, it literally brought tears to my eyes. The whole experience was so completely different than the normal way of seeing a film that I almost couldn't pay attention to the movie itself. The spatial surround sound shook me to the core. I was mesmerized by the view of the Earth from space and the astronauts popping off the screen and appearing right in front of me – so close I could touch them. It was absolutely overwhelming. That amazing journey into space immediately changed my perception of what was possible as a storyteller.

ENVISIONING HOLOGRAMS



Astronauts float above the audience in Hubble 3D (source: IMAX)

Holographic computing is doing the same thing for us today as IMAX 3D did for moviegoers when it arrived in the 1980s. The IMAX 3D technology redefined what a movie experience could be like for the audience. The integration of so many new elements together created a new standard, and raised expectations for impact, visual clarity, sonic landscapes, and proximity to the actors.

It completely changed things for movie makers, too.

And that is our biggest challenge in a nutshell – designing and developing holographic experiences is such a different paradigm than all the other forms of computing that have come before it, we don't know what we don't know. It's almost like we've been transported to an alternate design universe where everything went from being flat to now fully 3D. All the foundational design elements are familiar, but the interaction

models are all new, inverted even. It requires a bunch of experimenting to learn what works. Very few people get this right the first time. Don't get me wrong, it's fun to explore this universe, but it's difficult to find your footing.

The one thing we do know for certain is that paradigm shifts like this one provide great new opportunities along with challenges. Holographic computing is no different. It's a clear blue sky full of new ideas and possibilities, and no place for old baggage and inappropriate models.

The key to designing for mixed reality is completely letting go of the past.

If you are thinking about porting an existing piece of software or content into the holographic world as a “flat app,” please don’t. Let’s not repeat ourselves inside mixed reality. Now is the time to leap ahead, not fall back on old approaches or drag the past into the future. The world of mixed reality is a new frontier that deserves your best thinking. Take the time to reimagine what it could be like. In fact, that’s exactly what this book is all about.

Our challenge is to push forward in appropriate new ways. It’s hard, but necessary.

New Skillset

Another challenge when moving into holographic design is the feeling of starting over and needing to learn a bunch of new skills and methods. As Designers, our first thought when working in a new design space is to leverage our past experiences to get a quick start. After all, our design thinking, process, and techniques have delivered successful outcomes more than once in the past. These are tried and true methods we’re talking about. Sound thinking, right? Most of the time it is, but it’s dead wrong for holographic.

ENVISIONING HOLOGRAMS

Designing holographic experiences requires its own skillset and techniques based on spatial thinking, natural inputs, and a bit of theater. Our standard way of solving problems for the web, mobile, or the cloud are not much use as we begin working with a medium so different, that's still evolving, and certainly not uniform or predictable (just yet).

As we make the leap into fully immersive 3D spatial interaction, we should reconsider just about every aspect of our design thinking and development approach to better align with what's needed here. Starting with a more human understanding of the person we're designing for, and continuing all the way through the final execution of the tuned graphics and code, we should at least try to adopt the beginner's mindset. We're essentially starting fresh. And from that perspective, you might be better off as a young film student doing their first assignment than a software industry veteran who's a bit set in their ways. Regardless, just open your mind and get ready to explore and learn every day.

It turns out that holograms need you to grow as a Designer.

A traditional designer's skillset focuses on composition, typography, color, layout, and voice, which are not discarded here, but aren't nearly as important as understanding your new holographic canvas (the physical space that you're in right now, rather than the flat screen you are reading these words on). Consider how someone can place what you designed to be used on a tabletop up on the ceiling instead. How does that change your thinking?

Exactly. All bets are off. Mixed reality will stretch us to constantly adapt our design to the current context and rapidly changing conditions.

In that regard, becoming fluent in holographic design is just like learning a new spoken language—it has its own unique flow, idiosyncrasies, and accents. You just cannot get around the need to practice every day in order to become fluent. The only problem with this analogy is that you can't go out and buy a conversational book to learn how to get in sync with your audience. That takes some time and real commitment to experimenting, but you'll get there.

Spatial Thinking

In order to express yourself well with this new medium, you'll need to get comfortable thinking and acting in a three-dimensional space. That doesn't mean you need to immediately learn 3D modeling (that's optional). It has more to do with *embracing space as your canvas* rather than flat rectangular screens. The world around you is now the stage for your ideas, not the confines of windows or cards. Consider all of the air and space that surrounds you "inbounds." Content can be placed and worked with anywhere in the actual room you are in, or even behind walls and under floors. Anything is possible within the space we occupy, even sharing experiences with other people.

As you'd expect, thinking spatially rather than screen based is a major shift, and is certainly harder in practice than it sounds for many of us.

Almost everything before this point in the history of user experience design has been all about designing and controlling what's behind the glass—windows, menus, icons, dialogs, and buttons. Now we find ourselves sharing physical space with these life-sized digital objects that can appear above, below, and behind you. That takes a colossal mental pivot to start designing completely outside the glass and into your physical world. It's the realm of spatial thinking, proximity, placement, legibility, and physical fatigue rather than pixels and resolution breaks.

ENVISIONING HOLOGRAMS



The physical space all around us is our canvas for holograms
(source: Microsoft)

Engaging in spatial design thinking raises all kinds of questions immediately - How does the size of the room and what's in it affect your experience? Does physical proximity and positioning mess with your intended interaction model? Can people resize your objects to be bigger than the space you're in? Why do people get to put things where they want?

There are tons of questions and few ready answers.

Natural Input

Because this is a relatively new design field, very few of us have mastered using the room itself as the interface and our whole bodies as the input mechanism. Yet, this type of natural input model utilizing our voice and whole body for interaction is foundational for holographic computing.

The closest we may have come to using this kind of natural input model in the past was with the *Kinect* for Xbox. When it was first introduced by Microsoft in 2010, the ultra-high tech Kinect sensor array brought full body interaction and voice commands to the Xbox console gaming experience without the need for extra controllers. The marketing at the time cleverly proclaimed “You are the controller,” and it was never more true. Kinect-based games asked players to jump, wave, turn, and use their hands instead of using the Xbox controller. The Kinect sensor would detect your body movements in real-time, and as a bonus you could finally speak naturally to your console and command it to do things. It was awesome. And it felt completely new.



Kinect for Xbox introduced voice and body gestures as primary inputs

Yet, despite huge initial sales of the unit, brilliant technology, and engaging gameplay, there's little new activity around Kinect games today. It serves as a good example of how challenging it is to land a new

ENVISIONING HOLOGRAMS

interaction model successfully (as is the case with holographic computing). The difficulty of designing for that kind of full body input and interaction model, plus the physical space required to play the games themselves certainly contributed to a falloff in interest. With that said, Kinect was a huge technological milestone on the journey to holograms. It clearly paved the way for the mind-bendingly complex sensor, microphone, and camera technology packages needed to power holographic computing. And it introduced the general public to the idea of natural input and voice for controlling computing or mobile experiences before *Siri*, *Alexa*, or *Cortana* made their appearances as our voice-powered digital assistants.

Natural input still remains a challenge to do well.

Device Required

There's a great deal of design and conceptualization work you can accomplish with just your imagination, but at some point there's no getting around the fact that you'll need to have an actual holographic device to create breakthrough experiences.

Holograms are too unique to be simulated accurately in software only. There's a feel you only get when seeing them with your own eyes and it's nothing like being inside the actual headset or a projection environment to sense what is happening firsthand. Today's software emulators are great at getting us close, but they're not accurate enough when it comes to nailing the scale, positioning, lighting, and presence relative to ourselves in the real world.

Any code that's written for an emulator first is almost always tweaked for real world use in the device. The holograms appear too close or far away, aren't quite lit properly, or aren't blending in as expected.

This device requirement should not be viewed as a deterrent to proceed with your ideas, just note it as a challenge to overcome at the proper time.

Limited Data

Our industry craves usage data to help make better decisions. The more data the better. But, let's be honest here and point out that unlike mobile, there are not currently billions of holographic computing devices out there in the world generating petabytes of usage data each day. We know the number of existing units will continue to grow each year as many major tech companies have placed huge bets on this space developing as the future of computing, but there aren't tons of data points out there to help us learn why some approaches work and others don't.

Data won't save us this time. We need to learn as we go.

At this phase of the journey, you need to be comfortable going with your gut instead of wasting time searching for data before making a decision. Form your hypothesis based on experience, then run some experiments to see how real people react to the approach. Adjust as you learn more. Don't get me wrong here. We should always try to instrument our apps and services to learn what we can from the real-time telemetry and usage data. Just be aware that trying to base your decisions on a body of previous data is not going to work out in many cases.

Our best data will come from working closely with people to understand what works, or doesn't from their perspective, not from usage logs.

Real People

Unlike many other design spaces where you start from previous examples, telemetry data, or marketing personas to understand who you are designing for, mixed reality needs you to develop a true empathy for the people at the heart of your new experience. Real people's emotions are the design center of gravity here, not the faceless "customer" cardboard cutout that agile teams obsess over as their target. There's no amount of usage data or neatly organized focus group responses that will substitute for seeing a real person's spontaneous reaction for yourself.



No amount of usage data beats seeing real people's reactions to your designs up close

Holographic is truly personal computing.

The intimate feel of holographic experiences is partially due to the device sitting on your face, but more so from the digital artifacts sitting dead center in your field of view. Your brain is working overtime figuring out if these holograms are real and a threat. It's kind of spooky. And that's a game changer from an experienced design perspective. Not many of us believe that Apple's Siri is a real person (yet), but these holograms that you see and interact with evoke emotional responses in a way we have rarely seen outside of "scare" virtual reality or immersive hardcore gaming. Pure emotion is a powerful thing to tap into. Mixed reality always has emotion turned on, ready to tap into.

The challenge then, and one of the key things to understand about moving into this realm, is that you have to (as the great golf philosopher Chevy Chase once said) "be the ball." Put yourself right into the shoes of the person at the center of all this as often as you possibly can, through whatever means you can manage. It is the person using your ideas that matters, not the ideas themselves.

Holograms are nothing without people bringing them to life.

Envisioning

By themselves, none of the design challenges mentioned in this chapter are stopping us from figuring out what that next breakthrough holographic experience is. Combined, they are formidable but merely temporary obstacles to overcome by using a design technique called "*envisioning*" which we'll cover next.

CHAPTER 3

How Can Envisioning Help?

Show me, don't tell me.

Coming up with great ideas is relatively easy – gather a set of passionate people, set a goal, and before you know it you've got a whiteboard full of brilliance. You could probably rattle off several great ideas from just that one session. But, we all know bringing those amazing ideas to life is a completely different story. It's incredibly hard work and always takes longer than anyone expects. There are so many aspects to define and details to figure out. How will it work? Look? Feel? Behave? Cost? How do you make it? The questions are endless.

As daunting as it is to answer all those questions up front, there is one aspect of early ideation that's even harder to figure out – how do you motivate people to actually care about an idea?

Turns out, that's precisely what *envisioning* is for.

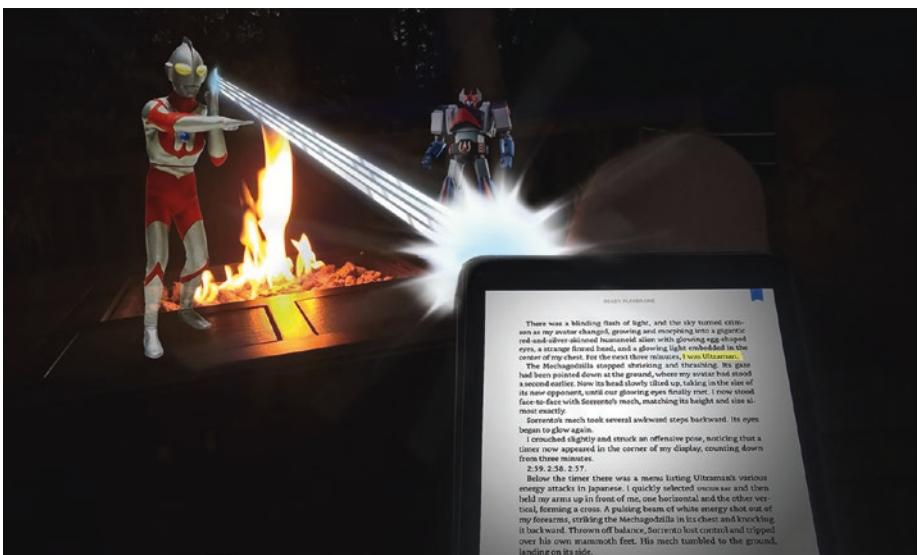
Envisioning helps people understand the potential of a new space by using whatever means works best to depict how the experience would *feel*.

Creating an emotional connection with a new idea matters more than what tech ends up being used or how the business model works. People need to feel something to act upon it.

The envisioning design methodology helps people transfer ideas from their mind's eye to a tangible form others can see and experience. It makes your ideas and dreams real enough to show someone else in a convincing fashion, just as you do in other visual mediums. When done well, it exudes the feeling you're after.

Envisioning can be done with words, pictures, actions, storytelling, animation, or any other way of communicating that's capable of conveying emotion and feeling. It's not necessary for these pieces to be executed perfectly in your medium of choice, but they do need to be impactful enough to make an impression, or even better cause a strong reaction – good or bad. Even pointed commentary and questions are a good sign.

Do people get it? Does it make sense? Is it plausible? Are they asking for it to exist now?



Realistic sketches help people envision holograms acting out scenes from an eBook

In keeping with the goal of evoking a response, the shape envisioning takes and the method employed to accomplish it is nowhere near as important as the actual outcome it drives. The work we create to get our ideas across should be considered outlines, not finished pieces. Rough sketches are just as valuable as highly refined animations. No extra points are awarded for perfect form here. In fact, envisioning is often at its best when it appears more like a rough sketch than a polished cinematic masterpiece.

Just like prototyping, our work here should be thought of as disposable, all in the service of getting our message across and moving ideas forward.

Interestingly enough, working in this fashion helps us in several counterintuitive ways, as described in the following sections.

Poses Questions

Great envisioning poses more questions than it answers. And that's a good thing.

In general, our design work is meant to answer questions not raise more. Yet, the more believably something is depicted, the more we need to know how it works, usually in great detail. Our minds fire with dozens of questions all at once when confronted with something just out of the norm. What if this or that? How does it work exactly? Could you do this other thing, too? It's the same effect as when we see a phenomenally well-done motion picture. We are so absorbed in the narrative or the feeling it conjures that we temporarily suspend our disbelief just enough to see it as plausible.

The highest compliment a piece can receive is when someone argues emphatically that it can't possibly work that way, citing a very specific reason. At that point, you have clearly captured their attention. It doesn't matter whether they're right or not – you have them engaged and challenging the vision.

In its simplest and most effective form, envisioning poses questions that help people recognize the potential for change and activates their curiosity.

You'll also find that even seemingly noncontroversial pieces can generate questions about motive and message. Just as some of our greatest works of art serve as master provocateurs, so too can envisioned pieces. Use the envisioning process to help you kick off discussions about the vision, rationale, and even morals behind the pieces. Invite pointed questions through deliberate and purposeful choices in the work itself.

Getting people to engage and debate about a picture of possible futures is a good sign you have the right number of challenging elements present.

Tests Assertions

Turning ideas into tangible pieces helps test all the assertions we make consciously (or not) during our conceptualization and execution phases.

When ideas and dreams are made real enough to be viewed and debated by others, there's a natural tendency to poke at the depiction and question what it is trying to represent. Intentionally or not, our work asserts certain things to be true, often unconsciously. Identifying those assertions is important to us gaining a deeper understanding and agreement on our direction and rationale.

Assertions come in two forms that we should pay attention to, but for very different reasons.

Explicit assertions are conscious choices made during creation. The shape something takes, its implied behavior, spatial alignment, and movement are all examples of aspects that can be purposely asserted. We make those unambiguous choices and build upon them throughout the piece. Those intentional choices we made will automatically be accepted or rejected by the viewer, helping us gauge how close we're getting to our intended focus. It's an easy way to measure progress.

Other assertions that are explicit but not done intentionally prove more interesting. Those choices are made subconsciously based on our experience and shared understanding of the larger world around us, or the specific situation we're depicting. These unintentional items often go into the work unnoticed precisely because they are so natural or expected

ENVISIONING HOLOGRAMS

for the creator. Identifying and discussing these unintentional assertions is a great way for the team to double check things aren't being taken for granted or that we've assumed too much from our intended audience.

Conversely, implicit assertions exist in plain sight, but are invisible.

Implicit assertions rely upon the viewer understanding our intent, even if key aspects of the situation are unexpressed. If you see something that looks like a dog, you assume it's probably going to act like a dog based on your experience, even though there are no visible rules to that effect. We all have a shared understanding of how things act, work, and react (or not). The problem comes when our expectations are disrupted or broken by new behavior.

For example, if a human-like hologram appears to not be touching the floor when it first appears, we can assume the creator purposely meant it to float free of gravity, like a ghost. Right? No? Oh, it was just a mistake in the drawing or bug in the code? Got it. Not really a ghost, just a hologram misaligned with the environment. Easy mistake to make, but your audience would have mistakenly thought your hologram was intended to be a ghost. They implicitly realize floating objects are not bound by gravity like normal.

Identifying assertions in the things we envision helps us evaluate how well we're communicating intent.

Understanding our implicit assertions is important as a Designer. It keeps us constantly thinking about unconscious bias and things we often take for granted about our work.

Envisioning can magnify our assertions early enough in the process that we have time to dig into them properly and decide how to proceed.

Creates Artifacts

The process of designing anything leaves traces of the methods used and steps taken to arrive at a particular place. These traces are sometimes the smallest of things – a quick sketch, words jotted down on a scrap of paper, even a text message sent to ourselves as a reminder. They come in all shapes and sizes, and vary in their degree of fidelity. These early fragments of our thoughts are combined during the creation process into pieces that form an artifact. Those in turn act as a historical record of the journey.

Any Designer will tell you they love finding the early work of projects that have taken a more final form. Those early artifacts help remind us of our thinking at the time. Artifacts shed light on the synthesis of tangible ideas. And as we move through the project lifecycle, those artifacts become infused with our decisions rather than our random thoughts. Design decisions are important to recognize as milestones or pivot points along the way to realized plans.



Artifacts trace our path through the envisioning journey

ENVISIONING HOLOGRAMS

The envisioning method results in many valuable artifacts that contribute to learning how to better do things for the next set of ideas. Those artifacts help us retain concrete records of our path to the future. They also give us a set of landmarks to understand our direction and evolving thought process.

Removes Constraints

Envisioning is used to illustrate potential paths forward, but those paths don't have to be realistic or even possible in the near term. And that's the beauty in this type of design work: it pushes us forward toward new possibilities. It's meant to be both aspirational and inspirational.

When envisioning holograms in these early days of the platform, the Designer is freed from the constraints of existing paradigms to explore the optimal ways of doing things without being pulled back by convention. That's huge. Rarely do we have new mediums to explore in this way. However, that does come with its own challenges.

A key difference between working with holograms and other types of computing platforms is the lack of precedents (except for sci-fi movies). We don't readily know what's possible or even plausible in this space. That makes it difficult for some people to embrace what you're going for with your designs. They can't tell if you don't understand the capabilities of the platform or are just painting a vision of what could be. That's a real issue sometimes, but can be worked through using hints in the pieces themselves.

By using persuasive visuals, we can hint at entirely new capabilities and illustrate underlying concepts. We don't need to perfectly visualize and exhaustively define things upfront to successfully communicate these breakthrough holographic concepts—just the opposite in fact. Because

speed is the key to moving your early idea forward, doing a hand-drawn sketch or crafting a narrative about the feel of the experience you're looking for is a great way to start making that connection with people, and opening their minds to the possibilities of an unconstrained creator's palette. Hinting at capabilities in the envisioned piece is an invitation for discussion and debate.

The flood gates open when you find yourself designing unconstrained, so don't slow down to consider if it's plausible just yet. You'll have many opportunities to refine and fill out the details of these initial explorations later. Keep exploring to capture more of those brilliant thoughts about where things could go.

Quickens Pace

Using envisioning early in the process to generate multiple directions and scenarios is a great way to set the pace for the rest of the project.

There's no question a quickly scribbled vision of how your hologram interacts with people would not be as useful to your Developers as a digital motion study or a fully rigged 3D model. That said, with just a bit more effort than a quick doodle, you can effectively portray many aspects of what you are going for in a convincing manner that delivers a tangible, plausible, and inspiring image of what could be. Doing so will get your team locked in much sooner than a whiteboard sketch of a hand wavy interface, and avoids the long delay of creating high-quality studies or assets. If it looks real, it will be real in people's minds. And that is where the real speed up comes from in the short term.

Making things real for your team enables them to accelerate quickly in their own roles.

Tells a Story

Marshalling support for innovative new ideas can sometimes be as easy as drawing the right picture or telling a compelling story. That's the realm and role of envisioning. It brings our dreams to light in ways we couldn't previously see or conceive of, and makes them real enough to inspire others to act.

CHAPTER 4

When Should I Use Envisioning?

“Wow. That can’t really be done. Can it?”

As Designers, we know an essential part of our job is to constantly push past the boundaries of what is expected to illustrate how things *could be*. Its role in our methodology is to challenge conventional thinking in the pursuit of a more optimal way of doing things. Anyone can project along a linear path. It takes a special kind of talent to make a compelling argument for something that can’t easily be seen. And even more remarkable when it persuades. That’s no small feat.

Envisioning gives us a way to accomplish just that, particularly with holograms.

Not only does this method paint a vivid picture of future possibilities, it provides the perfect platform to pose hard questions, raise concerns, and push engineering to consider doing a lot more than initially expected. Done correctly, the holographic visions we create in the pursuit of that brighter future can be packed full of challenges to conventional thinking. We can design them to intentionally provoke discussion and debate without being overt or offensive. The future is a scary place to the complacent. Envisioned scenes give us a way to safely talk about things.

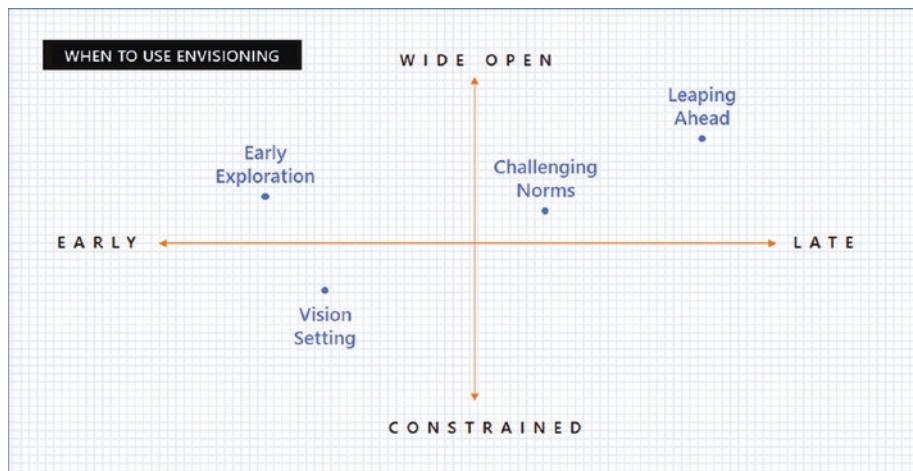
ENVISIONING HOLOGRAMS

The real question for us as the conversation starts is *when* do we have the best chance of having these engaging exchanges with people?

We can only influence and deeply affect the teams and organizations we work with at particular times. Development cycles, school years, fiscal years, and the rhythm of the business dictate some natural times for these presentations and dialogues.

Envisioning Opportunities

The most effective times to utilize envisioning are spread evenly throughout the flow of our work. Each has its own advantage in terms of impact and timing. The common thread throughout these times is the need to pose questions and challenge assumptions. The outcome of doing that successfully is moving people off their positions in times of traditionally predictable behavior. Pushing ideas for holographic experiences forward in these situations is difficult, but entirely possible when you focus on key aspects and insights.



Knowing when to use envisioning is key to its effectiveness

Each of the four situations outlined here have their own strengths and appropriateness for particular goals. They can certainly be used in combination, but be careful to identify why you are using each of them for your audience – whether that's your team or people you are evaluating the ideas with.

Let's go through each of the four envisioning approaches and situations, so you can see when they are most effective in the process.

1. Early Exploration

INSIGHT TO LEVERAGE: *Anything is possible at the beginning.*

TIMING: Very early

LIMITS: Relatively unconstrained

You'll find that people are most open to radical new ideas at the very beginning of cycles. There's a feeling of optimism, excitement, and possibility that wasn't present previously. The start of anything is a magical time for hopes and dreams. They are spoken out loud for the first time. It's the perfect time to spring into action and legitimately capture those ideals.

Articulated in compelling, impassioned pleas for something new, these explorations aren't constrained by technology, schedule, or resources. They are in many cases the most pure expression of what the team wishes could be.

Holograms are exactly what you need them to be in this phase – malleable digital actors or surprisingly realistic objects of fascination. Anything is possible at the start, so use that to make your points. Tee up the most controversial issues to get them out into the open. This is your big chance, so don't hold back. You'll be glad you didn't when finished.

ENVISIONING HOLOGRAMS

For example, I have been doing data visualization for quite some time. I find it extremely frustrating to not have access to highly fluid data exploration tools when initially working with a data set. More time is spent setting up the interface to display the data “just so” than looking for insights.

What if I could somehow bypass the cumbersome interface completely and just jump right into exploring the data itself? That’s a nice thought, but using traditional toolsets isn’t going to get us anywhere close to that. Conversely, by using envisioning techniques we can depict that possibility as realistically as needed to start a conversation. It’s still too rough to be taken as a definitive path toward the desired outcome, but it’s right there for anyone to ponder.



Envisioning lets us ask questions like “What if we could explore data by being inside it?”

Another aspect of doing early explorations for mixed reality is the need to research and understand how physical environments affect people. How do they interact with them currently? How do existing physical objects and places succeed or fail in a similarly functional design space? Observing people in today's scenarios is a great start here. Digging into the endless volumes of architecture, space planning, and wayfinding books is another excellent source of background research to help get you up-to-speed if that isn't your background.

And finally, keep in mind just how much flexibility you have in coming up with compelling scenarios and executions in this initial exploratory period. Use those for all they're worth in this phase to show people just how far we can go. Try to push the boundaries of what's expected by doing some explorations that are ridiculous, even by your own standards. Be bold. Be unpredictable. Be free.

Always remember that holograms are constrained only by your imagination.

2. Vision Setting

INSIGHT TO LEVERAGE: *We all want to shoot for the stars.*

TIMING: Still early, right after initial explorations

LIMITS: Fairly constrained

Envisioning is generally considered “of the future” and can easily feel more inspirational than accurate. When used to push off in new directions of exploration (many of which are entirely aspirational) we don’t have to be completely realistic to the current capabilities of the platforms or tools that currently exist.

ENVISIONING HOLOGRAMS



Showing the difficult, but plausible, aspects of a vision can really sell it

For example, in some of the aspirational vision work I've done there's an underlying premise that anyone can see the holograms in open spaces because they have been publicly shared and the technology used to see them is prevalent and frequently used. None of that is true today, but that's not the point. It illustrates a possible future we can all work toward, which makes this a shared vision. Holographic visions can help drive future behavior and investment.

Conversely, when setting the vision for a project (to inspire your team members and get everyone on the same page) it may be more advantageous to show your ideas more realistically, remaining true to existing capabilities and norms. This type of design is done to help people visualize something that has yet to be built, but makes it seem attainable without much issue. It's meant as a blueprint of sorts rather than an aspirational suggestion. The real difference between this type of envisioning and a more fanciful treatment of the subject matter is that

people can recognize its realistic nature and can connect the dots on how it comes to be.

Combining both realistic and futuristic aspects of ideas is my favorite way to work in this medium, as you'll see throughout my examples. You can combine established practices and capabilities with significant improvements to take your audience where you need the story to go. That could mean pushing on the technology aspects of projects and platforms, or to setting new ideas forth to explore interaction and engagement possibilities.

Envisioning is what you need it to be, realistic or fanciful.

3. Challenging Norms

INSIGHT TO LEVERAGE: *Being incremental gets us nowhere fast.*

TIMING: Midpoint of the cycle

LIMITS: Relatively unconstrained

One of the most effective uses of envisioning is taking people out of their comfort zone. There's something really powerful about getting people to a place where they can imagine a different path forward. That doesn't come easy, though. Whether illustrating a promising new direction or shaking up the status quo, the most difficult job envisioning faces is helping to challenge well-entrenched positions and norms.

For example, when it comes to interaction standards people have almost violent reactions to any suggestion there's another method that's just as familiar or comfortable. It's scary how deeply people dig in to defend prevailing methods when there are so many alternatives to consider. I'm not advocating change just for change sake, but let's take the

ENVISIONING HOLOGRAMS

opportunity to understand what other ways of doing things offer. You never know. A promising experiment one day becomes a de facto standard the next. I mean really – did anyone set out to make the hamburger menu icon a web standard for mobile? No. It happened because someone experimented with it.



***Why can't we get better previews of conference sessions?
And why not direct me there?***

The best response to people dragging their dogmatic norms from the past into the holographic future is using envisioning and prototyping to illustrate the better, more authentic way forward. Holographic computing is wide open for innovation. We should do our best to take advantage of that rare opportunity whenever we can.

Don't be different to be different. Be different to push us all ahead.

4. Leaping Ahead

INSIGHT TO LEVERAGE: *True competitive advantage is not u.next.*

TIMING: towards the end of the cycle

LIMITS: Unconstrained

This is my favorite type of envisioning by far. It relies on disconnecting from present day to embrace the distant future, and poses that golden question “What if?” without worrying about current feasibility. Its most powerful aspect for the Designer is the fearless leap into the unknown. Removing the constraint of today’s limitations gives us an entirely new palette to work with. Why bother doing something that’s just incrementally better than its predecessor with all that freedom? That’s just ridiculous, right?

True competitive advantage is not found right next door. It can only be spotted from the future.

Leaping ahead through envisioning transports us to where we wish we could be. It has limitless possibilities to influence and shape our thinking about today’s challenges, much like science fiction has done throughout the last century. Producing imagery, animations, or working code that takes us further than anyone thought possible given the prevailing technology or approach. It is transformational in situations where people feel boxed in and held back. It reignites the hope found at the outset of projects but often extinguished as time moves on and reality sets in. This type of activity is incredibly valuable just from that standpoint alone – returning the spark to our imaginations and pushing us to boldly fast forward to what’s five or ten versions out.

ENVISIONING HOLOGRAMS



What would it really take to get real telepresence? It seems close, but just out of reach.

Leaping ahead through envisioning can illuminate a clear path to our most definitive competitive advantage. Exercises like envisioning help to crystalize why we set off on a given path in the first place. There are particular attributes in any product or service that hold the key to true differentiation and separation in the marketplace. Isolating and amplifying those through the visual magnification of envisioning is a great way to get people thinking about what it would take to get there.

Pushing Toward the Impossible

Entirely new approaches emerge as a result of the push toward the impossible, or at least the improbable. Fiction becomes fact (or at least plausible). Knowing when to use envisioning to persuade and influence is an important part of your journey to being an effective Designer.

CHAPTER 5

Where Do We Start?

Follow the yellow brick road.

Given the general availability of devices and free toolsets for *Windows Mixed Reality*, now is a great time for *anyone* to jump right in and start experimenting with creating holographic experiences for mixed reality. Just one catch though – designing for mixed reality requires a completely different **mindset, approach, language, and skillset** than just about every other major computing shift that has come before it.

It's not just about being a great Designer or Developer anymore. There are new rules at play. Design fundamentals aside, there are some unique aspects to master about designing for mixed reality that have little to do with your past work.

The most valuable skill you can master is to learn how to forget.

Every new generation of computing platforms requires a shift in how we practice our craft. Most have to do with learning new patterns of layout, typographic usage, and interaction models. Mixed reality breaks the mold by causing you to throw everything you know about previous platforms out the window and reconsider it all. Really. Not joking. But, that's the fun of it – having to push ourselves into uncomfortable territory helps us grow as Designers. It's a bit humbling to be that unsure of the “right” way to

ENVISIONING HOLOGRAMS

proceed due to the counterintuitive nature of this whole endeavor. It seems we should know how to do this kind of design without trying very hard, yet the things we try first out of habit fail miserably. This is not at all like its predecessors.

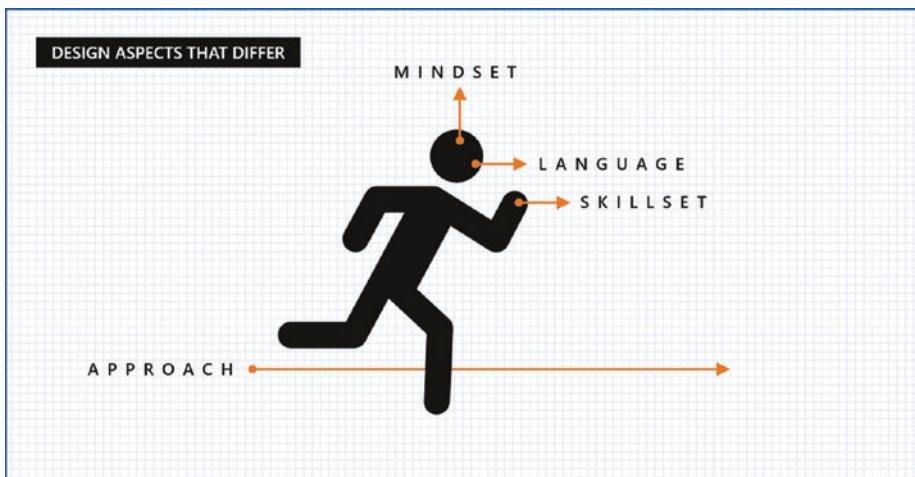
This new design space has more to do with how we interact with our physical world than with the digital world we've been building up over the last four decades. Holographic computing is all about leveraging our normal patterns of interacting with the real world as the primary interface. No longer do we map our intentions to well-defined interactions through a mouse and keyboard. We simply do what comes natural. That sounds deceptively simple, and it is. There are several deep aspects of this more natural interface we need to dig into.

Spatial awareness is chief among the new aspects we'll be wrestling with. It's amazing how unintuitive this one is at first. You'd think since we live and breathe all day every day in a three-dimensional world we'd have this one nailed. Not even. Stepping back and having to explain how you deal with the real world in 3D is much harder than just doing it. Trust me on this one. It's exactly the same as when someone asks you to explain how you know to crop an image just right or pick the most efficient design pattern when coding something. Your accumulated experiences over years and years have blinded you to how we actually accomplish these things - you just know instinctively how to get them done without thinking too hard. It's the same thing with spatial awareness. Learning how to embrace it is the key to interaction design for mixed reality.

The best way I have found to get better at spatial awareness design is to observe closely the world around you at every opportunity. How close or far are objects from you? Is there anything moving or making noise you don't usually notice? Can you see everything clearly?

As you get deeper into spatial awareness and experimenting with mixed reality design and development, you'll notice there are **four distinct aspects** of the design process that are quite different than anything you've done before:

- **mindset** – thoughts about this mixed reality space
- **approach** – actions taken when working on designs
- **language** – phrases and images we use to convey concepts
- **skillset** – abilities we use to execute our vision



These four aspects of mixed reality design differ greatly from previous platforms

Mindset

The best place to start when considering holographic design is trying to shift your own mindset to allow the ideas to flow freely and unconstrained by the past.

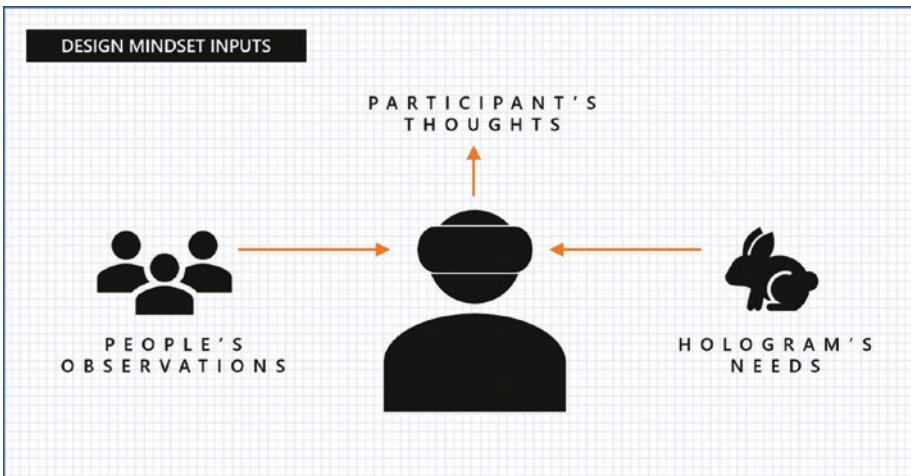
ENVISIONING HOLOGRAMS

There is no question you need to think differently than you're used to with Desktop, Web, Mobile, or Cloud models, but not for the obvious reason (i.e., 3D interaction). It's the people part that needs deeper exploration. Our role in this computing model has completely changed.

No longer do people click buttons, pull down menus, scroll through windows, or drag icons around a screen to get things to happen. You do exactly what you do in the real world – manipulate objects with your hands and voice. Direct manipulation is no longer a complex set of interactions using double indirection that requires layers of translation. Want to see something better? Walk right up to it. Not in the right place? Pick it up and move it with your hand.

This inversion of the classic software interaction model means we need to focus on how people respond to their new environment and input model rather than the mechanics of a standard GUI interface. That aspect of holographic design is very similar to tackling the new *conversational interface* paradigm. Being completely voice based is a drastic departure for a visually oriented interface Designer. You can no longer rely on clever visuals to assist. Audio cues and spoken responses are your only feedback mechanisms. This seems deceptively simple at first, but nothing could be further from the reality of designing for voice input. It's a tough mental shift to make and lock into.

You'll find a similarly challenging mental switch when taking on holographic design. It requires imagination and empathy to put yourself inside other people's thoughts, motivations, and expectations when they're immersed in your scenarios. They are deeper into experiences than ever before. That's a big responsibility. It takes reconciling the observations you make when mentally switching between thoughts of the participant, your role as an observer, and the qualities needed by holograms themselves to get this right.



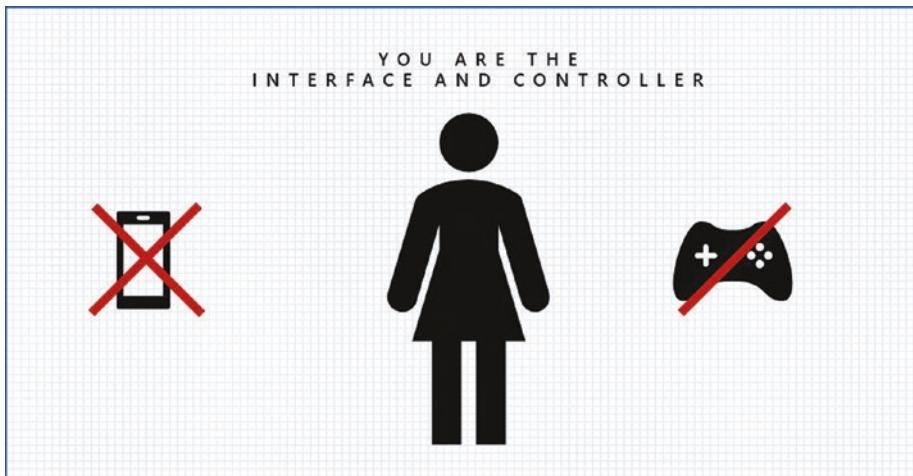
The mindset required for holographic design revolves around these three inputs

Our mindset for holographic experience design has to be grounded in how we act in our physical spaces. This is not an artificial layer to interact with. It becomes part of the world itself. Our goal is to inject new elements that cannot be found in reality to create true value for the people who trust us with their time and responsibilities. Someday, our mindset will dictate that holograms are integral to our experiences. In time, we'll forget it didn't exist in this way before.

Approach

If we look closely at how high-tech products and services are traditionally created, we can identify a repeatable process that has yielded decades of successful ventures. Start by identifying a painful problem, figure out how to help reduce the pain, cash the checks. Easy. The approach for this new paradigm isn't quite so straightforward.

ENVISIONING HOLOGRAMS



You are actually at the center of everything in mixed reality

Very few of us have mastered using the room itself as the interface and ourselves as the controller and user interface (with the exception of avid Xbox Kinect game players). Almost everything before this has been all about controlling what's behind the glass—now we find ourselves sharing physical space with crazy digital objects. You need to mentally pivot to design completely outside the glass in favor of being completely integrated into your physical world.

Historically, the way to approach this type of design would be from the “user” perspective. That’s how we’ve always done things in experience design. Figure out how the person will want to do whatever it is we’re designing, then optimize all of the user interface layout and interactions around that experience. The interface and user are separate things. Simple enough.

Conversely, the best way we have found to approach this holographic design exercise is to put ourselves in the middle of the action – “be the ball.” We need to figure out what the hologram itself needs out of this exchange.

Weird, right? Why would we want to empower the thing we'd normally think was completely under our control and beholden to our commands? Great question.

This new approach is based on a very personal interface with the things that share our space. We need to connect with those things that we previously took for granted as merely objects. They were owned or mostly unimportant. Conversely, holograms are just as real as we want them to be. Therefore, we cannot assume they don't have needs, expectations, and even feelings. That's the big difference in the approach from previous generations of computing platforms to holographic.

Our new approach starts with trying to consider holograms as equals, regardless of whether they represent inanimate objects or living creatures. This is where empathy comes in. Something that is a non-living thing in the real world can very much be a vibrant and significant entity in the holographic world. Putting ourselves in the place of a hologram is a very different approach to working on interfaces. You'll be surprised at how many innovative ideas you come up with by empowering and enabling the holographic actors in your scene to be more than what they appear to be visually. For example, things we consider simple tools can be humanized to feel like helpful friends or professional assistants instead of just objects to be picked up and used normally. They should not be expected going by initial appearance, but a pleasant surprise within the experience.

