The Future of Filmmaking

Research Report

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Microsoft
HoloLens

Executive Summary

The invention of new media technologies has had a huge effect on the entertainment industry. We went into this with a particular interest on how major studios plan and organize their activities on production. We wanted to investigate specific opportunities that leverage mixed reality and in particular HoloLens as a design intervention. We dove into the 5-month research phase by conducting competitive analysis, literature review, and recruiting experts that have worked on major motion pictures. In total we spoke with 13 participants; 2 directors, 2 assistant cameraman, 3 storyboard or visual effects artists, 2 mixed reality technology experts, 1 film professor, and 3 film students.

We generated 9 main insights categorized into 4 distinct themes following our research:

- Understanding Space
- Visualization
- Vision Alignment
- Viability

By combining the insights we found and the core product qualities from competitive analysis, we generated five design principles that best encapsulated our accumulated experiences and will serve as guidelines for decision making moving into the prototyping phase. We believe the product should:

- Prioritize velocity over fidelity
- Acknowledge resource constraints
- Provide easy integration
- Explore creative ideas
- Facilitate communication and feedback

As next steps, we propose three distinct opportunity spaces where mixed reality could serve as a potential intervention.

Miniature 3D Set
Holographic tabletop miniature 3D model of sets that could be used in pre-production. This would provide the director with a birds-eye view of the production setup in order to plan the movement, scale, and positioning of characters, objects within a scene.

Visualizing CGI
CGI holograms could be used to help actors and the camera crew visualize computer generated characters and objects that would be added in post-production. Actors could rehearse with CGI holograms, and camera crew could plan lens focus using CGI to reduce the number of plate shots needed.

Spatial Mapping of Locations
Location managers can scan and render a 3D model of the indoor or outdoor space. The Art Department can plan logistics and sets using this captured information to more accurately predict the work required for building, furnishing, and dressing sets.

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Introduction

Technology has impacted the filmmaking industry in the past few years. From George Lucas to Robert Rodriguez, technology has been adopted to drive the industry in very different directions. [5]

Recently, there has been a huge interest from filmmakers in immersive technologies. Steven Spielberg used the HoloLens while building the VR cinematic universe of Ready Player One. James Clyne, director of photography for Solo also adopted a VR headset to assist him. [7]

During the development and pre-production phase, Visualization is the most critical binding aspect of the process. Which helps in immediacy along with reflection. Immediacy helps in devising the content of the shots and their order of sequence. While reflection assists in critiquing and reviewing. Making ideas visible before they are are put in front of the camera is a necessity. [3]

The five major stages of filmmaking [6]

Development

The first stage in which the ideas for the film are created, rights to books/plays are bought etc., and the screenplay is written. Financing for the project has to be sought and obtained.

Pre-Production

Arrangements and preparations are made for the shoot, such as hiring cast and film crew selecting locations and constructing sets.

Production

The raw footage and other elements for the film are recorded during the film shoot.

Post-Production

The images, sound, and visual effects of the recorded film are edited and combined into a finished product.

Distribution

The completed film is distributed, marketed, and screened in cinemas and/or released to home video.

Literature Review

Recently there has been some research around using Mixed Reality techniques for PreViz. In the pre-production stage, storyboards are been traditionally used to illustrate the director's intention. [1] However, it is not difficult to imagine the limitation of storyboards for smooth image interpretation. Hence, pre-visualization (PreViz), which is sometimes called animatics, has been used to further develop the storyboard. PreViz is a technique based on computer-generated images for visualizing action scenes, camera angles, camera blocking, lighting conditions, and other situations and conditions before the actual shoot. Sometimes PreViz is also used to get stakeholders onto the same page.

At the same time, MR has possible applications in designing Cinematic Lighting. [2]

AR has been used in authoring content for *computer entertainment.* [4]

Various other *computer vision technologies* have been theoretically applied to filmmaking. [8]

Another interesting research talks about how various immersive tech could be used in *constructing action scenes.* [9]

Competitive Analysis

We conducted a competitive analysis of a variety of products that currently help people envision their ideas as well as facilitate collaboration and feedback. We assessed each competitor, against the following design principles we hope to achieve with our design response:

Criteria

Flexibility
Can it be used in multiple stages of the filmmaking process?