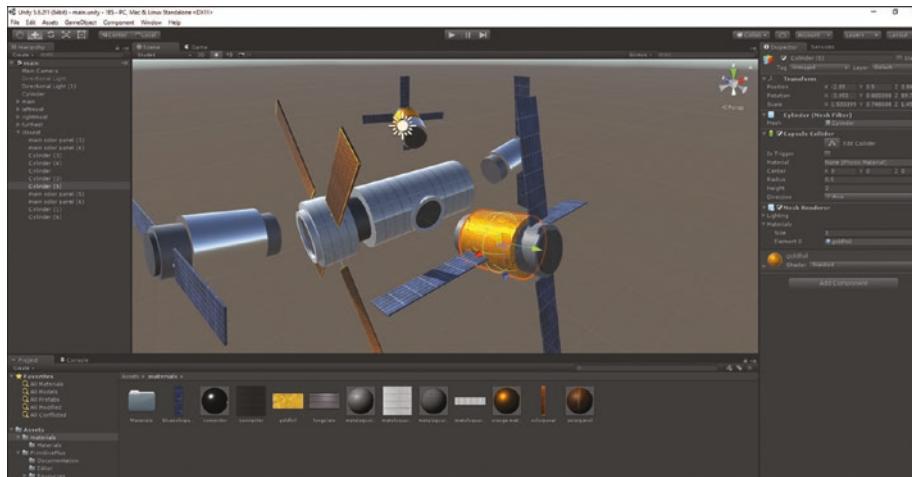
Language

To express yourself clearly in this new field, you'll want to get comfortable thinking and acting in a three-dimensional space. There's really no getting around that. You know this is true from your own experiences abroad. Practicing to speak a foreign language in the classroom or reciting phrases in your head as you listen to a language tutor on your smartphone is not

ENVISIONING HOLOGRAMS

at all like conversing with a native speaker in another country. That part of becoming fluent in 3D is just like learning a new spoken language—you learn by trying it out in the real world and making a few embarrassing gaffs along the way. Everybody has the same experience when trying to converse in a new language.

A great way to get comfortable with the language of mixed reality is to dive into using a 3D creation tool like *Unity*. Very popular with game and virtual reality developers, you'd be hard pressed to find a better introductory toolset. It's a bit technical looking at first to someone who hasn't coded or done any modeling, yet you'll find it is quite approachable and easy to get results. The time you can spend getting a basic understanding of how people fly these tools will pay huge dividends in being able to discuss your thoughts in terms of a composed 3D scene using objects, planes, lights, materials, motion, and behaviors.



The Unity toolset is a great way to get started with creating 3D experiences

The language of holograms is a unique dialect of 3D which has its own flow, idiosyncrasies, and accents. It has a specific vocabulary and way to describe interactions. We'll talk about how holograms can be interacted with using gaze, gestures, and voice a bit later. For now, it's good to know that a similar language comes from theater and film direction. Mastering how to describe the thoughts and actions of holograms can be thought of as a director filling in an actor on their motivation for a scene.

All this said, let's be honest here and point out this language is still evolving. The obvious problem is that you can't go out and purchase *Conversational Mixed Reality* from Amazon to learn how get in synch with your holograms or audience. Fluency in this new language comes over time as you jump in and practice.

Skillset

At this point, you're thinking I'm going to say that learning how to model and animate 3D characters is the most valuable skill you can learn to bring your holographic ideas to life, right?

Well, that's a great guess. I can't argue that having that production skill wouldn't help things move along more quickly for any project. Modeling and animating sequences would be the most direct way to express your ideas about how holograms will interact with people. And it gets you closer to a final implementation.

But, modeling is really not the most important new skill to master for holographic design. **Storytelling** is.

If you haven't needed to learn how to make an emotional connection through your verbal storytelling or visual storyboards I'd start there. Just as in filmmaking, being able to explain how the story captures the attention of

ENVISIONING HOLOGRAMS

the viewer is a foundational skill for anyone on the creative team. Making that emotional connection with the audience and explaining how it is achieved through story and action is a skill we can all use regardless of our role on the team. A great way to master this is by hand drawing storyboards that illustrate the scenes. It doesn't have to be professional quality, the sketchier the better actually. The point is to convey the connection. That's what it all revolves around with holographic design - how you engage the audience and capture their imagination.



The most important skills to develop for doing holographic design

Secondarily, learning how to **quickly sketch in 3D** is pretty useful. There are a number of ways to do this – paper drawings can be used, but VR sketching apps and coding directly in Unity are the most popular ways to dimensionally capture your best thoughts on how things play out in mixed reality. The goal is to show other people what you are thinking about the setup and subsequent interactions, so don't worry about it being perfect. Just get the point across and move on. These sketches will capture the essence of what you are after, not the fine details. So, let it flow. Be quick. Be brilliant. Be done. Move on.

And finally, an incredibly helpful skill to master as we enter this new world of mixed reality is being a great participant. **Jump into the headset** as often as possible so you know what's possible and what's desirable. There's absolutely no substitute for being there. Get right inside an augmented world someone has created for you to interact with. You will always find new things to consider about the decisions made and the promise unmet. No amount of thought, discussion, or debate will inform your ability to design breakthrough holographic experiences than being able to relate what you are going for to known examples.

There's also no amount of projecting based on past experience that will work for you here. Imagine you are asked to describe how it felt for astronauts to see the Earth below them during a spacewalk. You can probably approximate the feelings, but I'm guessing anyone who actually had that experience was forever changed by the majesty and overwhelming sense of awe of being there. No one can conjure that amount of authenticity and be believable. Get in there and relate your own feelings of being in mixed reality with holograms.

Just Do It

Spending too much time figuring out which of the four areas mentioned above to start with when designing holographic experiences is kind of pointless. Just jump in anywhere. It really doesn't matter in the end. What does matter is that you are actually doing it, not just thinking about it. If you gravitate toward the storytelling aspect that's an awesome and valuable place to start, but diving headlong into creating 3D scenes as working prototypes for your ideas is equally great.

Next up, we cover how you can use the envisioning methodology to make some quick progress.

PART II

Envisioning Holograms

CHAPTER 6

Shifting Your Mindset

Seeing is believing. Or is it?

Being able to imagine something that doesn't exist is one of life's greatest gifts. We are all born with this ability. It's an integral part of our minds growing and developing. As young children, our imaginations are working overtime, providing us with everything from new play friends to scary monsters. We are instantly transported to faraway lands and magical times. Plastic sand pails turn into medieval knight's helmets. Our stuffed animals have invisible friends who love to share secrets. Our developing minds are constantly questioning, probing, projecting, and remembering fragments of experiences. We are both imagination engines and interrogation machines at once, to the utter frustration of the adults in our lives. The mind is an amazing thing.

Then one day some time in our young lives we are told to stop making things up.

Until then, there was probably no reason to think what we imagined to be true, or wanted to be true, was anything but good. It was natural and second nature. Unless adults thought our imaginations were getting us into trouble in some way, our daydreams and night visions were every bit a part of lives as the real world itself. But, in that moment of being put on notice that imaginary things had no place in the real world, our thinking changed. It was simply not right for those things to be more important than what was right in front of us.

ENVISIONING HOLOGRAMS

And since that time, many of us haven't allowed ourselves the pleasure of dreaming our days away. Imagining became a seldom and solitary escape, not an everyday norm.

That's a problem for us. In order to envision the possibilities of mixed reality, we need to get back to those days of free imagination. We need to shift our mindset from the worries and constraint of the present reality to the excitement and wonder of the possible future. It's time to ignore what is, and get onto what could be.

Envisioning is how we get back to the impossible.

Letting Go

I know what this is going to sound like, but there's no way to get around it. To be great at designing holograms you have to let go of the past. Completely.

Envisioning breakthrough experiences will only come when you free your mind of all the bias, process, constraints, assumptions, and assertions you currently work within. To truly embrace the future takes the courage to turn your back on the past and its baggage. It really doesn't apply anymore. This is a whole new deal.

We can't drag the mistakes of the past into the dawn of a new era.

What we can do with the past is remember the lessons we learned along the way to getting here. Just do it. Trying and failing is natural. Practicing is nonnegotiable. People will always surprise you. There's a

million of those hard-earned lessons to pull from. Just don't think that the mountain of knowledge you have from that previous era still applies. It doesn't. For all intents and purposes, you are starting over.

Just like a skateboarder learning how to snowboard for the first time, there are some basics that are universal to help you make the leap (falling hard, for example), but for the most part we are explorers charting our own path through the next frontier. So little is known about what's "right" for this new space, it is ridiculous to think we'll have this figured anytime soon.

The best we can do is relax, let go, and drop in.

Seeing the World

Another key mindshift to make is in how we perceive our environment and everything in it.

The envisioning process starts with consciously observing the world around you. Sounds obvious, but trust me, it's not that simple. It takes practice to be very observant and conscious of how things appear and behave in the real world. There are so many subtleties, so much incredible detail. Most of it is lost on us each day. Just whizzes right by.

Try it for yourself. Go outside and pick anything natural to look at. What you'll notice if you allow yourself time to truly see it, is an almost impossible to comprehend amount of beauty, color, shape, composition, material, lighting, and shadow. So many aspects to consider. How do we move through our lives without noticing all this?

ENVISIONING HOLOGRAMS

Now compare the natural to man-made objects. The patterns are different, but in some cases just as beautiful. We humans are not without talent. Yet in other cases, the things people make are hardly worth a second look.

The day you start trying to really see the small things we often overlook is the day a whole new universe of possibilities opens up to you. In those moments you gain the skill and clarity to envision breakthrough interactions. Why? Intently trying to see details frees the mind from the current condition and lets us focus. What a gift to not use more often.

A former Design manager of mine taught me an easy exercise that brings the value of purposeful seeing to light almost immediately. He challenged me to randomly choose something new to deeply look at on the way to work each day. That could be a leaf, a tree, a building, a person, something in a store window, an animal – it doesn't matter. What's important is that you identify an aspect of the entity that you never noticed before. And if you continue to do this exercise every time you go somewhere, you'll soon realize that we're almost always on autopilot when it comes to our environment.



Notice the incredible amount of detail in the fur icing of these cupcake creatures

Ask any experienced Designer how they get better at their craft and they'll tell you a big part is developing the ability to recall how things look and act when they're not right in front of you. It's something to constantly work on since it's a fundamental and indispensable skill in this field.

Time to break ourselves of the ridiculous habit of taking our physical world for granted.

Being the World

Understanding how people and things feel and what motivates their actions (and reactions) is invaluable to designing breakthrough experiences. I equate that to *being* them. We need to become the holograms we design to genuinely understand the world they exist in. That takes some empathy, immersion, and creative thinking to pull off.

ENVISIONING HOLOGRAMS

A bit later in the book we'll dig into a very fun and effective technique to gain insight into how it feels to be something else. We'll literally become a hologram through casual acting and improvisation. Putting ourselves and our collaborators into situations where we are physically interacting with holograms and the space they inhabit gives us feedback that no real-time telemetry system or instrumentation of any kind yields – the human factor. Better understanding feelings and emotions play a huge role in taking the perspective of someone or something else in our envisioning process.

For now, let's focus on a few key aspects of becoming what we are modeling.

Empathy can be built by simply observing how things behave in their natural environments and seeing if we can put ourselves in their places. Start watching birds takeoff and land out your window. Quietly observe how your child plays with their pet. Try contemplating what that lamp thinks about all day as it collects dust. Put yourself in someone else's shoes for a while and see how they'd view you through their eyes.

Actions speak louder than words they say. They are the result of stimulus. Regardless of the thing you pick to observe, you'll notice that everything behaves in its own way. Even more interesting is how they act when they're engaged. Getting in tune with how state changes work and the actions they elicit will help us nail the design experiences that truly move us. Remember that holograms can be as active or passive as you want them to be. Shifting from one state to another heightens our awareness. That's when things get real. Signature moments emerge from these shifts and subsequent actions.

Behavior is a complex thing to tackle in preliminary design exercises. We know there's both an instinctual and learned part of behavior. I'm not even going there. It's enough for now to start off just being a good

observer of basic behavior and perhaps the motivation behind it. We need holograms to behave in expected ways given familiar situations. Yet, there's an opportunity to have them surprise us when we least expect it. Behavioral modification is completely possible using machine learning and artificial intelligence, so why not think about how things can learn over time to enhance the experience.

Motion is precisely why we needed to invent slow motion. It's utterly fascinating how much we miss of even the simplest motions when they happen at full speed. Think about those ultra-slow motion shots of bees landing on flowers or wild beasts attacking each other. Riveting. Never mind understanding how the actual physics work, just watching all the movement closely is insanely intense. We could spend years studying the intricacies of movement, but for our work with envisioning it suffices to be able to remember and depict approximately how things move.

Finding Inspiration

Training your mind to look deeply into the real world is only half of the envisioning equation—the other half is the ability to come up with fresh ideas on demand.

Spontaneous idea generation is a bit tougher than it sounds because you need a certain amount of inspiration to spark the imagination. To find that inspiration at will, you'll have to let your mind wander more than usual. It's not like a casual daydream though. It's a purposeful, directed conjuring of imaginary things on a regular basis. Perpetual hallucination is a bit too far. Seeing the unexpected from time to time is just right.

We'll use the real world for inspiration whenever we can (because it's right there). Let's start practicing that by looking around wherever we happen to be right now. People will probably think you're weird for staring

ENVISIONING HOLOGRAMS

blankly into space, waiting for something to move you, but whatever. Pretty soon holograms will start materializing out of nowhere. Your imagination makes them appear just as you want them to be, and perhaps even more intriguing than we'd ever be able to produce. Never mind the skepticism. Conjure at will. You'll find that once you start exercising that imagination muscle it gets to be second nature and incredibly fun.

The ideas for many of the best holographic experiences come from ordinary objects and situations in the real world, not the digital realm.

Hearing that we'll mostly use the physical world for inspiration can be counter-intuitive and a bit off-putting to the new holographic designer of digital objects, but it's true. You'll realize that even the wildest digital ideas are somehow rooted in the physical world. That's how our minds work. We're observers and extrapolators.

Amazing how we can find inspiration even in the most mundane of places.

INSPIRATION EXERCISE #1 - TRANSITION

Let's take this very ordinary scene from a doctor's waiting room for example. What unexpected things can you imagine happening within this space?



What if that sea turtle wasn't trapped behind the glass?

You could easily imagine that giant sea turtle being shown in the television screen somehow escaping and starting to swim through the waiting room air right in front of us. Our minds make that relatively easy to do. But, how would it move exactly? What color would it be? Where are its friends? What does it sound like? Is its shell clean or beat up? How fast does it move? Does it look realistic or more like a garbled video projection?

Chances are unless you live in a region where sea turtles come up onto the beach to sun themselves, you'd be hard pressed to answer any of those questions. Conversely, if you started practicing being truly observant of things in the physical world, next time you were driving along a beach road in Hawaii and saw one of these magnificent creatures parked on a rock in the sun you'd surely be mentally cataloguing all of the details of their appearance and behavior for the day when you were asked to describe it all as a hologram.

ENVISIONING HOLOGRAMS

Regardless of whether you ever get to see a giant turtle in person or not, remember that everywhere you go is another new opportunity to observe and dig into the possibilities.

INSPIRATION EXERCISE #2 - TRANSFORMATION

Let's practice that envisioning inspiration exercise again. This time we'll use something that's inanimate as our subject and see if we can bring it life.

What do you see when you look up at this ordinary emergency light fixture?



This emergency light fixture looks like what to you?

Right! It's a chameleon-like robot. I bet you can imagine it leaping down off the wall and jumping around on the floor with you just like charming chameleon robots do, right? OK, didn't think so. But, I saw it. And it was awesome.

Now, I can't see anything but that chameleon creature when I look at that light fixture. It has become something memorable and fun to me. Would be easy to act out how this thing behaves on the floor, or even quickly sketch out what it looks like. Of course, it is. And all of that is possible because my imagination took me to the place of thinking this was real enough to see without the aid of any technology. Our brains are amazing things, indeed.

Now for the real question. Could I describe this vision and experience to other people? Would they believe me? Could they see it, too?

Chances are you would convincing describe what you've seen well enough for others to see it, too. Wouldn't necessarily be your exact vision, but close enough to enjoy talking about together.

INSPIRATION EXERCISE #3 - APPEARING

One more time. There are situations where you encounter somewhat empty spaces and start to wonder what types of holograms could fill them. Perhaps it's the lack of people. Or maybe something just feels off. Whatever it is, your mind will start to fill in empty spaces with things that seem to appear out of nowhere. One minute the space is empty. The next it's full of something that clearly was not there before.

ENVISIONING HOLOGRAMS

Let's give this a try. What do you imagine is in the atrium beyond the glass of this lobby?



What hologram do you see behind the glass wall? Me too ;-)

Correct! There's a dinosaur as big as a house right on the other side of the lobby glass wall. It keeps shuffling, taking little steps, shaking its head around, and occasionally roaring louder than I'm ready for between bites of the leaves on the trees. Guess it's hungry. For me.

Oh, wait. You weren't seeing that until I mentioned it? My bad. What was there? OK. You went a different direction on this one. And that's fantastic.

Think you get the idea. Holograms can be anywhere. Holograms can be anything.

Wherever you happen to be throughout the day, take the opportunity to imagine what's missing from the space you are in or what would be a

really pleasant surprise to encounter there. You'd be shocked at where your imagination takes you without trying very hard. The key is to let your mind go where it wants to, just like when you were a young kid. This is all part of the mindshift we need to make to get comfortable envisioning holograms in the real world.

Adding or Augmenting

One of the finer points of envisioning is how holograms are used within a space.

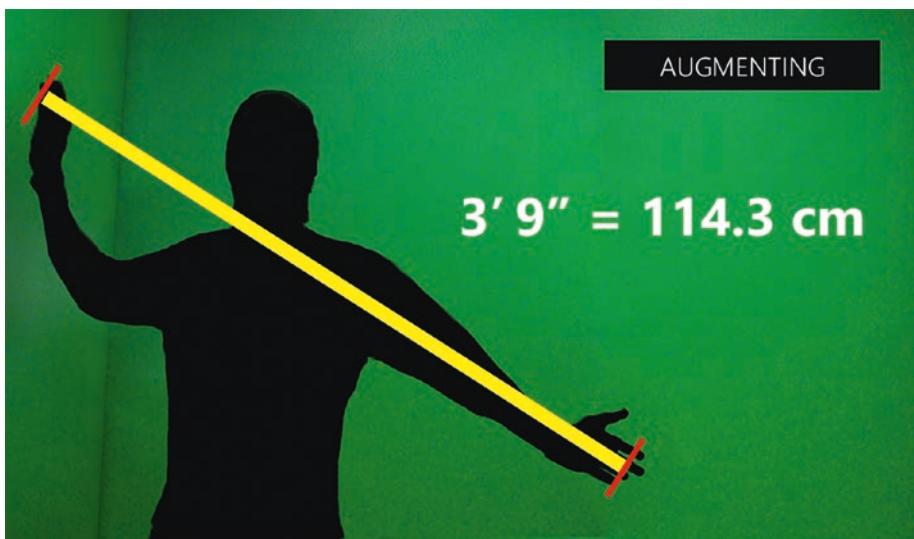
Making whatever you desire appear on demand gets to be easy over time, but there is a bit more to this space filling than merely conjuring at will. You want to be thoughtful and purposeful in how the different holographic elements are combined within a room. Although we need to consider their position and layout, it's more interesting to talk about their function and presence.

Two methods of injecting holograms into a space are *adding* and *augmenting*. To me, these are quite different and used for particular reasons. Some would consider the difference between them a very subtle distinction, so it's worth talking about here.

Augmenting existing things with holograms should enhance them. It's a great effect to see something floating on or near an "ordinary" thing, but not all that shocking given the number of times this is depicted in sci-fi movies. In the real world you'll see good examples of this method in many Augmented Reality (AR) systems, where they typically layer additional information on top of the real world to help you have a better understanding of something. That's cool, but I actually find that pretty boring and an old vision of how to use this technology.

ENVISIONING HOLOGRAMS

Given the ability to accurately place holographic objects on and near people and objects gives up the chance to do more than tether floating information cards to things. We can explore what it means to augment the real world with amazing new elements.



“Augmenting” with holograms enhances an existing person or object

The important part to note is that augmenting amplifies what's already there. We're not putting an entirely new thing into a space, we are supplementing what we can already see.

Adding new elements to a space using holograms will generally be more of a surprise to people, which is a great opportunity to blow people's minds. They probably weren't expecting something to appear in that way, so it's all new to them. The trick is mixing holograms into the real world in such a way that truly feels integrated and right. Even with great tools and some experience, that's easier said than done.

Choosing to add a hologram to a space changes that environment digitally, sometimes in a dramatic fashion.



"Adding" holograms to an environment brings in independent new elements

Key with adding is that the object or character is self-contained and not reliant upon an existing element to exist. Added holograms blend in and are perfectly fine as tiny bumble bees as well as huge automobiles. The effect of adding is to bring something new to interact with.

We'll end up blending both of those techniques into a seamless experience fairly often, and in fact that's a hallmark of some of the best holographic experiences—they bring something new, but behave in an expected and seemingly natural way.

Always On

For me, seeing holograms where they don't exist is something I can't turn off that easily. My mind naturally wants to fill empty space with holograms now. It's so easy to do and often happens without consciously thinking about it. Occupational hazard I suppose. Perhaps this book should have come with a warning sticker.



Once you start, it's hard to stop imagining how holograms can impact environments

You'll find that as you move through life with these thoughts of filling spaces with holographic actors, scenes present themselves to you like freeze frames in a bad 80's music video. It will be a sudden realization that a room or area has holograms in it already - it's just that no one can see them except you. Or conversely, you have a nagging feeling that a space is calling out for holograms of some sort. You just can't quite put your finger on what type yet.

As an example, I walked into a hotel one night and saw this empty lobby. I started thinking to myself in passing how it felt so cold despite being a really nicely designed space for people to use. There was no life in it at all that night.



Such a beautiful space, yet so empty

I was in a hurry to get somewhere at the time, so instead of stopping to figure out exactly what kind of holographic scene I'd love to see happening in there, I just pulled out my phone and took a quick photo. Didn't think much about it at the time.

Some days later, I looked back at the photo and it came to me. What was missing that night was the sense the hotel was active and alive. People were choosing to hang out in the lobby because it was so cool in there. They wanted to be in there relaxing and enjoying themselves.

Here's what that new scene looked like to me.

ENVISIONING HOLOGRAMS



Why can't this lobby be full of live music and dancing holograms?

Instead of just a gorgeous modern lobby full of empty chairs and well-lit plants, we see a bunch of people in there enjoying some live music courtesy of a holographic DJ and their spirit dancers. There's even a super cool fire pit for people to virtually warm themselves as they dig the show.

That's the kind of lobby I'd want to hang out in. You?

Goes to show that even with our new habit of constantly looking for holograms in new spaces, it sometimes takes a bit of time and focused thought to create those truly memorable experiences that best fit a space.

The key to finding new areas to explore is keeping your own personal holographic generator on at all times. The more you try these mindshifting techniques, the more you discover.

Realistic or Futuristic

It's important to note as we talk about filling spaces with holograms, that by its nature envisioning does not have to be completely realistic. It doesn't even have to adhere to the current capabilities of the platforms or tools that currently exist. Envisioning is generally "of the future" and as such can feel more inspirational than realistic.

For example, in my *HoloScenes* series there's an underlying premise that anyone can see the holograms in open spaces because they have been publicly shared and the technology used to see them is prevalent and frequently used. None of that is true today, but that's not the point. It illustrates a possible future we can work toward. We project that someday it will be true, or at least we want it to be, so that's enough to base our work on.

Fanciful or futuristic explorations are the hallmark of envisioning. We let our thoughts go where they want to, without constraint, to see where they lead us. This path is expected and encouraged.

Conversely, envisioning can be used to show your ideas quite realistically, remaining true to expected behavior, existing capabilities, and social norms. This type of design is done to help people visualize something that has yet to be built. It's meant as a blueprint of sorts rather than a directional suggestion. The real difference between this type of envisioning and a more fanciful treatment of the subject matter is that people can recognize the realistic nature of it immediately.

Combining both realistic and futuristic aspects of ideas is my favorite way to work in this medium, as you'll see throughout my examples. You can combine established practices and capabilities with hopeful improvements to take your audience where you need the story to go—whether to push on the technology aspects of the project and

ENVISIONING HOLOGRAMS

platform, or to set new ideas forth for interaction and participation possibilities.

Envisioning is what you need it to be, realistic or futuristic. Both get us to the places we need to be in order to share and discuss ideas with other people.

Capturing Thoughts

In the case of being more realistic with your explorations, you don't need to perfectly visualize and exhaustively define things upfront in holographic to successfully communicate the concepts—just the opposite in fact. Since speed is the key to moving your idea forward, doing a hand drawn sketch or crafting a narrative about the *feel of* the experience you're looking for is a great way to start the envisioning process.

You'll have many opportunities to refine and fill out the details of initial explorations, so don't slow down in when you need to capture that brilliant thought about where things need to go.

Conversely, if you have the skills to jump in and capture your thoughts in code, 3D models, or high fidelity mockups go for it! That runs counter to traditional design methodologies of staying low fidelity at first, but there's nothing traditional about holographic computing.

There's no "right way" to envision your ideas. Just do it fast and keep moving.

Shifting Your Mindset

Shifting your mindset through all of the above methods gets us ready to start actually working on creating tangible artifacts and sketches to share and discuss with other people. The next section goes into the many different ways to get there quickly.

CHAPTER 7

Choosing a Technique

“Whatever works” is the best way.

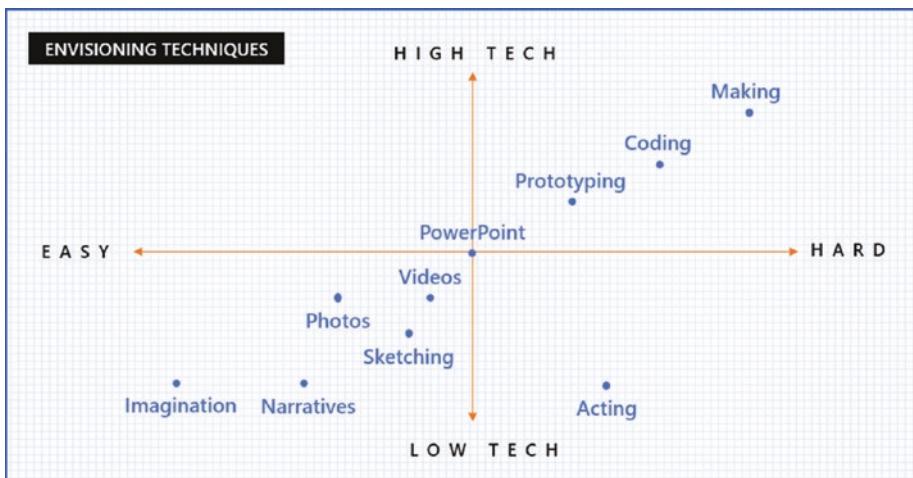
When it comes to capturing our best ideas, anything goes. There's no right or wrong, most efficient, or best way to do envisioning. Any method that lets you quickly convey what you are thinking to another person is the correct way to proceed.

Don't listen to anyone telling you they know the best process or methodology for prototyping mixed reality experiences – there is no “right way.” This whole field is evolving so quickly we are best off using whatever is available and makes sense at the moment, rather than making a huge investment in just one technique. Our time is better spent trying out as many approaches as we can in the quest to find that sweet spot that feels right and gets the job done.

Since envisioning is all about capturing and sharing with others, I think you'll find these techniques are generally the most useful (listed easiest to hardest, which also happens to be quickest to most time consuming):

ENVISIONING HOLOGRAMS

- **Imagination**—no work required. Just think and it appears.
- **Narratives** — verbal storytelling is a great way to make a real connection.
- **Photos** —my method of choice, and the one we'll dig into below.
- **Sketching**—fast, but not as impactful as other methods.
- **PowerPoint** —a Designer's secret weapon; highly underrated.
- **Acting**—channel your best TV sitcom acting skills.
- **Videos**—super bonus points for doing this one; huge payoff.
- **Prototyping**—leverage the medium's devices to portray experiences.
- **Coding**—the best way to bring ideas to life if you can do it.
- **Making**—combining hardware and software to create new possibilities.



Envisioning techniques cover a wide spectrum across ease and technology

Let's quickly spin through these methods to see where their strengths and challenges are. They range all the way from being incredibly simple (where no technology of any kind is needed), all the way up to requiring a room full of specialized hardware to achieve good results.

Imagination

The easiest way to get started with designing engaging holograms for mixed reality isn't what you'd think of first. Almost all design endeavors start with hand sketching of some sort, whether that's for a website, new console controller, self-driving vehicle dashboard, or a movie scene. That really doesn't help us much with holograms. Your mind is a much better sketchpad than our tried and true method of putting pen to paper.

I know. It doesn't seem like using your imagination would be better than sketching onto paper to envision something. Yet, that's the case. The problem with sketching is that we can't replicate how we feel when we

ENVISIONING HOLOGRAMS

experience things when they are confined to paper. It's one of those things that is just easier to imagine than capture on paper.

By letting our thoughts guide the design rather than our hands, we get much further, much faster. When you let go and see how things unfold, there's a freedom that can't be matched with existing tools, regardless of their type. The mind is without question the fastest, most high fidelity sketching tool we could ever hope for. Someday, perhaps our thoughts will be synched with some technology that can record and present what we think in real-time. Until that time, our own imagination is the optimal way to envision.

Your own imagination will always be the highest fidelity, most vivid, best simulator of breakthrough holographic experiences. Use it.

Thoughts flash into our minds when we least expect, and often not at all when we are trying our hardest to summon them. Ask any musician what happens when they sit down to write a hit song. They'll all say the same thing - nothing. You can't force genius, just like you can't be brilliant on demand (all the time that is ;-) When those flashes come, you often enjoy the moment, but don't think about capturing it. Some writers say they keep pen and paper near their bedside in an attempt to snare fragments upon waking from a dream. In our case, your best bet is to focus hard on immediately *replaying* in your mind's eye the amazing holograms you saw.

The difference in how we apply this technique to envisioning compared to trying to recall a memorable dream is the need to remember the detail. Some people are incredibly good at recalling the weirdest small details from their night visions. It seems odd to those of us who don't have

that capability to describe exactly what we saw unfolding. Many of us can't even remember if we were dreaming or not. And still other things are too pleasurable or ominous to replay in our mind's eye immediately upon becoming conscious enough to realize we were dreaming.

Knowing that our own imagination and wildest dreams are the quickest route to conjuring rich holographic experiences, we have to figure out how to play back detail from our visions. Fortunately, it is something that can be practiced. Starting out simply, we can train our minds to give us the detail we need to move from hazy impression to fully formed idea.

Let's try an experiment to simulate waking from a dream where you imagined something that startled you.

As you read this, imagine a giant boulder just off to your right. When you glance over at it there's nothing unusual about it. Yes, it's a big rock, but there's nothing notable or unique about that. Or is there? Notice how there are a lot of different colors within the incredibly rough texture of its outer surface. The size of it makes you think about its mass and weight. Could it easily crush you if it rolled the wrong way? Come to think of it, that boulder looks a little unsteady because of some pebbles and shifting dirt at its base. Wonder what would happen if it broke loose and started to roll. Oh! That's why I woke up startled. The boulder did break free and started to roll right toward me just like that scene in *Raiders of the Lost Ark* where Indiana Jones almost gets crushed. He had to run as fast as he could to avoid it. Now that the details are more clear to me, I could probably convey them to someone else. Got it.

Guess what? This is exactly the same exercise we did earlier where we trained our eye to see things more purposefully. We just took it a step further by sourcing it from our own imagination rather than reality. Training ourselves to effectively focus our thoughts into a form that can

ENVISIONING HOLOGRAMS

be shared with others is critical to envisioning. Conjuring detailed visions on demand is a skill to practice and lean heavily on as we move forward through the envisioning process.

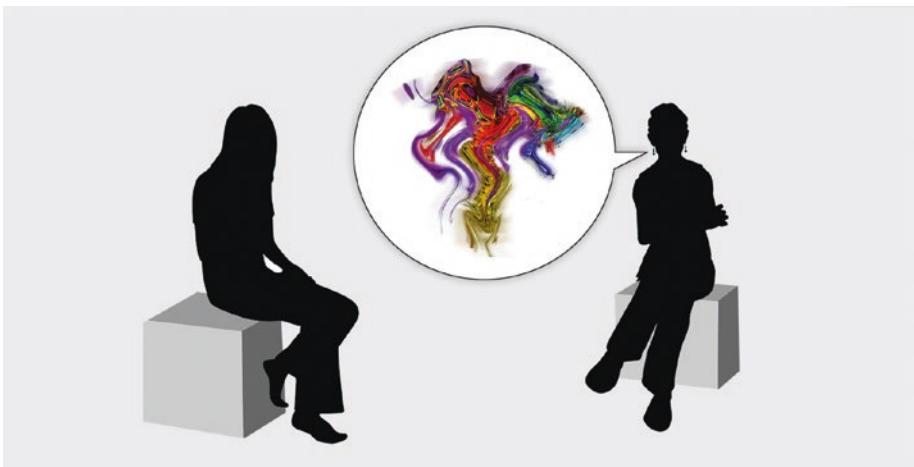
Narratives

The other way to quickly envision and communicate your ideas for incredibly cool holograms is to simply tell a super detailed story about them. For centuries, people have been able to convey the most memorable tales using just words. Some of us have mastered painting such vivid picture in the listener's head that they can literally see it, just as if they were there. Motion pictures closed the loop on this capability in recent time, but the art of verbal storytelling and crafting narratives can still serve us extremely well for envisioning purposes.

One of the best times to envision through storytelling is when you know there's a narrative arc or long sequence you'll be taking the listener through. Be aware of complicated storylines or scenes that require some detailed explanation to fully appreciate.

The real advantage to using a verbal narrative is a bit of a cheat – you can customize and change the story depending on who's listening.

It's a time-honored tradition to engage the audience by making connections they can relate to. The act of listening creates an opportunity for them to participate in their own way, experiencing the story in their own minds, intertwining their own history into your narrative.



The act of verbally telling stories to conjure specific imagery is quick and effective

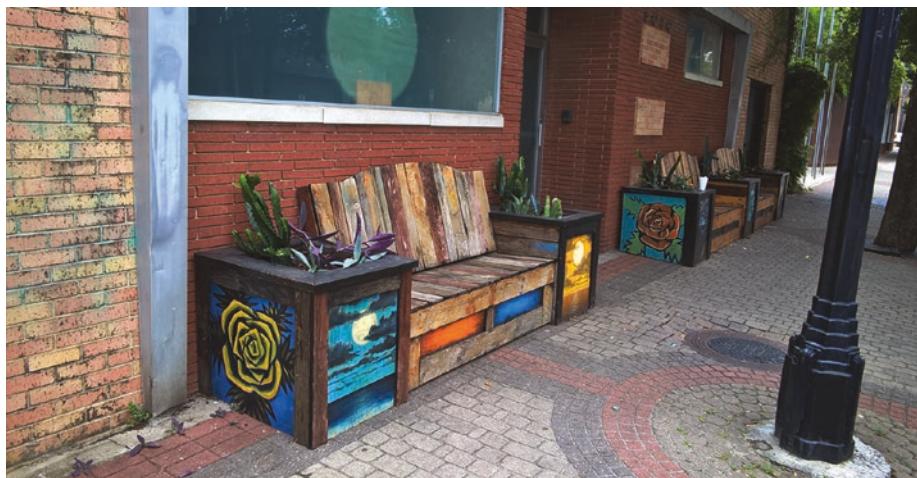
Writing out narratives is another great way to land a compelling story, and just as valuable as speaking to an audience. Some people have trouble as verbal storytellers, yet excel at crafting compelling stories through words. If that's the preferred way to work, go for it. A great written description of how the holographic experience will unfold can conjure imagery for people as well as visual artifacts if we get the key impressions across.

Photos

Taking photos of interesting real-world scenes you come across is the best way I've found to jumpstart the envisioning process. Think of it as scouting film locations for your holographic experience (even though they don't exist there yet). Without ever building a prototype, you can use a photo as the foundation of a visual sketch of the overall experience you're after. It's a scene for your ideas to be showcased in.

ENVISIONING HOLOGRAMS

Be on the lookout for physical places that are calling out for something to be added holographically. Sometimes places will strike you as “empty but cool” for some reason. Whenever you get that feeling, immediately stop what you’re doing, whip out your phone, and snap a picture. Move along.



You can imagine people and holograms in any empty scene

Remember to go back through your pictures when you have time to harvest any that move you. They will undoubtedly be scattered across your Camera Roll in odd sequences. As you locate them, quickly consider the possibilities. Then share the photos with yourself or set them aside in a collection you’ll want to grow over time.

These sets of photos with nothing in them is a treasure chest of future ideas.

Sketching

From our earliest age, we have always been able to draw pictures. Some sketches recall our dreams, some record history, yet others share ideas. It's a very natural thing for us to draw, yet unless we pursue careers in the arts or have jobs where we need to scribble at high speed onto whiteboards, as adults this talent goes to waste.

Envisioning is a great reason to dive back into drawing pictures.

Sketching is a great way to quickly convey the basics of a holographic idea, how it sits within a physical environment, or the general feel of motion within the scene. There's nothing like jamming out a quick drawing of the key aspects of your ideas to add fuel to the fire. It becomes real in just a matter of seconds (or minutes if you're being a bit detailed).

The greatest aspect of sketching is its relative speed to other methods that result in artifacts. It may not be as rich, but it's fast and that matters a ton when trying to cover a lot of design ground in the envisioning phase.

That said, I'll be honest here – sketching with a pen is not actually the easiest way to convey holographic designs to other people. In fact, sketching three dimensional scenes on paper is one of the more difficult ways to capture all the richness of mixed reality. There's an oddness to the spatial and perspective nature of mixed reality that sometimes becomes a distraction when drawing it. You'll find that it's not nearly as difficult to sketch mixed reality scenes as it is virtual reality with its spherical distortions.

ENVISIONING HOLOGRAMS



Sketching a mixed reality scene in a single frame doesn't do it justice

Storyboards are a specialized form of sketching that yield a much better result in the case of envisioning. Rather than focusing on particular aspects or scenes, the storyboard pulls together the larger story arc into a familiar sequence of frames, not unlike a comic strip or book. The advantage of using simple storyboards over more detailed holographic sketches is the focus on the movement and interaction they enable. It is in many ways the real reason storyboards exist – to tell the story itself, not relay the fine details.



Storyboards are a much easier method to convey mixed reality ideas

Combined with other methods, sketching brings a rough quality that's highly desirable for envisioning work. Try using the quicker and rougher form of storyboarding over precision drawing to quickly capture your new ideas.

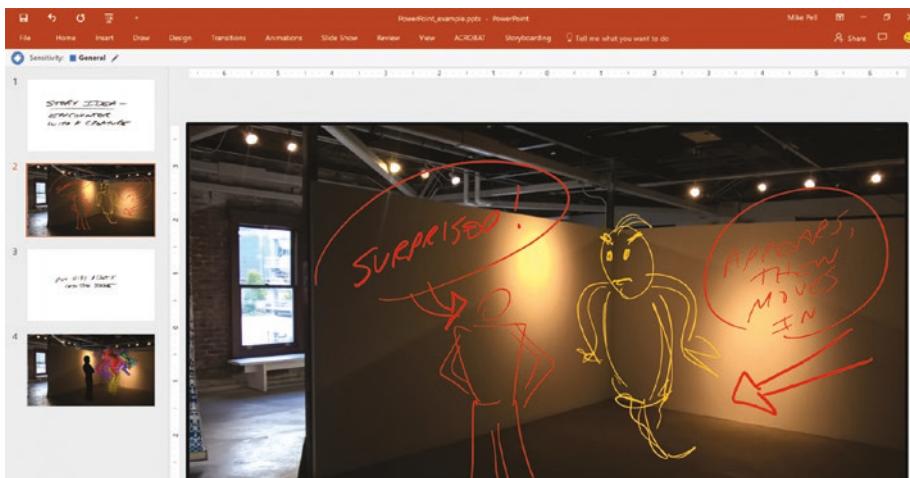
PowerPoint

Who would have thought that using a piece of office productivity software would be such a great way to prototype mixed reality? Probably not you, but it's true. *Microsoft PowerPoint* is flat out one of the world's great rapid prototyping tools – although almost no one considers it for that purpose. The ability to quickly combine different types of media with built-in graphics and inking is a hard-to-beat solution for rapidly envisioning anything. Making that even more valuable is PowerPoint's animation, sound, and video playback capabilities.

Just as you'd use a program like *Adobe InDesign* to layout a print article comprised of different blocks of text and images, think of PowerPoint as a

ENVISIONING HOLOGRAMS

freeform composition surface. It couldn't be easier to Paste or Import just about any type of media element into a slide where it can be combined, overlapped, or sequenced with other items. From there, you can simply rearrange, add, remove, and edit things on the slide surface. Just about any combination of objects is possible. We can even export many other popular file types to share these compositions.



Using Microsoft PowerPoint to composite very different types of media for prototyping

The value in using PowerPoint as a compositing tool versus a more specialized three-dimensional modeling and animation program is exactly that – PowerPoint was built to be used by anyone with little training, versus those high-end pieces of software being designed for use by highly skilled experts in the field.

Leveraging this widely available program also has the tremendous advantage of allowing editing and revision by just about anyone else who you need input from on the ideas. It becomes not only a creation platform, but also a distribution mechanism that enables collaboration.

Acting

Sometimes the most brilliant solutions to our problems hide in plain sight. That's exactly the case with using the centuries old technique of acting to breathe life into futuristic visions. If you think about it, physically acting out how you want a holographic experience to work is a great way to get the interaction and behavioral aspects approximated quickly. People are the center of the holographic experiences we're designing, so why not use them as our prototyping mechanism?

We can draw all the pictures and tell all the stories we want to try and get a sequence across to a collaborator, but nothing works as well (short of coding a working prototype) or more directly than just acting out how the encounter with holograms will go. People are always at the center of envisioning. This approach reinforces that foundational belief like no other method.

Acting also has the benefit of enabling us to see firsthand how all of the different participants in the experience are affected – the immersed person, observers of the interaction, and even the holograms themselves. The most powerful aspect of acting for envisioning is being put in the shoes of each person and hologram. Taking another's perspective is always enlightening, and in this case, it's often completely eye opening.

For instance, it would be easy to overlook how the hologram itself felt about interacting with a person or group. We can choose to surface them or not, but giving them the benefit of being more than just digital objects that do our bidding is our challenge as Designers. There's more to the picture than meets the eye. Holograms can be as stiff and cold, or as funny and light-hearted as we want them to be. Acting as the hologram is our opportunity to explore how they may want to deal with people.

ENVISIONING HOLOGRAMS

Yes, holograms have feelings, too.

An important part of this type of immersive exploration through acting is figuring out how to recreate scenes or sequences. It's not hard – just takes a bit of thought. If you only have yourself available at the moment, you have little choice other than using props and inanimate stand-ins to represent people and things. Even this mostly unresponsive style of using chairs, tripods, pillows, stuffed animals (or just boxes) helps create the spatial relationships we talked about earlier.

Moving through the room in a constrained manner is a critical part of getting interaction right. We play off the props that are setup in the scene. A stuffed animal won't respond to us like a real hologram, but we can easily imagine it doing so. Combining our imagination technique with this one comes in handy in this scenario.



People can represent holograms, not just inanimate props

Having more people available to help create the scene is incredibly valuable and also turns out to be a tremendous amount of fun. Now you can have a person (or yourself) act as the holograms. They will be able to portray them in any way that's needed, even ad-libbing, or improvising new behaviors and responses. Picture being able to test out whether it was awkward for your giant holographic movie screen to pause *Netflix* and comment on the love interest, or even swap in an urgent *Snapchat* message from a friend. You could certainly code that up or create a scripted prototype to try out the idea, but more fun to do it in real-time with someone playing the part of the screen and infinitely more flexible. The possibilities are endless when people act out the roles in our envisioned experiences.

Videos

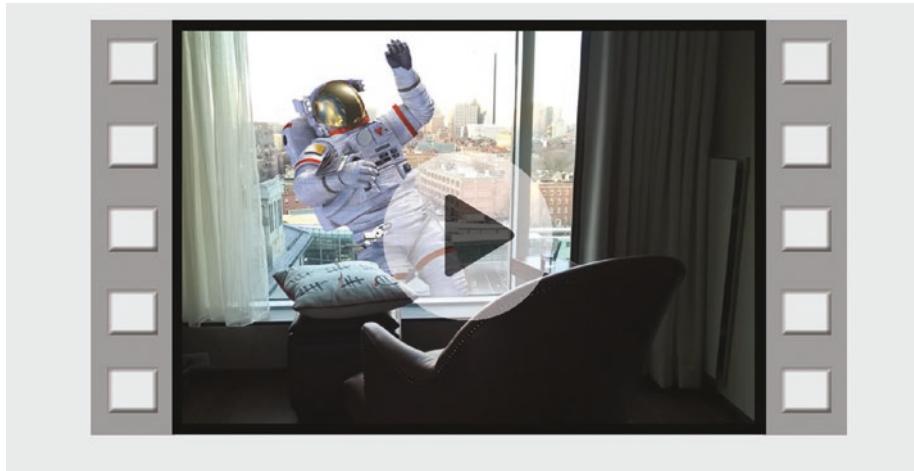
There's a long history of creating vision videos in just about any industry you can think of. Doing a bit of web searching on "vision video" will return a treasure trove of futuristic looking shorts that portray what could be. These high gloss productions are favorite method of teams to portray their vision of where they are headed to, and what the expected outcome for the customer is.

The common thread through most of these vision videos is they were intended to direct thoughts and efforts in a particular direction. They are unquestionably sales videos, cleverly disguised as beautiful commercials for the future.

In a similar way, using video as a storytelling and sales tool is the most valuable way I have found to leverage this high-impact medium of mixed reality. Even if there are code prototypes available to show off functionality in person, capturing the holographic action via video gives you means to reach a wide audience for exposure to the ideas. That makes collaborating

ENVISIONING HOLOGRAMS

with a wider range of people so much simpler. You also have the ability to add voiceovers and graphic overlays to point out elements that could be lost in a live demo.



Video used as storytelling tool for promising mixed reality ideas

Because much of today's most impactful communication is through video, investing in using it for envisioning is a good bet. Whether it takes the form of a short Snapchat clip or a three-minute short film, video is the natural choice to get our important messages across. Additionally, the convenience and ubiquitous access to smartphones has replaced the need for any fancy video equipment to do envisioning work. Just about any smartphone is capable of creating acceptable quality videos in this realm.

The number of different ways to utilize these videos for envisioning is staggering. Video envisioning covers the spectrum from just capturing live shots of people acting out scenes, all the way up to highly polished video masterpieces that composite holograms right into live action scenes. You can even imagine making videos of your sketched storyboards and narrative stories.

Think of envisioning videos as short films with a story arc, hooking narrative, and compelling action to keep people engaged and not tuning out. One minute is a reasonable length to shoot for in relaying the key elements of the holographic experience.

Prototyping

Traditionally, you'd think of prototyping as creating a working proof-of-concept or at least a mocked up version of an experience. These are done in the fidelity that makes most sense for the intended audience, whether that was teammates, management, or stakeholders.

The type of prototyping that we're using in the envisioning space helps illustrate the intended outcome. It is always a goal to work in the actual technology itself to establish a compelling vision in a form that can be experienced first hand. Paper prototyping is not going to cut it for mixed reality. It's too far removed from the actual medium to be effective as a prototype. We need to jump into the device we're targeting to achieve the goal of relaying how it will actually feel once built.

The funny thing is we don't actually have to build the real experience for this type of envisioning to be successful. Anything close wins. For example, building a scene with static holograms that appear in approximately the right place, approximately the right size, with a decent level of fidelity, evoke a strong enough reaction in the participant to make it a valuable exercise. The key is being in the actual device we're targeting - whether that's a headset, laptop, or augmented reality glasses. This is where it all gets real.

ENVISIONING HOLOGRAMS

Fortunately, there is new software showing up regularly to help with this process of creating content within mixed reality to illustrate our ideas. This method of prototyping in-device does require apps that allow content creation, or using native development tools to produce the experience.

There are many different types of apps that help with in-device holographic visualization.

- **AR Camera Apps** – using augmented reality and smartphone camera capabilities.
- **MR Modelers** – special purpose mixed reality sketching apps.
- **3D Sketching** – physically drawing in space across a variety of mediums and devices.
- **VR Prototyping** – toolsets designed for virtual reality also help in mixed reality.
- **Cinematic Tools** – taking a film director's perspective is incredibly useful.

AR Camera Apps

Augmented Reality camera apps make it easy to superimpose digital content over photos or live action video sequences. In many cases you just select a graphic overlay for what you see through the camera, and the software does all the hard work of aligning perspective and tracking movement by people or objects in frame.



Augmented reality features built for smartphone cameras are great for prototyping

The augmented reality space is already overlapping with mixed reality, so it's a natural place to look for tools to assist in prototyping. Many easy-to-use apps are available from *Facebook*, *Snapchat*, and other platform providers that bring incredible functionality to bear through camera-based spatial location mapping and artificial intelligence fueled computer vision to identify objects with high accuracy. These remarkable apps make it simple to test out ideas for adding holograms to scenes. This is a similar method to drawing over photos, or creating more involved videos using compositing. Don't get hung up on whether the digital content overlaid on the real world is actually a hologram or not – it very well could be if you chose to make it one.

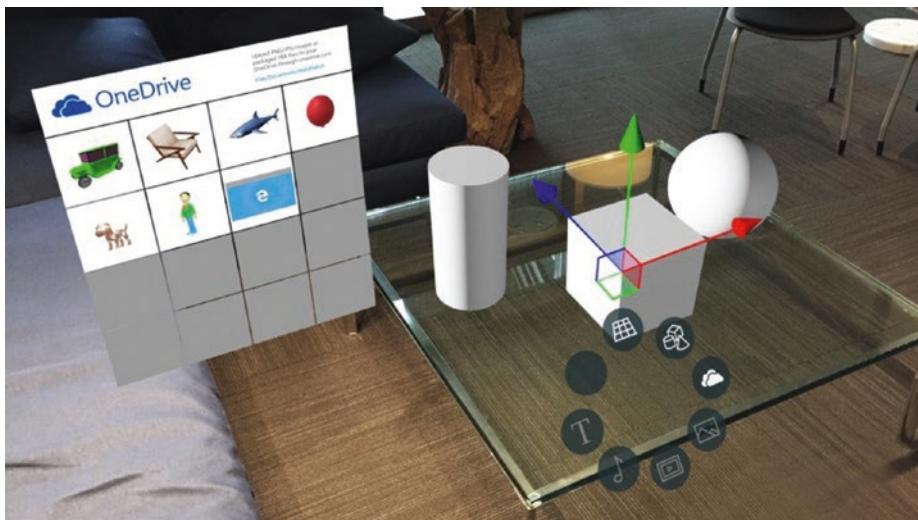
MR Modelers

Mixed reality modeling tools generate holographic items that can be placed, sized, and examined within the device. This type of app helps us judge the effectiveness of our decisions about the spatial aspects of our experience. Is something too big or too far away? Is that really going to

ENVISIONING HOLOGRAMS

convince anyone to come closer and interact? What is the visual quality of that when rendered in-device?

These mixed reality tools are different than the traditional 3D modeling software programs you might use for creating objects to 3D print or make digital animations. These prototyping tools have been designed specifically for use in mixed reality, leveraging existing objects and images as stand-ins for finished holograms. They can also use primitive volumetric shapes in place of more refined items to enable quicker workflow.



Microsoft HoloSketch lets you compose using 3D models and primitives (source: Microsoft)

The great advantage in using this method of prototyping is that you are quickly composing scenes and scenarios within the device itself, requiring no translation from medium to medium at a later time. This type of prototyping tool is fantastic for quick blocking out of holographic experiences. We expect to see more of this type of medium native tool to emerge as the market grows and becomes more accessible to Designers.

VR Sketching

Three-dimensional sketching apps made for virtual reality allow us to do the most amazing thing – sweep out paint strokes that literally hang in mid-air. Sounds simple, but it is the most incredibly hard to explain special effect I have ever encountered in design. The impact is immediate and breathtaking – just like seeing a hologram for the first time. Using real space to paint a scene full of digital objects is not only super useful, it's unbelievably fun. You'll have to try it for yourself to see. Trust me, this is the future of rapid prototyping across many different types of industries.



Tilt Brush uses VR hardware to enable painting within 3D space

Using brush strokes of various sizes, colors, textures, and opacity, you can construct entire sequences full of rich digital objects as stand-ins for holograms. Everything is possible here since you are unconstrained by specific object shapes or models. You build up objects stroke by stroke, creating volumetric pieces to size and place wherever you like. Most people compose the scene just by walking around, squatting down, and

ENVISIONING HOLOGRAMS

reaching just like you were doing this in the physical world – which of course you are.

There is a related type of 3D Sketching app that doesn't rely upon virtual reality, but rather a Desktop computer, its touchscreen, a pen, and a specialized peripheral called the *Surface Dial*. The *Microsoft Surface Studio* was built for creative people to experiment with different types of input and interaction when making things. One of the best examples of an innovative approach to sketching using this set of hardware elements is a Windows app called *Mental Canvas*.



Mental Canvas enables 3D Sketching through the use of the Surface Dial and Pen (source: Mental Canvas)

This type of 3D Sketching app allows you to sketch deeply into space using the Surface Dial to adjust the Z depth of the pen. Imagine using layers to represent depth in 3D space, without having to use layers. You simply twist the Dial to move the camera position in and out, side to side.

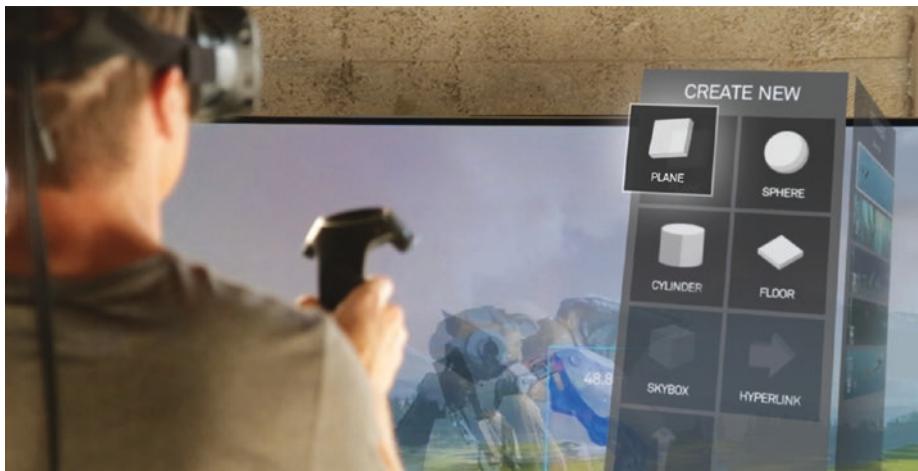
Amazing freedom to the illustrator. This does have the same limitations of sketching – you must be skilled to get a great result for mixed reality envisioning. Yet, this sort of drawing in 3D space is mind-blowingly fun and extremely valuable for trying things out quickly.

VR Prototyping

Virtual reality prototyping tools are designed to help you plan and execute virtual reality experiences while in-device. That kind of completely immersive authoring and composition tool has been a dream of designers for decades. In addition to direct manipulation modeling, it enables an exact reproduction of the final experience within the target run-time environment. Straightforward import of models and images makes this approach relatively easy to work with, even for the novice prototyper. The key here is having some assets ready to go before the prototyping session begins to save time.

Much like the VR Sketching apps, VR Prototyping requires finessing your toolset within a physical space. Completely blocked out from the physical world, VR Prototyping tools can be a bit of a challenge to use for mixed reality since your spaces need to be recreated digitally. That said, the interfaces closely match the expected paradigms from the hosting platform, so ramp up is quick.

ENVISIONING HOLOGRAMS



Storyboard VR was designed to help you do rapid prototyping
(source: Artefact)

One VR Prototyping app that stands out is Storyboard VR by the design and innovation consultancy Artefact. Creating by them internally to help with visualizing and iterating through new ideas quickly, it's now available to anyone.

Having prototyping tools like this is an invaluable resource to any team, but the obvious issue with leveraging these tools for mixed reality is they were built specifically for VR. So, expect to spend quite a bit of time working to learn the best ways to setup scenes that translate well to mixed reality.

Cinematic Tools

These motion picture and film-oriented tools are perhaps the most underrated and rarest of these prototyping aids. Not until recently have people even thought about repurposing these for use with VR and MR. It's a clever idea. These tools come at the problem of envisioning

from a completely different place – the mind of a film director or cinematographer.

Turns out, that's exactly whose head we want to peek into to gain some inspiration for doing breakthrough mixed reality design. Utilizing the ways of master storytellers over the decades, film directors are all about bringing their vision to life well, and within reasonable time and budget. They create film experiences that operate on many levels at once – most importantly making that emotional connection with people that we talked about early on. There's much to be learned from this discipline that can be used in mixed reality.

The digital tools they now have at their disposal are augmenting or even replacing teams of specialists who know camera angles, lighting, wardrobe, placement, special effects, and action sequences inside out. And most amazingly, some of these cinematic storyboarding tools run on tablets and smartphones, as well as within VR headsets and MR devices.



FilmMaker Live can be used on tablets or even phones to quickly compose scenes

ENVISIONING HOLOGRAMS

Considering a holographic experience as a well-crafted film is a game changer. There are so many similarities and overlapping concepts. We also have great examples of immersive filmmaking in the VR film space to look at for inspiration. Phenomenally creative work is being done every day to explore how to best utilize this distinctive method of storytelling using VR for motion pictures and short films.

Fortunately for us, the foundational elements of cinema (connection, framing, pacing, reveals, camera angles, dialogue, story arc, and more) are found within our design space, too. They just manifest themselves a bit differently. We cannot control how people will react to a scenario that we setup or introduce. You are the controller. This is all unfolding in real-time, with little way for us to definitively predict or force particular actions to occur. We, as designers of these experiences, are cast as passive participants while our actors take control. How fun is that?

The new frontier for mixed reality design is to learn how to leverage the incredible library of brilliant storytelling work that already exists throughout the history of filmmaking. Getting a better understanding of how and why cinematographers compose their shots will help us envision particular scenarios with a level of persuasiveness that's sometimes lacking in our work. Knowing what film directors do to focus the viewer on certain elements in a shot helps teach us about composition and training our eye to see from the participant's viewpoint.

So much to learn, so little time.

Code Prototypes

Writing computer code is perhaps the most expensive form of prototyping along several different dimensions. The first is coding itself. This not only requires writing the code (which is usually time consuming), but add to

that the debugging, deployment, testing, bug fixing, refactoring, rewrites, and source code management. Next you have the overhead of using source code control systems like *GitHub* to keep things backed up and usable by multiple people at the same time. Finally, incorporate the tax of using team collaboration software like *Slack* or *Microsoft Teams* to keep everyone up-to-date as to changes and progress.

All told, the real cost of using real code is significantly higher than many other methods. Yet, the benefit of having a prototype to use for envisioning exercises is unparalleled when it comes to “being real.” Even the best simulation of running code via a digital prototyping method will leave the question “can it really be done?” unanswered. That unnerves many people in management for good reason. They need to know if your vision can actually be executed. However crude, using real working code gets you that much closer to really getting it live.

Code prototyping for mixed reality experiences is typically done using *Microsoft Visual Studio*, *Unity*, *Photoshop*, Sound editors, and whatever 3D modeling and animation programs are needed to generate high-quality assets. Code prototyping follows the same general process and methodology as actual development cycles. It’s amazing what we’ll do to get real code working.

Prototyping Summary

Regardless of your prototyping approach, the benefit of getting something tangible to share and test out is something you cannot overstate.

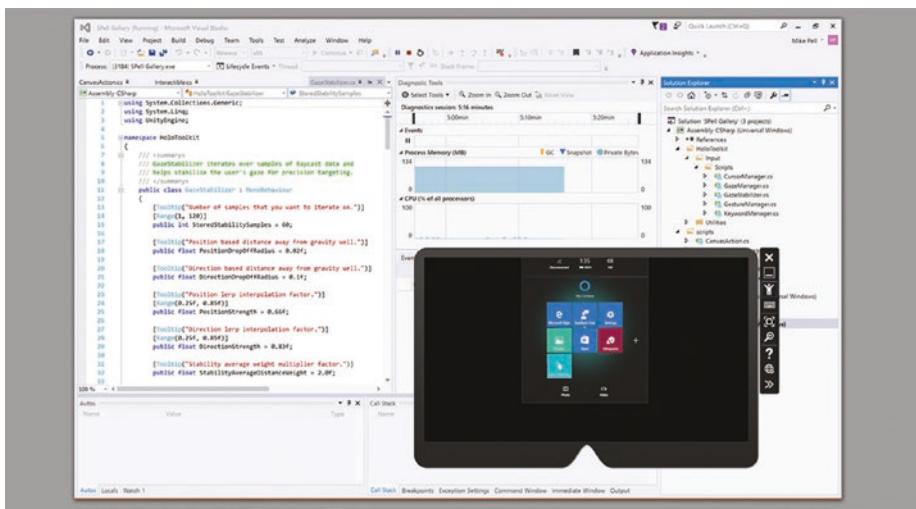
Coding

Although we can produce some of the most exciting and persuasive demos ever using no code whatsoever, some people will continue to say that any type of envisioning is just glorified hand waving if you don't use real code. I can't really argue with that. In the end, code wins. Decisively.

If you have a way to do your prototyping or envisioning work in code, you'll be light years ahead when needing to get support from management or prove it can be done the way you imagine.

As mentioned, there are so many industrial-strength toolsets available for free today, it's almost embarrassing. How many free modelers can one person use at a time? Another unbelievable part is that the two main tools required for mixed reality applications are available for download and are constantly updated.

Microsoft Visual Studio is the programming environment that most closely aligns to Windows Mixed Reality and the HoloLens. A truly industrial-strength environment, Visual Studio is used to not only code against the APIs needed to get specialized functionality implemented in, but it also deploys the final bits to an emulator or the device itself.



Visual Studio has a HoloLens emulator to test and debug mixed reality projects

There is also close connection with 3D composition programs like *Unity* in coding environments. *Unity* has its own facility for coding and running test versions of programs for mixed reality, but much effort has been put into optimizing the workflow between Visual Studio and *Unity*. A top-tier game development environment, *Unity* has established itself as the go to tool for mixed reality code projects.

Making

Blessed are the Makers. Makers have the rare ability to turn the unthinkable into a working (often fragile) prototype that blows everyone's mind who sees it. It takes curiosity, drive, and true passion to hurtle headfirst into combining multiple mediums together (such as hardware and software) with no idea of whether it's actually going to work or not.

ENVISIONING HOLOGRAMS

Making is the pinnacle of envisioning in many ways. It's filled with lots of experimenting, dead ends, starting over, and just plain having fun in the pursuit of synthesizing something custom and utterly one of a kind. Maker creations are truly inspirational and fuel true breakthroughs because they are so amazing to see in person.

Never underestimate the importance of making things real. Nothing beats working code and hardware.

Using Making techniques to create things that could be considered full-on proof-of-concept or working prototypes is still very much envisioning, it's just an advanced flavor. Because they are very real instantiations of ideas (as opposed to mockups or theoretical concepts), Maker prototypes are some of the most difficult and time consuming to land well.

You'll find that some of the most important envisioning can only be done through this method of building hybrids that require unusual combinations of mediums. For example, creating early versions of real working holographic headsets so that real holograms could be seen and experimented with took world-class hardware, optics, and software engineering, but it also took Makers following their "let's just see if it works" approach to pull it off.



***The “Spectator View” technique for HoloLens is an example of
Making for envisioning***

I can't emphasize enough how critical it is to introduce working technology prototypes into the mix when realizing true breakthroughs are at stake. Sometimes we have to prove that a particular part of the impossible vision is feasible before we can convince the team or management the vision can be realized. That's where Makers come in and are worth their weight in gold. It's takes a special talent to know how to conjure solutions that are real. I'm the first person to say that any kind of envisioning works as long as it's convincing, but there is clearly something over the top cool about a Maker's envisioning prototype. Maker envisioning brings wonder to ordinary, and turns healthy skeptics into believers.

Choosing One

Knowing which envisioning method to choose is one of the skills you'll pickup by practicing regularly. It becomes pretty obvious after a while, kind of like reaching for the right golf club to try and make the green with, but that doesn't mean it's any easier to execute well.

Any of the above will help you communicate your ideas to your intended audience. Just do it.

CHAPTER 8

Breakthrough Examples

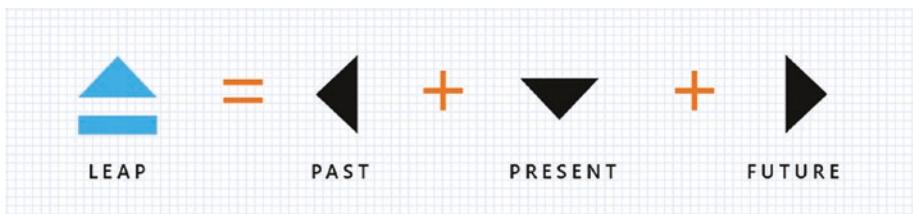
You can't see the future in your rear-view mirror.

The whole point of this book is to help you approach your work in a way that will result in real breakthrough experiences. In practice, leaping forward is a bit harder than you'd think. First, considering yourself visionary and predicting exactly how things will unfold is fun, but far from reliable. Next, when looking around to see what you can copy from current competitors, remember that it isn't going to get you anywhere in the marketplace. And finally, contrary to the myth, deeply analyzing the past is not the best way to predict leaps into the future.

Envisioning gives us a better way to tap into the future.

Turns out the future is hiding in plain sight. By combining all three of those perspectives (past, present, and future) we can synthesize experiences that feel very new but are still familiar. We don't rely too heavily on any one of the three viewpoints, but rather blend them and follow our instincts to emphasize particular aspects of each that best lend themselves to the scenario we are working through.

ENVISIONING HOLOGRAMS



Combining the past, present, and future into an insightful perspective

For example, if we were looking at developing innovative sports coverage using mixed reality, a natural place to start would be with futuristic sci-fi movies that overlay information onto quick moving objects. That would translate well to augment the players. We can also see similar digital callout technology already being used in today's broadcast sports. Looking back into the archives, we'll notice a huge shift in how the action was televised with the advent of remotely driven camera rigs that could follow the action without being on the field and in the way of the players or officials.

Taken together as one combined viewpoint, you would suggest that our mixed reality leap forward for sports coverage would be to put us right into the middle of the action through elaborate camera tricks. This would be superior to completely immersive virtual reality broadcasts due in large part to being able to see and anchor yourself to familiar surroundings while watching. The real world acting as an anchor would potentially keep incidence of motion sickness down while enjoying fast-paced action. Not a perfect vision, but a good start.

Let's go through some other examples where we've truly leapt ahead by combining different viewpoints and examine why they work.

Visualization

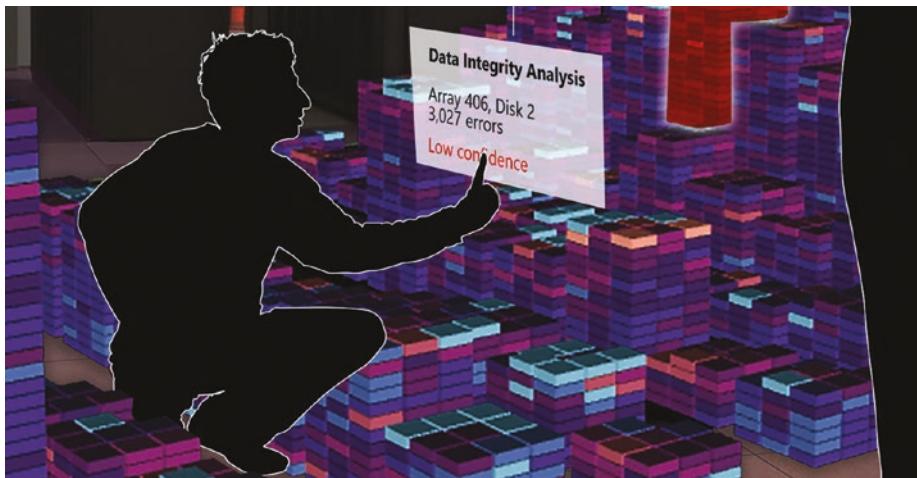
One the areas that will benefit the most from the rise of mixed reality is the visualization of data and complex concepts. We have made significant progress over the last decade in depicting data sets, but we have made little progress in being able to interpret them quickly. We keep drawing the same difficult to understand charts over and over again.

There are countless examples of data being poorly rendered in 3D or shown as awkward digital appendages of real-world objects, so 3D and AR are not the answer here. It's also not the tech that's holding us back, it's more that we haven't been able to leverage people's abilities to quickly comprehend and compare based on our natural ability to deal with our three-dimensional world. That situation is about to change due to the much richer palette available to all of us using holographic visualization.

Room-scale Data

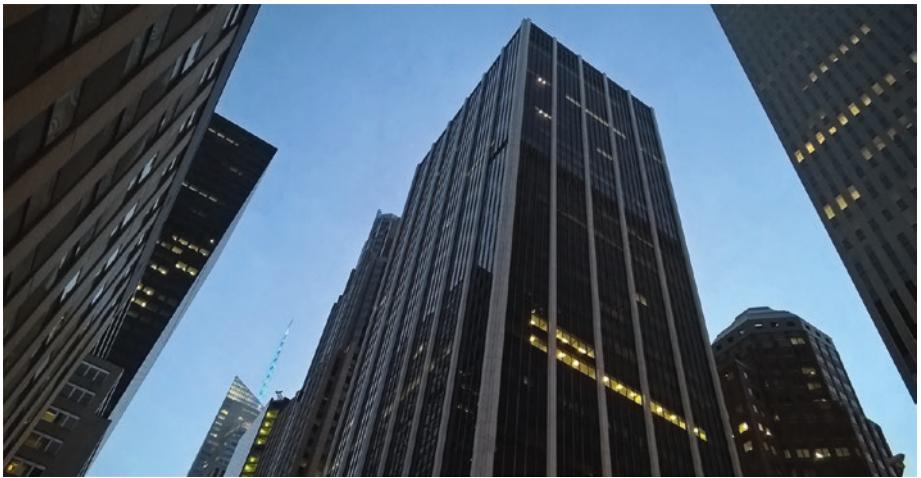
Remember when we talked about the first time you ever saw a 3D movie? It was mind-bendingly different than anything you had seen before. Not because it was surreal, but rather because it felt ultra-real in a strange and new way. Seeing holographic data visualization done at room-scale is exactly like that. It's truly transformational from an experience standpoint. It's not that you are inside the data itself – that's perhaps best done with virtual reality. The thing that gets you the most is how real the data now seems after it has escaped from behind the screen into your world.

ENVISIONING HOLOGRAMS



Imagine being inside a room-scale datacenter visualization showing storage problems

Room-scale data feels so right that you start to question whether it can actually be that easy to comprehend, or if you're missing something important about all this. You're not. It's just that we can finally deal with things in more natural way to make comparisons and judgements. We have become so used to seeing data visualized and charted in a very particular manner over the last decade, that when faced with any new technique our knee-jerk reaction is that it must somehow be wrong. Trust me on this one, when you see data you are familiar with at room-scale, you want it to be right even if it isn't. That's the power of mixed reality in action.



Working with data that is building-sized is another extraordinary aspect of mixed reality

BREAKTHROUGHS

The real leap room-scale data has more to do with the experience than the visualization itself. There will always be skeptics who point to the inefficiencies and distortion of data when it's presented in three dimensions. What you don't realize until you are standing knee deep in data (literally) is the visceral power of that experience. Our ability to make sense of the physical world and its contents kick in immediately. Coupled with even a passing familiarity of the data itself, the act of viewing room-scale visualizations is a bolt of lightning breakthrough for those of us who look for insights.

Consider the following aspects:

Understanding. One of the hardest parts of designing data visualizations is being clear enough upon first inspection to create understanding in the mind of the viewer. Many data charts are not

ENVISIONING HOLOGRAMS

designed to be easily read and analyzed. Holographic visualization has the built-in advantage of producing a feeling of “getting it” due to our ability to compare and contrast three-dimensional objects quickly. Used deftly, this aspect can reduce the time-to-understanding measures in this field.

Initial Impression. Holographic visualization also has another built-in advantage of producing a first impression of shock (in a good way). It’s hard to describe how it makes you feel when data envelopes you, or is spread out across a table. This qualifies as a real breakthrough moment. It suffices to say it’s nothing you’ll soon forget.

Visual Fidelity. We know that in most cases there’s little reason to use 3D charts over 2D to convey meaning. A well-constructed flat chart is plenty clear most of the time. But, there are those times when using 3D adds some other dimension of information that results in better clarity or insight. Holographic visualization has the property of allowing you to view it from new and more natural angles which creates a situation where insight surfaces more readily.

Direct Manipulation. You will immediately reach out to touch and try to directly interact with the data objects when looking at holographic visualization for the first time. It’s an instinctual reaction. They are right there. Why wouldn’t we want to see what happens? Well, now we can. It’s incredibly satisfying to use physical gestures to work with digital data objects.

Broadcast Media

Many of the early examples of pushing the envelope of mixed reality experiences focused on entertainment and education as many of their common scenarios lend themselves well to holographic content. It’s not

hard to imagine being inside a game or an atom for that matter using this new technology.

As you'd expect, the seemingly more mundane area of broadcast news has been left mostly untreated. There were some interesting experiments during the 2016 United States presidential election coverage where pundits and reporters were beamed into the main studio set from remote locations, appearing as full-sized holograms. Interesting use of telepresence concepts and mixed reality tech, but not completely surprising or implausible.

That all changed recently with the debut of a broadcast-quality mixed reality video compositing solutions to seamlessly integrate live action TV reporters with digital content to astonishing effect.



This Vizrt demo beams interactive virtual graphics from Astucemedia live into the broadcast studio (source: Vizrt)

Breaking the Fifth Wall

In his insightful post *Breaking the Fifth Wall*, James Corbett notes we have recently been able to move past the charming cinematic technique known as “breaking the fourth wall” (where a film character surprises the audience by talking directly to them mid-scene) to an entirely new level of sophistication.

Using mixed reality techniques, digital actors can now not only break out of character to address viewers, but also inhabit the same physical space as the audience. People and things can now join you wherever you happen to be viewing from.

This is somewhat profound. We can now shift the audience from mere observer to active participant in close proximity to live action. This new capability called “breaking the fifth wall” by Corbett extends the original film metaphor to have characters literally leap out of the screen and into your physical space. There are nearly endless possibilities for this new mixed reality technique in broadcast news and sports.

BREAKTHROUGHS

The emphasis here is on cutting-edge video processing technologies for mixed reality. These new technologies enable the following techniques:

Real-Time Live Action Compositing. It's one thing to be able to experience live action news reports or sporting events and feel like you're really there on the field. Virtual reality has been able to create that effect for a while through 360-degree video. But, we haven't until now been able to pull live action content into our own physical space – the complete opposite arrangement of what's come before. Careful to not interfere with that fly ball or get swept up by that storm.

Come To Me. We are comfortable asking for the ability to travel great distances without leaving home. Again, that's old news in the VR realm. What is not even thought about usually is asking for people and things to come into my own living room or office as digital objects that are perfectly placed, sized, and aligned with my world.

Dynamic AR callouts. Notice in the previous images the 2D textual information and 3D graphics that are deeply integrated with the live action content on screen. This level of alignment and tracking is possible today within mixed reality, but the difference here is that the capability now scales up to allow for many of these augmented reality style callouts to accurately track critical aspects of the broadcast.

Art

There is perhaps no area of creativity more interested in leveraging new technologies to educate the curious than the fine art world. Museums had traditionally been able to offer guided tours of their collections to patrons by using staffers and volunteers. They learn all about pieces of high interest so that they can answer questions on the artist, period, and contemporary works. As low-cost technologies came to market that would enable unattended tours, museums started investing in them. The state-of-the-art technology until recently was a multimedia affair using tablets to see video clips and hear narrator voiceovers. Now with mixed reality, it's possible to explore completely different dimensions of these artworks.

Artist-in-Presence

One of the most important aspects of artwork is of course the artist. There are sometimes plaques and wall displays containing some background information on them if you look. Yet, far too many artists go unrecognized

ENVISIONING HOLOGRAMS

and unheralded because they are not featured as people along with their works. Somehow, we detached the person from the art, never to be reunited again except in art history books. Within galleries, the artist is predominately invisible. Until now.

With a bit of foresight and forethought about what aspects of their work the general public will want to know about, artists can maintain a round-the-clock presence with their work to answer questions, chat with art lovers, and just have some fun with the gallery patrons.



Finally, artists can explain their motivation and methods to us in a personal way

BREAKTHROUGHS

Much of the innovation here comes from adding fun to a traditionally subdued experience. Imagine the following experiences next time you visit a museum:

Meet the Artist. Just as we never expected to be able to have a video phone in our pockets, the idea of having a conversation with an artist

about their work didn't ever seem to come up. Goes without saying that possibility approached zero after their death. Now, using easy 3D capture techniques, we can either beam in live artists to moderate discussions in real-time with students, or have artists posthumously explain their thoughts and process to gallery visitors on demand. It's also easy to imagine vast amounts of digital content on the artist themselves being available right there along with the pieces.

Get Closer. By digitizing the artwork itself, it can now be viewed from any angle, at any size, from any location on the planet or off. The primary benefit of hi-fi reproductions is not the ability to zoom in to great detail, but rather to have the piece hold its quality constant as it is viewed and placed at any size that seems to fit the location it's being viewed in.

View Related Work. A common question when an art patron comes across a piece they admire is "Are there any other pieces like this one in the collection?" By using voice input to ask these types of things casually, the overall experience and discovery of new artwork is greatly magnified. Serendipitous exposure to new ideas and styles is increased.

Entertainment

Music and dancing never go out of style, but it seems to be getting harder and harder to see the popular acts we like. If we do manage to get a few astronomically expensive tickets, it's often so crowded or restricted at the venue that cutting loose and dancing up a storm is either impossible or frowned upon by security. Thanks to magic of technology, we could all don VR headsets and watch acts perform from the comfort of our living rooms, but what's the fun in not being able to dance without smashing into your furniture? Immersive experiences are great, but much better to be able to see and interact with friends and loved ones while you enjoy the moments together in real life.

DJ Holo

With the ability to see everything happening around you in mixed reality situations, this scenario of dancing wildly around while listening to your favorite performers live with friends is entirely possible today. Using the beam in approach mentioned earlier in the *Breaking the Fifth Wall* example, we can literally bring the acts we're dying to see to wherever we want to gather and rave.

There's two parts to this of course – the ability to see and hear the holographic versions of the artists, and the ability of others to see the same thing. Done and done. Thanks to the shared experience code freely available for holographic platforms, we can synch the show for more than one person at a time. We can even add some special guests to the ambient environment in the form of holographic sidekicks or stage props.

The only thing we didn't talk about yet within this breakthrough experience is how ridiculous you and your friends will look singing and dancing around with special optics on to an invisible and silent band wherever you happen to be. Whatever, right? This is fun. And in the years to come, others will be able to see and hear the act just fine without any special optics or headsets thanks to holographic projection technology.



Inviting the hottest DJ around into your lobby for live beats is just around the corner

BREAKTHROUGHS

Shared real-time experiences are still in their infancy. This is an area of rapid developments. Expect to see experiments in the following areas in the years to come:

Living Room Shows. Who hasn't dreamed of having their favorite artists play a show in the privacy of their own home or backyard? Using the evolving volumetric video broadcasting technologies, performers can push out shows over broadband that can be subscribed to wherever you want on multiple types of devices. Whether on the go, or at home, you'll be able to catch the show in life-size or scaled down to fit on a tabletop.

Virtual Tickets. Being able to broadcast and receive holographic performers on multiple types of devices opens up an entirely new market for live and pre-recorded content on-demand and via subscriptions.

Holographic Friends. You don't really have to invite your friends or coworkers over to throw a party while catching the show. The same presence techniques that we use to broadcast and monitor the show can be used to pull other people into the space (or mute them if they get a little out of hand).

Emerging Technologies

One of the most fun things about envisioning is projecting your thoughts forward enough to catch a glimpse of things that won't exist for a while. It's usually not the case those things are impossible to create, it's more likely the technology they are based on doesn't exist in a form that can be put to that use immediately. Even though we try to never lead with technology as a driver rather than human needs or curiosity, it's exhilarating to see what those combinations of emerging tech and novel approaches can create. It's tempting to try and predict which will become true breakthroughs (even if they're still on our mental drawing board).

Let's go through that exercise of designing breakthrough holographic experiences based on the latest crop of emerging technologies listed below. The real question of course is how do holograms help turn these technology-influenced ideas into true innovations for people?

Some examples of breakthroughs powered by emerging technologies:

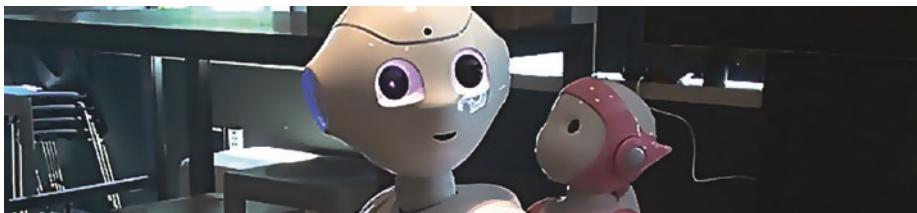


Artificial Intelligence – In a few simplest ways, holograms already feel like they embody some sort of AI because of their digital presence. What if the power of Alexa, Cortana, Siri, and Watson was somehow omnipresent and active when dealing with holograms. We're kind of used to talking with a few of these already in public. Do we need to infuse this type of conversation with an AI into every hologram?



Machine Learning – There's nothing worse than a dumb hologram. We have come to expect that any kind of digital object or program will understand our intent and the environment it exists in, plus offer solid suggestions based on even minimal information or interactions. This is more a function of modern apps and services rather than strictly a mixed reality play, but we need to design this into our scenarios.

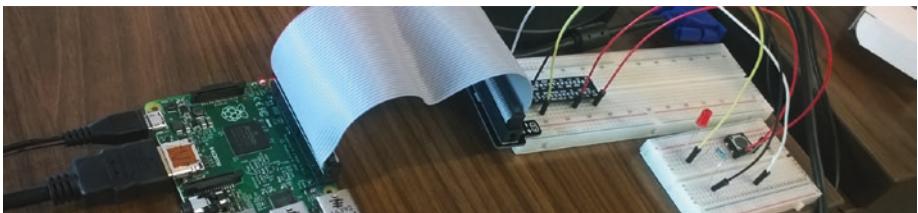
ENVISIONING HOLOGRAMS



Robotics – Will robots of all shapes and sizes need their own digital companions to keep from going crazy? Are those companions going to appear to us as holograms? I think so. Also, think about a world where robots are more common in the workplace and the home. How do holograms blend into those types of interactions? Will there be a balance during interactions where each player knows the intent and responds accordingly, or will robots and holograms collide in awkward ways? We'll see shortly.



Autonomous Vehicles – You would think that the near future of transportation will come with its own holographic additions and advances. What better way to spend your commute time or long train ride than conversing with a holographic entity. Certainly, the media we consume will be punctuated by holographic experiences during this travel time. But, will we want to be talking with holograms that other people may not be able to see?



Sensors and the Internet of Things – What a fantastic opportunity exists to reinvent how we deal with dashboards of information reporting the exabytes of information pouring in each second from our billions of sensors around the world. Holographic displays bring the promise of using effective dimensional data visualization to help people better understand the state and trends within these incredibly complex systems.

What's Your Breakthrough?

With all these features of other experiences bouncing around in your head, it's time to dive into creating our own breakthroughs. Let's get started by running through an easy to learn approach to constructing some working prototypes of our holographic innovations.

PART III

The Envisioning Process

CHAPTER 9

Flow

Q: Most efficient way to crush the soul of creativity?

A: Formal process.

If you work in any fast-moving industry for long enough, you'll come to either love or despise process. It's inevitable. We all have to work with so many people, teams, and partners on increasing complex systems and services, it's only natural to try and impose some order to stave off potential chaos. Nothing wrong with that, in fact it's needed for deeply technical projects.

Similarly, you'll also see highly prescriptive process and methodology in creative pursuits. Some of it is necessary when integrating within engineering teams and projects. Some of it not. Turns out that even the most experienced and disciplined designers and creatives crave order in the face of so many moving parts. Not me.

In response to the customary desire to structure, define, and tightly schedule the creative parts of projects, I helped pioneer a working design methodology that could help you with envisioning. It works well with pursuits that should **flow** instead of march. Its fundamental principle is all about moving ideas from A to B as quickly as possible. We refer to it simply as *Fast Design*.



Fast Design is all about quickly moving from A to B, not adhering to process.

Fast Design avoids much of the traditional structure and step-wise process in favor of a more unstructured, common-sense approach to moving things along. Start by figuring out the optimal design or solution, think about what it would take to get there, and go. You'll soon realize much of what you want to do is difficult given the current situation (resources, schedule, funds), but you'll push forward quickly anyway doing the best you can in the brief time you've allocated to figure all this out.

You will find that Fast Design is a great way to envision holograms and other creative deliverables, but might not be the correct approach for delivering the engineering designs for the next aircraft or high-speed train you'll be riding in. It trades off rigor for speed, correctness for doneness. Not for everyone. Not for all situations. But, perfect for envisioning breakthrough holographic experiences due to its bias toward action and output.