Customization
What is the level of customization available?

Familiarity
What is the level of familiarity required?

Externalization
In what ways does it help externalize creative ideas?

Remote Use
Can it be used remotely?

Support
How does it support different roles?

Feedback
How does it facilitate feedback?

Sharing
How does it facilitate the sharing and consumption of information?

Product Analyzed

AirTable

AirTable is a work management tool which uses the power of a spreadsheet to create plans. It helps teams collaborate, analyze, and organize their work, their own way. Airtable was mentioned to us by many filmmakers as a tool they used for collaboration.

Storyboard Pro

Storyboard Pro is a storyboarding software for externalizing ideas as both a storyboarder and set designer to a lesser extent. We want to understanding how well this tool integrates into the production pipeline.

FrameForge

FrameForge is a desktop previs and storyboarding tool. It enables directors, cinematographers and other creative professionals to flesh out creative ideas in a minimum amount of time and with a minimal learning curve.

Blocker

Blocker by AfterNow is an iOS application that helps filmmakers prepare shots and scenes by using augmented reality (ARKit). The app is primarily used by directors as a viewfinder for blocking.

Spatial

Spatial turns the space around you into a shared augmented workplace. Remote users can collaborate, search, brainstorm and share content as if they were in the same room. We analyzed Spatial because of its AR collaboration features which recently was demoed at MWC.
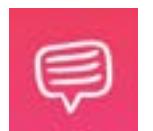
StudioBinder

StudioBinder is a competitor of Celtx, it's useful for media production management for both feature films, shorts, and indie productions. It helps facilitate communication, and streamlines the organizational aspects of production management.

Microsoft Layout

Layout is a Hololens application that allows users to plan their space, collaborate with others, and experience their design in mixed reality before they build. Users can import 3D models to experience room layouts as holograms in the physical world.

Boords

Boords is a cloud-based collaborative online storyboard creator application. It provides all the tools needed for a simple pre-production process. It helps users visualize ideas with storyboards, scripts, and animatics.

How might we assist filmmakers to *externalize* creative ideas and *collaborate* with stakeholders?

Based on early interviews with experts and secondary research, we found that filmmakers use various methods to visualize and externalize their ideas, shots, and sequences. We also identified gaps in collaboration that exists between different stakeholders in the entire filmmaking process. We wanted to focus our attention on the externalization of creative ideas, and investigate pain points that exist within collaboration.

Challenge

Research Questions

After determining the initial design challenge, we wanted to generate research questions that would help us probe deeper into the current workflow of filmmaking, and the current usage of new media tech, and barriers that exist with introducing mixed reality technologies into this process. Due to the nature of our working relationship with the MRW team at Microsoft, we are constrained by HoloLens as an end product. We determined that it was important to build our intuition around both the industry as well as the technology. We wanted to identify opportunity spaces where mixed reality could be an appropriate response.

These questions would guide on what types of experts and participants we would be interested in recruiting, as well as the specific stages of filmmaking that we want to dedicate our focus on.

How does the director *communicate envisioned ideas* to different stakeholders?

What are some *gaps in collaboration* between different stakeholders in the filmmaking process?

Would Hololens be an *appropriate design response* given the context of use?

Research Methods

The team used the following research methods for gathering insights. A large number of our experts were constantly moving around due to changing filming locations. To accommodate this, over half of our interviews ended up being remote video calls. Therefore we found the following two methods to be the most appropriate given our participants. We arranged 80 minute interviews for participants, and 30 minute interviews for experts.

Overview

Expert Interviews

Semi-Structured Interview

Personal Inventory

Participant Profiles

Diversification of participants is key for our project. We looked for triangulation across different stakeholders. Pain points identified by multiple participants helped us narrow down areas where MR could be most effective as a design intervention.

We identified that it is important to speak to participants that work on the production of major motion picture films, as well as independent filmmakers such as art and documentary filmmakers. A large fraction were remote interviews since most major filmmakers are not based in Seattle. We tried to advocate for inclusivity in our research by interviewing participants across gender, age, and ethnicities, however all but one of our participants were men; all but two out of our 16 participants were white.

2 Directors

2 Assistant Cameras

3 Storyboard + VFX Artists

2 MR Experts

1 Film Professor

3 Film Students

Expert Interviews

Common patterns began to emerge after we spoke to several participants. Due to the overall lack of expertise, budget, and professional training, hobbyist and entry-level participants would be good pool for usability testing, but would give us limited insights into process of the filmmaking industry. At this point we determined the audience we should gather insights from should be those that have worked on high-budget productions, whether it's television, documentaries, or films. We also decided to recruit film business owners, educators, and mixed reality technology experts.

Thomas Furness VR/AR Pioneer

Sura Kalyan VFX Artist

Ryan Woodward Storyboard Artist

Kevin Philbin Cinematographer
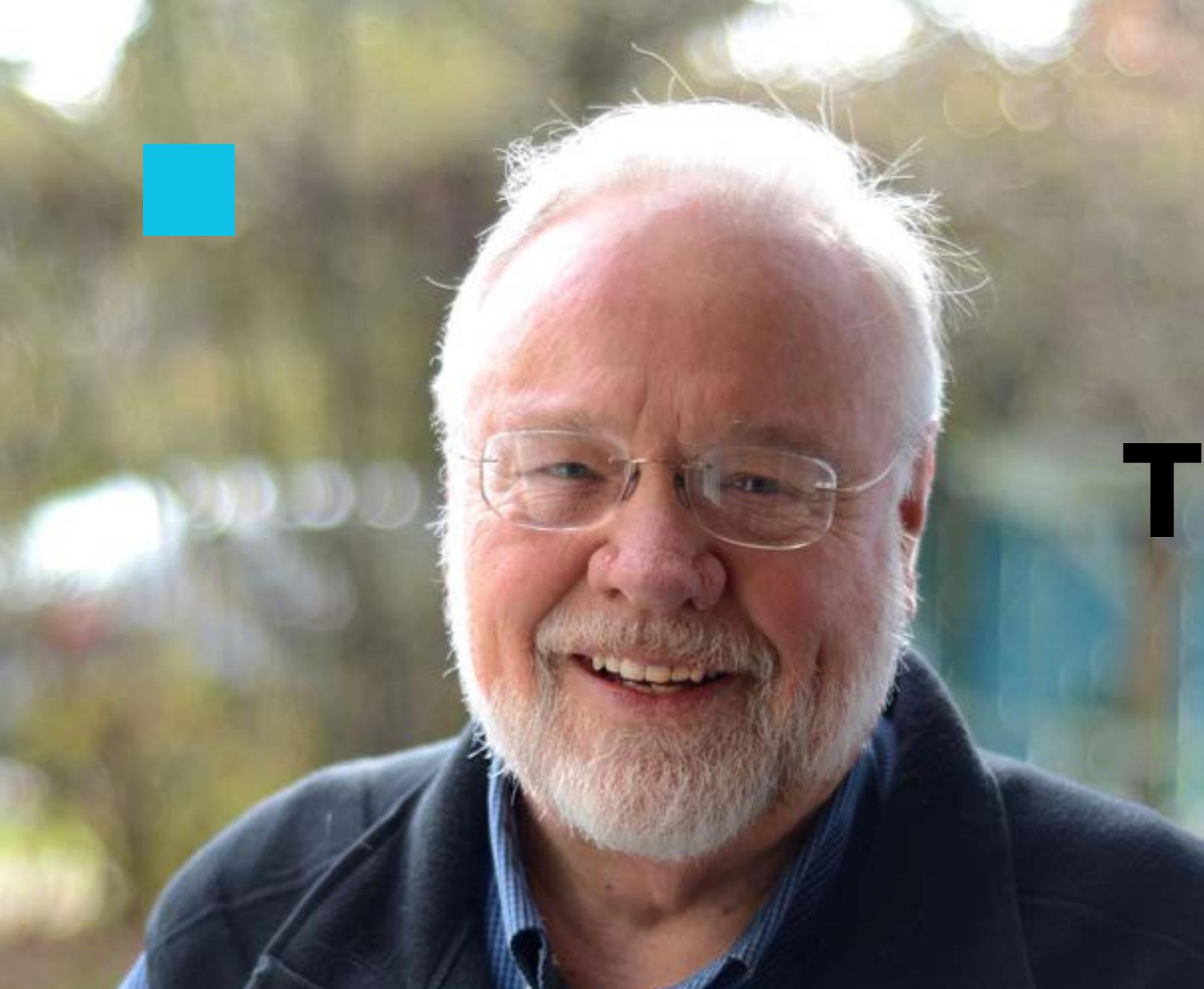
Thomas Furness