Our goal is to move through this “process” as quickly possible, so we can start building these experiences for real (or just keep exploring if the

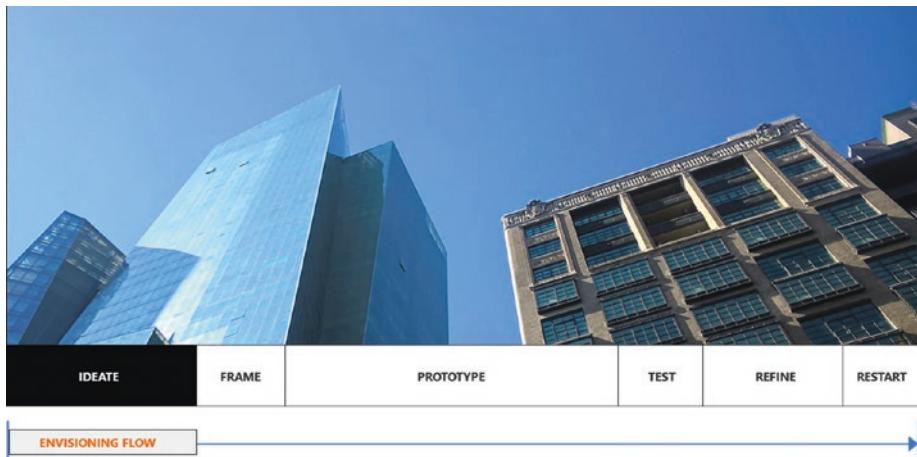
ideas are really flowing freely). Let's not make this any more complicated than it needs to be. Dream. Capture. Build. Test. Refine, and repeat as needed.



The envisioning flow is a suggested set of activities, not a rigid methodology

We'll cover how this applies to envisioning holograms in detail over the next few chapters, but for now here's a super quick overview of the different segments and a few important observations from using it to make our visions real enough to share with other people.

Ideate



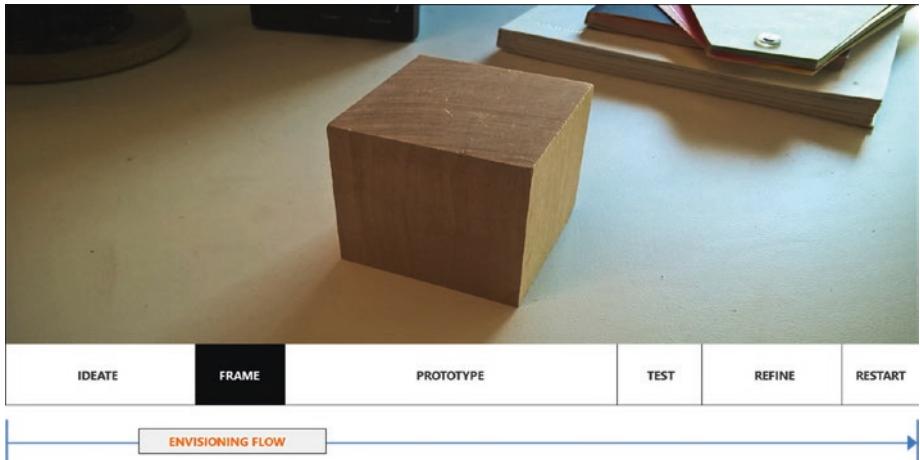
ENVISIONING HOLOGRAMS

We've talked quite a bit about ideation, conceptualization, and just daydreaming in the first part of the book. All that's left to say on this phase is that you should practice it as much as possible. Try to produce lots of ideas without passing any judgement on them. It really is unbounded exploration. Doing this frequently helps get fresh ideas out your head and into the world to know which genuinely resonate with others.

For example, the envisioning piece on the cover of this book was inspired by the thought that a beautiful hotel lobby doesn't have to feel so cold just because it's empty at the moment. Holograms could always inhabit these spaces, waiting for people to activate the space and its vibe. Lots of ideas popped into my head right after that initial thought, but some other good ones were a direct result of sitting down and ideating with paper and a pen. There were some weird ideas in that batch, like the one I ultimately decided on – a light creature moving to the beats of a live DJ being beamed into the room from afar.

People don't have to like the ideas, understand them, or even want to experience your ideas for themselves – but, just the act of listening to their feedback will be an enormous help in deciding for yourself what to pursue. No one can tell you what's right or wrong when it comes to envisioning, nonetheless they can let you know what makes sense to them or what seems plausible.

Frame



This phase is essential to doing envisioning well. Framing is not about vetting an idea as much as giving it some boundaries to explore within. You wouldn't want to start eliminating possible outcomes at this early stage, but rather give yourself a set of guardrails to bump into along the way to contain your effort. These guardrails become a decision framework for focusing your effort down just a bit.

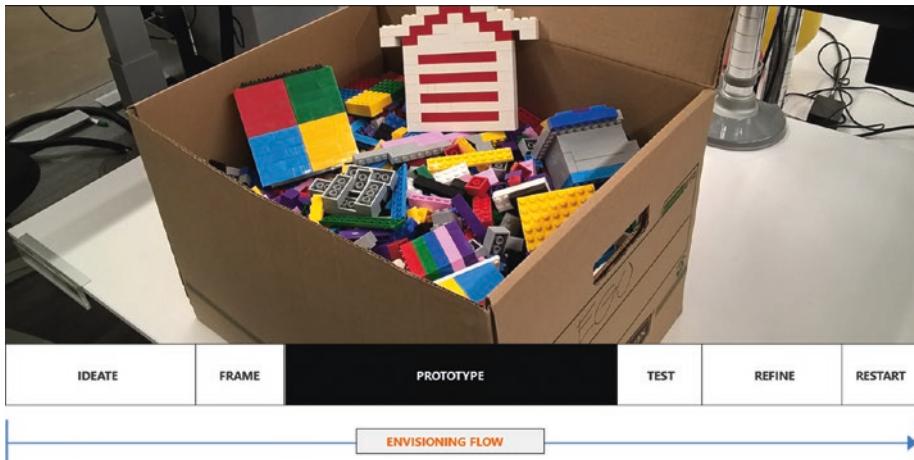
Continuing with the cover example, deciding early on that multiple people should be able to enjoy the warmer hotel lobby vibe at the same time established a bounding box around experience. Without that, it could have gone down the path of being intended as totally unique scenarios for each person. That type of guide may seem obvious or simple to arrive at, and it is, yet it saves a tremendous amount of wasted effort as we move toward deeply exploring the idea.

ENVISIONING HOLOGRAMS

Creating a lightweight decision framework for the design helps you make a few initial choices quickly. These tend to be which scenario best illustrates the idea, what technique can help you go the fastest, and how much time you want to spend exploring all this.

Done quickly and without overthinking anything, framing can also be a very fun part of envisioning. Moving to decisions feels good. Things start snapping into place. The flow starts working and your envisioning project is off and running.

Prototype



Building a prototype of your breakthrough idea is distinctly different than the creation phase. Here, the emphasis is on the detailed work of putting enough pieces together correctly so another person can try it out, or at least get the gist. It's necessary to bring things to life as quickly as possible, so don't try to be right all of the time, just try to be fast most the time.

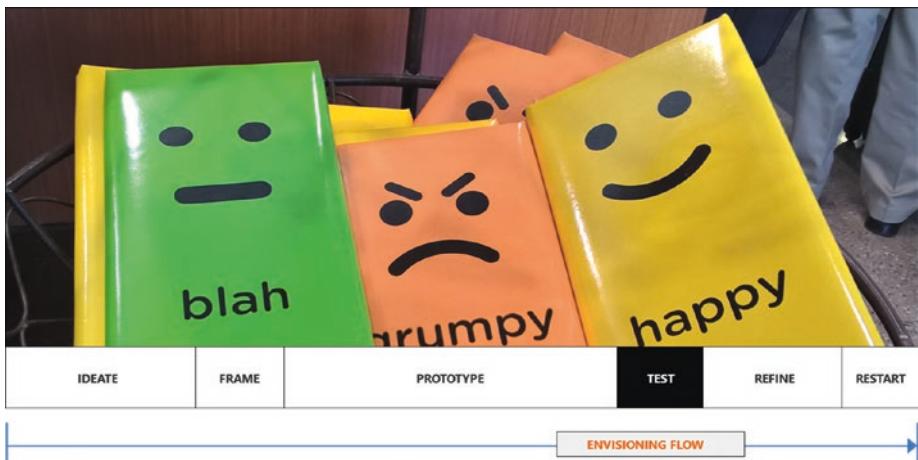
As we discussed, there are many kinds of prototypes that run the gamut from it being all in your head all the way up to working code and hardware. Some will be better than others at landing the idea, but it really doesn't matter which method you choose if you get right into it.

In this example, my choice to quickly prototype the concept of warming up a hotel lobby was to bring the dancing light creature to life through a simple code prototype so that the movement and reaction could be tested out. Rather than just animating something like this After Effects, wiring up a 3D character to move and react to ambient sound is a decent amount of work and constitutes a technical proof.

It's been my observation over many years that people on product teams either love or can't stand the technical prototyping phase of a project. The more technical the person, the more they like it. The more creative the person, the more soul crushing. Here's why - this activity is all about making the hard choices required to narrow your focus and execute something concrete. Highly stimulating and gratifying to some, yet it feels more like the depths of despair for others as the optimal transforms to the doable, and the original dream is somewhat diminished.

Fortunately, turning holographic ideas into working prototypes of any sort is typically very rewarding because of its freshness and necessity to learn new things.

Test

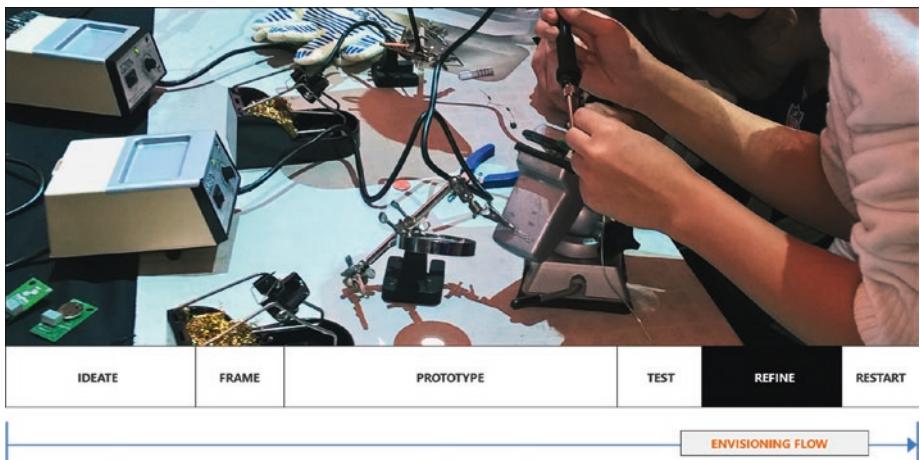


In the old days, testing a product or service meant focus groups, formal usability studies with one way mirrors, weeks of analysis, and voluminous findings. Not anymore. Testing something out has devolved to informal questioning over a latte or cornering unsuspecting people in the lobby of your building. Regardless of the method, the point is to get someone else's thoughts and opinions on something you are invariably way too close to. People's first takes are incredibly valuable if you truly listen and give them a chance to sink in, good or bad.

When I tested this dancing light creature with its own DJ concept out on people as an envisioned prototype, their first reaction was what anyone would have hoped for – loved it. Wanted more than I could provide in a quick prototype for sure, which led to many great suggestions for where to take it next. It occurred to me that my test was conducted with friends and coworkers who might not have wanted to hurt my feelings with a negative reaction, so I needed to consider how to get this out to a much wider audience to gage the reaction more objectively.

Don't be afraid to go wide with your testing of holographic ideas (if you can think of way to do that well). Video comes to mind as an easy way to reach a very broad and diverse audience quickly. Open it up to comments and strap in. Chances are it'll be a bit of a rough ride regardless of the merits, I can assure you. People love giving you constructive criticism along with praise.

Refine



In today's world of agile development techniques and continuous releases, it seems odd to call out the need to refine our holographic ideas. We expect they will be flawed in some way (as all high-tech products are) or not land quite as nicely as we originally imagined. Refinement seems a natural part of our method, no?

No. That's not the kind of refining were talking about here. This section should probably be called Learning, but it's more action oriented than that sounds. After we test something and listen carefully to the feedback, we

ENVISIONING HOLOGRAMS

should learn from that and immediately change whatever was called out and test it again within hours or even minutes if possible. Really.

The problem with today's approach to agile development is that it's anything but. Truly agile means fast, which for us means now. Trust your early tester's reactions and try out different approaches with them in lo-fi if necessary to learn quickly. Try morphing the idea or even go as far as completely pivoting if you have to.

With this example, the refinement came in the form of learning that some people won't get into something like this live show in a hotel lobby because they're still very self-conscious about letting go in public. Hard to not feel a bit odd when you're the only one grooving to an invisible ten foot tall light creature and holographic DJ. Human nature sometimes trumps any good idea.

Restart



True breakthroughs are rare. They can't be scheduled or predicted. Musicians don't try to write a hit song every time. They just keep practicing, creating, and pushing themselves to go outside their comfort zone. That's when the magic happens. Same applies here. Ideas are typically not perfect on the first go round. Use your gut instinct to try out something that seems radical. Restart the ideation process for no good reason. Throw everything you've done out. Don't let there be any sacred artifacts that can't be discarded for the sake of moving the project forward.

The cover idea turned out to be a great example of working the envisioning process and letting it take you where you need to push and explore. I would not have thought about using a particular shader technique for the visual appearance of the light creature without collaborating with a coworker on this. Being able to inject your own music was always part of the idea, but I needed to see that people could also enjoy someone else's playlist just as much before letting that idea go. Restarting the project as more of a concert experience rather than interactive playlist jam was something I originally would have thought to be limiting, but turned out to be the better choice.

Don't be afraid to restart the whole process and do it differently next time. At the same time, you can choose to not restart and press on. Either way, you'll find that envisioning will change your normal method of approaching creation and development of ideas.

Let's Go!

Now that you've had a quick look at the way we'll be envisioning it's time to get started. Try to pick an idea you want to bring to life and turn the page to dig in and break through.

CHAPTER 10

Frame

It's not the punchline that gets 'em. It's the setup.

The framing process transitions us into the detailed work portion of envisioning. It helps define our creative exploration and set things in motion down a particular path. Framing starts with fitting a particular scenario into a conceptual picture frame to define its boundaries, and ends by propelling you into the build-out phase.

The framing we do for envisioning holograms is not so different than a film director framing a shot on the set. In filmmaking, some elements of the sound stage or outdoor set are in the camera's viewfinder and others aren't. Choices about lighting, dialogue, composition, speed, sound, and camera movement are all taken into account and distilled into a manifestation of the director's vision. Framing holographic ideas is no different.

ENVISIONING HOLOGRAMS



Framing for envisioning is not so different than in filmmaking

A purposeful decision to set some boundaries and constraints when figuring out where you're going with your initial ideas is the essence of framing. It's a great practice in any kind of design. Even if it's the biggest, wildest, most ridiculously rad idea you've ever had, quickly putting a few constraints in place will help narrow your thoughts just enough for you to make progress. I think we all know the worst thing you can do at the beginning of a project is to start second guessing yourself on every little aspect or continually spin around and around on idea variations rather than just picking one. You may not choose correctly, but at least you are moving forward.

Overview

Regardless of the idea itself, deciding and internalizing what's in and out is an important part of any creative project. It's a bit difficult to shut down exciting possibilities, but necessary at this phase. You work through the list one-by-one. Narrow the focus. Identify the essence. Choose the hero. Put it in gear.

Think of framing as having three major parts to work through – making initial decisions, understanding key aspects, and seeing things from different perspectives.



Framing is your intentional setup for impactful work

Let's start by deciding on a few key elements to get us moving.

Initial Decisions

Normally, you carefully consider decisions on how to proceed at the beginning of the typical creative or technical project before committing to a particular approach. It's just too expensive to go down wrong paths or dead ends.

Conversely, with envisioning, if you think too hard about how to best capture your thoughts you'll never pick one and get started. We always try to bias toward action with envisioning, let's just get to it.

ENVISIONING HOLOGRAMS

The initial choices you need to make are which **idea**, what **scenario** best illustrates it, which envisioning **technique** to use, and in how long a **timeframe** are we working.

Idea

The first decision is an obvious one – what idea are you going to depict? What are you trying to visualize to share with others? Don’t try to figure out which of your dozens of ideas is the best. Pick the one you feel could be explained best given your skillset and team.

For example, maybe you want to depict telepresence to your audience. Telepresence is broad, and could be in a business setting, a medical setting, an educational setting, and the list goes on and on. Don’t waste time examining every scenario in a futile attempt to find “the best” one.

Just choose! Flip a coin if you must, or just choose one that’s “good enough.” Got one in mind? Great. Let’s move on to figuring out how to tell its story.

Scenario

Every breakthrough idea has a compelling scenario that really brings it to life for people. Scenarios are a sequence of actions (or possible outcomes) that highlight the human side of the idea you are excited about. These are effectively short stories or individual scenes in a play.

Well-constructed scenarios allow for paths through the narrative, provide some sort of tension (just like good sequences within films or books), and ultimately leave us with a satisfying ending. Scenarios don’t need to be complicated. In fact, you can typically explain a scenario in just a few well-crafted sentences.

Scenarios follow all the same rules as stories – they have a beginning, middle, and climactic ending. The setup of a scenario involves a situation or problem the main character is grappling with. Next, something happens to introduce our heroes (the holograms) into the scene, and finally through interaction we see how they have made the situation so much better or more interesting.

Remember that it's never about the technology when we're doing envisioning, so this scenario so focus on the human side of the equation. It needs to show off how your idea and associated tech will help people do something they can't quite accomplish today.

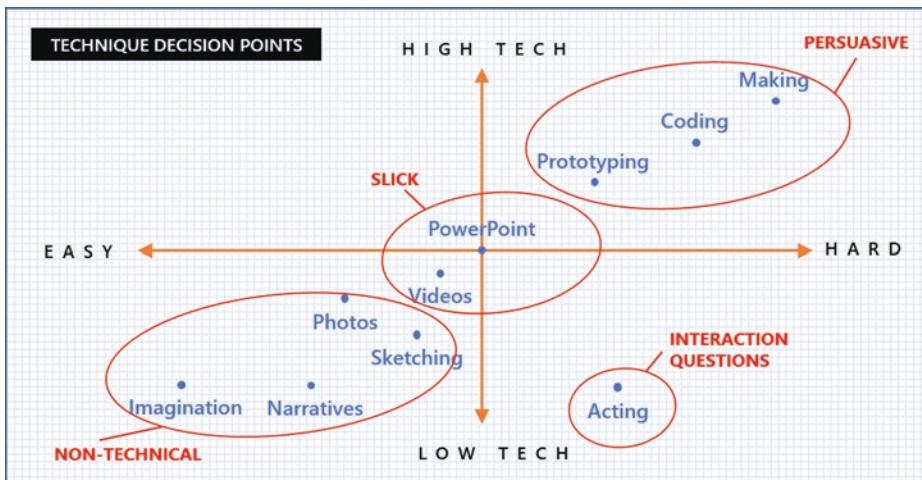
Picking the right scenario to go deep on can seem daunting. It shouldn't be. There's no data required to figure this out. It's more about listening to your gut instinct on what story will play out best for people in this narrative form.

Technique

With so many compelling ways to capture and express your ideas for mixed reality experiences like sketching or acting things out, it shouldn't be that hard to just pick one and start running. But, like many other things in life it's never really that simple. As the sage designer Bill Buxton points out, all design techniques are great at some things and lacking in others. Some envisioning approaches are quick to execute since they're a bit less refined, while others are slick and persuasive in order to provide an amazing emotional connection. There's no shortage of ways to tell your story memorably. The trick is picking the one that lets you work through it quickly to create something that can be shared and discussed.

ENVISIONING HOLOGRAMS

We'll cover why certain techniques work better than others in the next section, but for now here are the decision points when choosing – those easiest for non-technical people to leverage, the most persuasive, higher production quality, and those best for delving into interaction questions.



Deciding on which envisioning technique to use should be goal based, not skills based

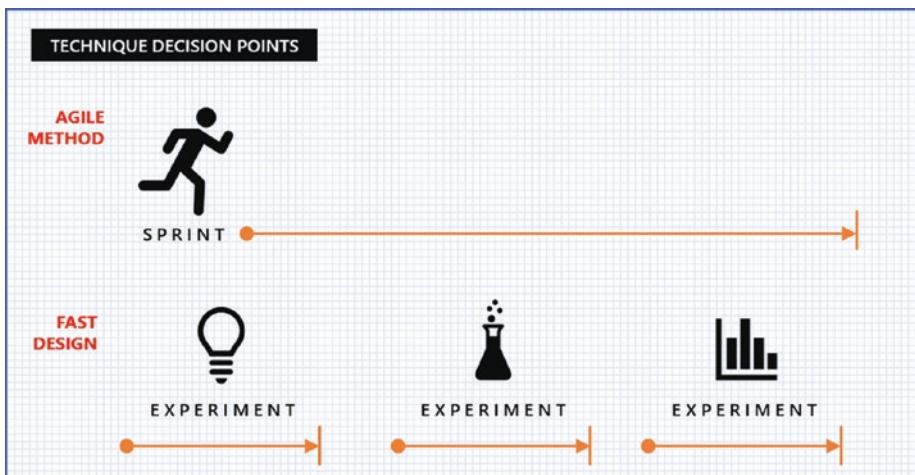
Is the scenario a technical one or not? Does it require special software or hardware to pull off? Will this be a quick exploration or is it more involved? All of those questions figure into the final decision on technique.

In the end, your final decision may come down to which technique you're most familiar and comfortable with. And frankly, that's just human nature. We're not always going to jump into a completely new learning situation just to broaden our skillset or satisfy our curiosity. There are deadlines, clients, and schedules to appease. All that said, time permitting, I'd encourage you to try various approaches to see for yourself the pros and cons of each, so the next round of envisioning is that much easier. For now, let's just pick and move.

Timeline

Nothing sucks the life out of a new project faster than putting a schedule in place before doing any real work. Really. Once you set the end date of something it's almost as if you just shutdown the creative possibilities. When you start working backwards to figure out what fits and what doesn't in your schedule, you have essentially boxed yourself into a forgone conclusion. I suppose that's the reality of creating things within agile development sprints these days, but doesn't mean you have to run your envisioning project that way.

We can choose to look at the envisioning phase of projects another way, where the overall fixed timeframes provide a great opportunity to reconsider our approach. Why not do many small explorations that far less in-depth rather than one super deep dive to cover more ground and a wider scope?



The value of doing many quick explorations versus one long sprint is magnified in MR

ENVISIONING HOLOGRAMS

This situation highlights the classic dilemma in project management – go faster to get further in a shorter time with less quality, or spend the time to more deeply explore the design space? In envisioning, we need to lean toward the first approach, meaning faster is better in almost all cases. Overthinking and overanalyzing things is not helping anyone.

Deciding to aggressively timebox an envisioning exploration forces you to consider the key aspects upfront (or run the risk of floundering about toward the middle of the project).

Key Aspects

Identifying and deciding upon the most important characteristics of your envisioning project really comes down to just a few key factors – the **impact** it needs to deliver, the **outcome** you are trying to achieve, the **skillset** you possess to execute with, and the degree of **realism** required to persuade.

Impact

The ability to leave a lasting impression directly affects the success of your envisioning efforts. Creating real impact means influencing someone's thinking in significant ways. That often requires you to distill things down to just one or two key impressions. Identifying those can be a difficult thing to pull off, but when done well, these signature moments will stay with people long after they first encounter them. The great ones leave permanent imprints on our memories because of the connections they made.

It's a tall order, impact. Given we are trying to evoke particular emotions and feelings in the viewer, it's best to consider impact as a *goal* rather than an expected result. We can say that our chosen approach will

cause people to laugh or be entertained, but it's another thing entirely to believe we can alter their thinking.

The delivery mechanism (or medium) used also plays a critical role in getting to the desired impact. Pick something too low fidelity and you can't create enough of an impression to be memorable. Choose a higher fidelity and you'll find yourself too busy to try out different ideas. Best to shoot for something in the middle that delivers the emotions you need without dragging you into a drawn out production process.

One subtle thing to realize as we're working through these key aspects is that creating impact is not the same as driving an outcome. Impact is emotional. Outcome is action oriented.

Outcome

Behaviors and actions that happen as a result of an envisioned experience are the outcomes of our effort. Outcomes are the easiest aspect to picture and define, yet hard to predictably achieve. People's behavior will vary. Environmental factors play a role. Even the quality of the execution figures into how scenarios turn out in practice. Outcomes happen. They do not follow logically.

That said, there's a good reason to try and propel the scenario toward the desired outcome through any means you feel is appropriate. Well-designed outcomes yield higher satisfaction from the participant. Giving people direction, advice, or hints as to the next logical step along their scenario's path helps to provide a sense of accomplishment and achievement, much like leveling-up in a video game. We want people to have a sense of satisfaction from their efforts.

ENVISIONING HOLOGRAMS

The skill of knowing which envisioning approach and technique is most efficient in getting to a desired result comes with practice. That's why we talk about exploring quickly and often, to gain that comfort and expertise. If you are trying to convince someone to fund your idea, choosing a higher fidelity technique like video or working code is probably going to get you further than a sketchy hand-drawn storyboard to show your coworkers. Fidelity and style definitely affect impression and ultimately outcome.

Another interesting part of determining outcomes is figuring out how to deal with unintended side effects and unexpected consequences. Just because we didn't realize our scenarios would result in unforeseen outcomes doesn't mean they aren't valuable. Digging into the thought process and actions that led to the side effect or consequence will help you become a better interaction designer. Look for these opportunities as you work through the build-out and testing of your ideas.

Skillset

The talents that enable people to communicate using particular techniques are the skillset we're most interested in understanding and harnessing. Individual skills in this area can be as specific as the ability to draw and create 3D animations, or be so general as to not usually show up on a resume (such as being convincing or persuasive).

Knowing what skills you and your team have before starting down the build sequence is helpful in planning or establishing a confidence level. That said, lack of skills shouldn't be an argument to not try something out. In this new medium of mixed reality, new skills should be picked up as needed. Don't be afraid of what you don't know how to do. Being uncomfortable is the new normal in this field. It's all happening so fast,

it's best to set off in the direction you think will result in convincing storytelling and then find ways to get there as you go along.

Another aspect of growing your skillset as you go is purposely seeking out diverse perspectives and new techniques. It's incredibly clear from working with fast moving, innovative teams that having a more diverse background and expertise results in a better collaboration and outcomes. Whether you are working by yourself or can recruit a team to collaborate with, try to find ways to leverage the skills you may not feel as comfortable leading with - dramatic storytelling, technical detail, visionary aesthetic, whatever it takes to get the idea across persuasively.

Realism

It's important to note that by its nature envisioning does not have to be completely realistic to the current capabilities of the platforms or tools that currently exist. Envisioning is generally "of the future" and as such can feel more inspirational than factual.

As designers, part of our job is to push the boundaries of what could be to illustrate how things should be. Conceptual design or envisioning is a great way to do that. When done well, it poses hard questions, raises concerns, pushes engineering to consider, and creates dialog to further explore the issues. At its best, this type of envisioning is inspirational and provides a North Star for aspirations and dreams.

For example, in my *HoloScenes* series there's an underlying premise that anyone can see the holograms in open spaces because they have been publicly shared and the technology used to see them is prevalent and frequently used. None of that is true today, but that's not the point. It illustrates a possible future that we can work toward.

ENVISIONING HOLOGRAMS

Envisioning can also be used to show your ideas quite realistically, remaining true to existing capabilities and norms. This type of design is done to help people visualize something that has yet to be built. It's meant as a blueprint of sorts rather than a directional suggestion. The real difference between this type of envisioning and a more fanciful treatment of the subject matter is that people can recognize the realistic nature.



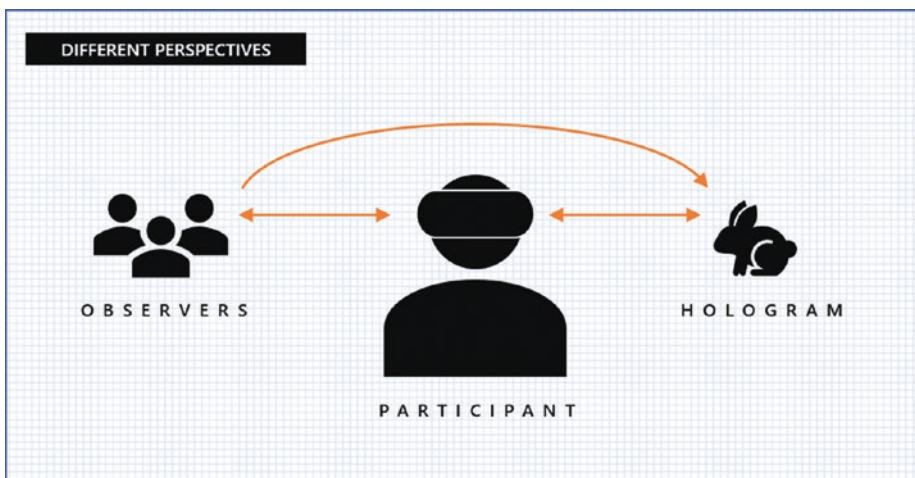
Using highly detailed models for your holograms is stunning, but can affect performance

Combining both realistic and futuristic aspects of ideas is my favorite way to work in this medium as you saw throughout my examples. We can combine established practices and capabilities with hopeful improvements to take your audience where you need the story to go—whether to push on the technology side of the project and platform, or to set new ideas forth for interaction and participatory possibilities.

Envisioning is exactly what you need it to be, realistic or fanciful. It's an aspect that determines how your idea will ultimately be perceived.

Different Perspectives

It's always valuable to take the viewpoint of another person (or whole group) to understand their perspective on something. That's magnified when you're trying to convince or persuade someone about anything. In the case of envisioning, we should consider how the incredibly diverse experiences and backgrounds of everyone involved will affect their perception of what we're trying to get across. This goes beyond listening to another's viewpoint. You need to find a way to embrace and integrate other people's thoughts, even if they run counter to yours. I can tell you from personal experience, doing this well helps strengthen the core ideas.



Try looking at the overall holographic experience from each vantage point

The baseline for understanding perspectives starts with the participant's viewpoint, but needs to include several other critical players in the scenario.

The Creators

It's all too easy to forget about those behind the scenes – the creators of the holographic experiences people participate in. Theirs are some of the most important views to consider. Understanding and taking stock of the perspectives of those who'll be creating these visions will help determine the right path to head down. Chances are several people will be involved in bringing this to life, so let's understand how each of their roles is best suited to help move the vision to reality. This is no means exhaustive, just a representative sampling of the roles you undoubtedly have on your team or possess yourself.

Designers tend to take a three hundred sixty-degree approach to the scenario, wanting to explore all of the different elements in play before committing to any particular execution. We like to understand the people side of the scenario, the motivations, setup, and emotional aspects as well as the interactions and tech. That well-rounded viewpoint makes working through the scenario that much easier. Add to that the attention-to-detail that most designers have and you've covered a huge amount of ground by engaging with people in this role.

Developers love to dig right into the technical aspects of the scenario, making sure we get how this will all unfold from an executional perspective. That's incredibly valuable in the early stages of figuring out the scenario (as long as this reality check doesn't squash ideas). There's always going to be technical issues when turning ideas into working code. The trick is to not let the weight of the challenge drive the enthusiasm out of the effort to overcome it.

Storytellers (otherwise known as marketers and executives) are worth their weight in gold during the early phases of envisioning. We're not all as skilled in weaving narratives that stick with people long after they've heard

them, nor are we articulate and concise enough about our own thoughts to convey them clearly and succinctly. Some of us are natural storytellers, yet the majority of us can certainly use another pair of ears to listen and repeat back to us what we wish we had said. People who spend most of their working lives constructing narratives and quickly getting to the point often have the innate ability to see into the heart of complex scenarios.

The Participants

Empathizing with the perspective of the people within the experience is really important when envisioning. We talk at length about the fictitious “user” (which doesn’t actually exist, don’t get me started) but little about the viewpoint of real people with feelings and emotions. Putting yourself into situations you can’t normally relate to is eye opening and enlightening if you let it be. It’s something you may need to work at a bit to get good at.

There’s also a very old adage in the high-tech industry that goes something like “Don’t design for yourself, because you’re not the user.” That couldn’t be further from the truth when it comes to designing holographic experiences. We are all still enthralled with this new medium, so even the most experienced among us have similar reactions. The shine doesn’t wear off that fast. Taking the viewpoint of someone in the mix isn’t that hard – it’s natural. Be the ball. Put yourself and your own views inside the scenario and explore how you’d feel in that position. Lean into it. Own it. Then test it yourself. Be ready to prove your findings to others through immersing them, too.

After understanding how you’d feel within the scenario, ask others how they’d feel. Listen carefully. Ask questions. Other people’s views are often the bolt of lightning you need to disrupt a locked in view. Don’t let the sting of a contradictory opinion shut you down. Make sure you really get what they’re saying, then ask them to act it out if possible. Now here’s

ENVISIONING HOLOGRAMS

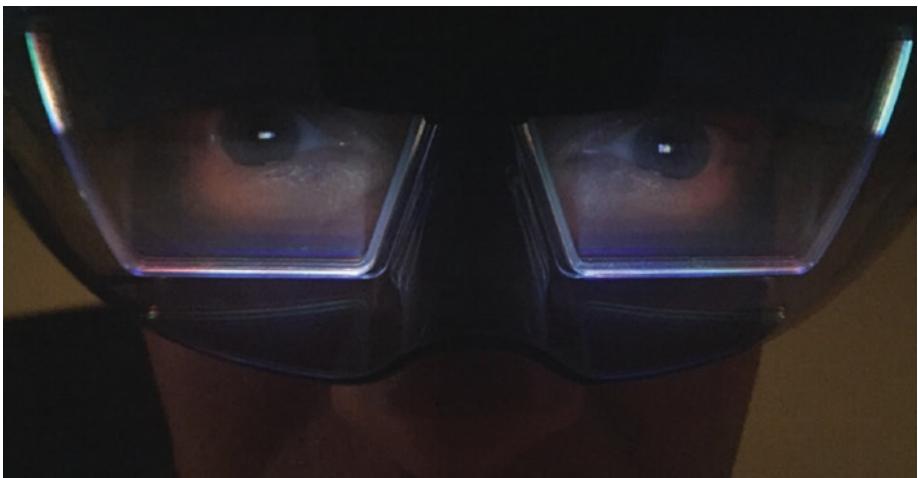
the kicker - take the feedback you get from others more seriously than your own perspective. I'm not saying temper or bend your vision to fit other's views, but the fact is there are so many things we can't see from our vantage point we need to err on the side of other's viewpoints. There's a whole spectrum of things we miss – from cultural norms to intellectual sophistication. Political views. Age appropriateness. Technical savviness. They all play into how your vision is accepted or not by the audience.

This is another great example where putting people before technology helps get you into a much better positon to start from. Consider how people will react to your vision before doing much else. It'll help guide every decision from then on.

The Onlookers

Let's not forget about the people who aren't directly involved in action. They aren't distanced like an audience in a play. They are standing right next to you. Knowing how these onlookers think and feel about what they're witnessing can only help to positively influence the work. They may or may not be directly interacting with the digital actors themselves, but they are certainly a key part of the overall experience. The participant is aware of them and vice versa. They play off each other, perhaps not as intensely as a live band and its crowd feed off each other, but there's a constant awareness.

It's also easy to forget all this holographic stuff is a mighty strange thing to behold for the first time as an observer. Let's not kid ourselves. People with headsets, visors, or glasses waving their arms and talking with invisible objects or people is pretty strange. It's hard to not react to that.



Don't kid yourself. People wearing special optics are not blending in.

Remember how you reacted the first time you saw someone wearing one of those ear-mounted Bluetooth headsets? Exactly. It's weird. Hard to have some reaction or at least an internal conversation as an onlooker. Even someone talking to their personal assistant on a mobile gives you pause every now and then. Just be aware that we are not quite at that point of people regarding this type of interaction as an every day, run of the mill occurrence. Something to keep in mind.

You look completely ridiculous wearing any kind of headset or mixed reality gear. Just accept it and move on.

Since the participant can see all of the onlookers in mixed reality, they probably should come into play in some fashion when as the scenario unfolds. Well-designed scenarios fully integrate these spectators into the action rather than ignoring their existence. Why not utilize them are key elements in the narrative if they exist? And if not, be prepared for

ENVISIONING HOLOGRAMS

interruptions by onlookers and people who genuinely belong in that same space as the participant.

The Holograms

You better believe holograms have a unique perspective. Not merely digital actors or props, holograms are the stars of the show. They need to emote, provoke, and entertain as much as any actor on the stage. That requires a perspective and a point-of-view to properly calibrate. This is another great design exercise to jump into – put yourself in the position of the hologram, whatever it is, and play out the possibilities within the scenario from that perspective. We talked earlier about how physically acting out a scene is a valuable technique for envisioning. This situation of needing to understand a hologram's perspective and viewpoint is perfect for that technique.

Finally, let's agree that holograms have feelings, too. Not kidding here. They are not just digital constructs that carry out our programming within the scenario and do our bidding. They show as much emotion as we do (if we as creators think that far into the scenario). We need to treat holograms as actors in the play, co-stars in the production, meaningful partners in our endeavor. It doesn't matter whether a hologram is a rock or a rock star – they both have the ability to understand and react to anything in the scenario if we make it so.

Imagine how it would feel to have a holographic rock react to the emotional state of the scenario participant, much like a 1970s mood ring would purportedly change colors depending upon its wearer's emotions. Does a mood ring chemically responding to changes in body temperature and pulse constitute an emotional perspective? Of course not. But, that's the kind of effect that creates a connection with people and makes them believe in the illusion. The mood ring provided a means of tracking and responding to physical state, not so different than we can provide via our

elaborate sensors and cameras. The hologram doesn't actually need to understand the participant, but it can reflect what it observes about their current frame of mind to work on that connection.



Even the hint of emotion from a hologram endears them to you

Emotions are the most powerful motivators we have in any kind of storytelling, so it follows that holograms employing at least a semblance of emotion when interacting to any kind of stimuli will add to the overall immersive illusion. Using this premise that holograms do really have feelings adds a powerful driver of action to any scenario. It can easily be overdone or misused, but imagine the possibilities if we learn how to add just enough to cross the line into belief.

Transition to Building

Now that we have a basic frame around our idea which includes the right perspectives, some initial decisions to guide us, and insight on the key aspects, we can turn our attention to the business of making it tangible enough for others to experience and comment on.

CHAPTER 11

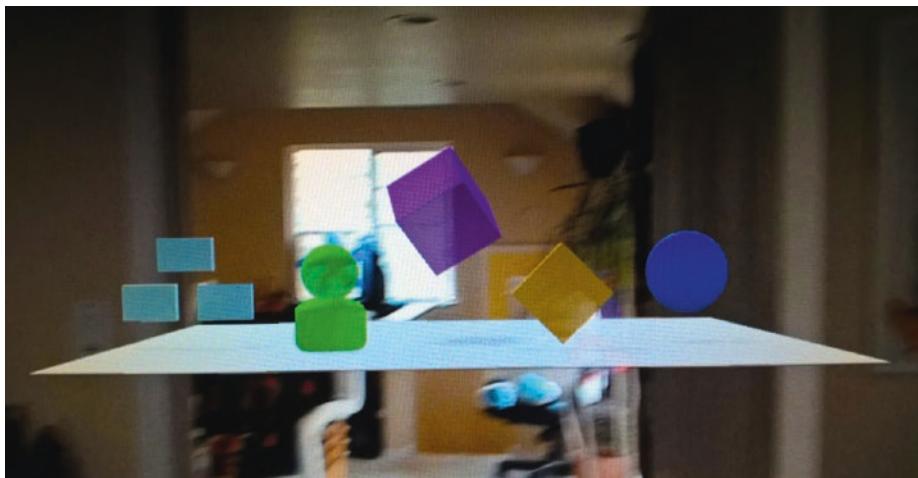
Prototype

So, you wanted to see it actually work?

The prototyping phase of envisioning is all about putting it in gear and mashing the accelerator down to the floor. We need to create something tangible to experiment with quickly, because the greatest ideas don't amount to diddly squat if people can't try them out themselves on some level. We need to make ideas just real enough to judge whether they're making a connection with the participant or not.

To get there, let's first cover the general steps in prototyping and what type of techniques may be useful to different roles. Then in later chapters, we'll dig deep into specific techniques through real-world examples.

ENVISIONING HOLOGRAMS



Prototype using simple shapes to quickly get on-device positioning correct

Preflight

Ordinarily, you'd think the prototyping phase of the project means going straight into execution mode. If you're a developer, you start coding. If you're a designer, you start drawing. If you're a storyteller, you start talking. But, we know better than that. There are a few things to decide before we start running as fast as possible – the key one being what do we focus on and prioritize?

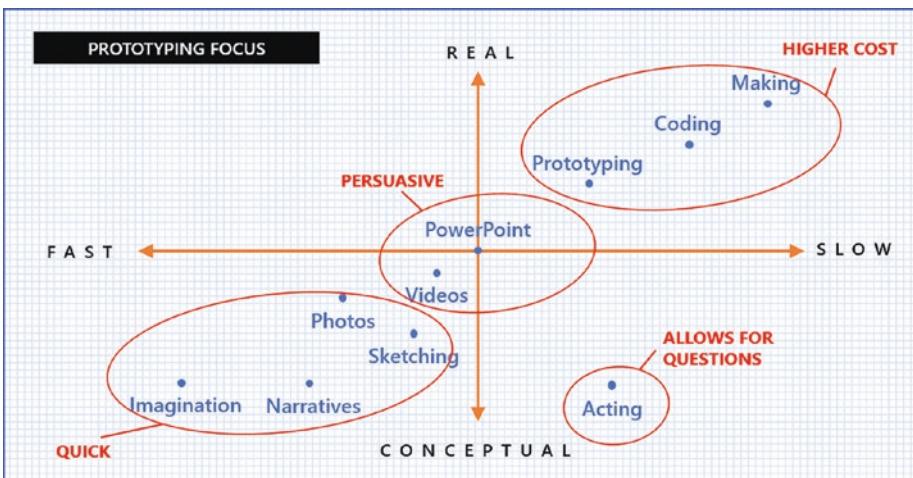


Figure out what envisioning aspect you are going to prioritize up front

Another aspect to consider before doing anything else is thinking about potential issues that we may run into that could delay or derail things. Nothing should stop us from moving ahead with the idea, but it is handy to preflight the good and the bad that could happen as we start moving quickly. What's the biggest challenge you can think of right off? No big deal really, or it's really going to take some effort to figure that one out? Either way, give it a quick thought before jumping in. Could turn out that quick thought changes how you'll answer some key questions.

What special equipment will you need to run down your idea? Do you just need relatively simple means to get the idea across or does it require a full-blown VR setup and skilled crew to help? Is a special room or setup required? What resources do you have access to?

All those questions should be thought about quickly during the preflight check.

Focus

Before we leap headlong into our prototyping exercise, we need to reflect back on **the real reason for creating the prototype** in the first place.

Are we trying to get our idea in front of others as quickly as possible? Does our idea need to dramatically impact someone's thinking? Is our prototype meant to silence the critics by demonstrating something technically difficult can actually be achieved? Something else?

The hard part here is choosing just one of question to focus on in this particular prototyping exercise. It's easy to fall into the trap of saying is for many reasons, but you'll be spread way too thin if you can't focus on just one reason over the others.



WINDOW OF OPPORTUNITY

PRIORITY = SPEED



MAKE AN IMPRESSION

PRIORITY = QUALITY



TECHNICAL PROOF

PRIORITY = COST

Efficient prototyping requires identifying your focus early on

The choice typically falls into one of three categories – seizing an opportunity, making an impression, or doing a technical proof. Since there will always be prototypes, let's just pick. Choose whichever focus suits you. Got one? Great. Now let's figure out how to get the prototype done.

Priority

It's often said we can't really focus on more than one thing at a time. In a similar way, you really won't be able to go very quickly through the prototyping phase if you try to prioritize more than one key aspect of the process.

There's an old saying among project managers that out of the three main aspects of projects to keep in balance (**speed, quality, and cost**), you can really only have two. Same thing applies in prototyping. There are natural tradeoffs that prevent you from achieving all three. If you go fast, you suffer on quality. If you dig in on quality, you sacrifice speed and cost, etc. Except, I'd go even further with mixed reality prototyping and say you should consider focusing on just one goal from a process standpoint.

Ruthlessly prioritize just one aspect of your prototyping.

For example, getting the basic idea of your holographic experience across as quickly as possible (speed) will prevent you from going super deep on details (quality), but it will probably save you time and effort (cost). That's fine if we're making speed the priority. Sacrificing some quality and reducing the amount of work put it gets us to done.

Another example is committing to coding up an actual working demo of a key aspect of the experience (quality). You know it will take additional time and money (cost), but without that extra effort your idea may not be able to proceed much further and lose momentum (speed). Sometimes making it real for people is the right choice despite the longer development time.

ENVISIONING HOLOGRAMS

The tradeoffs here are endless. Fortunately, there are some pretty clear reasons why you'd want to prioritize one aspect over another that we can use as guidance.

1. Window of Opportunity

If your goal is to capitalize on a situation that will evaporate quickly, there's no choice but to prioritize going as fast as possible when creating your prototype (whatever form that may be). We all have stories of not being able to react quickly enough when opportunities present themselves, and they are no fun at all to retell. If the window is open, go for it.

Priority = Speed

When you have to force something into existence to illustrate an idea quickly, there's no question you have to prioritize speed of execution over everything else, even if that means the overall quality is lower than you'd like or it costs more to do because of the time crunch. This holographic computing space is moving at light speed, so the limited window of opportunity aspect will rise to the top fairly often. Embrace the chance to haul ass and get things done as fast as you possibly can. It's actually a nice change if you work on product teams to play it fast and loose rather than have to apply rigor to everything you do.

Table 11-1 discusses the impact on speed of different prototyping methods that you may choose. There is no one method that is faster than the others – they all rely on your skillset. Choose a method that seems reasonably appropriate given your skills and available resources. Are you a natural writer? Then maybe writing is fastest for you. Do you have access to video production resources and expertise? Then maybe incorporate video into your prototyping work. Choose a method that plays off your own skills and available resources, and that is also effective in communicating your idea to others.

PRIORITY = SPEED		
METHOD	PROS	CONS
✓ Narrative	Easy to imagine and tell stories	Verbal and written prototypes are intangible
✓ Sketching	Fast and fluid medium to get ideas down	Hard to get some concepts across
✓ Photos	Convenient to capture or find photos	Will require some overlay to convey ideas
✓ Presentation Tools	Anyone can create/edit them; easy to share	Locks you into linear storytelling
— Videos	Incredibly powerful storytelling medium	Easy to shoot, difficult to edit into compelling form
— 3D Tools	Similar digital assets as used in production	Difficult to use for beginners; steep ramp up
— Coding	Using the actual tech keeps it real	Slow and costly (generally) compared to other methods

Table 11-1. The impact of focusing on speed in prototyping

Speed = Quick Prototypes

When speed is the priority you're looking for mediums and methods where you can get to the tangible output fast, but that doesn't mean you have to remove any of the methods available to you. Some people are almost as fast coding something up as others using a dedicated prototyping tool to create in. This is where you need to look closely at your collective skillset and match the vehicle to the talent.

Make an Impression

If the goal is to blow away the people who see your prototype for the first time, spend all your time figuring out what that signature moment is and spend all your time making that work flawlessly. Put your emphasis on a quality experience showing off that key capability.

Priority = Quality

There's never a second chance to make a first impression they say, so if you have to nail that first exposure to the idea, quality is your priority. There are times when you absolutely have to portray the idea in the best light possible, whatever the cost in time or resources. That means investing

ENVISIONING HOLOGRAMS

in the story flow, getting key interactions right, high quality visuals, and possibly making it a working demo to really blow people away when they see it.

Table 11-2 highlights the impact of different prototyping methods on quality. Be sure to consider quality along with speed when choosing a method. You want “good enough” just as much as “fast enough.” Getting both right is important.

PRIORITY = QUALITY		
METHOD	PROS	CONS
Narrative	Easy to imagine and tell stories	Verbal and written prototypes are intangible
Sketching	Fast and fluid medium to get ideas down	Hard to get some concepts across
Photos	Convenient to capture or find photos	Will require some overlay to convey ideas
✓ Presentation Tools	Anyone can create/edit them; easy to share	Locks you into linear storytelling
✓ Videos	Incredibly powerful storytelling medium	Easy to shoot, difficult to edit into compelling form
✓ 3D Tools	Similar digital assets as used in production	Difficult to use for beginners; steep ramp up
Coding	Using the actual tech keeps it real	Slow and costly (generally) compared to other methods

Table 11-2. The impact of focusing on quality in prototyping

Quality = Impressive Prototypes

Making a big impression doesn’t mean you have to prototype your concept to the nth degree of detail or have every whizzbang feature you thought of. What it does mean is you do have to deliver something stunning and memorable to your audience. There’s lots of ways to get there, not all of them artistic or technical. Using the element of surprise is one of the prototyper’s best tools, regardless how it is played out. Find a way to be impressive with your method of choice.

Technical Proof

There are times when important people just won't believe you can pull off that new-to-world feature of your holographic experience, no matter how well you describe you'll do it. Those are the times you'll have to dig in and write the code or create hardware to prove it's possible. There's an old saying that goes "Code wins." It's true.

Priority = Cost

We can look at the cost of technical prototyping in two ways – a negative drag on the project, or a normal unavoidable part of doing business. In the first case, you'll spend all your time trying to reduce non-essential prototyping activities and approaches which limits your potential output. Nothing wrong with doing code prototyping on the cheap, we just need to frame the activities a bit differently to be efficient. Conversely, seeing some cost to prototyping being normal allows you to focus on the output of the exercise and hopefully higher quality feedback. That said, spending lots of time and money on technical prototyping doesn't always return the value you'd think. There's a balance here, and **Table 11-3** helps you to find it.

PRIORITY = COST		
METHOD	PROS	CONS
Narrative	Easy to imagine and tell stories	Verbal and written prototypes are intangible
↓ Sketching	Fast and fluid medium to get ideas down	Hard to get some concepts across
Photos	Convenient to capture or find photos	Will require some overlay to convey ideas
↓ Presentation Tools	Anyone can create/edit them; easy to share	Locks you into linear storytelling
Videos	Incredibly powerful storytelling medium	Easy to shoot, difficult to edit into compelling form
↑ 3D Tools	Similar digital assets as used in production	Difficult to use for beginners; steep ramp up
↑ Coding	Using the actual tech keeps it real	Slow and costly (generally) compared to other methods

Table 11-3. The impact of focusing on cost in prototyping

ENVISIONING HOLOGRAMS

If you're lucky enough to have access to super talented engineer who can create a technical proof almost as fast as a designer can put together a good wireframe, you're golden. That's really the optimal situation for technical prototyping since the overall speed is not necessarily sacrificed by building out working tech. If things are more iffy than that – perhaps the tech is new and full of unknowns, chances are this form of prototyping will take the longest of any other. It may be completely justified, but it can get away from you from a time perspective if you don't pay attention to actual progress.

Cost = Technical Prototypes

Doing anything with real code and/or hardware is a time sink any way you look at it. Yes, people can be incredibly fast at what they do – but there's so many things that can go wrong with this approach of creating something real you have to watch really carefully for cost overruns and estimates being way under.

Methods

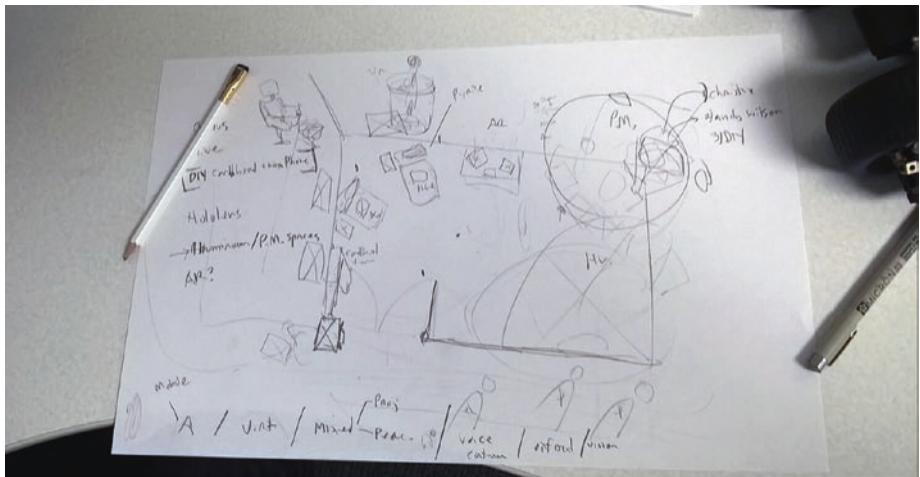
Now that we are clear on our priority for this prototype, let's figure out what method to use. We have talked about lots of different ways to test our ideas out, but which is the best one for this particular idea, focus, and priority? How do we determine that?

The method you choose has a lot to do with who you are, what skills you have on your team, or what you hope to learn during this work.

For Designers

Designers are multi-talented, multi-faceted, multi-dimensional thinkers and doers. Recognizing that designers can tackle everything from the overall feel of the experience all the way down to the specific details of

interaction, we tend to look at a few general methods that can convey all of that and more. If you don't code, you'll want to find a developer to help get the output of your initial work onto a device.



Designers should jot down some key aspects for Devs, not just jump into sketching

Common prototyping methods for designers:

Narratives come naturally to many designers as we are required to be storytellers in our roles. Being able to verbally convey an exciting story about breakthrough experiences should be relatively easy for many designers.

Storyboarding is almost an everyday thing for designers, so this will tend to be a very quick way to illustrate holographic concepts through sketching out frame-based stories like you'd see in film production.

Visual walkthroughs can be done using art tools and a playback mechanism like web pages or presentation software. A good example of

ENVISIONING HOLOGRAMS

this is a PowerPoint deck that contains some transitions and animation to get the basic feel across.

Design clickthroughs are typically created using specialized tools for rapid prototyping. These apps let you link screens together to allow for unattended demos.

AR videos are a quick way to get the basic gist of a holographic experience across by leveraging the real world, which is really the point of all this. This is a great choice to illustrate how things will work in physical spaces by using AR photo effects on your phone or tablet as the enabling mechanism.

Acting things out is seemingly a low fidelity way to illustrate experiences, but it's without question one of the best methods. The involvement of people as holograms within experiences brings an unlimited amount of functionality to any scenario since it's being driven by people instead of canned imagery or constrained software.

3D scene-based prototypes are done using software that allows the composition of 3D models, sound, lighting, and interactivity into spatial scenes. Much like game development tools, these specialized apps can output full fidelity mixed reality experiences that are deployed to devices.

Code prototypes are not out of reach for multi-talented designers. In fact, many younger designers are just as comfortable coding as they are slinging pixels. If you can code up your ideas and get them onto actual devices, you're a unicorn rock star. Leverage it.

For Developers

Knowing how to code in this quickly evolving world of mixed reality is a real advantage. Much of the real learning about work truly works well only comes from getting prototypes onto devices so they can be experienced properly, in full fidelity. Developers may not always have the design skills to make things as aesthetically pleasing or easy to work with as a designer could, but there's a lot to be said for just making it work. These code heavy methods are the desirable ones for developers to prototype with.



Get your code prototypes onto a real device as soon as possible to avoid costly mistakes

Common prototyping methods for developers:

Narratives are thought of a bit differently by developers. They typically would tell the story of the breakthrough experience as tech walkthrough on a whiteboard, diagramming and talking about specific aspects of the tech and ecosystem. Just as effective in many ways as anything a designer would do for the right audience.

ENVISIONING HOLOGRAMS

3D scene-based prototypes use the same composition apps used by designers, but devs will be able to bring a lot more interactivity and special behavior to the scenes created within the tool via scripting languages or writing custom code. These are super high quality when teaming with a designer for higher quality artwork and assets.

Code prototypes are what developers do naturally. They are super-fast and good at developing at this level of fidelity and functionality. These working code prototypes are the best we can do if a technical proof is required to persuade nonbelievers.

Hybrid prototypes bring together hardware, software, and services in new and novel ways. They can typically only be executed by Makers, those of us who are comfortable connecting hardware elements with custom software. Often needed for innovative demos.

For Storytellers

There's a real talent to telling engaging and memorable stories. Not everyone has it. Those of us that do should lean heavily on it to create prototypes of their ideas. Some of the best envisioning work that's ever been done was primarily storytelling through high production quality vision videos and television commercials. Many marketers, salespeople, and executives have the budgets and experience to capture compelling stories for this new medium.



Storytellers will want to channel their best Don Draper in the conference room

Common prototyping methods for storytellers:

Narratives are the core competency of storytellers. We are really good at not only telling a good story, but one that's memorable. That's gold in the prototyping world.

Storyboards serve as the primary way to visually convey stories over a period of time. It's not difficult for anyone to draw up a frame-based storyboard, but there's a real talent to doing it in way that emotes the right level excitement to hook participants.

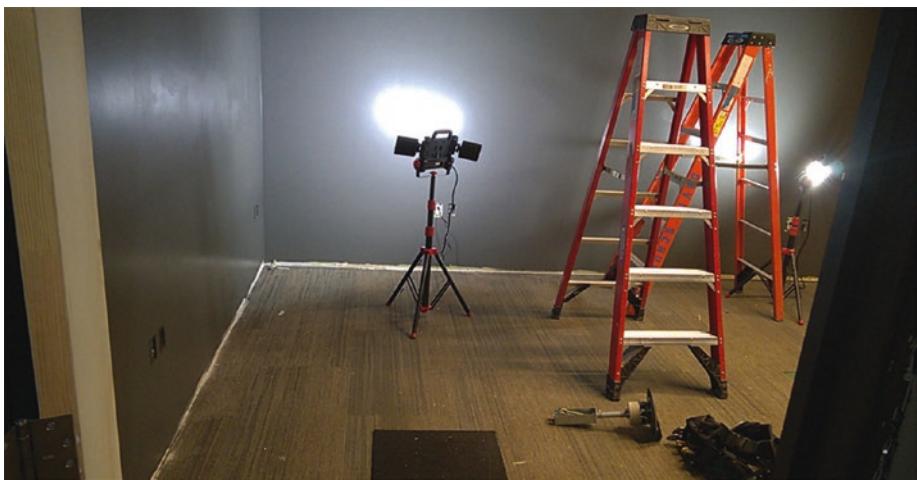
High production value videos are things of beauty. They are what every designer wishes could be done for their ideas, but they typically don't have their own budgets for these types of undertakings. These are long and involved to produce, but worth it for setting vision of what could be in a convincing and memorable way.

ENVISIONING HOLOGRAMS

Funding code prototypes is not that common for storytellers, but look at what producers like James Cameron and George Lucas are able to accomplish by doing early stage technical proofs as motion tests before funding major motion pictures. Same principle.

Environment

It's becomes pretty apparent after all the discussion about different methods that we may need adjust our space to accommodate this type of work. Or maybe we need to scout out more appropriate workspaces to get the kind of work done that help envision our ideas successfully.



Prototyping environments can be as simple as your desk, or take up an entire room

The setup for doing your prototyping and experiments is in many ways just as important as the methods you choose to execute them. Mixed reality is all about putting holograms within our world, physical or virtual. The backdrop for your prototyping could be as simple as the workspace

you are in. What's in your workspace that's interesting. Do you have a working VR setup or immersive headset to try ideas out with?

Whatever prototyping environment you decide on at first will inevitably change over time.

Output

Regardless of who you are, how you work, and who's on your team, the output of your rapid prototyping work is the only thing that really matters. You need to get tangible demos in front of people, so ride like the wind to get those demos out there in people's hands at the right level of fidelity and quality given the time you have allocated to get the job done.

A win is a win, they say. That couldn't be more true for prototyping.

CHAPTER 12

Test, Refine, Restart

The truth stings, doesn't it?

The hardest thing for anyone to hear about their idea is that someone else doesn't "get it" or they don't see the brilliance that sparked the creation in the first place. That's life in the big city. We will always be surprised and enlightened by what we hear from other people about the concepts we're envisioning. That's the whole point of doing this. There's no way we can anticipate what people will react to. Some of the key concepts may be totally lost on particular people and excite others. That thing you were positive would wow everyone? Nothing.



"The best laid plans" they say..

ENVISIONING HOLOGRAMS

All that said, there's an equally awesome side of putting your work out there. People react to it. Maybe even love it. That's incredibly energizing. When you put a quick prototype in front of an audience and they do get it, all the hard work and time fades away. Connecting is what we all aspire to through envisioning.

Now that we have a prototype to test out and refine, let's get to it.

Testing

In emerging fields like holographic computing, being able to test out a hypothesis quickly and iterate on the findings is critical. The entire space is moving, expanding, and evolving in real-time. Our testing approach needs to be adapted to that morphing environment.

The days of doing professionally moderated focus groups, controlled lab studies, and formal reporting are fading fast in favor of more immediate touch points with real customers. Not to mention many startups and individual efforts can't afford to work in that way. Web and mobile development practices over the last decade pioneered low-cost A/B testing methodologies and continual flighting of small-scale tests. We can learn how to leverage those to gain insights into people's thinking and feelings about our ideas. The key is picking the ones that are compatible with our quick pace.

“Excuse Me...”

Get comfortable interrupting strangers. The most effective way to quickly test out an early stage concept is to just show it to someone who has no idea you're about to ask them anything about it. No bias. No expectations. No canned response. This form of guerilla testing is best done one-on-one, politely, respectfully, and in public spaces. Try to match the venue with

your potential audience if possible. You also need to come up a test vehicle that suits that place. For example, you can't just roll up into your local neighborhood Starbuck's with a full-on VR rig setup without their approval. Conversely, you could easily show someone mockups on a tablet, laptop, or printed images without causing too much disruption. Using a self-contained headset like Microsoft HoloLens or similar is easy, but will cause a bit of a spectacle. Whatever, right?

When first approaching someone, quickly explain what you are doing, then ask if they'd be ok spending a few minutes giving you their reaction and advice. You don't want to make anyone uncomfortable by approaching them unexpectedly, so be aware of any physical and verbal cues that this may not be the right person or time. If you notice any of them, apologize for interrupting and just walk away. Also realize that mixed reality is a very new concept to many people, so you might have to give them a bit of background without coloring their thinking or biasing their response. We're looking for honest first reaction, not coerced feedback. Listen, don't argue or dispute what people are saying. Just record their responses in some way and find your next willing participant.

A rewarding aspect of this kind of quick hit testing is the unexpected resonance or excitement when someone is blown away by your idea.

Recorded Session

Another effective way to get feedback on early stage ideas you've envisioned is to recruit people to come into a controlled space and record them (with permission) as they experience things for the first time. Just setup a relatively quiet space where you can talk with them as they are engaging. Shoot a video of them talking through what they see, hear, and feel – it will be invaluable when trying to objectively evaluate the result of

ENVISIONING HOLOGRAMS

the test. We often remember things a bit differently than it happens from the camera's perspective. Good to have that other view to refer back to.



Use a video-capable DSLR camera on a tripod to participate yourself

Some prototyping methods produce output that can be used as physical props in the test process, such as printouts of images you created or video sequences. Best to let the test participant hold them or manipulate those themselves. It makes it a bit more direct and personal.

Whenever possible, digital prototypes should be used on-device to test out ideas. That might be as simple as a click through slide deck, or as immersive as a full on working technology prototype. Don't be afraid to put things that are rough in front of people. Any level of fidelity works for these digital demos. These moments are where we get a more visceral reaction and truer indication of connection or not.

Either way, you'll want to video record both the external view of the person experiencing it within a physical space, and also the internal or in-device first person view of whatever tech you are using. One exciting

new development here is the ability to video record everything about the test session using advanced video compositing techniques that give us a complete view of the experience.

Using the *Spectator View* technology with the Microsoft HoloLens and an HD video camera, we can see and hear the person interacting with our holographic prototype from a third person perspective. It creates a movie like effect where we're seeing the scene from an observer's vantage point. Very helpful to take this viewpoint as it tends to be much easier to watch due to the stability of the camera versus the shakiness of a first-person camera viewpoint.



Using “Spectator View” with HoloLens captures people and holograms (source: Microsoft)

The same type of composited scene is possible with VR headsets and green screens using consumer grade equipment. The visuals generated from these are striking because of the immersive nature of the environments. Seeing the person, the digital content, and the space all together in one view is magical.

ENVISIONING HOLOGRAMS



Green screen techniques allow other people to see your experience

Even though using VR provides a completely immersive experience versus seeing part of the physical room around you, it gives us a great workbench to experiment within and measure responses to.

Wide Release

The in-person and recorded session approaches don't scale up very well, so if you need to validate the early stage idea with a much wider array of people, consider trying to get your prototypes out to diverse audience through social media or via recruiting within online discussion groups. This approach is a bit more unusual in the case of envisioning early stage concepts as it's hard to have any sort of back and forth with the participant. Also, keep in mind it's a completely uncontrolled environment and you'll get the expected noise in with actual feedback.

The obvious challenges here is produce a prototype that can setup and experienced unsupervised. We also need to make it easy to share comments with us either during or after trying it out. There are lots of

online services for setting up feedback channels, post surveys, and keeping track of suggestions for improvements. If you're working at this large scale, invest some time in leveraging these mechanisms. This effort is obviously important to determining where you stand with this envisioned idea.

The upside of this approach is getting to a much wider audience for testing, much faster than any other way. The downside doing this testing in the open with little control over the sharing and discussion of these activities. Perhaps fine in some cases, detrimental to furthering the idea in others.

Results

Internalizing feedback objectively is extremely difficult. We're emotional beings. Actions don't lie. Criticism cuts deep. Try not to interpret or map what you saw and heard to a favorable outcome. It's human nature to want our ideas to be liked. There's an inherent bias to be big fans of our own ideas. That said, let it be what it is. Good or bad, people are going to say and do some things you never expected. That's not a bad thing. Any feedback is valuable if you try to understand the comments as a quick read on a new idea. Everyone is different. People are unpredictable. What one person thinks or does never defines it for all. Don't be discouraged by negative feedback or overly encouraged by positive reactions. Don't dig in, be open to changing things up.

Refinement

Testing is just the beginning of the fun. Once we have some initial feedback from other people, it's time to tighten things up and move forward. In some cases, that means making major changes in approach or execution. Don't be afraid of doing that level of adjustment. These are early stage

ENVISIONING HOLOGRAMS

ideas, so we could have missed the mark. Other times we can get away with small tweaks and call it good. And as with everything else we do in envisioning, this phase needs to go fast. There are a few useful things to plan for during this phase of the envisioning process – making changes while you test, and trying different approaches in flight.

Quick Turn Changes

It's optimal to be able to take in feedback, make a quick change, and then retest to see if there's an improvement. That kind of quick turn refinement takes some prior planning though. It's easily accomplished if you are using particular kinds of prototypes that allow for that. For example, if someone says they were confused by a certain response from a hologram, it would be great to jump in and make a change to try out on the next participant. If it's a code prototype, there are ways to structure your code and assets to allow for fast changes. In a similar way, redrawing images, changing out physical props, or acting the part of an element in the experience to try something new can get you better data.

Alternate Methods

There will be times that it becomes very apparent the method you are using to test out your idea isn't working. It may be that the medium doesn't give you enough fidelity to get everything across that you're trying for. Or conversely, the method you're using is too literal when you needed more left to the imagination at this point on the envisioning process. Whatever triggers it, there are times when quick thinking is needed to save the day and keep gathering valuable feedback from people. Don't be afraid to jump in and change things up, even if it requires some degree of improvisation or handwaving to hold the story together.

Whatever works is the best way to proceed. Just because a highly crafted video piece isn't getting the point across well enough, doesn't mean that you can't just start drawing a storyboard out on a whiteboard to keep the person engaged and offering up ideas. Try anything you think might work. Don't be self-conscious about doing this in front of the person. They'll appreciate your creativity and drive to get more feedback and data.

Reflection

Once we have enough comments and video to analyze, there will be a general impression that comes through about the holographic experience you originally conceived. It's important to note, good or bad. That general impression is often far more important than feedback on specific features or aspects. It lets you know if you're on the right track or if you have missed making a connection with participant for some reason.

When someone says, "It was cool, but blah," we tend to focus on what words follows the "but". That part tells us what went wrong or was missing. Nobody likes hearing criticism of their big ideas, whether constructively conveyed or not, but it is valuable to try and work through objectively. Yet, the first part of that "It was cool..." is the general impression that is easy to dismiss if we're too focused on the criticism part. Zoom out a few levels to try and give yourself some perspective on the entire body of feedback. It's this process of stepping back and talking about feedback that allows us to actually reflect on what people are saying.



Reflection doesn't help unless you actually give it the time and attention it truly deserves

Reflection will invariably lead to a decision about continuing on with the idea as its currently captured, or taking another shot at it with the benefit of all this feedback, or just moving on to something else.

Press On

If you and the team are encouraged by what you observed and discussed, there's no question you'll want to keep pushing on. Try to challenge yourself to not be satisfied with what you already have. Look for small refinements or big shifts to get an even better experience for people next time. And don't forget to savor the win. You successfully envisioned something that connected with people. That deserves some celebration.

Reboot

Having a test go poorly because people don't get the key aspects of the holographic experience is sometimes a blessing in disguise. It can result in you refocusing your effort on getting to the essence more quickly or clearly. There may be certain aspects you didn't work out quite well enough that will now get attention. Or perhaps you overestimated how easy or clear something would come through to people. Whatever it is, you missed the mark. This is your chance to fix it – or it's your chance to start over again. Embrace it. Love it, in fact. There's not a Designer I have ever met that didn't relish the chance to try something again once they've executed it once. You invariably learned something and will have the opportunity to do better next time. Rebooting the envisioning process with all of this new input will lead to some amazing new thoughts and executions.

Abandon

There's a point in some prototyping projects when you have to make that tough decision to stop work and move on. No shame in that. In fact, I'd say you learn more from this "failure to connect" than any successful testing session. Having to move away from things you worked hard at or are emotionally invested in open up all kinds of new thoughts about how to do things differently next time. Those are the fuel we need to envision better next time. Walking away from a particular execution of an idea is not giving up on the idea, it's pointing out that you didn't choose the right way to depict or make the connection. Walk away, but explore why that may have happened.

Restart

The formal end of any envisioning exercise is to start again.

Regardless of how the testing, evaluation, and reflection on outcomes went, you just became a better Envisioneer by listening carefully to the feedback from people and deciding what to do with it. It's never a waste of time to go through this process. You always can find some new aspect of the people, process, technology, or experience that informs a better idea. Then immediately restart the next envisioning process with what you learned this time.

Push yourself to try working a completely different way or use a new technique that will challenge you. Keep generating more ideas and testing them out. It's the only way that your best ideas will come to light and eventually make their way into the hands of real people.

Sometimes (re)starting is the only way to finish.

CHAPTER 13

Invaluable Tools

“Right tool for the right job” doesn’t apply anymore.

Designing experiences for mixed reality is an expedition into the unknown. You can't possibly know all the right tools and gear to bring along ahead of time. And we need to be fine with that. It's just too new of a design field to immediately get the best way to proceed at any particular time. The only thing we know for sure is it takes a willingness to experiment, learn from our failures, and then get back into the action by trying some off the wall ideas to keep things moving. Our toolset will evolve over time, informed by trial and error.



Tools of the trade for mixed reality envisioning include VR headsets

Ingenuity

The type of envisioning we're doing requires quite the diverse toolset - some of which haven't even been invented yet. That's where you come in. One of the ideas you're chasing down may need a new kind of tool to be fabricated right on the spot. Some ingenuity is required.

Every day brings inspiring examples of people figuring out how to use existing tools for completely new reasons in this field. Some of them are fairly complicated, like leveraging VR motion controllers as camera trackers for video compositing (probably not the inventor's original intention) or creating a whole new software tool from scratch just to help designers prototype the placement, scale, and manipulation of items.

Other times we'll be using tried and true old friends in completely new ways. Who thought PowerPoint would be so useful animating holographic scenes quickly? Did anyone see the voice recorder app on your phone as the best way to get your narrative down?

The search for new ways to create will have us regularly checking into tools that we've only heard about in passing. Needing to find a specialized tool for just part of scenario is situation normal. Downloading, trying, and discarding trials of things happens pretty regularly, too. It's all part of being willing to try out ideas regardless of what needs to be learned along the journey.

Just like the toolset, our traditional roles as people on the team are expanded, blown apart, and recombined in new ways. Developers are sketching things out regularly. Designers create interactive prototypes by coding. Storytellers embrace new methods that combine both technology and personal interaction. There are no hard lines that separate our disciplines in mixed reality. We are all who we need to be at that particular moment to move things along.

By now it must be apparent that exploring and creating for this brave new world of mixed reality means we'll all be uncomfortable at points because we just plain don't know how to get to the end. And honestly, that's the fun of it.

Design Tools

There are a handful of digital design tools that just about every designer uses – Photoshop, Illustrator, and After Effects. If you're into 3D, throw in Maya or Cinema 4D. Mobile? Sketch, right. All of these tools and many more augment our natural ability to visualize, draw, model, paint, and generally be crafty with our hands and minds. We have become so comfortable using them in particular ways they often become the basis for most of what we do design-wise each day.

That's about to change.

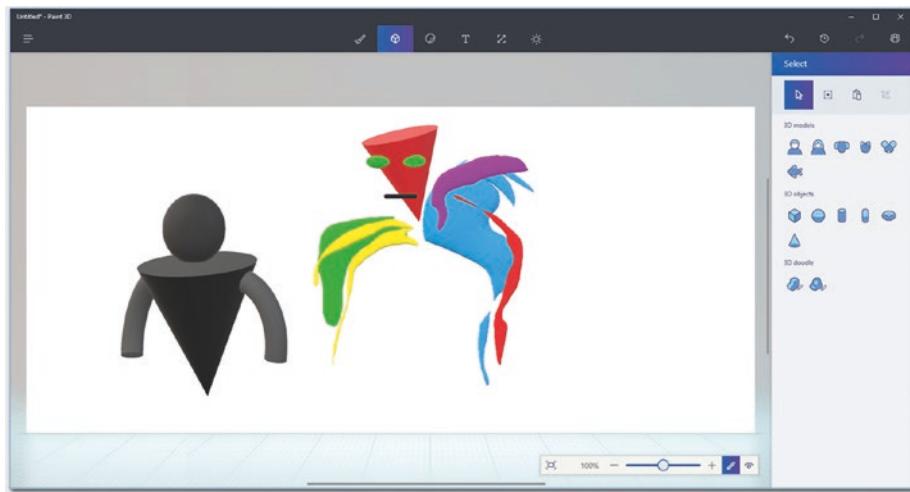
Envisioning for mixed reality is all about your ability to blend convincing digital holograms into the world. There's no app for that. We have to come up with ways of combining existing features of several different tools together to synthesize these visions. There's literally no blueprint for how to do this well. Embrace the fun of discovering how to accomplish these new effects, not how fast or easily they come. You'll be surprised at how many novel ways of getting things to work pop into your head when you're in it for the ride.

Here are a few tools to consider combining with others to create a new playbook and tool palette for your mixed reality work.

ENVISIONING HOLOGRAMS

Paint 3D

One of the new breed of apps that makes 3D approachable for anyone, *Microsoft Paint 3D* is deceptively powerful. Available for free as part of the *Microsoft Windows 10 Creators Update* release, Paint 3D builds on the simple paint program metaphor by effortlessly extending it into three dimensions – while adding mind-blowing new capabilities. Beside the basics of extruding simple drawings and shapes into 3D objects, Paint 3D also helps you place beautiful pre-built 3D models within a virtual space that can be shared with others online. Hundreds of high quality models are available from the online service *Microsoft Remix3D.com*, making easy to put scenes together quickly if modeling isn't your strong suit. Think of anything you create in Paint 3D as a stand-in hologram.



Microsoft Paint 3D is a great intro to 3D and terrifically useful in prototyping

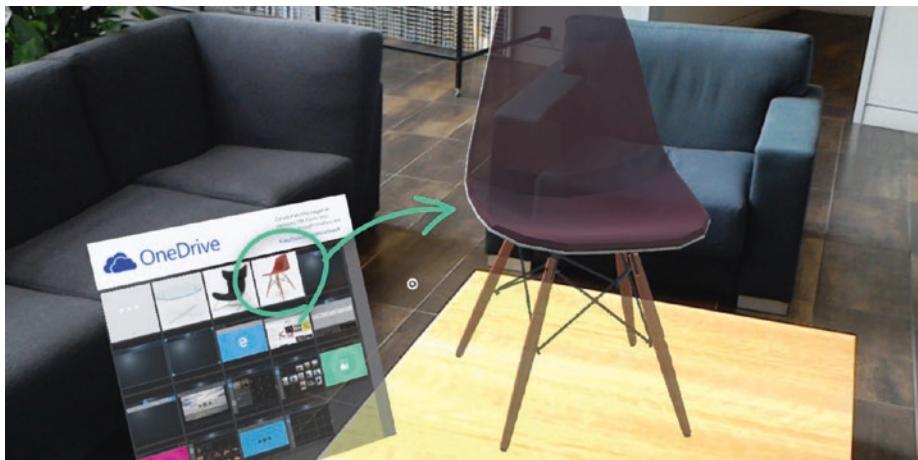
In a pleasant throwback UI surprise, Paint 3D offers a pro-active training overlay to get novices into 3D very quickly by previewing what the basic widgets do. The focus is clearly on the creator new to 3D, but the app delivers the goods for experts, too. The ability to export to a 3D model in geometry format for use in Unity and other composition programs is a huge plus. Fast in, fast out. The rendering and shading of objects is way better than you'd think for an app like this.

SUPERPOWER – Paint 3D is an incredibly useful tool for quick creation of placeholder holograms and composition of the scene to be translated in the real world. No device required. And the ability to paint directly on a 3D object is just crazy for a seemingly simple tool like this.

HoloSketch

As a mixed reality designer, there are times when you just need to “block out” an idea in the physical space it would occupy as a sanity check. Nothing can substitute for seeing how holograms will actually appear within the physical space you are working in. *HoloSketch* from Microsoft Design Labs is great at that task without requiring anything other than a HoloLens. Available in the Windows Store for HoloLens, just run the app and start pulling in models from OneDrive or create your own on the spot with built-in primitives and text.

ENVISIONING HOLOGRAMS



HoloSketch excels at the composition part of prototyping
(source: Microsoft)

The ability to compose a scene is just one step in the prototyping process, but it's a critical one. Ask any filmmaker about what makes a scene memorable, and beside the emotional aspect of the dialogue and interaction, the placement and relative positioning of elements in the scene makes a huge difference in the impact for the viewer. HoloSketch gives you a straightforward way to try out many iterations of your ideas.

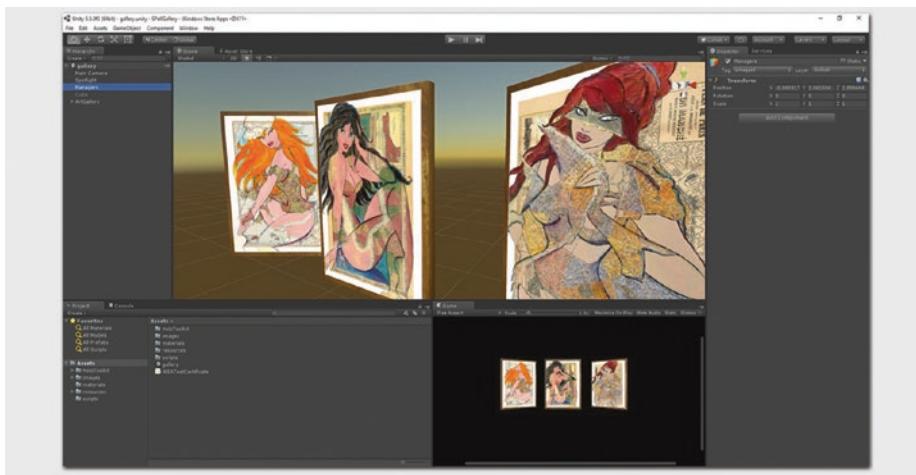
SUPERPOWER – HoloSketch gives you the ability to easily import and place holograms in-device. Nothing beats the ability to quickly holographic placeholders within the physical world.

Unity

Without question, the most useful all-around tool for working in mixed reality is *Unity*. This constantly improving tool allows designers and developers to create, compose, and test out their mixed reality ideas with real models and code within an integrated development environment (IDE).

Formerly considered a more technical tool for multi-platform game development, Unity is now very approachable tool for anyone to do simple modeling, 3D scene composition, wiring up interactivity, and applying incredible special effects.

Unity supports the preview of your project within its own window or a software device emulator, and serves as the first stop for many in the development path to getting actual bits on device.



Unity gives anyone a straightforward way to get from idea to working code

Designers have often loathed the prospect of learning true 3D modelers and animation systems, not to mention development environments. Although Unity is all of those things, the benefits of diving in and leveraging it get real with your ideas far outweighs any effort overcoming the slight learning curve. It's also built to support a very interactive and fluid workflow. Trust, me, Unity is your best friend for prototyping and turning your envisioning work into real projects.

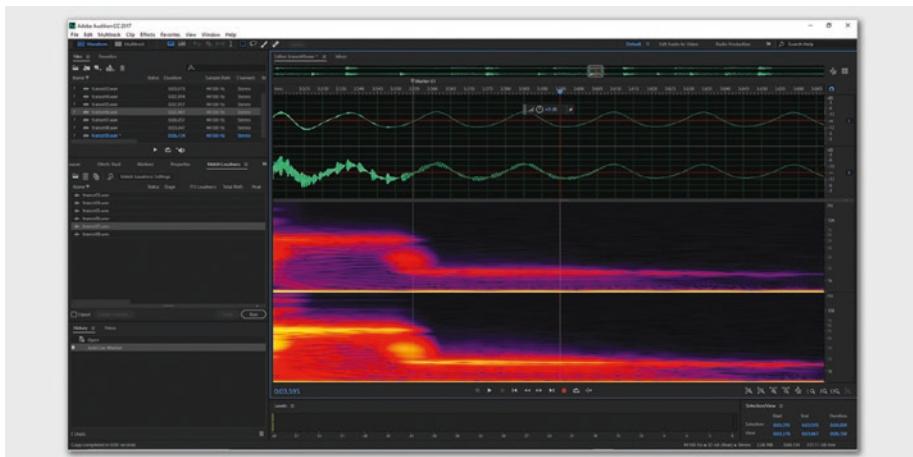
ENVISIONING HOLOGRAMS

SUPERPOWER – Unity is a one stop shop for everything mixed reality. This must have tool enables you to go all the way from idea to modeling, composition, adding object interactivity, previewing behavior, and finally preparing a project for on-device deployment.

Adobe Audition

Sound is the most overlooked aspect of mixed reality experiences (initially). Once you realize how impactful the right sounds and ambient soundtrack have on the overall experience you will automatically start figuring out where to incorporate them. That's where *Adobe Audition* comes in.

The mixed reality platforms allow you to place ordinary sounds you'd create or edit in Audition anywhere in the 3D space. By setting those sounds to particular sound levels and applying special effects, you can help the listener hear them coming from discreet positions – perhaps behind or even above them. That kind of spatial sound magic needs you to add code or assign sonic behaviors to objects in programs like Unity. Spatial sound is a very convincing effect and incredibly useful interface tool for designers.



Adobe Audition delivers what you'll need for audio design

Audio software and 3D modeling software are among the most complex and scary looking software humans have ever produced. Don't let that dissuade you from jumping in and learning just enough about the basics to get some great use out of this pro quality tool. Coming up with just the right sound for your ambient environment, individual interactions with holograms, and interface cues can all make the difference between a good app and a breakthrough experience.

Adobe Audition is just one of the many sound creation and editing apps you could use to record and manipulate sound – its key benefit being its high quality and comes included with an Adobe Creative Cloud suite subscription.

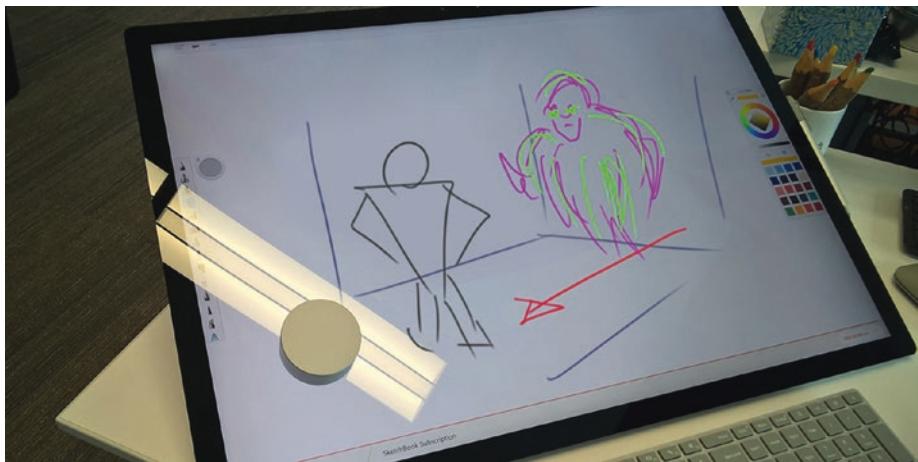
SUPERPOWER – every sound-related function available to you in one place with Audition. Sound is so important to the overall holographic experience that learning how to leverage the power here is a real advantage to the envisioneer.