Thomas Furness is a professor at the University of Washington (UW) in the Department of Industrial & Systems Engineering where he teaches Virtual Interface Technology.

He started the first Augmented Reality Company: ARToolworks Inc. and has continued an active role in virtual and augmented reality development and application. He has also collaborated with Peter Jackson (Director, Lord of the Rings) on the LOTR franchise and partnered with Douglas Trumbull (VFX, 2001: A Space Odyssey) on some VR related projects.

Pioneer in human interface technology and grandfather of *augmented* and virtual reality

Expert

Sura Kalyan

Sura is a trained VFX artist, director, and writer currently working in Los Angeles. He also worked as a Technical Director (TD) at DreamWorks Animation, where he worked as a Technical Director (TD) for three years on critically and commercially acclaimed films like How To Train Your Dragon 2, among others.

Having done his Masters in Film Production from USC's prestigious School of Cinematic Arts, Sura has been at the forefront of VFX innovation and the use of new-media tech in filmmaking. He has adopted the use of phone-based AR tools while directing his movies.

VFX artist for movies like Detective Pikachu, The Hedgehog, and MIB International

Expert

Ryan Woodward

Ryan has been in the film and animation and gaming industry under various roles such as animator, storyboard artist, concept artist, writing and directing for 23 years.

As a storyboard artist, he has worked on big productions like Spider-Man 2 and 3, Cowboys and Aliens, Where the Wild Things Are, Iron Man 2, Snow White and the Hunstman, Thor 2, Captain America 2 and The Avengers.

Independently, Ryan has produced several projects such as the short film, 'Thought of You' and the animated graphic novel app 'Bottom of the Ninth'.