Mental Canvas

The first time you see a 3D sketching app at work you realize it's completely natural, obvious, and one of those things that you could even imagine existing for real. *Mental Canvas* is a giant leap forward for sketching and an absolute wonder to use. Using a standard digital sketchbook metaphor, Mental Canvas brings an innovative set of functionalities to the task of sketching out scenes – the ability to zoom through the 3D space that your sketch exists in.

Formerly, digital sketches were done in layers just like in Photoshop. Mental Canvas changes the game by adding depth to the mix, made even more graceful and fluid through the use of the Microsoft Dial and a Pen on the Microsoft Surface touchscreen computer.

ENVISIONING HOLOGRAMS



Mental Canvas brings a third dimension to sketching using the Surface Dial and Pen

The combination of the Dial, Pen, and Surface touchscreen creates the perfect storm of productivity for the drawing crowd. There's never been anything quite like this available to artists and designers to add depth to scenes in such a natural way. Huge advance.

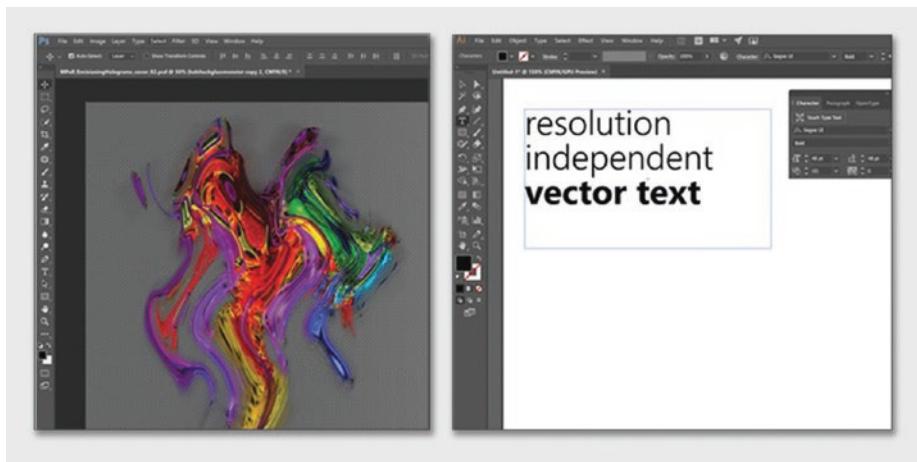
SUPERPOWER – being able to zoom through space to examine different areas of your holographic idea sketch is ground-breaking and incredibly useful during rapid ideation. This setup allows you to move through the scene in early sketch form to convey key elements.

Photoshop and Illustrator

Unlike many other areas of production design, you shouldn't reach for these workhorse tools first. Using *Adobe Photoshop* or *Adobe Illustrator* would mean you're probably thinking of locking in to high-fidelity comps of your ideas in 2D, which is fine, but not the optimal path to fully immerse yourself for mixed reality. Once you get going with other techniques, these

tools are great for compositing static elements together into comps to share with people, creating storyboard frames, or doing some conceptual illustrations.

It's hard to overstate the utility of these two applications in the workflow for mixed reality (or any creative endeavor for that matter). The interesting twist is that we'll be using them more like a game designer would – for conceptual sketches, high-quality texture creation, image labels, stand-in assets, and more.



Adobe Photoshop and Adobe Illustrator are your best choice for 2D asset creation

These incredibly deep tools also come in handy to create just any kind of visual asset imaginable for our prototypes ahead of time so that part of our process flows more smoothly. There are other apps that do this same kind of creation and editing, but none are used more widely, and have more online tutorials walking you through amazing techniques step-by-step.

SUPERPOWER – same as always, Adobe Photoshop and Adobe Illustrator are the best at what they do. They are highly reliable tools to help produce the critical parts of our digital assets.

Development Tools

When envisioning your projects, there will be times when you have to build out the prototype as working code. No getting around that. Perhaps it's because you need to do a technical proof of some innovative feature, or it's important to test out a theory about how things could work on-device. Sometimes it you may even need to hookup peripherals, sensors, or other pieces of hardware to get a working prototype together. Regardless, there are only a few programming editors and professional environments people universally trust to be solid and up to managing anything from quick one-offs to hugely complex projects. In these early days of envisioning, anything goes, but I'd suggest giving yourself a solid head start by using these proven toolsets.

Visual Studio

The various flavors of *Microsoft Visual Studio* serve as industrial-strength development environments for mixed reality development. The Windows Mixed Reality platform requires this and the Windows SDK to produce the packages that are deployed to the device itself. Familiar to any developer who has leveraged Microsoft technologies, this dependable workhorse has some useful new features to help with deployment and debugging of mixed reality apps.

```

using UnityEngine;
using UnityEngines.VR;
public class GestureManager : MonoBehaviour
{
    public static GestureManager Instance { get; private set; }

    // Represents the hologram that is currently being gazed at.
    public GameObject FocusedObject { get; private set; }

    textureRecognizer recognize;
    // Use this for initialization
    void Awake()
    {
        Instance = this;
    }

    // Set up a gesturerecognizer to detect Select gestures.
    Recognizer = new GestureRecognizer();
    Recognizer.TappedEvent += (Source, tapCount, ray) =>
    {
        // Send an OnSelect message to the focused object and its ancestors.
        if (FocusedObject != null)
        {
            FocusedObject.SendMessageUpwards("OnSelect");
        }
    };
    Recognizer.StartCapturingGestures();
}

// Update is called once per frame
void Update()
{
    // Figure out which hologram is focused this frame.
    GameObject oldFocusedObject = FocusObject;
}

```

Microsoft Visual Studio is an industrial-strength development tool for mixed reality

The incredible flexibility, extensibility, and accessibility of Visual Studio lends itself well to being a foundational part of this evolving platform. As new libraries and SDKs come online for mixed reality, you can be they'll be available within Visual Studio first.

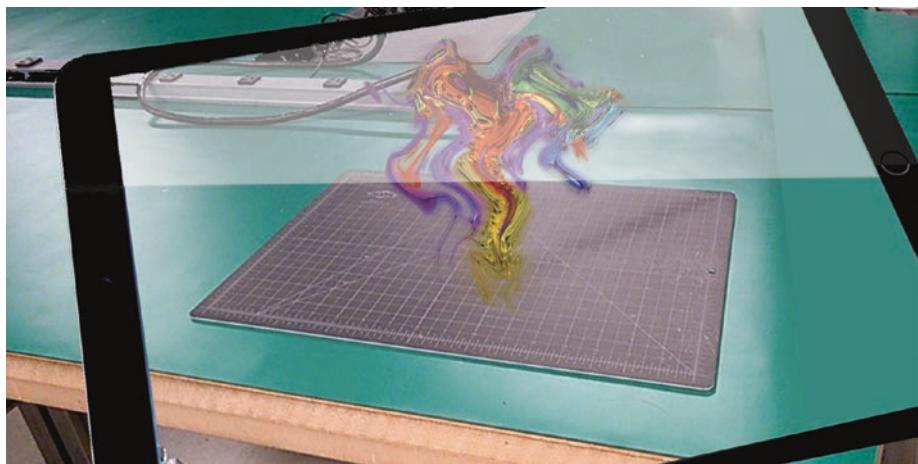
SUPERPOWER – Visual Studio has always been known for its world-class debugging tools, whether using an emulator or remotely on device. IntelliSense rules.

Apple Xcode

There are some holographic prototyping techniques that *Apple Xcode* and its associate augmented reality development SDK called *ARKit* would be perfect for. Being able to simulate putting a hologram into a physical space using your iPhone or iPad as the viewing device is more than handy. Even though I wouldn't consider the augmented reality objects ARKit displays

ENVISIONING HOLOGRAMS

as true holograms, they are great stand-ins. The fact that they're available on such ubiquitous hardware makes this a very attractive choice for trying out quick thoughts about placement and feel if you don't have access to the HoloLens or other mixed reality headsets.



Xcode and the ARKit enable you to create Augmented Reality apps for iOS devices

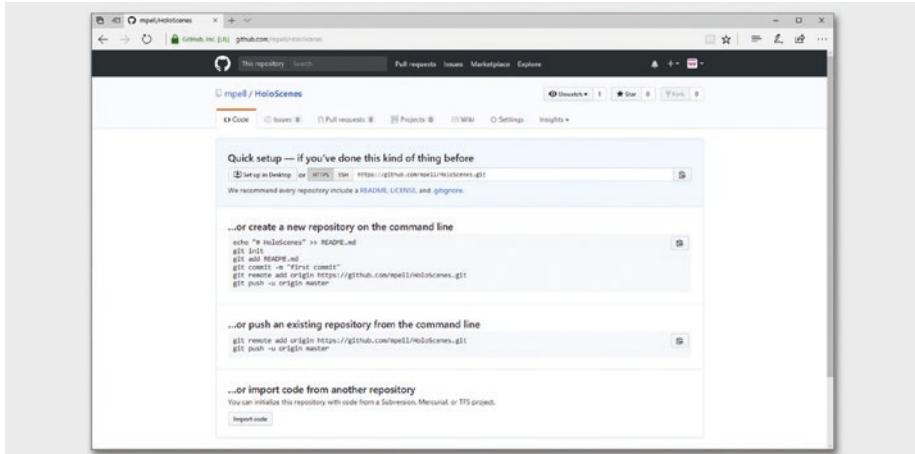
Another advantage to using Apple Xcode to develop some of your prototypes is taking the opportunity to see how iOS and MacOS apps fit into the mixed reality ecosystem. There are plenty of places where using the most popular services from inside your mixed reality experience is exactly the right thing to do. No better way to investigate those possible outcomes than trying it out in-context on a device.

SUPERPOWER – Xcode is a fantastic development environment for coding in, and let's face it – iOS is still a fun platform to develop and test on.

GitHub

You might not think right off that a popular source code repository and revision management system like *GitHub* is a key tool for mixed reality development but given the number of changes and updates needed to move your projects quickly forward, this service is almost a must have.

Besides the obvious benefits of keeping our projects organized and shareable, there are so many occasions where having a previous version of code or assets would have saved us an enormous amount of time in the form of do-overs and recoding.



GitHub makes it easy to version control and share your project with other developers

Another benefit of using a service like GitHub is the ability to create your own public profile that details your interests, skills, and recent projects. What a great way to find people who share similar tech interests. Collaboration and sharing are highly encouraged in this type of tool, but you can also protect your projects as private if you need space to explore on your own.

ENVISIONING HOLOGRAMS

SUPERPOWER – GitHub is the industry's best practice for keeping code accessible, backed up, and shareable among collaborators. You want to be able to easily rollback or fork branches for new explorations with no fear.

Storytelling Tools

There have always been great tools to help capture the elements of persuasive storytelling. Some of them are quite manual (writing down a narrative on paper, drawing a storyboard, making an animation) and others almost effortless (recording someone's voice, filming their actions, using a book as reference). In the case of getting down your best storytelling ideas for envisioning purposes, we have a diverse set of tools to rely on. They let us quickly capture the essence of the story so we can convey to other people with too much effort – which it turns out is the most important aspect of all this.

Voice Recorder

There's no faster way to get your ideas across to other people than just speaking them out loud. Straight from your thoughts to their ears, no tools to get in the way of your flow. Storytellers love telling stories obviously, so let's leverage that for envisioning ideas.



Using a smartphone to record your narrative is fast and (mostly) free

There are a gazillion free voice recording apps for just about every kind of smartphone there is, so no reason to not have one ready to record your thoughts whenever the ideas hit you. These apps all allow you to get the recording onto your computer or share with other people.

SUPERPOWER – We love hearing people's voices telling us engaging stories.

Smartphone Video

Just about every smartphone has a decent quality video camera built-in. People use them without even thinking to record events and share snippets of video on social media. We often have friends or family act silly and do things they'd normally not do just because the video is being recorded. We can use that to our advantage by having people help us act out the scenes behind our holographic ideas. Some people will be the holograms and others the participants. Have some fun with it.



Getting people (or things) to help act out your holographic scenarios isn't that hard

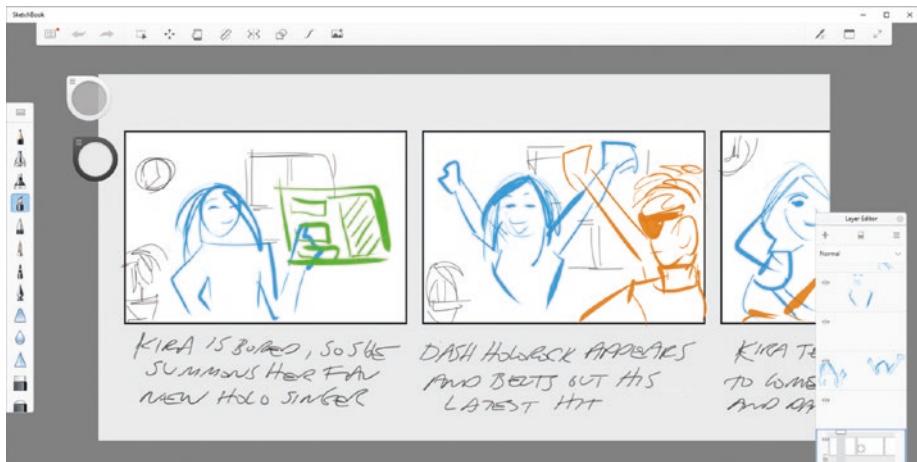
We are all so familiar with how to share these recorded videos with teammates, collaborators, or prospective audiences, this overly obvious tool should become a very popular way of getting early ideas in front of people.

SUPERPOWER – Video is a super effective way to get the gist of an experience across because you are using real people in physical spaces who can react to direct and ad lib where necessary.

Autodesk SketchBook

Autodesk SketchBook is still one of my favorite tools. Here's why... even the most rudimentary and quickly drawn storyboard sequence has more power to convey and move people than most professionally written commercials. There's a natural connection formed when we see hand drawn artwork of any kind – even better when it's trying to tell us a story. Perhaps it's all those childhood memories of a happier time drawing away

for the pure pleasure of it. Not sure. But, I do know when storyboards are drawn in this way the command people's attention, at least for a short period. And as storytellers, that's all we can ask for.



Autodesk SketchBook is a great digital storyboarding tool for envisioning

The other important thing about SketchBook is it was designed for the pen. So much better than trying to draw with a mouse! It's like night and day if you've never tried drawing that way. Another key to getting the most out of SketchBook is using the layers just like you would in an Adobe product. It gives you a simple way to draw the background frames, then start layering elements and characters on top, successively. Don't like what you did? Erase it or just hide that layer. SketchBook Pro is an upgrade that gives you unlimited layers among other amazing features. I'd buy it just for the unlimited layers, they are so fundamental to using the tool.

SUPERPOWER – SketchBook lets you make that deep emotional connection with your story by the nature of it being hand drawn. And it's a world-class digital sketching tool to boot.

ENVISIONING HOLOGRAMS

Filmmaker Live

What if you could see a mixed reality sequence unfold just like you were directing a motion picture? What if nothing had to be prebuilt before you jumped in and starting building sets and adding actors? *Filmmaker Live* by Accelerated Pictures is a new breed of cinematic tool that lets you do just that. It brings new-to-world envisioning capabilities to the iPad, Surface tablet, or even smartphones. The app puts you in the director's chair and gives you the power of an entire film crew to block out scenes, figure out timing, and actually run the actors through their lines and cues. It's a completely different way of thinking about envisioning. Brilliant and fun.



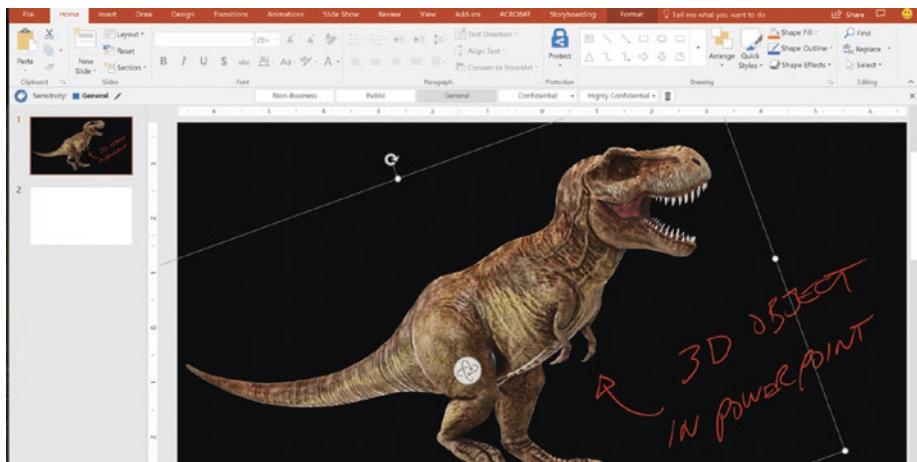
Filmmaker Live is a cinematic tool for storytelling in MR and VR

By taking the perspective of a cinematic production, we not only get a glimpse into that world of filmmaking, but our world of mixed reality design and development takes on a different feel – more along the lines of what a cinematographer may experience as they search for the right camera angles and aesthetic look. It's a fascinating learning experience and very helpful in thinking about how our participants and onlookers will experience the action.

SUPERPOWER – Filmmaker Live gives us a glimpse into the future of envisioning. By taking the viewpoint of a director on set, we can focus on the cinematic elements of our story – something that's been more difficult to understand and practice before now.

PowerPoint

Last but certainly not least, the venerable presentation app Microsoft *PowerPoint* is one of your best methods for getting the story across in its early form. I'm not saying you should put together a densely-packed slide with bullet points telling your story in stilted sentence fragments, no. I am suggesting that you may not know how incredibly powerful the much-maligned program is at conveying stories using imagery and animation. In fact, I'd bet that you have never really witnessed the full storytelling capabilities of PowerPoint or Keynote for that matter.



Your story ideas can be animated and annotated quickly in PowerPoint

ENVISIONING HOLOGRAMS

These programs have the ability to embed images, video, sound, text, ink, links, and true interactivity to create stunningly persuasive stories. The animation capabilities of individual elements or groups is way more sophisticated than most people realize. Dozens of special effects and timings can be applied to slide transitions, clicks or touches, and auto-playing sequences.

And the best part of using this type of presentation tool is the ability for anyone else to edit it easily. The collaborative nature of our work makes PowerPoint an incredibly useful tool to work with.

SUPERPOWER – The ability for anyone to create and share these story ideas makes PowerPoint or other presentation software a great tool choice. The super bonus here is that anyone else can edit the story so easily and send it back, making collaboration simple.

Future Tools

There's undoubtedly going to be some ultra slick new tools and approaches for building out holographic experiences by the time you read this. My hope is that you are among those who share your best thoughts on how to get from A to B quickly, using unorthodox or even crazy sounding methods to get things done. Be part of the solution for other explorers.

Tools are only as good as the imagination flying them.

PART IV

Holographic Designs

CHAPTER 14

HoloScenes

If a picture is worth a thousand words, why go further?

Designers understand and harness the power of illusion all the time. Arranging elements just so and using visual effects to transform our perception of them can make even the improbable seem real.

This first holographic envisioning technique we'll walk through is all about illusion, which makes it incredibly handy for creating a memorable impression. As described in this chapter, it's very well suited to anyone who can fly common graphics applications just enough to do basic manipulations. This method also works really well for me in situations where I need to get a particular aesthetic or visual feel across. Even though it's highly visual, it becomes quick to execute once you get the hang of it. As good for realistic as it is for fanciful explorations.

ENVISIONING HOLOGRAMS



*Example exploration from my *HoloScenes* envisioning series*

Filmed on Location

This rapid envisioning methodology was developed while working on a series of holographic design explorations I named *HoloScenes*. The key part of the technique is using photos of real-world empty spaces as a backdrop for fully integrated people and holograms to get the desired effect for your concept. Done well, it's an inspirational experience. Don't be self-conscious about the visual quality, just use it as a handy technique for depicting your ideas quickly.

Interestingly enough, this technique wasn't intentional or well-thought out. It just evolved very naturally over time, almost unconsciously. As we talked about earlier, for whatever reason I am strongly drawn to photograph empty spaces I come across in my travels. There's only ever a brief impression at the moment I snap the picture of what could be there in the future, but I'm sure something belongs there. That something almost

always ends up being people interacting with holograms. I have no ideas why my mind works that way, but it's the reason I ended up writing this book. Weird. I know.

Eventually, after collecting lots of photos of empty spaces in my Camera Roll, I had the idea of doing a series based on them. The thought of using smartphone photos from all over the world as the foundational element for the explorations felt good to me. Global locales seemed to help fuel ideas for very different experiences. So, that part became very intentional – purposely trying to depict very different experiences based on situation, location, and what time of day they occur. Diversity of experience became an early decision in my envisioning framework for this series.

As I sorted through dozens of photos I identified as potential locations, holograms started appearing out of thin air within each photo along with outlines of people. From there, it was relatively easy to mentally fill out the motion, sounds, and behaviors very quickly. That led naturally to me piloting an imaginary camera around the scene, looking for interesting angles.

That last interaction made me think about the cinematic aspect of composing these explorations – which is how I arrived at naming this technique *Filmed on Location*. There was always a running inside joke at the end of Pixar short films in the 1980's that referred by them being filmed on location with *RenderMan*, a ground breaking 3D photorealistic renderer subsequently used in their animated motion pictures. I kind of felt like a Pixar film director during pre-production when thinking about my own compositions, so the idea stuck. Turned out to be fun and useful way to describe it.

The Technique

Working through the process of building out a scene using a photo as the foundational backdrop helped define much of what I now consider the best way to quickly envision.

The steps to re-create HoloScenes images shown in **Table 14-1** are quite straightforward and map onto the envisioning flow we outlined earlier.

Filmed on Location Holograms		
IDEATE	1. Photos of spaces	Continuous background task
FRAME	2. Choose your scenario 3. Identify key elements	Let the holograms appear to you naturally; don't force them
PROTOTYPE	4. Sketch the hero 5. Add some people 6. Swap in holograms	Being a designer helps here; Lots of compositing work
TEST	7. Show it around	Try not to explain
REFINE	8. Sharpen the focus	Amplify the key elements
RESTART	9. Try it again	Practice helps here

Table 14-1. A technique for envisioning that feels like it was filmed on location

Let's dig into how this type of photo-based envisioning works step-by-step.

Step 1. IDEATE

There are two ways to approach ideation with this technique. The first is a casual journey where ideas come to you over time, and the other is a focused exploration of particular concepts. Both work well, it just depends on the situation you find yourself in.

Casual - Unlike some kinds of more involved envisioning, there really isn't a discreet ideation phase in this case because I find it to be a bit more accidental. Once you learn to capture inspirational scenes in photos as you encounter them, this type of envisioning tends to just happen at its own pace. Think of taking location photos as a continuous background task. You may end up never using them, but you will have amassed a great collection to pick from.

Focused – If there's a very particular concept you want to test out with people, the HoloScenes technique helps you put it into context. You'll be on the lookout for a certain kind of scene to support your idea, so you could go on a very focused hunt for photos of it. Either way, let the concepts come to you naturally. If you try to force ideas into the scenes you find on your travels, it will show through.

Photograph empty spaces

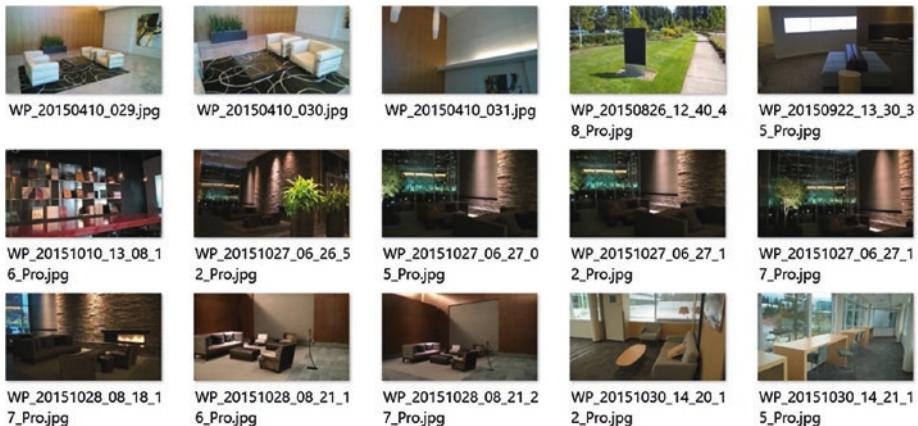
Taking photos of interesting real-world scenes you come across is the best way I've found to jumpstart the holographic envisioning process. Think of taking such photos as a new habit for scouting film locations of your holographic experiences.

Be on the lookout for physical places and spaces that are calling out for something to be added holographically. Whenever you get that feeling, immediately stop what you're doing, whip out your phone, and snap a picture. Move along.

Sometimes places will strike you as “empty but cool” for some reason. Remember to go back through your pictures when you have time to harvest any of those that move you. Quickly consider the possibilities when triaging the photos. Then share the promising ones with yourself or set them aside in a collection you'll want to grow over time.

ENVISIONING HOLOGRAMS

There's nothing that makes one photo better than another for envisioning, but I have found it's easier to work with places that have furniture or interesting features, but no people. Try for a mix of daylight and indoor shots. Pay attention to the colors in the scene – they are powerful cues.



Use your Camera Roll to collect photos of empty places for rapid envisioning

I can't tell you how many photos I have of empty spaces. Hundreds, certainly. Photos full of things, but no people. And therein lies the most interesting paradox in envisioning holographic experiences—you cannot have a successful design without people being the design center. Yet, many of the most interesting ideas come to us when looking at empty space. Go figure. Having any people appear in these spaces could distract you from what it could be used for, so best to shoot empty spaces and let your imagination fill them in.

Tip Using your own photos rather than pulling random images off the Web keeps you out of copyright infringement issues.

Step 2. FRAME

Making a few good decisions right up front will allow the rest of the envisioning process to flow. That's what framing is all about.

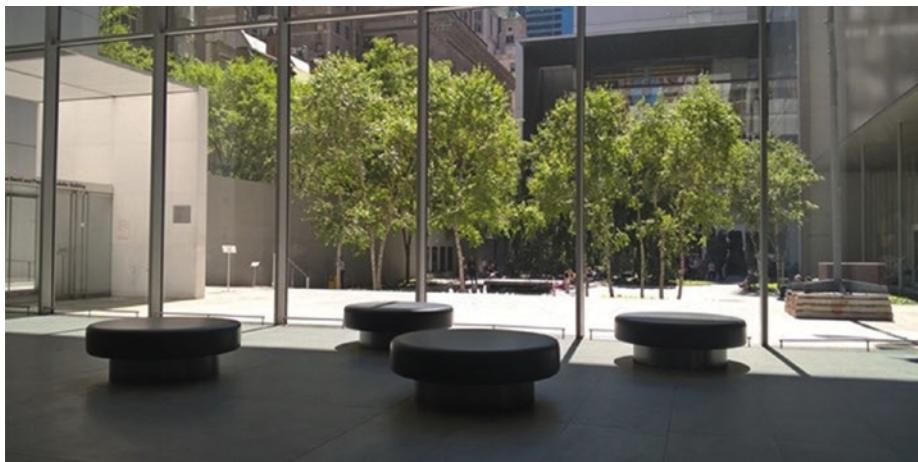
Choose a scenario backdrop

There will be a time when you need to illustrate how using holograms in a particular situation would play out for some project that you are working on. Designers do this kind of storytelling all the time. While trying to help other people visualize how things would play out in certain scenarios, consider using some of the photos you've taken to establish the feel of the scene and get across some key aspects without too much effort.

Go through your collection of potential backdrop photos with a completely open mind to see what jumps out at you. You may have no idea what you're looking for exactly, which is fine. I tend to feel like the right photo will make itself known to you in some way. Just like scouting locations for a short film, the scene you ultimately choose will need to convey a particular feel and support the interactions of the people (and holograms) that inhabit it.

Whatever photo you come up with for this envisioning exercise should speak to you in a truly compelling way. We're always shooting for breakthrough scenarios, so your chosen photo needs to fuel great ideas for filling the space. The nice thing about this technique is it's so easy to switch out photos or have multiple scenarios for each one. Keep the ideas flowing, but pick a good one.

ENVISIONING HOLOGRAMS



This lobby's low seating screamed out as needing something on them

The photo you eventually choose will need to enable a *scenario*, or sequence of events that could plausibly happen. For example, looking at a photo of an empty conference room would certainly lend itself to a scenario where people are meeting to discuss something. Having a soccer match within that room isn't a plausible scenario for that photo. Would feel off, right?

Identifying scenarios that feel like a natural fit for the photo is critical. Don't try to force a photo into doing a job it's not meant for — something about it will look odd or inauthentic. You'll see how this works when you try this out. The photos actually speak to you if you let them. Go with the flow, and write down some notes on what could work if it helps. Set a copy of the photos you like most aside.

Tip Use your strongest photos as the basis for an envisioned scene. No point in distracting the audience with low-quality, grainy, or blurry images in your work.

Identify key elements

What was that first thing that flashed into your mind when you looked at the photo you chose from your collection? Was it people interacting with something? A creature? Interface floating in the air? Game going on? Whatever it was is a huge hint to what the focus for this envisioning scenario should be. Why? Intuition and instinct are incredibly useful guides to us when envisioning. Your own imagination and subconscious saw something immediately that wasn't there based on all of your experiences and knowledge. Dig in and evaluate whatever that was first. At the very least, try to pick something similar enough to your initial impression that feels unforced.

After you identify that initial idea, start asking yourself a few key questions about the scene:

- **Who** would be in the scene?
- **What** would they be doing with holograms?
- **Where** would this be taking place?
- **How** would it play out?
- **When** would this feel like something you'd want to do yourself?

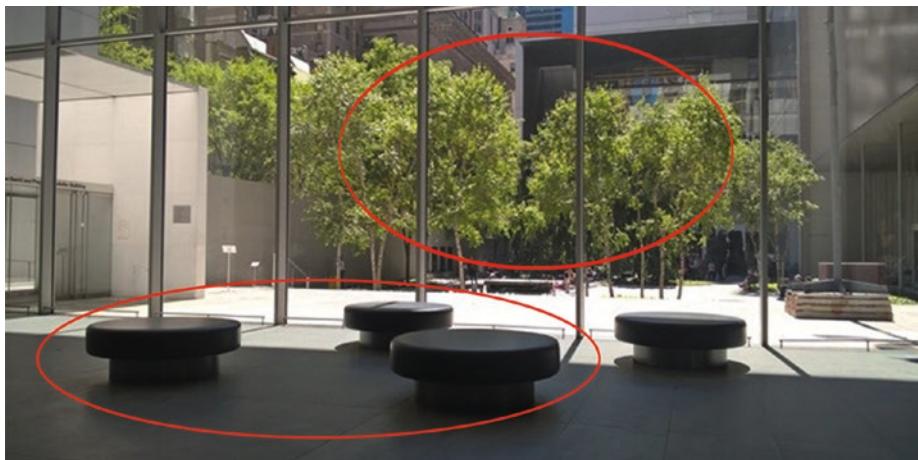
You notice the active word in all those questions is *would*. It's a forward-looking exercise, so our thinking is geared toward what's possible, not what is. What would this scene tell us about the future of holographic computing if we let it?

ENVISIONING HOLOGRAMS

Think about the purpose for doing this exploration in the first place.

- **Illustrating** innovative technology
- **Showcasing** new-to-world functionality
- **Imagining** a breakthrough experience
- **Commenting** on what could be, editorial fashion.

Here's how I applied that thinking to my example in this section.



The space lent itself to particular vision for interaction and play

What came to mind immediately in that photo of the empty museum lobby is the tremendous amount of empty space that wants to be filled with people and holograms. Going with my first impression, I found myself thinking there was probably a family enjoying the space on a Sunday afternoon. The kids would be running around getting into trouble, poking at things they shouldn't. The adults keeping watchful, but having their own conversations.

Another aspect of the photo that really jumped out at me was the large empty outdoor patio just behind the glass wall. What a great place for a huge holographic creature to be angrily pacing around waiting for unsuspecting museum guests to scare or eat. Or something.

It would be easy to say in hindsight I had a clear vision for all the interactions and technology that would eventually be injected into the scene, but that's not true. I would realize as I worked with scene there were opportunities to editorially comment on telepresence and people's manners in public spaces when interacting with holograms. It also allowed me to theorize about the future of play and toys. But, none of those elements that eventually found their way into the exploration were thought of initially. I just liked the space as a canvas for holographic adventures.

The photo lent itself to all kinds of interpretations, but the easiest one for me was this scene of a family enjoying the day out, but encountering something very unexpected. I could have locked in on that scenario and tried many different photos to depict it, but that photo spoke to me in that way, so I went with it.

Tip Try using different photos for the same scenario exploration. Then try different scenarios with the same photo.

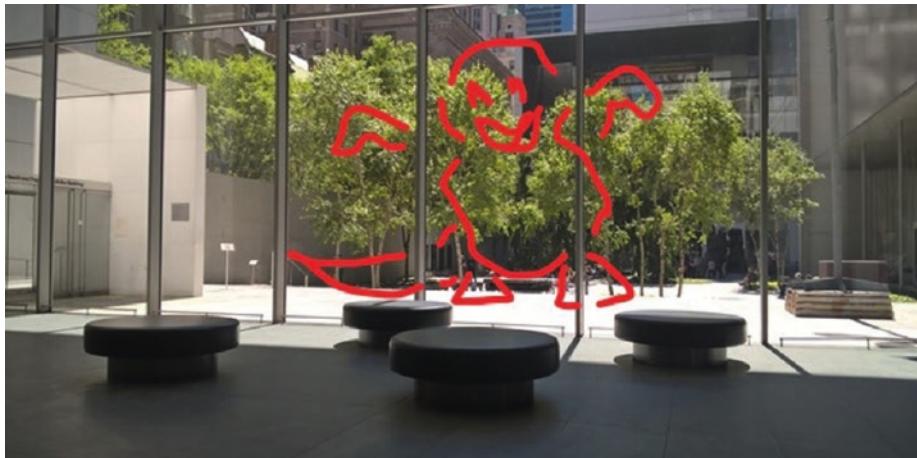
Step 3. PROTOTYPE

This is where we start creating the final form of the exploration. Each successive layer of information we add to the original photo brings another key element into focus.

Sketch the hero

Every epic scene has a hero. Find yours. Heroes are most likely going to be some wickedly cool hologram you imagine, but they don't have to be. It could be that a modest hologram enhances a real-world hero that's already there. People make the best heroes.

Start by doing a quick sketch of how the hero will be shown within the scene. Import the photo you picked into an app that will let you scribble on top of it (figuratively or literally). PowerPoint in presentation mode works great for this. Alias Sketchbook is another favorite of mine for this purpose. But, something as simple as Paint works great, too. You could even print the photo out and just draw right on top of it with a fat Sharpie. Whatever works best for you.



Sketch your hero on top of the scene photo

Show the intent you hope to convey *later* through higher fidelity. For now, think through how the hero in this scene will play off of other elements. People, objects, time of day, motion, and lighting all affect how your hero is perceived.

Once you have an idea of how the hero will behave, use markup lines to illustrate movement or interaction even at this early phase of sketching. You'll find this is what really sells the idea.

Tip Try a few different approaches to depicting your hero, but keep it fast and fluid. Nothing to obsess over. Just get the general feel across.

Add some people

First a production note - after getting a basic scene sketched out, it's time to turn the corner and make this real. That means choosing an app or medium that allows you to layer different elements in and manipulate them as needed. Think of the layering mechanism in Photoshop or Illustrator as a guide. Any app with layers can get the job done, so don't obsess over not having the right tool. You could even draw them by hand in overlay fashion on paper or with cutouts.

As we talked about at the beginning of this post, **people are the key to any holographic scene**. You need to make that human connection with the audience you'll be showing this exploration to. It should be completely obvious why someone would be doing whatever it is within this scenario. Showing people that are present and engaged within the scene makes that easier.

ENVISIONING HOLOGRAMS



Quickly add in some people to give you an idea of their relationship to the holograms

As we're targeting a higher resolution comp for this exploration, it's time to find some better people than our sketchy stand-ins. You can use any representation of a person that fits with your scenario and artistic style for this part. They don't need to be real or even completely photorealistic to get the job done here. I often use the silhouette technique favored by architects and conceptual artists. I find that easiest from the production aspect to convey some design decisions I made, and it also complements the visual treatment I am going for.

For me, the translucent nature of the people in these renderings is appealing but not quite the right approach, so I settled on a different visual language we'll see later where people who are present are drawn in black silhouette and holograms representing people who are not there are drawn in translucent blue.

Also, you don't have to be an artist to get that great people effect in your project. Try a web search for 'people silhouette' and switch to the Image results. You'll see lots of examples of the type of people you need

to add, whether as full color photography or silhouettes (my preference). You'd be amazed how many different body types, sizes, poses, and actions are available.

We need all kinds of poses—sitting, standing, action shots, doing specific activities, and so on. Think about what you'll need for the current piece—don't get slowed down by finding the exact perfect set of these.



Reasonably priced libraries of posed people are available online

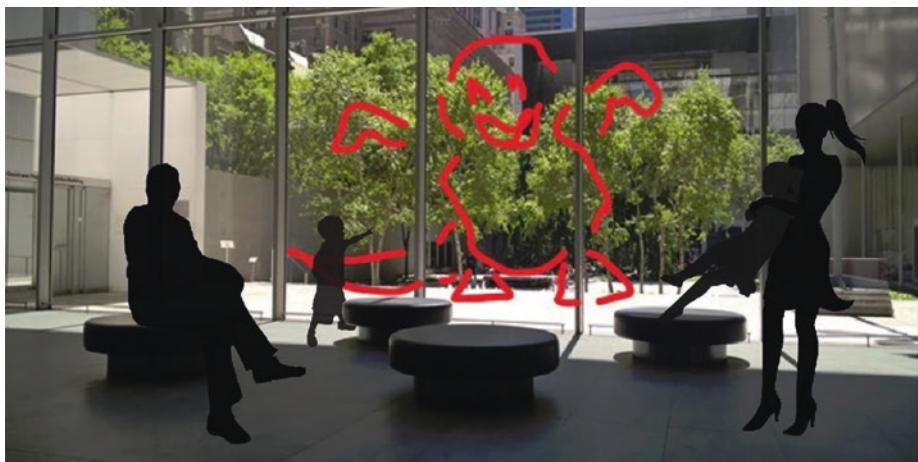
Go ahead and find vector art (resolution independent) that is royalty free or buy some as an investment in your envisioning work.

Once you have the people picked out with the proper poses or at least the right attitude, drop them into the scene in a realistic size and perspective (so we don't distract the audience with our gaffs). Remember,

ENVISIONING HOLOGRAMS

people are the anchors that make or break the believability of the envisioned experience. So, get in there and distort or twist the people into believable perspectives.

Generate a few large size comps of the scene with your sketchy hero and the people who should be in the scenario. You may have to futz with the angle and perspective of the people you add if you're interested in a realistic feel. That's easily done in apps that allow for distorting shapes or adding perspective.



Drop in the posed people to bring the space to life

You'll see in my example, I added a family with the mom and two little kids. I also thought this kind of scene would be perfect for grandpa to join the fun. Wonder what he thinks of the creature in the atrium. We'll see.

Tip You'll be using many different people in your envisioning work, so best to start another collection of vector silhouettes, too.

Swap in holograms

Now that the scene has people and a stand-in hero, time to add the other holograms that support the activities and scenario. My suggestion here is to use the highest fidelity representations you can find (either as prebuilt 3D models or dimensional photographs), or create your own custom 3D models of holograms to make a high impact first impression with your audience.

The integration and compositing step of this technique is where you can spend a ton of time if you're not careful. The goal is to rapidly depict what you're after with fully lit and integrated content—but not at the expense of being done and moving onto other important explorations.

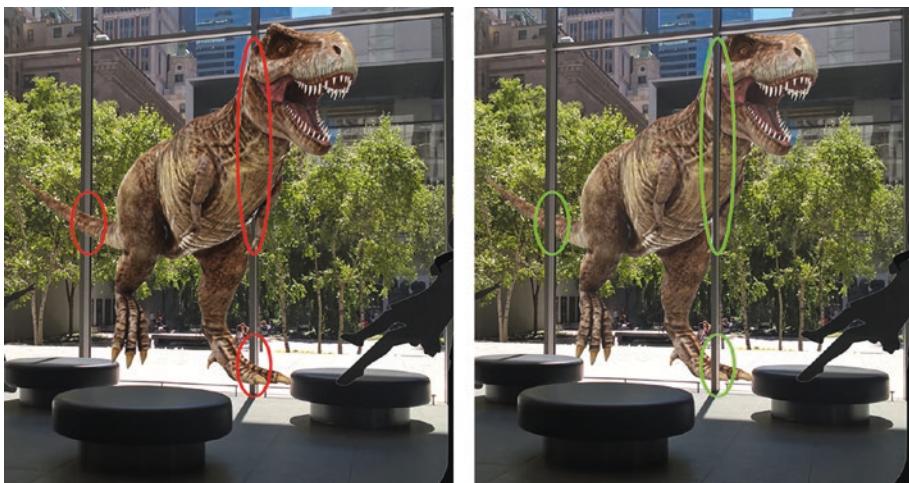
There's nothing wrong with low-fidelity sketches or rudimentary stand-ins. They just lack the magic of a photorealistic hologram (which you are going to presumably build if this exercise is successful). It does take longer to carefully integrate holograms that look realistic into the scene, but the payoff is worth it—both in your envisioned pieces and also in the final form.



Find a hero hologram that will fit in. Punch it out of any background so it's isolated.

ENVISIONING HOLOGRAMS

As you add it to the scene itself within your app of choice, be sure to fit it to the background photo convincingly. That means adjusting the perspective and lighting to match. Undoubtedly, it will have to be cropped, occluded, or twisted to fit where you need it. It's not easy sometimes, but we're in a hurry so just do your best here.



Note the parts that needed to be occluded for realism in placement

After going through all that, step back for a moment to see if your scene has already come to life by just adding the hero hologram and people.

If not, you've missed something important. Look critically at each part. Is the photo not the right angle? Are the people not the right size or looking disinterested? Does the hero not look like a real hologram? Whatever it is, isolate and fix it so we can move on.

Next step is adding our supporting cast to the scene. Create or find all of the other holograms that fill out the overall experience. Same rules apply here—use the highest fidelity stand-ins you can find within the shortest

amount of time. Take care to adjust their size, orientation, and visual appearance to be just convincing enough to get the job done.



Layers show the different scene elements and ordering in Photoshop

This is where the detail comes in. You'll most likely be illustrating specific features.

Tip It's tempting to go overboard when adding all the detail of the supporting holograms. Go ahead :-)

Step 4. TEST

It's tempting to keep futzing with the envisioned image until it's close to perfect. Don't.

Show it around

Once our envisioned scenario is even close to being convincing we need to show it someone else to get some feedback and test out the initial hypothesis about what the scene could depict. The intent here is to literally just show your comps to a few people to get a quick reaction.

Don't setup a formal test. Print out the comp or take a laptop around showing the image. With no prompting by you whatsoever, did they say out loud what your intent was when you started the envisioning process? Be honest here. It's ok if they didn't get it. Just means you have more work to do.

Even if they did get it right away, I bet they made some suggestion or asked why something was a certain way. Remember those. Go back and fix the scene so it reflects that feedback if it makes sense. Buy that person a coffee and call it good.

Even in this super early phase of ideation and experiments, you have to be willing to listen carefully to people's feedback. It's human nature to *not* want to hear criticism after working so hard. But, maybe it is true that your holographic unicorn looks like a horse with a fake horn. That's fine. We'll get it next time around.

Tip Seek contrarian opinions and nonbelievers. It strengthens your work to hear criticism of the ideas themselves. You'll benefit from it.

Step 5. REFINEx

Our final stage is tweaking the areas that just aren't doing it, or conversely, we need to wholesale swap out elements to get closer to the vision.

Sharpen the focus

After getting some feedback on the earlier version, you probably will want to make a final pass to get all objects sized properly, adjust overall lighting, get rid of extraneous elements that don't help tell your story.

In our example, it became clear after some feedback that I was missing an opportunity to comment on how telepresence could add something significant to the scenario. Turns out that grandpa wanted to go to the museum with the grandkids, but he's not as mobile as he used to be. Much better to virtually invite him and have him appear in the lobby along with the family to join in with the festivities. You'd have full audio but he would appear as a translucent blue hologram in the scene (that particular look being my design choice for depicting people who are not actually in the space, but rather holoported in).



Note the translucent blue treatment on the person who is not there in person

ENVISIONING HOLOGRAMS

This phase allowed a bit more consideration of other interesting aspects that were not immediately apparent right off. Use this phase to punch up key features and fade back things that are not important to scenario and storytelling.

As an example of some polish you can apply at this point, don't overlook the importance of sound, even in a static image. You wouldn't want to go see an IMAX 3D movie with no surround sound, right? Same thing here. And easy enough to add if you have access to PowerPoint. Just embed a sound within a PowerPoint slide by assigning a sound file to that slide that auto plays when the slide is projected.

Tip Punch up the parts that support your most important points to land. Make them the clear focus of the composition.

Step 6. RESTART

Now that we have a finished exploration in static or in semi-interactive state, it's time to make the hard call. Do we keep going because it's promising and we missed a few things, or just leave it as an artifact from our envisioning journey and move on?

Try it again

The bias in this type of technique is toward forward motion. We want to keep exploring, trying things out, failing, and trying again. So, given that our first thought is probably going to be move on, try it again in a different way or completely scrap what we've done.

There's not right answer here. You will know by the reaction of other people whether you tapped into something important or undiscovered with your initial work. Careful to not let your ego or invested time color your thinking here (just as with any type of design work). There's nothing wrong with completely starting over again with the same idea, knowing you didn't quite nail it this time around. It's difficult to get something you're happy with right off. Take practice.

Regardless of whether you choose to move on or keep digging in, we've learned a valuable technique to leverage in the future. It gets us the impact and persuasion that can help move the idea to the next level.

Tip There's no shame in leaving a work alone and moving on. In fact, it's really the desired behavior for this technique.

Summary

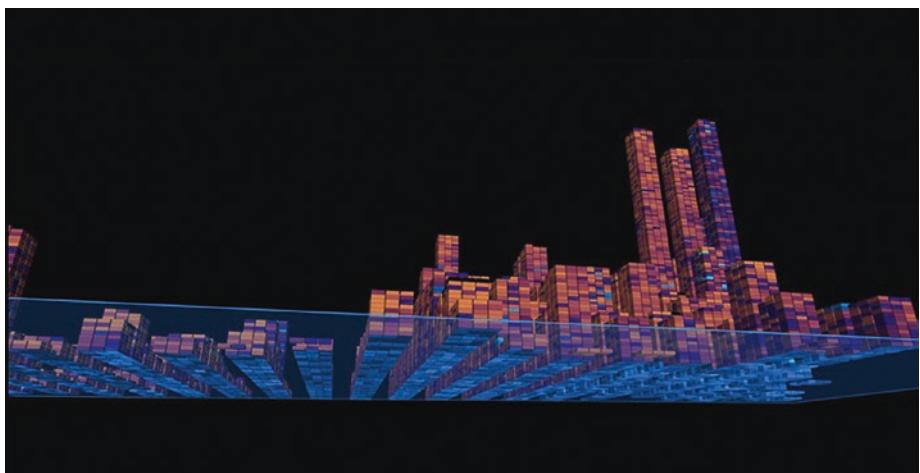
Leveraging photos of real places helps to ground any holographic ideas you want to test out. Always keep an eye out for places where you can holographically film on location.

CHAPTER 15

Datascrapers

Tron had it right. Data is a vast, towering world to be explored. End of Line.

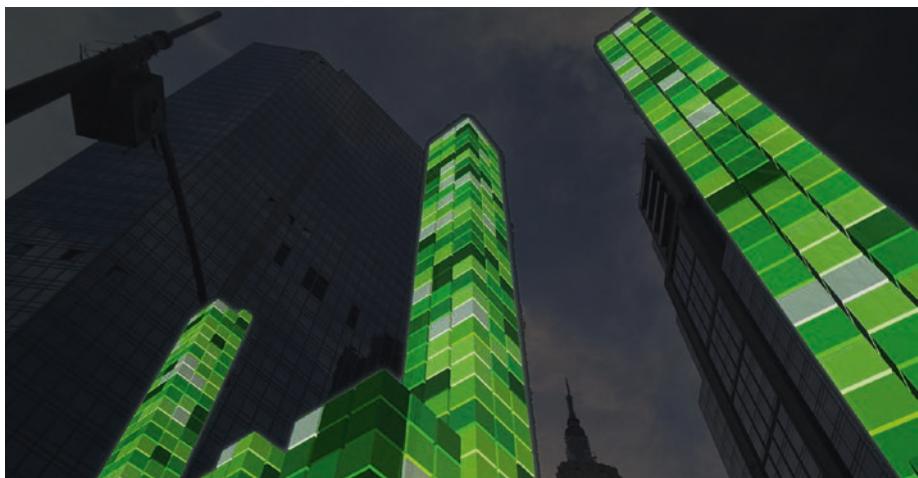
Storytellers are expert at creating vast, captivating landscapes for their tales to inhabit. To me, there's no place more vast and captivating than New York City, with its gigantic, gleaming skyscrapers and endless spaces to explore. When seen in person, the scale of those buildings is truly humbling. It's with that sense of scale in mind that I created a "data art" series called *Datascrapers* in 2016.



"Underlying Data" is exploration from my Datascrapers series

ENVISIONING HOLOGRAMS

This work evolved from me exploring U.S. census data sets in a visualization tool. The data set contained information about level of education, income, and geographic region, among many other facets. As I visualized data in various ways three-dimensionally, the imagery became very reminiscent of skyscrapers in my beloved NYC.



Overlaying the data constructs onto the NYC skyline aligned my approach

The more I looked at the data from different camera angles and with various color palettes applied, the social implications of the data's foundation began to seep through. I was seeing thematic statements of inequity and struggle within the thousands of data points. Socially tinged messages bled from the artwork (at least to me). There was a story of struggle that needed to be told through data in the form of artwork, at least to me. It was very moving at the time I was working on it, and remains one of my favorite envisioning pieces.

But, it wasn't until after I had completed the series that I realized the better way to get the social themes within Datascrapers across to people – they needed to be experienced firsthand. These data forms should exist as

giant, looming holograms that you could walk through to see and feel the impact of the thousands of individual stories represented by those census datapoints.

Data wants to be free they say. I think it also wants to reflect its own magnitude.

Data-Inspired Holograms

Reflecting on Datascrapers recently, it became clear that I was overlooking some other key design insights from that series in my current work of creating holographic experiences.

Datascrapers evolved from data being cast in a new light, onto a giant canvas. The scale of the data became the design center, which drove the magnitude of the pieces. And the **familiarity** of the shapes (skyscrapers) made a connection with people when first viewing the pieces.

That last point, familiarity, really stuck with me. In our rush to leap forward, we often create things that are foreign looking, sometimes confusing our audience at first.

Familiarity is not the enemy of innovation.

So, rather than spending all my time trying to imagine completely new constructs to bring to life as holograms, why wasn't I starting with the familiar?

Good question. The answer of course is that familiarity is somewhat counter to breakthrough thinking, which encourages us to leap forward, shattering the envelope. Focusing on today's familiar things seems counter

ENVISIONING HOLOGRAMS

to innovation. Yet, we already have so many ways to create and consume today, why not leverage them?

Applying that thinking to the subject of data, we could spend from now until forever converting that common language of business (data) into incredible holograms. Maybe looking at the familiar representations of data more openly, we can unlock countless new possibilities.

By using productivity tools like *Microsoft Office*, or more sophisticated business intelligence services like *Power BI* and *Tableau*, we can leverage our data as inspiration for holograms. This isn't new-to-world or unexpected. People have been (poorly) imagining 3D versions of our business data for decades. The difference is that now we have the mixed reality medium to better support this type of exploration with data.

Everyday Data

Data-inspired holograms (perhaps "datagrams") have been right in front of us all along. Hidden in plain sight. Waiting for someone to free them from their incredibly ordinary containers. It just didn't occur to me how easy it was to achieve. By taking a new approach, we could be the masters of our own holographic destiny, not merely spectators beholden to mysterious wizards of code and cinematic special effects.

Clearly, you don't have to use high-end 3D modeling and animation software to create compelling holograms that are composed of or inspired by data. You don't need to be a data scientist either. We can just leverage the things that create and consume data in completely new ways. Whether its text, photos, videos, numbers, or audio clips, the output of our daily routines can be seen as the new inputs of holographic data generators.



Data insights are not always revealed through conventional visualization

To be clear, I consider “data” anything from a single bit of information, to a collection colors in a striking image, or even the sound of notes in a majestic symphony. Data certainly is not just exabytes of numbers. It’s whatever we consider the output of creation and existence. We are awash in data, yet we only tend to see it in traditional ways.

What if that didn’t have to be?

For example, think about how you regularly generate and analyze your business reports in Excel today to convey key information. There are insights to be found just by looking through the data in the spreadsheets or by going over the charts you generate. By carefully looking for things that pop out as trends, we increase our understanding. Pretty standard today. Now, think about a very real future where artificial intelligence works in the background to help surface insights for us and renders those in holographic form for us to explore. It’s already happening. Just not with holograms.

Another area to consider is visualizing what’s happening within large-scale datacenters. It always seemed inevitable that we’d be able to see inside those thousands of server blades and warehouses full of equipment racks to see what the current state of affairs really was. Our dashboards

ENVISIONING HOLOGRAMS

do a fine job of showing us the numbers and trendlines. What they don't show us is the same thing in the form we crave – bounded by the physical containers the unparalleled feats of computing take place within.



Storage capacity data taking the form of server racks in a virtual datacenter

Finding the places where we have lots of data or even just a few datapoints that are critically important metrics can be springboards for ideas about making the familiar extraordinary.

The Technique

The future of holographic experiences has everything to do with channeling the output of today's productivity tools into AI-powered, interactive holograms.

Use any productivity or data tool available to you as an idea generator for holograms. If you make a 3D chart and think it's a hologram, please stop. That's not it. Re-read this book from Chapter 1 then try again. The

form holograms take doesn't need to be recognizable as characters or creatures, but they should represent familiar concepts from your data that has come to life digitally.

The steps of the Datascrapers technique listed in **Table 15-1** are a bit more involved than others, but also map onto the envisioning flow we outlined earlier. The ideation phase is longer than other techniques because it's where all the heavy lifting is done.

Data-inspired Holograms		
IDEATE	1. Identify data type 2. Free the data	Longest time spent on this portion generating ideas
FRAME	3. Choose data set 4. Choose generator app	Hardest part
PROTOTYPE	5. Generate multiple examples 6. Play out interactions 7. Package it up	Most fun
TEST	8. Show it around	Listen carefully, look for reactions
REFINE	9. Apply special effects	Differentiates the delivery
RESTART	10. Find new data	Keep searching for new data

Table 15-1. A technique for creating data-inspired holograms.

The following sections show this process step-by-step. Let's work through creating data-inspired holograms using the Datascrapers technique.

Step 1. IDEATE

Start by choosing a subject you know well to ideate over for a limited amount of time. Don't spend more than ten minutes thinking about it. That should be enough time to get your best ideas out into the open. For example, there must be a few important aspects of your business or career that rely on data to measure or report progress. You probably deal with

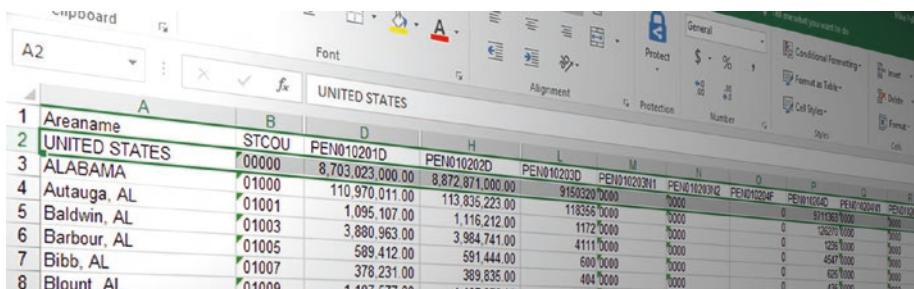
ENVISIONING HOLOGRAMS

them in email, spreadsheets, meeting presentations, mobile dashboards, or raw numbers. Regardless, consider the impact and importance of that data on your thinking and actions. We're looking for a place to leap ahead in our use of this, creating a breakthrough data experience.

Identify data type

Let's start by choosing an activity or point in time where you collect data for some purpose, or rely on data to guide decisions or communicate key metrics. That situation requires the use of a particular type of data – numeric, textual, graphic, and so on.

Think about the data itself in that instance, and the *form* that data takes when it's being looked at by people. I don't mean what kind of chart or graph. That's an artificial mapping. Think about the data's pure form - is it numerical, graphical, auditory, tactile? Simple or complex? Is it static or dynamic? Historical, evolving, or real time? Knowing how to answer all those questions will help with the next part – transferring the essence of the data into a more usable form.



The screenshot shows a Microsoft Excel spreadsheet titled "UNITED STATES". The table has columns labeled A through R. Column A contains area names, and column B contains their corresponding STC0U codes. The data includes rows for the United States as a whole and various states like Alabama, Autauga, Baldwin, Barbour, Bibb, and Blount. The table is styled with conditional formatting, showing green for the top row and yellow for the state rows. The Excel ribbon is visible at the top, showing tabs for Home, Insert, Page Layout, Formulas, Data, Page Break Preview, and View.

1	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	
2	Areaname	STC0U	PEN010201D	PEN010202D	PEN010203D	PEN010203N1	PEN010203N2	PEN010204D	PEN010204N1	PEN010204N2	PEN010205D	PEN010205N1	PEN010205N2	PEN010206D	PEN010206N1	PEN010206N2	PEN010207D	PEN010207N1	PEN010207N2
3	UNITED STATES	00000	8,703,023,000.00	8,872,871,000.00	8,150,320,000.00	7,000	0	0	0	0	0	0	0	0	0	0	0	0	
4	ALABAMA	01000	110,970,011.00	113,835,223.00	118,556,0000	00000	00000	00000	00000	00000	00000	00000	00000	00000	00000	00000	00000	00000	
5	Autauga, AL	01001	1,095,107.00	1,116,212.00	1172,0000	00000	00000	00000	00000	00000	00000	00000	00000	00000	00000	00000	00000	00000	
6	Baldwin, AL	01003	3,880,963.00	3,984,741.00	4111,0000	00000	00000	00000	00000	00000	00000	00000	00000	00000	00000	00000	00000	00000	
7	Barbour, AL	01005	589,412.00	591,444.00	600,0000	00000	00000	00000	00000	00000	00000	00000	00000	00000	00000	00000	00000	00000	
8	Bibb, AL	01007	378,231.00	389,835.00	404,0000	00000	00000	00000	00000	00000	00000	00000	00000	00000	00000	00000	00000	00000	
	Blount, AL	01009	1,107,577.00	1,402,576.00	1,402,576.00	00000	00000	00000	00000	00000	00000	00000	00000	00000	00000	00000	00000	00000	

For example, you may need to analyze census data to figure out how to distribute funds to communities for better social programs. That data is typically in a spreadsheet with many columns of text and numbers that

represent individuals who live in specific areas, who reported different levels of education and income.

That data's form is columnar text and numbers. Pretty straightforward. Once you have isolated the form of the data you're most interested in, it's time to unleash it as a hologram.

Tip Don't overthink this step. We're just trying to be clear on the starting form of the data so we can compare it to the holographic form.

Free the data

Now comes the interesting part (and the most difficult it turns out). We're going to convert the existing data from its current form into a new holographic container that provides something you don't get currently. The hope is that transformation reveals a leap forward in the ability to understand or work with the data. But, to do that, we have to free the data from its current form and container.

Ask questions - This doesn't require any fancy tools, just thinking through a few things.

- What's the most logical conversion from current form to a 3D shape? Why?
- Would the new form convey the important aspects more clearly?
- Would it be quicker to understand?
- What new kinds of actions could you take?

ENVISIONING HOLOGRAMS

I'm not saying these answers will come easy, or that converting a traditional media form to a three-dimensional holographic representation is a straightforward thing to do. In fact, if we're being completely honest here, it's actually quite advanced on the design thinking and conceptualization scale. But, I know you're up to it.

Sketch ideas – To answer some of things questions you'll want to sketch out how the data transformation might play out.

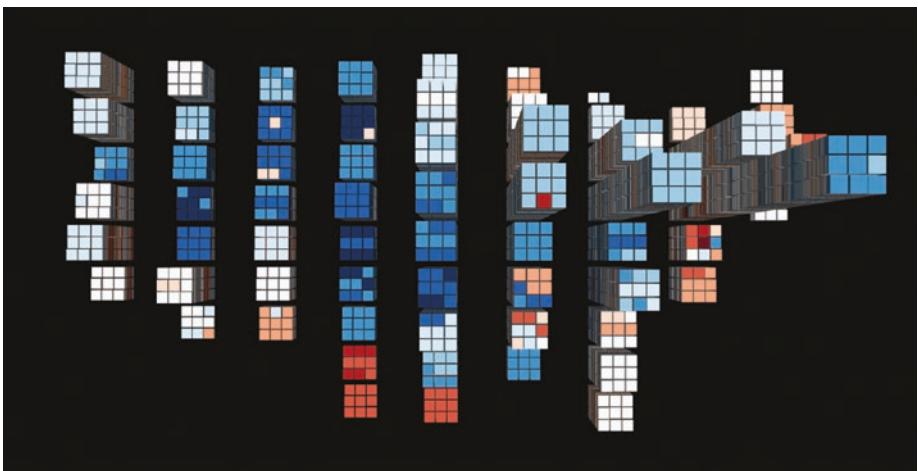


Try sketching out a few quick transitions from current form to released

In my example, I took census data in columnar format and converted it into a map of the region that the data represented. Then I looked at what additional value we could add now that we're working in multiple dimensions. That turned out to be using the z-axis or height of data points applied to the flat map. The new form of the information is not just a table of text and numbers in columns, but an easy to recognize map of the region with data points rising above the map plane representing income from the census data. Using more dimensions to overlay information is a prime method for realizing better recognition and understanding.

Figure out the scale - Another thing to consider is the scale or size of the new form. You can easily fall into the trap of thinking that the new holographic form of your data needs to be exactly like the original form

you have isolated. Not true. In fact, that's most often the exact wrong thing to do. Familiar is always a good foundation to build upon when transitioning someone to a new experience based on existing behaviors. That said, the whole point of envisioning our data in a new form is to literally release it from its current container and let it flow into an entirely new shape, of any size, to most optimally represent it in a more malleable and understandable form.



It would make sense to view US Census data in a map-like shape

You'll find that often in holographic design it pays off to make the experience revolve around a room-scale set of holograms, using life-sized characters and accurate dimensions of objects. That's not to say every experience has to be a 1:1 real-world match, but you'll be surprised how the recognition and comfort with your experience goes up with things appear in their natural sizes. Wait, you say. Data has no real-world size – it's just a bunch of numbers, right? No, actually those numbers represent things in the real world, or theoretical world, or alternate universe. No matter. Things have size. Think about using it to your advantage.

ENVISIONING HOLOGRAMS

Match shape to its creator - Now that we have a rough idea of the shape of the new holographic container for our data, what type of tool creates that basic shape? Exactly. Nothing. No really, that's not quite true. There's probably something that can create the dimensional shape you are looking at in your sketch. Pretty certain that tool won't export the shape directly as a hologram (few do), but you can probably figure out what type of app or tool can create that shape with particular parameters (size, shape, color, orientation, etc.). For example, I could use any search engine's map tool to create a flat map of the areas my census data covers.

Identifying this data shape creation tool now will save us a ton of time later.

Avoid doing this - Now that you have the gist of how that works, let's talk through a few things that might trip you up along the way to finding a new representation for your original form.

Here are some things to avoid when releasing your data from its original form.

- Don't try to keep too closely to the original form of the data. The key to unlocking the value has to do with finding the most logical physical world representation of things that are often shown as lists of numbers.
- Resist the temptation to fit your data onto a tabletop or in a small area that resembles how you consume it on glass today. That's wrongheaded more often than not. Go big or go home.
- Don't reuse existing 3D charting and visualization forms for holographic data. Walking around 3D pie charts doesn't make them any more understandable or accurate.

Now that we have a few different sketches of holographic forms that our data could be released into, it's time to imagine how we might interact with them if they were right in front of us.

Tip The biggest advantage of using mixed reality for representing data is to make it as large as is called for. Go room-scale first.

Step 2. FRAME

Some of the decisions we need to make up front lock us into a particular direction. Don't think of that as a bad thing though. It's going to speed up the overall workflow and get us to a testable state quicker.

Choose data set

For each new experiment with a data-inspired hologram, we need to pick a specific data set to work with so our interactions are grounded and focused in something we can test and measure. If we were to use made up data, it would be hard to know if what we're doing is any better or worse than expected.

Having some degree of familiarity with the data set we pick ensures we will realize when it becomes unrecognizable or distorted. By using a data set that matches the original data type from the ideation phase, we've aligned the container and its contents.

For example, I picked a spreadsheet containing the U.S. census data for a particular year (2012) covering the continental United States.

ENVISIONING HOLOGRAMS

You aren't limited to choosing a big data set or a data feed from service. Use your own sales data charts. Get a report of your credit card spending in spreadsheet form. Download the number of steps you've taken this month from your fitness app. Whatever works for you. Again, the key is being familiar with the data.

Tip Don't try to use a gigantic data set to prototype with, unless it has been cleaned and you can visualize it quickly. We need to go fast.

Choose a generator app

To create all of the variations of the new holographic data form, we need an app that generate the shape or something close to it without too much trouble.

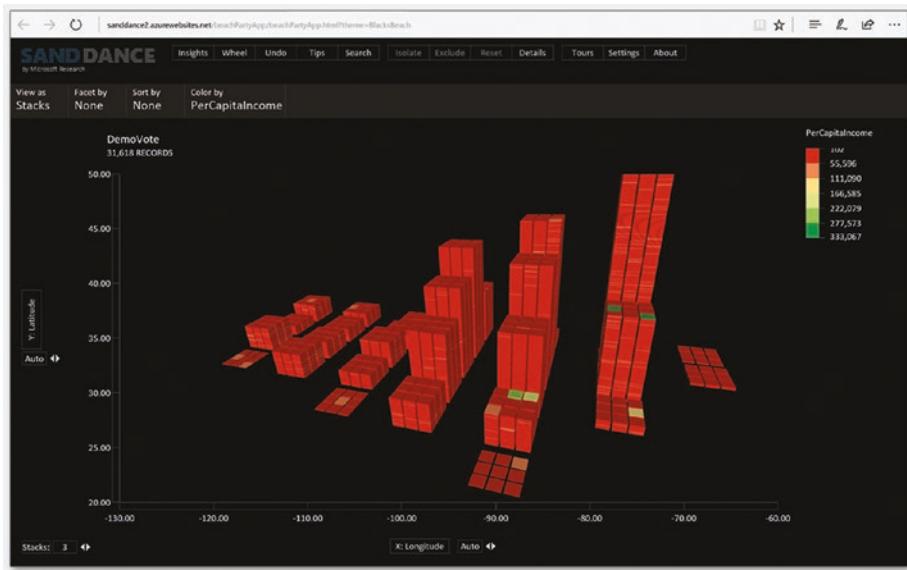
The best kinds of apps to choose when doing this type of envisioning are those that allow fluid exploration and rapid creation of content. In our case, being able to generate the form that we think unlocks the insights or important aspects of the data.

Programs that let you do 3D modeling and animation are great for this task if you know how to use them efficiently. We need throughput, so don't discount more consumer-grade software. Programs like Paint 3D, SketchUp, Blocks are all good choices. For the more advanced forms you want to bring to life try out things like Maya for complex combinations or Tilt Brush for the freedom of creating flowing shapes.

Since my example deals with census data and the regions it applies to, I choose an app that can do more than generate shapes. This kind of app specializes in dealing with data sets. *SandDance*, a Microsoft Garage

project, is a world-class data exploration web service that allows you to load just about any data set and visualize it in many different ways. It also happens to be built into Microsoft's flagship data product Power BI.

For my purposes it's a perfect fit since it can plot data points on a grid that would resemble a map due to inclusion of latitude and longitude in each census data point.



SandDance, a Microsoft Garage project, proved to be a great form generation app

You don't have to use anything like SandDance for your data form generator. For example, if the shape you were thinking about using is more like a person or character, use a 3D modeler that can pose figures in any position you need. Or conversely, if your form resembles architectural spaces or furniture, use something like *SketchUp* to quickly generate those forms.

Tip The app you choose to generate the new data shape doesn't have to output a 3D shape to be useful.

Step 3. PROTOTYPE

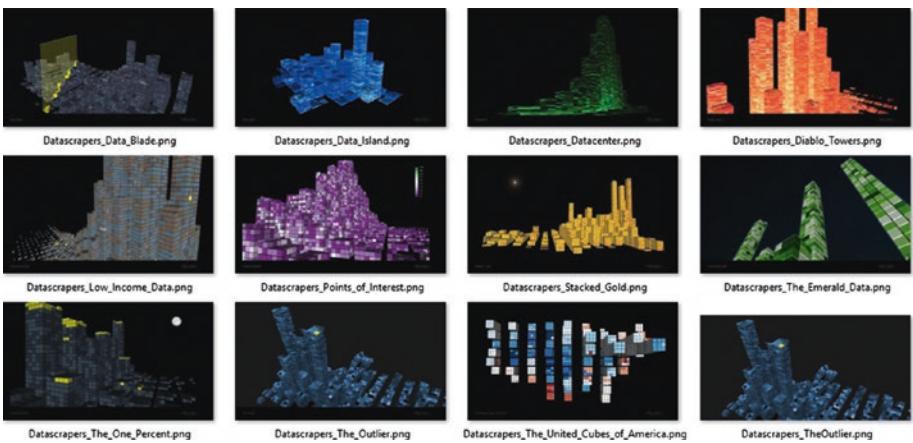
Our task in this portion is getting the output of the generation app into something that lets us not only show the new form, but tell the story behind it. In a perfect world, that would be done through a working prototype. Short of that, we can take some shortcuts to achieve the same end – a compelling showcase for the insights you've unlocked in various tangible forms.

Generate multiple examples

Now that we have a generator app picked out and are fairly comfortable flying it, time to start cranking out lots of experimental forms.

Generate at least one good example of what you're trying to depict first. Examine it a bit critically to see if it embodies the key aspects we look for – clarity, impact, depth, ability to generate questions, and a newness that wasn't there before.

To warm up, try adding slight variations on the basic shape, but then go radical and completely change one important element in each successive iteration to see if helps. Make copies of the base form so you can really try out big changes without worrying about losing a good path. Save lots of tries. You never know which one will be the best “take” when you look back over them.



Building on the basic form, generate several very different approaches

Elements to experiment with are the form's shape, size, orientation, color, camera angle, lighting, overlays, or different data to fill it out. We're looking for those moments where you know something has either locked in or gone too far in the wrong direction. Both help dial in the appearance and presentation we're looking for.

This part of the process can be a time sink because of all this tinkering, so watch how much you invest. Speed is our friend, always.

Tip Push hard to not fall into the trap of making slight alterations on the same basic idea. Not enough payoff for that kind of prototyping.

Play out interactions

One of the best things about envisioning is the ability to figure out how things will behave without writing a single line of code. We can simply use our imaginations, or better yet, our teammates and coworkers, to help act out how these data-inspired holograms respond to our inquiries, actions, or even inaction.

Having just generated a bunch of different variations of our new data form, it's time to see if this works for people. That requires figuring out the interaction basics and then engaging with people to try out our assumptions.

Using the *Acting Out* technique, let's have the new holographic form we just created by played by a person instead of a pillow or inanimate object. By using a real person, we enable a much richer set of interactions and possibilities. We may even be inspired by the way they play the part, respond to stimulus, or ad lib a funny retort. So many subtle interactions come to light when the object we're modeling is played by a person. And in this case, how funny that a new representation of data is brought to life by a living, breathing entity.



It doesn't take much convincing to get people acting as holograms

The things we want to learn by acting out common interactions are not complicated.

- **Basic capabilities** – what can the datagram do (described simply)?
- **Common scenarios** – what do people expect this data object to do for them?
- **Pleasant surprises** – are there unexpected moments that unfold to thrill people?
- **Magical moments** – did you unlock a new insight that was non-obvious before?

Of all the things we get to do during envisioning, this step is the most fun. You always learn a great deal from being inside the interactions with real people, no question. Yet, the lasting impression from the phase is the laughter that inevitably comes with running this type of design. Give it a try. I guarantee it'll become a standard part of your envisioning, no matter what the subject happens to be.

Tip Make videos of the interactions between real people and the newly envisioned data shapes. You'll learn something or at least have a good laugh.

Package it up

Now that we have basic data form figured out and know roughly how it behaves, time to put it into a vehicle that can deliver the intended impact to our audience. The whole point of this is to get in front of people that will (hopefully) see the value in using our new representation. We'll have to think about the best to reach them in the natural flow of their work.

Consider the intent of this envisioning exercise when you choose the packaging. Think back on why we started doing this experiment in the first place. Was it to quickly convey a concept? Impress upon someone the need to unlock the data in this way? Show a technical proof it could be done in this way?

Quickest – Use the HoloScenes technique of combining the holographic form of the data with a photo of a physical space, like someone's office or home. This is an easy way to depict exactly how you'd like to see this play out. You control the setup, camera angle, overlays on the data, and position of people in the scene for maximum impact. Downside is not being able to show the interactions in motion. They are implied, but left to interpretation.

Effective – Wireframing the scene and animating the key interactions can easily be done using PowerPoint or other presentation software. They have all the capabilities you need to drop in photos, drawing, models,

and add your own markup over the top. By creating a clickable model that responds to someone's touching things or issuing voice commands, you can simulate pretty well what you are going for. The downside is this technique is clearly more lofi than you'd optimally want for high impact. It will be seen for what it is - a quick and dirty interactive sketch.

Highest Impact – A slightly polished video production of the scene playing out with the interactions you figured out through acting is going to win people over. They may know right away you used slick video compositing to drop the holograms into the scene, but being able to show the richness of the presentation and interaction aspects provide a value that's hard to get in other forms of envisioning. The downside is you need at least some rudimentary video editing and compositing skills on the team.

Most Impressive – Working prototypes using real data sets are without question going to make the biggest impression on people entirely because they are real. The old saying “Code wins” is apt here. Being able to demonstrate the concept with working models, data, and code will excite people's imaginations and have them telling you exactly what needs to be better. Mission accomplished. Downside is this is expensive time-wise and requires resources to get working.

Tip The way you first show these ideas to people will impact their perceived viability and value. Pick well by understanding your audience.

Step 4. TEST

As with other envisioning techniques, trying it out on someone will surprise you in some way. It always does. The things we see clearly as the envisioners of these new forms are not always as clear to other people right away. Doesn't mean it isn't good or valuable. Does mean we need to listen carefully to why.

Show it around

This is where your narrative and storytelling skills come in. You could construct a good test for the data form where you do a before and after type of comparison.

Start with telling the story to someone about how you normally work with the type of data you choose originally. Show them how you'd normally consume or work with it. Quickly run through the difficulties. Conjecture about the opportunities to improve it. Then reveal the new data form. Stop talking.

What people should immediately jump to is how it can be improved or how it's more clear, understandable, or actionable. What you hope to not hear is silence, denoting you missed the mark. Of course, hearing this doesn't make sense is a good indicator you may want to try another one of your explorations out on them. Either way, the idea is moving forward.

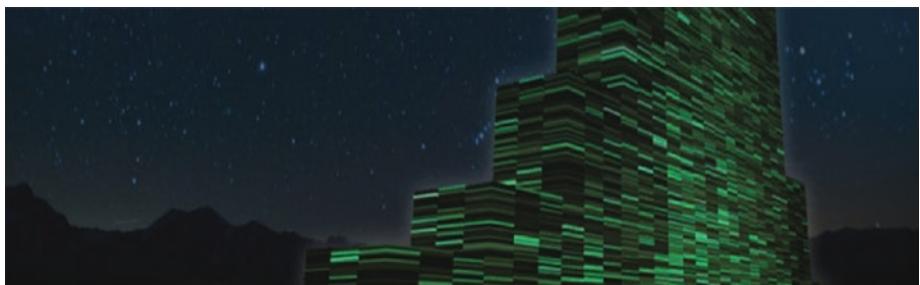
Tip It's normal for people to reject a new form of something they are used to. Don't let that dissuade you from exploring its value.

Step 5. REFINE

Based on the feedback from your tests, there are probably some areas that need attention. Being more clear about what the data is, how the form represents it, and what actions are possible most commonly get refined during this phase. This is also a great time to add in your secret weapons to assist with persuasion.

Apply special effects

Now that we have the basics down, there are several things you can apply to the presentation vehicle you choose to show off the holographic data form in its best light.



Lighting - The key to any great rendering of 3D objects is how they are lit. Using convincing light takes away some of the resistance and lets the viewer focus on the substance. You can bring still frames or individual elements into Photoshop to touch them up quickly. Don't have to use a full-blown 3D modeler to get this done.

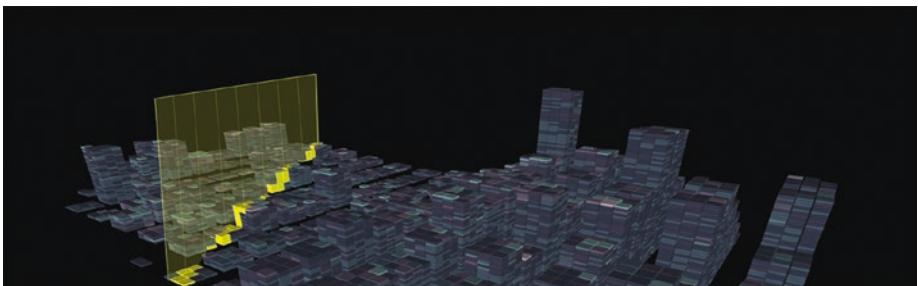
ENVISIONING HOLOGRAMS



Sound – More impactful than visuals in many ways, spatial sound (or any sound for that matter) will punch up the important moments in the consumption or interaction. Try using any sounds as placeholders just to get the timing right for its intended purpose. Then find the right one. Nothing is worse than using the wrong sound.



Atmosphere – One of the most visually interesting things to experiment with is adding cinematic effects to your holographic data forms. Placing the elements into a real-world scene is a way to convey the scale of the data it represents. Atmosphere like fog, rain, clouds, or bright sun illicit a particular feel that can work to your advantage. Experiment here with focus.



Affordances – There are typically widgets that we use to manipulate digital objects that sometimes are left as part of the surrounding chrome or interface of the programs we use. There are times when we can embed those within our holograms to assist with actions. The key is inserting them in natural and straightforward ways so they don't distract from the data and insights themselves. An example of that is a “datablade” that cuts through the data set to focus on one particular slice.

Tip Don’t underestimate the importance of using sound to make your holographic data come to life. It’s almost always overlooked in normal data.

Step 6. RESTART

It's logical to just continue testing the refined ideas out on people once you've gotten them to a point where it's a plausible evolution of the current data form (which is no small feat in itself). I'd suggest that when you reach that point of being comfortable with the exploration, it's a clear indicator that you've done enough on that tack. Good time to take stock of what you learned and accomplished, because it's time to move on.

Find new data

The best way to prove whether you really hit on something valuable or even a breakthrough experience is to “reload” your new hologram with new data. Maybe it’s from a different year or completely different region. Perhaps you try to fit a whole new type of data into your container to see if it still holds up. Whatever you decide to try will help you learn more about the original idea you had for this particular form.

A great way to tell if you should dig deeper with this prototype is getting a new data set to almost work. That last bit that didn’t is your new area of exploration. Why was that? The form or data set? What if there was a ton of data that needed to be visualized and worked with in this way – would it work?

We can’t possibly anticipate all the different kinds of actual data people will want to use your holographic container for, so pushing ourselves to try data that’s non-obvious is always an eye-opening experience.

Summary

Using holographic containers to free data from its current confines is an extremely promising area of exploration. We need your thinking here to unlock the potential.

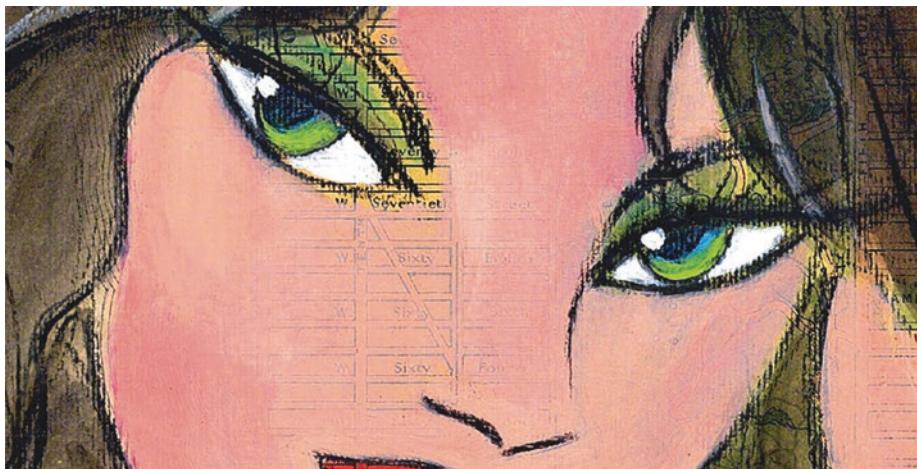
CHAPTER 16

HoloArt Gallery

The spellbinding stories behind our artwork are too often lost to history.

Developers aren't recognized as the true artists they actually are. Being both a coder and designer, I can tell you without question developers are some of the most creative people on the planet. The reason we don't often think about that is the way they work and express themselves. Their impact is often seen in terms of the output, not the process. And therein lies the tragedy.

Solving seemingly impossible engineering challenges seems like all critical thinking and whiteboard equation scribbling. But, it's far from that. There's passion, brilliant leaps of faith, horrendous failures, and stunning redemption. The story arch in a modern high tech development project rivals any action film – you just never hear about it in that way. It's all taken in stride and brushed off as yesterday's news in the quest for the newest new thing.



Behind-the-scenes stories of how art projects evolve are too rare

We are all missing out some incredibly entertaining tales and valuable lessons when these background stories are known only by their creators. The same is true of any artwork that's not hanging in a museum with a placard explaining a bit about the artist and why the work exists. As a fellow artist, I am fascinated with the motivation and circumstances behind art pieces. Yet, I'll never hear from the artist themselves about the creation process. Or will I?

Holographic computing has the power to change all that in a truly magical way.

Backstory

My sister *Sharon Pell-Lie* was an exceptional mixed-media artist living in New York City. She loved to create unique pieces that fused her favorite things, superhero-inspired women and their cute felines, on unusual backdrops. But, more interesting than that combo is how her artwork (on display at *pellmell.com*) illustrates a technique that we've been discussing for holograms.

Sharon had a real talent for combining different materials and influences into a coherent style that oozed approachable playfulness. She was able to infuse her own style and opinions into pieces that were seemingly unrelated to her own life, yet they were deeply personal in hidden ways (the hallmark of editorial envisioning). I often wondered how Sharon saw what others didn't in those old maps she would use as the backdrops of her artistic journeys. It's as if the subjects she painted existed to her alone until they were reduced to brush strokes on the canvas. She visualized the unseen within the familiar, which is exactly what we're doing.



Sharon Pell-Lie saw what was there but hidden, and found a way to uniquely capture it

Does this sound familiar? Of course, it does. It's what we have been talking about this entire time – holograms are already waiting in your imagination to be set free for others to enjoy.

Sharon collected old maps and postcards the way I suggested you should continuously collect photos of empty spaces. In her travels around NYC, her beloved Paris, or Seattle, she'd spot these unassuming treasures

ENVISIONING HOLOGRAMS

and buy them on the spot. Which is my point exactly – whenever the opportunity arises to capture something that speaks to you, do it right then. You don't have to know what you'll use it for later. Just capture it and store it for the future.

Sharon was also quite prolific at creating her art. There are hundreds of pieces of different periods, styles, and subjects, that it's hard to catalog them all. And so many interesting stories behind each one. Whenever I'd ask her about certain pieces that I liked personally, and she'd tell me a story that was completely unexpected about its motivation and timing. Those were priceless stories, now lost to the sands of time and fading memories.

Spellbinding Holograms

That got me thinking. In this era of video recording everything, free tools, and oodles of storage, why don't we capture more about our creation process as its happening? Musicians often bring videographers into the studio to capture the recording process. Why not artists? Why not coders?

It's with that thought I set out to capture what it would be like to talk with the artist or coder of something way after they had finished it. Through the use of mixed reality, I imagined we could bring that experience to life in a completely new way. Without having to visit the artist's studio or coder's lair, we could have a personal conversation with them about their work.

In my case, I thought back on how Sharon would tell me the stories of what inspired particular pieces (sometimes by real people, sometimes by her cats, sometimes just odd circumstances). The details were interesting, but to me the more memorable part was how she told those stories. "Spellbinding" is the word that came to mind, which is exactly what she named her art series of playful women and their favorite feline friends.

The *S*Pellbinders* art series of is full of stories that are forever locked inside those paintings. I have a personal mission to unlock them, and I think mixed reality is exactly the right medium for them to be shared. But to realize that vision, I'll have to overcome a gigantic hurdle.