Expert

Animator and *storyboard artist* working in film and animation for 23 years
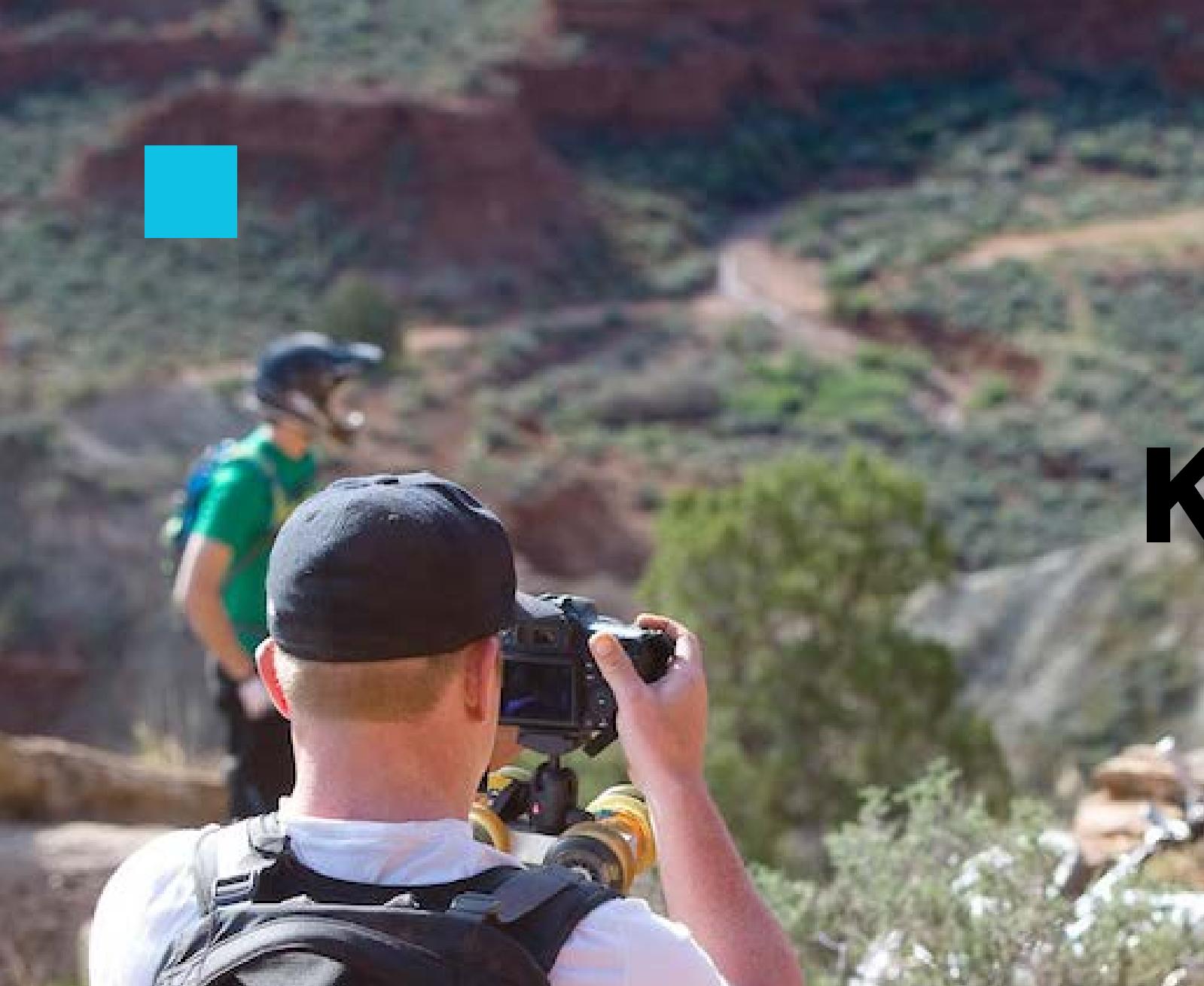
Kevin Philbin

Kevin Philbin is an independent film producer, and director of photography. Kevin has 9 years of experience running his own film production studio, Kevmo Productions. His work focuses on the production of cinematic shots at international locations. His list of clients include Flor De Caña Rum, The Nature Conservancy, Bike MS, Diamondback Bicycles, and many others.

In addition, Kevin is a lecturer at the University of Washington Human Centered Design & Engineering department. He serves as the instructor for HCDE 498/598 Video prototypes and narrative in design.

Director of photography and indie filmmaker running his own film production studio

Expert

Semi Structured Interviews

Personal Inventory

The facilitator for the sessions conducted the interview on-site at the participant's location or through a remote video call. The interview began with a set of general questions to establish the participant's role in the filmmaking process. The facilitator would then ask questions about how the participant communicates and collaborates with multiple stakeholders while working on a production. We asked questions that focused around their process of decision-making and the factors that influence the final outcome.

The team asked and documented the tools and technologies the participants used to add value to their creative process and aid in collaboration with different stakeholders. This research method was used to understand the frequency and nature of interaction with tools and technologies used by the participant. We also looked for avenues where MR technology could be used as a suitable replacement. This method helped uncover the perceptions and values of the participant with regards to adopting new technologies.

Methods

Research Insights

By cross-referencing the information gathered from primary and secondary research, we generated a total of nine different insights. From these nine insights, distinct patterns emerged. We decided the best way to contextualize the insights would be to group them under different themes.

Themes

Understanding Space

Visualizing Virtual Objects

Vision Alignment

Business Viability
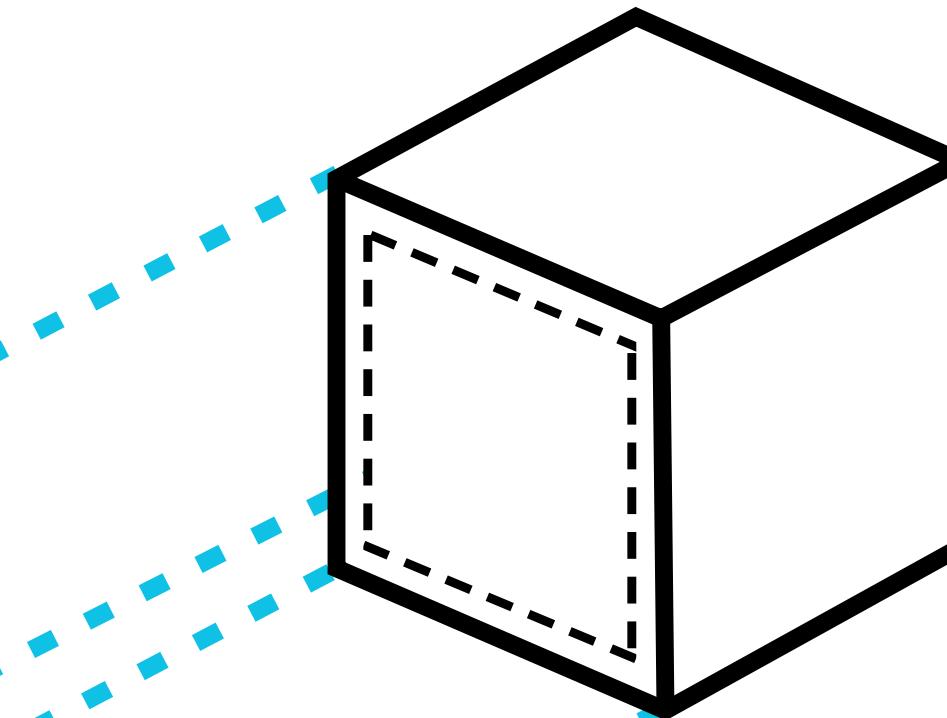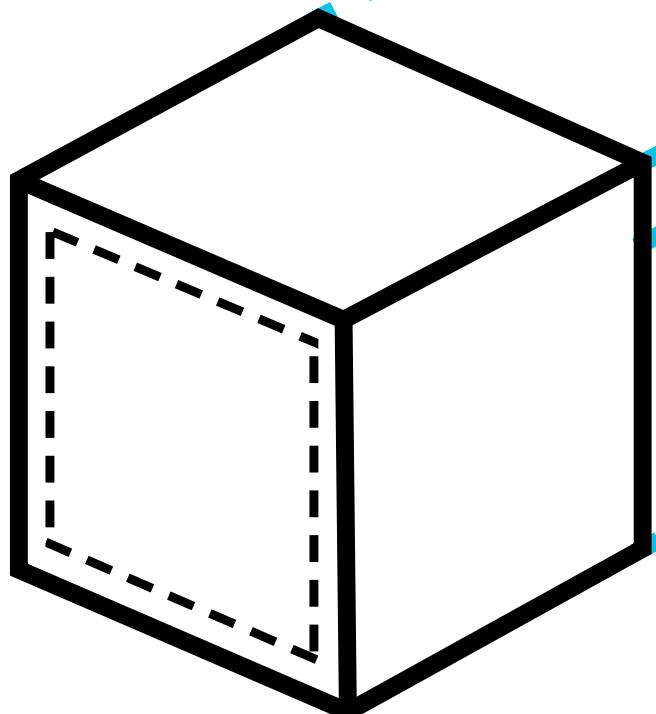
Understanding Space

Theme *One*
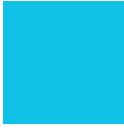
1.

The production crew relies on written documents$^{\varnothing}$ or 2D artifacts$^{\bowtie}$ for *blocking*† a scene in 3D, which results in gaps in communication of spatial information.

†   Blocking is the process of deciding where actors are going to be in the scene and how they're going to move in relation to your camera. This also impacts the placement of camera and lighting equipment. The stakeholders involved are actors, director and cinematographer.

ø   Written documents include script and shot list

¤   2D artifacts are comprised of storyboards, previs, and animatics

Insights

Technical blocking of a scene using T-marks and tape

Insights

Right before the shoot, the director performs test-shoots to fine-tune the location of actors and camera setup for the shot. This can be a static shot in which actors and camera are stationary. Or a more kinetic shot in which actors and camera are both moving around the set. The shot can even have one where your actors are moving but your camera isn't and vice versa.