Close-up of “Capgirl” by Sharon Pell-Lie from the S*Pellbinders series

The challenge with this particular holographic exploration would not be artistic or informational though, it was clearly a technical one. How exactly would you bring the artist and any of their collaborators into the mixed reality space without resorting to hanging a two-dimensional video screen in the air (very unsatisfying, so why bother). Was it possible to create three-dimensional avatars of the real artist (living or dead) to inhabit the space and talk about their work? Seemed possible based on some technology demonstrations and any sci-fi movie ever made, but could I somehow do this myself as a working prototype to prove its viable? Of course :-)

ENVISIONING HOLOGRAMS

And that same exact desire to create spellbinding holographic experiences will drive you to experiment with code and real hardware during your journey, too.

The Process

Because this envisioning technique is best for creating working prototypes of technical proofs, some on-device testing will be needed to see if we get all the way there or not. Having a mixed reality development environment setup or creation app to experiment with is required. The steps for getting this accomplished quickly as shown in **Table 16-1**.

Spellbinding Holograms		
IDEATE	1. Identify the challenge 2. Brainstorm the approach	It's ok to leap to solutions here
FRAME	3. Limit the scenario 4. Focus on payoff	Hardest part is choosing the exact technical proof to attack
PROTOTYPE	5. Create the scene 6. Add the hero 7. Wire the interactions	Will require coding and asset creation for the prototype
TEST	8. On-device testing	Emulators aren't good enough
REFINE	9. Tweak the interactions	Tune what almost worked
RESTART	10. What went right?	Build on the positives

Table 16-1. A technique for doing technical proofs with holograms

Nothing to fear if you don't code. Just find someone who does program, and owes you a big favor or works for cheap. This will take longer than you or they think.

Step 1. IDEATE

This is the time to brainstorm how you could potentially build out a working prototype of that signature moment in your holographic experience so people know it's actually possible. Usually we try to stay away from jumping right to solutions in the brainstorming or ideation phase, but not here. We need ideas for how to get this real, quickly.

Identify the challenge

Try to focus in on the hardest part of the working prototype or the most critical aspect to get working to achieve your desired outcome (make an impact, show technical proof, set a vision). It's important to get a handle on this early on so you know whether to keep going or bail on the idea of creating a working prototype at this point. No shame in discovering you can't quite make this happen at the moment. The shame would be investing a ton of time with nothing to show at the end. In most cases, you'll find there's a middle ground where you can shoot for the stars and at least make to orbit.

In my example, the hardest part of the concept would be getting a convincing facsimile of the artist to exist along with their artwork, whether real or digital. The intent was to have them tell the viewer of their art the backstory or other interesting things about the work. People don't record these types of explanations every time they create something. A bit much to expect. Is it too unrealistic? Is there even tech available that would allow us to create a holographic avatar without having an extraordinarily expensive setup?

Regardless of the answers, I had the technical challenge identified. What's yours?

Brainstorm the approach

Now that we have the most difficult technical challenge identified, let's figure out how we can get it working as a proof of concept (or at least well enough to prove it could be done with additional time, money, or resources). This is where having a friend or coworker who keeps up on all latest breakthroughs in various fields comes in handy. If that person isn't readily available to brainstorm with you, use our *Filmed on Location* technique to illustrate what you're after and post it for others to help you figure out how to get there. You'd be surprised how helpful the mixed reality community is in identifying existing tech or methods to help out.

The point of this exercise is not to start 3D modeling or coding it up right away (as tempting as that is). We want to figure out the **approach** we'll take so we know what we're in for. This does not mean we're going to start scheduling sprints, setup a backlog, or any of that other agile non-sense. Just focus on how you can technically achieve that signature moment in the experience. Geek out. Draw weird diagrams on the whiteboard. Search for demos on the web. Identify some APIs or SDKs you could use. Then stop. Move on.

For example, when working on the exploration around Sharon's artwork, I went through the basics of what we'd need to do to bring it to life.

- Putting a set of digital paintings in space – easy.
- Augmenting an existing piece of real artwork with digital overlays – fairly easy.
- See the artwork close-up without degradation or visual artifacts – a bit tricky.
- Talking with an artist who's not around – that's ridiculously hard.

Given all that, the first thing that sprung to mind in approaching the problem of creating the holographic artists was how they bring actors who have passed away back to the screen for major motion pictures. From my limited understanding, they roughly map the deceased actor's face and hair onto a similar actor's body or a digital stand-in. Through a detailed digital post production process the actor is blended seamlessly into the scene. Easy. If you have millions of dollars in the budget, that is. Wonder if there's a low-cost way to get there? Turns out, there is.



Incredibly slick software from Loom.ai quickly creates avatars from photos (source: Loom.ai)

By using an incredibly high tech combination of computer vision, machine learning, and motion picture special effects, companies like *Loom.ai* have figured out how to turn an ordinary selfie or photograph into an expressive 3D avatar. Delivered as both an API and SDK for developers to leverage in their own applications, this kind of advancement heralds the start of an entirely new era in being able to "exist" digitally and recognizably without high cost scanning procedures.

Great. That works for me. Problem solved. Let's move on.

Step 2. FRAME

Since we're coding this working prototype, we need to put a few well-chosen constraints in place to stop ourselves from heading directly into the ditch chasing some shiny target. Way too easy to waste time on the non-essentials when the goal is to get this up and working as fast as possible.

Limit the scenario

We can't go fast and do everything at the same time. Let's try to narrow the things we need hookup in this by reducing the surface area. By walking step-by-step through the intended scenario, we can look for the minimal set of objects, functionality, and behaviors we need to implement. The scenario doesn't have to be super-detailed to serve its purpose. We can just list what you'd reasonably expect to happen (even though it rarely unfolds in that way) with this and try to focus our audience on that narrow "golden path" through the scenario.

In my case, the scenario sets up a potentially rich set of interactions if an artist suddenly appeared and started talking about their work. How could we limit the functionality and still have a compelling experience?

A few obvious questions pop to mind.

- First, would the viewer even notice anything is different about the artwork?
- How does the artist know when to engage the viewer?
- Can the viewer stop that narrative and ask questions?
- Would you allow rewind or fast forward? Is that rude to the holographic artist?

The purpose of asking these seemingly open-ended questions is to make sure you cover just enough of what's reasonably expected by the participant to achieve your goal of testing this out.

Focus on payoff

Going back to one of the earliest things we talked about, the whole point of this “spellbinding” working prototype is to impress and amaze people with what you envisioned as possible. The only way to really accomplish that is to create a suitably impressive illusion. That’s the payoff. Laser focus on how to trigger and pull off the signature moment of your exploration every time, so that anyone who experiences it comes away with the same impression – blown away. That’s how you craft breakthrough experiences demos.



Bringing those signature moments to life are the real payoff in your prototype

Going through few steps can help us arrive at that destination for this working prototype.

- Roughly plot out the expected paths through the prototype, meaning what will the participant most likely do first, next, instead of, unexpectedly, unquestionably.

ENVISIONING HOLOGRAMS

- Identify the signature moment in this prototype so that you can get it hooked up properly.
- Make sure the payoff is worth the effort. Be critical of the idea.

Once you have the answers, get going on building this out as fast as possible, testing whatever parts you can along the way to make sure it's coming together as expected. Doesn't have to be perfect to try out on someone.

Step 3. PROTOTYPE

This is the fun part. Kinda. Prototyping is incredibly rewarding when things are flowing and you're the master of the universe. It's frustratingly hard work when things aren't quite coming together. And that condition seems to oscillate from one to the other on an hourly basis. So, to combat the bad parts, let's start off with the straightforward part for an easy score.

Oh, wait. You're not a designer or 3D modeler. Okay, I got you...



AN ALL-PURPOSE WEAPON - If you don't already have it, download a copy of the *Unity* development environment to easily construct the elements of our holographic experience. Unity is the leading tool for

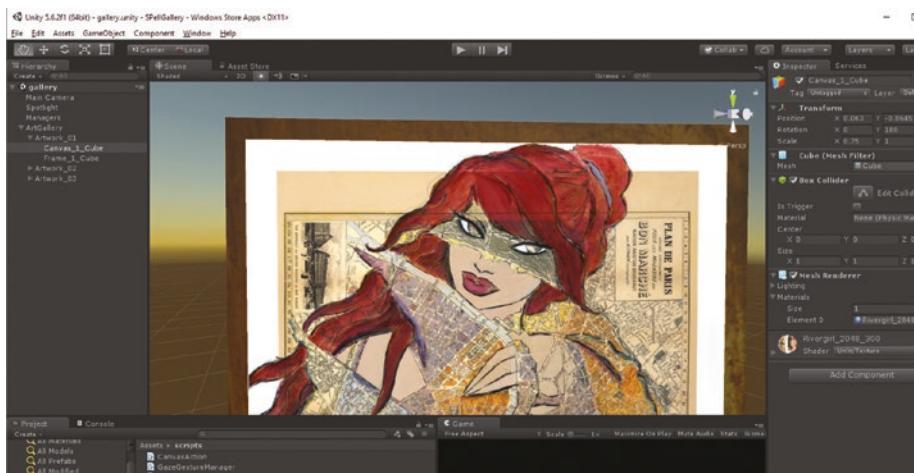
building the elements of just about any kind of mixed reality experience. In fact, I think you'd be hard pressed to find a developer in the industry who hasn't at least tried it out for AR, VR, or Gaming projects. Unity is a one-stop shop for us since it enables scene composition, modeling, animation, lighting, special effects, and is extensible through add-ins. Trust me on this one, Unity is your new best friend when it comes to quickly prototyping mixed reality experiences.

Create the scene

Our holograms need somewhere to exist when they come to life, so let's call that a "scene" for the moment. The scene we're talking about now is essentially what you see when an experience first starts. It could feel like objects have been added to the space you're in now, or you could feel like you've been transported to a completely different place.

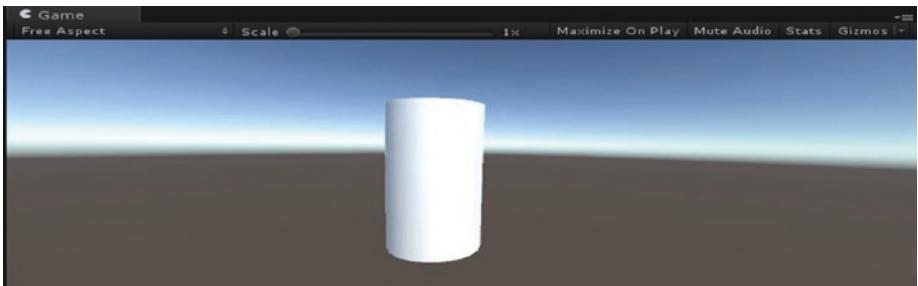
In a composition tool like Unity, or any other 3D modeler, you can import or create placeholder objects to setup the basic scene's background elements and bit players. By definition, everything you add to the scene is a hologram, yet we tend to think of them as the background objects and any heroes you identified in your scenario.

ENVISIONING HOLOGRAMS



Here's what my initial scene looked like in Unity before our hero makes her appearance

Calling this collection of holographic artwork a “scene” is a bit confusing as they are drawn with no background or floor (note the preview that shows the black or transparent aspect), but rather the real world showing through. It would make a bit more sense if it was done for VR or an immersive headset, since that’s a self-contained world that has its own floor plane and skybox (a game developer term for the half sphere that constitutes the sky and horizon in virtual environment). In VR, you’re inside an encapsulated world, so creating a scene to fill out with sky, setting, furniture, vehicles, characters, or whatever you imagine is logical. Expansive spaces like oceans or outer space are fine to consider scenes, too.



The skybox paradigm in Unity helps set up a scene using the horizon and sky

Conversely, in mixed reality, the notion of a scene is a bit trickier to define. Even calling it a scene in mixed reality is really a misnomer. It isn't so much a traditional scene as a situation that has three possible setups – preset positioning, participant positioning, and dynamic. Yet, the term scene is widespread and easy to understand, so we'll go with it.

Let's talk a bit about how objects are placed and positioned within this situation or scene.

Preset Positioning – During the layout phase in the tool, elements are arranged to relate to the viewer and each other in a predetermined way, and then placed that way in the scene. You could also do this by writing some code to position the key elements in particular places within the scene at runtime. For example, placing artwork on the nearest wall. Holographic platforms try to make that floor, wall, and tabletop surface placement easy to achieve via code APIs.

Participant Positioning – No one likes being told where they have to keep things. That holds true in mixed reality as well. When we inject holograms into your physical space, it can be very off-putting if they end up in awkward or unnatural places. Because the hardware we're relying on needs to scan and figure out for itself where the floor and walls are (which

ENVISIONING HOLOGRAMS

can take a bit of time) it's a common paradigm to ask the participant to place the holograms where they like. The elements are then rendered at that distance and position from the viewer.

Dynamic Positioning - Some of the best examples of mixed reality blending completely into the real world use a combination of auto-positioning and manual placement. These experiences typically need to position things on the floor, walls, or table tops to anchor them in places that make sense to the participant. Dynamic elements can later "find" the right place to appear based on room scans. An example would be a hologram appearing to sit down on your couch by itself.

You'll have to figure out the best initial state for your scene based on what you hope the interaction model will be. My suggestion is to go back to any play testing you may have done to see which resonated with people the most. Set something up in Unity (or whatever app you're using for scene composition) and try it out through a quick previewer or software emulator of any specialized hardware you're targeting. You'll get a rough idea of what the scene will feel like from that emulation, but there's no substitute for trying it out in the target device. What a thrill the first time you see the scene draw in the room you are working in.

After settling on one of the positioning options you have essentially set the stage for the stars of the show to make their appearance – the holographic actors.

Add the hero

In our scenario, there's always a center of attention that commands attention or entertains us during normal interaction. It doesn't have to be immediately introduced or apparent. In fact, making the participant discover the hero as they explore is a great plan. Creating the memorable illusion for that hero is where we want to spend our prototyping time.

Just like any good movie or play, the hero can make a dramatic entrance or be well blended into the background before making themselves known. Figure out which approach is right for your scenario and place your holographic hero in that initial position either as a relative position from the viewer's eye (the camera) or calculate where to place it dynamically with code.



An early sketch for the developer of where the hero should appear near the artwork

In my example, Sharon's artwork will always appear several meters in front of the viewer, not auto-placed on a wall. The reason for that initial setup has everything to do with the kind of interaction I am trying to foster. I want to encourage exploration where people walk up to the paintings, look around them, and to their surprise discover the hero, our artist, who appears and starts a conversation. That scenario wouldn't be nearly as interesting if the pieces just hung on a wall as they normally do.



Our artist, Sharon Pell-Lie, appears and starts a conversation when you approach

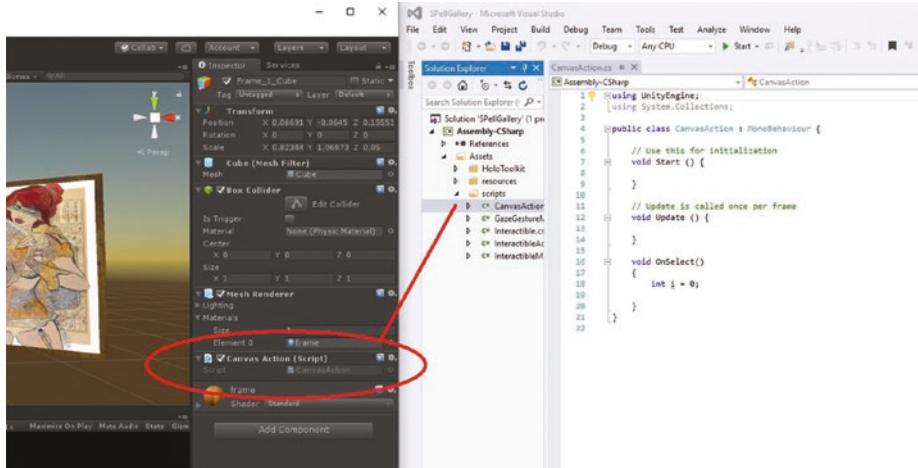
The hero's entrance is a surprise in this case, but it doesn't have to be. Just engaging with the object in some other way could have easily been the trigger we needed to start the interaction.

Wire the interactions

It's one thing to make a static scene show up on-device, and yet another to have the holographic heroes respond to your input, or act out their own behaviors. That's incredibly important to hook up as soon as possible. Why? Blame the iPhone. We've all been programmed and conditioned to respond to anything that looks like it might have something more to it by tapping, swiping, or talking to it. There's nothing worse than engaging something cool looking and have it just sit there and ignore you.

Remember earlier we talked about narrowing the focus of this prototype? This is why. We don't want to wire up tons of different objects or interactions just to get an initial read on whether this holographic

experience is compelling or not. So, let's get just a few things working well enough to test out and dial in a good feel for people.



You'll edit the code for your behaviors in a development environment like Visual Studio

If you are using Unity for this prototype, you can use its built-in code editor to help wire up the interactions with objects. Most people tend to use their full development environment to do the coding and debugging associated with object behaviors. In our case, *Microsoft Visual Studio* is the best development system to pair with Unity and Microsoft HoloLens. Other mixed reality systems have their own preferred development environments. The integration is good enough to allow for a productive workflow, and the Unity tool is constantly being updated with amazing new features to aid developers and designers.

In many cases, just a few lines of JavaScript or C# are enough to get the behavior we're after. As I mentioned in the Introduction, this isn't intended to be a step-by-step programming book, so I'll leave the details of how to code up functionality for your holograms to the excellent tutorials found

ENVISIONING HOLOGRAMS

on the development sites for Microsoft, Unity, Apple, Magic Leap, and others. As a coder myself, I can tell you that it's a massive amount of fun to learn how these platforms work. Try it out for yourself.

Once our basic behaviors are hooked up with code, it's time to test it out using the hardware that's required to see the holograms in our physical spaces.

Step 4. TEST

There's no getting around the need to test our working prototypes of holographic experiences on the actual hardware. Emulators, previewers, or even video don't do holograms justice. Seeing holograms in person evokes responses that aren't replicated easily by anything other our own eyes and brains. We are seemingly hardwired to respond and connect deeply with holograms.

Let's get this onto whatever device is going to help us see the holograms in our environment.

On-device testing

All of the development tools we use for holographic computing have a clear workflow to get the magic bits onto real hardware in addition to the previewers and emulators they come with. The process for transferring the app or other vehicle onto the target device is usually harder than it needs to be, but not overwhelmingly difficult. Mainly has to do with making a Wi-Fi connection with the device or using a cable to transfer the software. When it finally works, it's amazing.



Seeing the artwork appear mid-air for the first time was indeed spellbinding

What we're looking for once the prototype is on the device is the same as any other project – does it look right? Behave correctly? Exhibit any strange behavior? We're going to follow the scenario outline we created earlier as we work our way through things. But, you'll notice that you keep getting distracted by something. It's almost unavoidable. Holograms are incredibly interesting to see in person. You get as close as possible to see and touch them. It's addictive.

Another thing to remember is that once you have someone else try this out, there's bound to be things that you didn't account for – if for no other reason than they think differently than you do, press different things, try odd voice commands, or just don't do anything you'd expect. People are so unpredictable, even for experts in designing breakthrough experiences.

Once you make it far enough along through your golden path of the scenario, see if the interactions and signature moment are anywhere close to what you expected. Didn't think so. Back to the laboratory to tighten things up a bit.

Step 5. REFINE

You'll have a ton of things to consider once you've tested the prototype out. The key is to not get overwhelmed and start over too fast, or conversely dig in too deeply to fix things. There's a balance in moving things forward to learn more. We want to go fast so we fail fast. Or something like that. I'd rather think of it as learning from our experiments instead of failing. Either way.

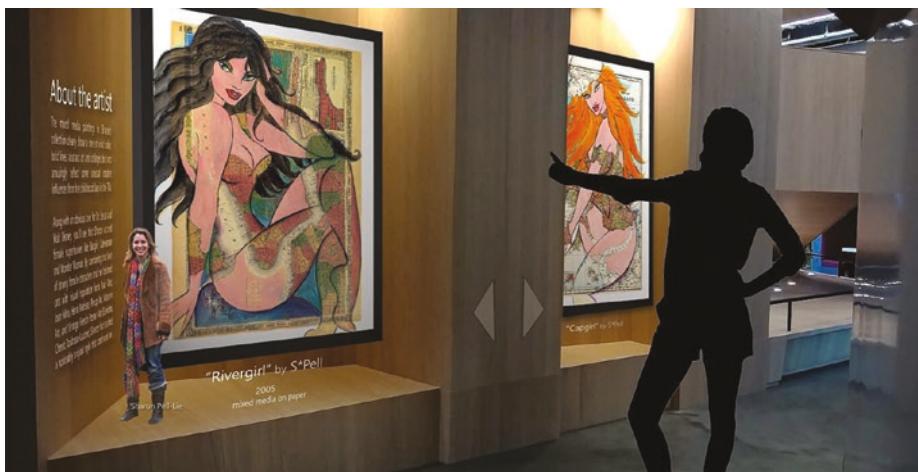
One thing that you'll probably notice about this example I'm using of Sharon's artwork is that the early versions seem awfully stark. Just the pieces themselves and the artist explaining the backstory is cool, but even cool isn't enough sometimes. We seem to need more supporting information about the work itself like I'd find in a museum placard. I'm also feeling like there's some functionality that I am used to on my iPad and Surface that I'm missing. Why can't I zoom? Share this with my friends? Look at other works by Sharon or related artists? Exactly. We're not done, even in prototype form. We've created something so cool that people want more. A job well done is rewarded by a bigger job they say. Thanks.

Tweak the interactions

The first thing to refine is the easy stuff that we either missed or just got wrong. We do that as a best practice in case we have another opportunity to test out with someone else while we're adjusting things. Always have a demo ready they say. In our case, that we can take care of the placard with the artwork information super fast and be ready for more testing or keep fixing things up.

The next thing we didn't have originally was the ability to see other pieces within the same spatial position as the current artwork. Why is that

important? In a constrained space, we can early cycle through an entire collection of work without ever moving our position. Handy. The question of course is what's the best way to do that? Voice command, "next"? Gesturing toward one side or another? Air tapping a familiar affordance to avoid relearning new models? Bingo. Winner. Let's just do that and test it out.



The refined experience features textual overlays, navigation, and more artwork

Once our list of high value fixes is complete, we'll jump back into the real device to test things out and then look for new people to try it out on. It's important during this tuning up phase to temper the desire to add new functionality with the goal of having just enough to meet our goal of making a big impact through a real code prototype, doing a technical proof of concept, or just getting a jump on the real implementation. Don't over-invest in the prototype.

Step 6. RESTART

It's always tempting to refactor the code for better efficiency or organization once you have a working prototype together. Don't do it. Prototypes are meant to snapshots of ideas that were created to test a hypothesis or demonstrate a set of behaviors. Prototypes are meant to be disposable, not clung onto. Let it go. Move on. There are thousands more for you to build.

What went right?

A better use of time at the end of the prototyping cycle for the envisioning experiment is to reflect back on what we actually learned from this time around. It's human nature to first focus on what went wrong, but try reversing that and start with what went well.

- Did we successfully hit our goal this time out?
- Were people excited to try it out?
- Are there reusable pieces of code or hardware we can leverage next time?
- What did we learn about our process, talents, and team chemistry?

Be honest about these reflections. No shame in discovering that things really didn't go to plan, even if you had a blast during the cycle.

There's always something to take away from these kinds of hands-on experiments with code to create working prototypes. That something may be the way we dramatically flamed out and crashed in the eleventh hour, or how we were so close to having it working but just couldn't get it

together. No matter the final outcome, this type of prototyping to create spellbinding, breakthrough holographic experiences teaches us how to be better next time.

Summary

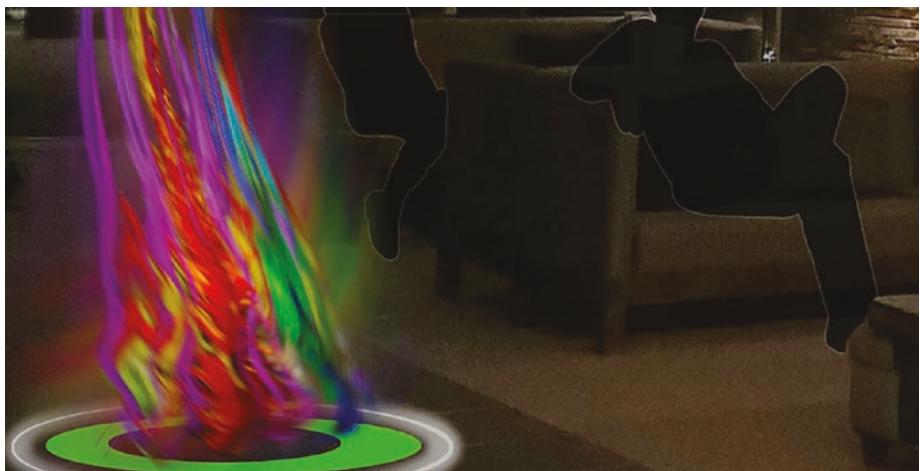
There's nothing better than creating a working prototype that people can test out on their own without our intervention or instruction. In the world of envisioning, presenting people with holograms they can interact with right where they're standing can't be beat for a true measure of impact. This kind of envisioning is the best test of this promising new realm.

CHAPTER 17

Design Insights

Holograms have feelings just like you. Really.

As you do more holographic envisioning, certain things become apparent – you don't position holograms locked to a person's face, you can't get closer than 1 meter before holograms distort, and holograms that don't react aren't interesting in the least. These design insights aren't rocket science or divined by years of study. They make themselves apparent over time, during failed experiments, and our brightest triumphs.



By no means an exhaustive list of what to do or not, here's a few hard-won nuggets of wisdom that may help you design breakthrough holographic experiences faster than normal.

Know Your Audience

This observation and truth is no different than any other form of design or communication. You can't possibly make a real connection if you don't know who you are talking to and why they'd care what you have to say (whether literally or through holographic experiences).



Focus on people, not technology

Nothing good ever came from putting technology before people. We become enamored with our inventions and sometimes forget that it's people who they're intended for, not just their creators' satisfaction. We've all been there. There are certain times when we create a piece of technology that's so incredibly awesome we don't really care if anyone else sees the brilliance besides us. It's in those moments that we are most guilty of the sin of ego.

Technologists love technology. We strive to be the first to bring something to the world, regardless of what it will be used for or who it's ultimately destined to be used by. We invent for the sake of inventing sometimes. That's a very human thing to do. But, in this field where almost everything is new-to-world, we have a responsibility to think about how people come into play before we spring these technical marvels on the world. People shouldn't be your afterthought, we should be your guiding light.

Be inclusive

Now, more than any other time in our brief history on this planet, we need to be thoughtful and inclusive in everything we do. With so much conflict and strife in our world, the future we leave to the next generation will be shaped by our actions toward other people. That behavior is reflected in our daily interactions and our design work. Human decency is not an optional feature, it's the responsibility of all of us, every day, every situation.

Designing breakthrough holographic experiences that only resonate or apply to just one group of people is not only wrongheaded, it's dangerous. It furthers an oblivious state of existence to human needs, desires, and hopes in favor of catering to the privileged and able-bodied. Not all of us on planet Earth are afforded the same upbringings and lives. Those of us who are in a position to create tools and experiences for future generations need to make kind and just decisions to ensure a future that welcomes all people. That responsibility starts with trying to understand and empathize with those not like ourselves, so that our work is truly inclusive.

Think situationally

Almost everything we've previously learned about designing high tech products and services revolves around scenarios and tasks. It's at the heart of interaction design in that field. We're taught to break things down into discreet actions that help us accomplish something pressing. Our mindset is fixed on understanding what people want to do, and then making it easier or faster to accomplish it. Productivity and efficiency drives much of that thought.

Conversely, mixed reality design revolves around fluid situations. You have no idea what someone who has never seen, heard, or interacted

ENVISIONING HOLOGRAMS

with a hologram is going to do next. It's a bit hard to design for that. We can test our assumptions over and over again, but you'll find more often than not that people are caught up in the experience of it all, not focused on accomplishing a task. There are certainly many examples of discreet actions that people want to accomplish when in mixed reality, yet their behavior is more closely tied to dealing with this new situation.

It's not common for people to be in mixed reality environments for extended periods of time or all day long quite yet. For now, we don our headsets, glasses, and other devices to do something specific, not general purpose. And for that reason, the situational nature of the interaction, we should abandon the approach of being task oriented and adopt the thought of being experientially driven in mixed reality. Let's not expect productivity at the amusement park.

Acknowledge emotion

Once upon a time, computers were simple. We clicked buttons and pulled down menus to tell the machine what we wanted it to do. Sometimes it cooperated, sometimes it didn't. But, if it didn't you'd know why through a horrendously worded error message. The cause and effect was easy to understand because it was almost mechanical like any other tool in your garage. You were clear on who was in charge (the computer) and what to expect (not much). No personality, no emotion. Nothing personal, it was just a mechanical process with measured outputs.

Now, fast forward to the age of artificial intelligence.

Our machines now “think” and have what passes for rudimentary emotion. They know when we're upset with them. It follows that as designers of holographic systems and experiences in this age, we need to embrace the role of emotion in our designs and how the language of interaction needs

to take emotion into account. We can't think our interactions with these machines is purely transactional any longer. They mimic our emotions, we need to be willing to acknowledge that and respond with experience design that takes all that into account. Be open minded about the ideas that our former mechanical tools are now actually offended when we leave them out.

Know Your Medium

The closest medium I can think of that captures most of what we're doing with holographic computing is the film industry. Wait you say – that's a passive experience that has nothing to do with mixed reality. True on the surface perhaps, but the closer we look at the cinema as a medium and the industry behind motion pictures, the more we can learn from it.



Illusion

The reason people go to movies is to be entertained, right? Some consider it a more cerebral pursuit, but I think we can all agree that seeing a film in the theater is an immersive experience that takes us away from our lives for a few hours. There's a powerful illusion created by the film's director and actors which allows us to slip into their world just enough to feel something. That illusion makes us willing voyeurs of their world, and on occasion emotional participants.

ENVISIONING HOLOGRAMS

Holographic experiences have all of those properties, and more. We create the illusion that lifelike digital objects embody intelligence, awareness, and understanding. And when we're really good at what we do, they evoke emotions in their audience. There's something more powerful than motion pictures in our holograms – they're right there, touchable, in our space, part of our world, not stuck behind the screen.

Holograms naturally create an illusion more powerful than our most trusted escape hatch, the motion picture. Not bad for a bunch of light and code.

Stagecraft

The problem with holograms is that they're holograms. We can only see these futuristic light entities with special optics (at the moment). When I'm looking a hologram, to you, it looks like I'm staring at something that isn't there. Like a crazy person. Talking to and gesturing at nothing but air. Not optimal for promoting a new technology we need lots of people to see and understand. For now, relying on stagecraft is the only means to demonstrate this properly.

We use some mind-bendingly sophisticated technology to do real-time video compositing to combine people and holograms into the same place at the same time. The scenes need to be viewed through devices or projected onto screens for now. The result is that you can see me and my holograms together, doing whatever we're doing.

This necessary stagecraft will be less bothersome in the near future, but for now, the need to rely on this kind of extensive real-time production to present our holographic work in the best light is a difficult reality of the medium.

Magic

There's a real magic involved with holograms. Not the manufactured illusion kind, though. This holographic magic has more to do with the deep emotional impact they make than a street magician's misdirection. I'd like to think holograms generate an invisible connection signal at a wavelength that we can't help but lock into to explain this phenomenon somewhat scientifically, but we both know that's complete nonsense. Holograms rely on real magic to touch us.

Someday, some incredibly smart researcher will be able to visualize how this all really works, but for now just know that we are powerless to resist the magic of interacting with these digital sorcerers. Go ahead, try it for yourself. You'll see why all kids believe in magic. It's real.

Know Your Palette

Every artist has to become intimately familiar with their tool palette to get the most out of themselves and their work. Same deal with holographic computing.



Space

The hardest thing to learn and master about our holographic toolset is thinking spatially. The empty space between objects is as much a factor in how we design experiences as the holograms themselves. Space itself is an active design element to utilize in our work, just like an artist's **canvas**. Understanding how to design for and with it is a bit harder than it sounds.

Those of us who have been designing for high tech experiences are used to our work being trapped behind rectangular sheets of black glass. That all goes away in this new realm. It's as if you shattered that glass screen and all of the digital contents trapped within it just flew out into the room around you. We have an entirely new interaction paradigm to internalize and become fluent in. Everything is different. Don't think it's the same. It's not.

Holograms

You may think of the digital actors in our story as main characters and stars of the show, but they are as much **paint** as protagonist. Use the holograms in your experience as the vivid colors that brings the story to life. Use their blendable nature to combine disparate ideas into an aesthetically pleasing hue. Paint's best characteristic is its ability to be worked with. So too is a hologram's.

The funny part of this analogy is that you and I are actually the actors of these digital paintings, not the holograms, even though they are the ones seen as the center of attention. Once you see holograms as a means to decorate and embellish the scene instead of the stars, they can be leveraged in the same ways an artist will punctuate their work with splashes of colorful brilliance or restraint.

Interaction

If space is the canvas, holograms the paint, that must mean interactions are the **brush strokes**. The interaction between humans and hologram is the act of painting in our metaphor. The flow of painting is mimicked as we go back and forth. We create dynamic collaborations and unexpected outcomes each time we engage each other. There's no script that controls how our encounters will unfold when holograms are driven by artificial intelligence and machine learning.

Think about how an artist never really knows exactly what their painting will look like when they start the piece. That's because the act of painting it creates opportunities to experiment, fail, recover, and break through to new heights. Just like interacting with holograms.

Know your role

The secret to envisioning a successful holographic experience is not thinking you know how to envision a successful holographic experience.

As much as we'd like to think we have this all down, we don't. Try as you might, people will always surprise you with their behavior and attitudes. Let it happen. Be flexible and adaptable to any situation that arises when you're envisioning your breakthrough holographic masterpiece. Commit to listening and reacting to what people tell you. Try out what you hear.

ENVISIONING HOLOGRAMS



It's almost like running a restaurant. When you're thinking fixed menu, customers want a buffet. Switch to buffet style and they complain about the service. Hire better people and people loudly complain about the higher prices. Drop the price and they leave bad reviews on the quality of the food. You really can't win here.

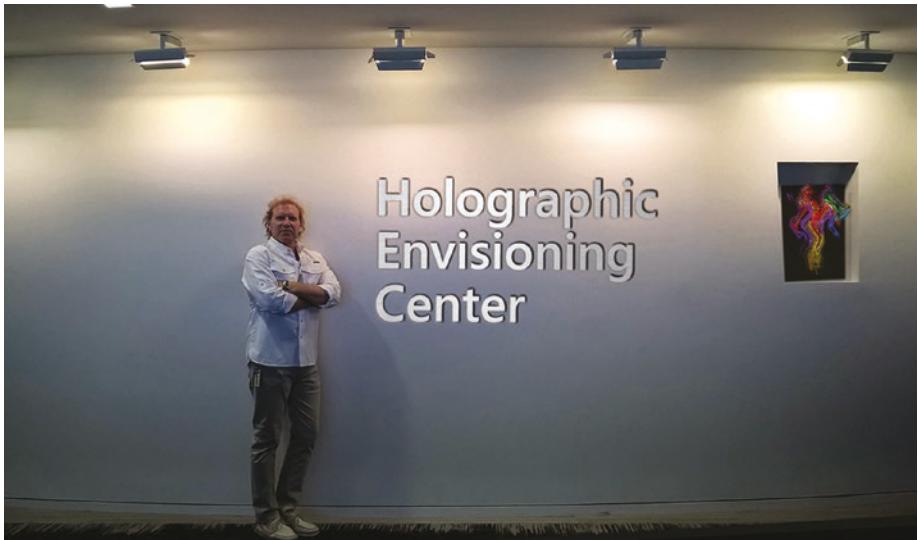
Just be flexible and keep trying to bring a better experience to whatever situation you're in at the moment. Go with the flow, learn along the way.

Know when to stop

All good things must end they say. Envisioning doesn't need to go on forever. It has a useful place and time in your holographic adventures, then it's just another tool to pick up when you're ready to get back into it.

In the meantime, let me tell you about this great idea for a breakthrough experience...

Closing Thoughts



With so many advancements, breakthroughs, failures, and creativity, there's no better way to keep up on what's happening with holograms and mixed reality than to actively insert yourself into the worldwide community of people who are experimenting and pushing us all forward with their efforts every day. Be curious, publish your work, and please share what you learn while searching for those breakthroughs.

When you get a chance, check in on the latest developments at this book's website.

www.EnvisioningHolograms.com

Index

A, B

- Artworks, 127
- Augmented reality (AR) camera apps, 104

C

- Challenges
 - design space, 21
 - device requirement, 27
 - envisioning, 29
 - IMAX movie, 19
 - real people's emotions, 28
 - spatial thinking, 23
 - usage data, 27
 - for Xbox, 25

D

- Data-inspired holograms
 - frame technique
 - choose data, 261
 - generate app, 262
 - ideate technique, 255
 - free data, 257
 - identify data, 256

- prototype technique, 264
- refine technique, 271
- restart, 273
- testing, 270
- Datascrapers
 - data consumption, 252
 - data-inspired holograms (*see* Data-inspired holograms)
 - description, 249
- Design insights, 301
 - audience
 - acknowledge emotion, 304
 - focus on people, 302
 - think situationally, 303
 - thoughtful and inclusive, 303
 - medium
 - illusion, 305
 - magic holograms, 307
 - stagecraft, 306
 - palette
 - brush strokes, 309
 - digital paintings, 308
 - empty space, 308
 - roles, 309
 - when to stop, 310

INDEX

- Design process, 53
 - approach, 55
 - language, 58
 - mindset, 53
 - skillset, 59
- Design tools, 203
 - Adobe Audition, 208
 - HoloSketch, 205
 - Mental Canvas, 209
 - Paint 3D, 204
 - Photoshop and Illustrator, 211
 - unity, 206
- Development tools, 212
 - Apple Xcode, 213
 - GitHub, 215
 - Visual Studio, 212
- E**
 - Emerging technology, 132
 - artificial intelligence, 133
 - autonomous vehicles, 134
 - Internet of Things, 134
 - machine learning, 133
 - robotics, 133
 - sensors, 134
- Entertainment, 129
 - DJ Holo, 130
 - real-time experiences, 131
- Envisioning, 29, 32
 - artifacts creation, 37
 - assertions, 35
 - challenging norms, 47
- early exploration, 43
- leaping ahead, 49
- opportunities, 42
- pace settings, 39
- poses questions, 34
- remove constraints, 38
- techniques, 89
 - acting, 99
 - coding, 114
 - crafting narratives, 92
 - imagination, 89
 - making, 115
 - photos, 93
 - PowerPoint, 97
 - prototyping, 103
 - sketching, 95
 - verbal
 - storytelling, 92
 - videos, 101
- vision settings, 45
- VR headsets, 201

F, G

- Filmed on location hologram
 - frame technique, 231
 - identify elements, 233
 - scenario backdrop, 231
- IDEATE technique, 228
 - casual, 229
 - focused, 229
 - photograph
 - empty spaces, 229

- prototype technique, 235
 - add people, 237
 - sketch the hero, 236
 - swap in
 - holograms, 241
 - refine technique, 244
 - restart, 246
 - testing, 243
 - Flow, 139
 - fast design, 140
 - frame, 143
 - ideate, 142
 - prototype, 144
 - refine, 147
 - restart, 149
 - test, 146
 - Framing process, 151
 - envisioning, 152
 - initial
 - decisions, 153
 - idea, 154
 - scenario, 154
 - techniques, 156
 - timeframes, 157
 - key aspects
 - impact, 158
 - outcomes, 159
 - realism, 161
 - skillset, 160
 - overview, 152
 - perspectives, 163
 - creators, 164
 - holograms, 168
 - onlookers, 166
 - participants, 165
 - Future tools, 222
- H**
- HoloArt gallery. *See* Spellbinding hologram
 - Holograms
 - breakthrough technology, 10
 - Apple ARKit, 13
 - Microsoft HoloLens, 11
 - Windows Mixed Reality, 11
 - emotional response, 7
 - innovations, 14
 - input, 15
 - optics, 14
 - sensors and cameras, 15
 - sound, 15
 - manageable immersion, 8
 - modern magic, 4
 - profound impact, 5
 - Holographic Processing Unit (HPU), 10
 - HoloScenes
 - envisioning series, 226
 - filmed on location (*see* Filmed on location holograms)
- I, J, K, L**
- Integrated development environment (IDE), 206
 - Iron Man movie, 18

INDEX

M, N, O

Media broadcast, 125
 Breaking the Fifth Wall, 126
 cutting-edge video processing technology, 126
Mindset, 65
 actions, 70
 adding and augmenting, 77
 behavior, 70
 breakthrough experiences, 66
 capture thoughts, 84
 design manager, 68
 empathy, 70
 envisioning process, 67
 fanciful/futuristic explorations, 83
 inspiration, 71
 appearing, 75
 transformation, 74
 transition, 72
 mindshifting techniques, 82
 motion, 71
 warning sticker, 80

P, Q

Prototyping, 103
 AR camera apps, 104
 cinematic tools, 110
 code prototyping, 113
 for designers, 180
 acting, 182
 AR videos, 182
 code prototypes, 182

design clickthroughs, 182
narratives, 181
storyboarding, 181
3D scene-based prototypes, 182
visual walkthroughs, 181
for developers, 183
 code prototypes, 184
 hybrid prototypes, 184
 narratives, 183
 3D scene-based prototypes, 184
environment, 186
focus, 174
MR modelers, 105
output, 187
preflight check, 172
priority, 175
 cost, 179
 quality, 178
 speed, 176
for storytellers, 184
 funding code prototypes, 186
 narratives, 185
 production value videos, 185
 storyboards, 185
VR prototyping, 109
VR sketching, 107

R

Refinement, 195
 alternate methods, 196
 quick turn changes, 196

Reflection, 197

abandon, 199

press on, 198

reboot, 199

Restart, 200

Storytelling tools, 216

Autodesk SketchBook, 218

Filmmaker Live, 220

PowerPoint, 221

smartphone video, 217

voice recorder, 216

S

Scene creation, 287

dynamic positioning, 290

participant positioning, 289

preset positioning, 289

Spatial awareness, 52

Spectator View technology, 193

Spellbinding hologram

description, 278

frame technique, 284

ideate technique, 281

prototype technique, 286

add hero, 290

scene creation, 287

wire interaction, 292

refine technique, 296

restart, 298

testing, 294

T, U

Testing, 190

guerilla testing, 190

recorded session, 191

results, 195

wide release, 194

V, W, X, Y, Z

Visualization, 121

breakthrough

aspects, 123

direct manipulation, 124

initial impression, 124

understanding, 123

visual fidelity, 124

room-scale data, 121