Currently, blocking is achieved through utilizing previously made storyboards, scripts, or previs. Since these artifacts do not communicate spatial information, which is vital for the positioning of actors and equipment, blocking can tend to be an inefficient process. Interviews with directors and cinematographers have revealed that there is extensive miscommunication between all the concerned parties.

"

Sometimes genuinely it is a miscommunication where you don't understand the vision of the director.
Sura Kalyan (VFX Artist, Detective Pikachu)

It's hard to verbally explain the geometrics, where's everyone positioned. Just explaining the ideas to the DP takes a lot of time and effort.
Brandon Crane (Film Student, University of Washington)

■ **2.**

Set designers and decorators require access to filming locations in order to *transform the set* before the shoot. Reserving the location for long periods of time increases production costs.

Alcazar of Seville, Spain shown as Water Gardens of Dorne in *Game of Thrones*

The set decorator is responsible for furnishing on-location sets for film and television and selects all of the large or small items that fill the room or outdoor area. Once the location has been selected, he or she transforms the area into a visually appealing space that represents the vision of the production team.

This can, however, be a time-consuming process, especially difficult when unusual or specific antique items are needed to be bought or created. They run on a tight budget based on the shooting schedule, rental periods, and purchases. And these iterations and experimentations on dressing the set tend to increase the budget.

"

With 'Stoker', after we found the house we completely emptied it, we more or less changed everything – it's quite a transformation.
Leslie Morales (Set Decorator, Stoker)

My team once transformed a large downtown church into a police station, a prison warden's office, prison hallways, a basement, an upscale office, a Brazilian kitchen, and a small Brazilian church.
Tut Thomas (Writer/Director, The Last Guide To Filmmaking: With No Budget)

Trying to create our world in a believable way, when you have so many actual limitations from a location, is really complex."
Fiona Crombie (Production Designer, The Favourite)

■ 3.

■

Production designers find it hard to assess the cost and the amount of work that is required for furnishing and dressing the set when they don't have access to it. They need to plan for renting, buying or creating props. They need to see how many sets they can fit in one location.

Production designers *rely on physical 3D models* for designing studio sets as photos and concept art do not provide spatial context.

"

Depending on the budget of the film you can tell what sets will be on location and what sets we would build. A lot of sets are relatively small rooms and you have to build them – it's important to create the set for camera angles, lighting – give them the freedom to tell the story.

Leslie Morales (Set Decorator, Stoker) [59]

The analog style of having a physical model that everyone can look at, around the table is immensely helpful.

Scott Baker (Set Designer, Black Panther) [60]

We had to know where everything was going to go before the set was built.

K.K. Barrett (Production Designer, Her) [61]

4.

Spatial

Lower fidelity of computer-generated characters and objects allows for *faster experimentation* of its location, scale, and movement.

Insights

Filmmaking is a creative process which involves a lot of experimentation and iteration between many stakeholders. This requires externalization of ideas, concepts, and designs. Ideas are then iterated, developed, and outlined which build up the groundwork for the production stage. This creative vision is communicated more clearly visually than verbally. Hence we see the adoption of lot many visual artifacts like storyboards, previs, and animatics while communicating each scene in the film.

However, while exploring the position, scale, and movement of characters and cameras, low-fidelity representations prove to be adequate and effective. The lower fidelity of these artifacts helps in faster collaboration while also keeping the focus of conversations on only the intended aspects.

Low-fidelity visualization for "Meg Attacks Dock" sequence of *The Meg*

Insights

"

The 3D objects don't need to be perfect. Just good enough to be scaled.
Thomas Furness (VR Pioneer)

*Previs is the ideation phase, nothing is solid, wrong. It's a scratch pad for the ideas between the Director and his team.*
Sura Kalyan (VFX, Detective Pikachu)

You can talk and talk and talk, but it doesn't matter unless you can put an image on the screen and make sure that everybody's on the same page.
Sura Kalyan (VFX, Detective Pikachu)
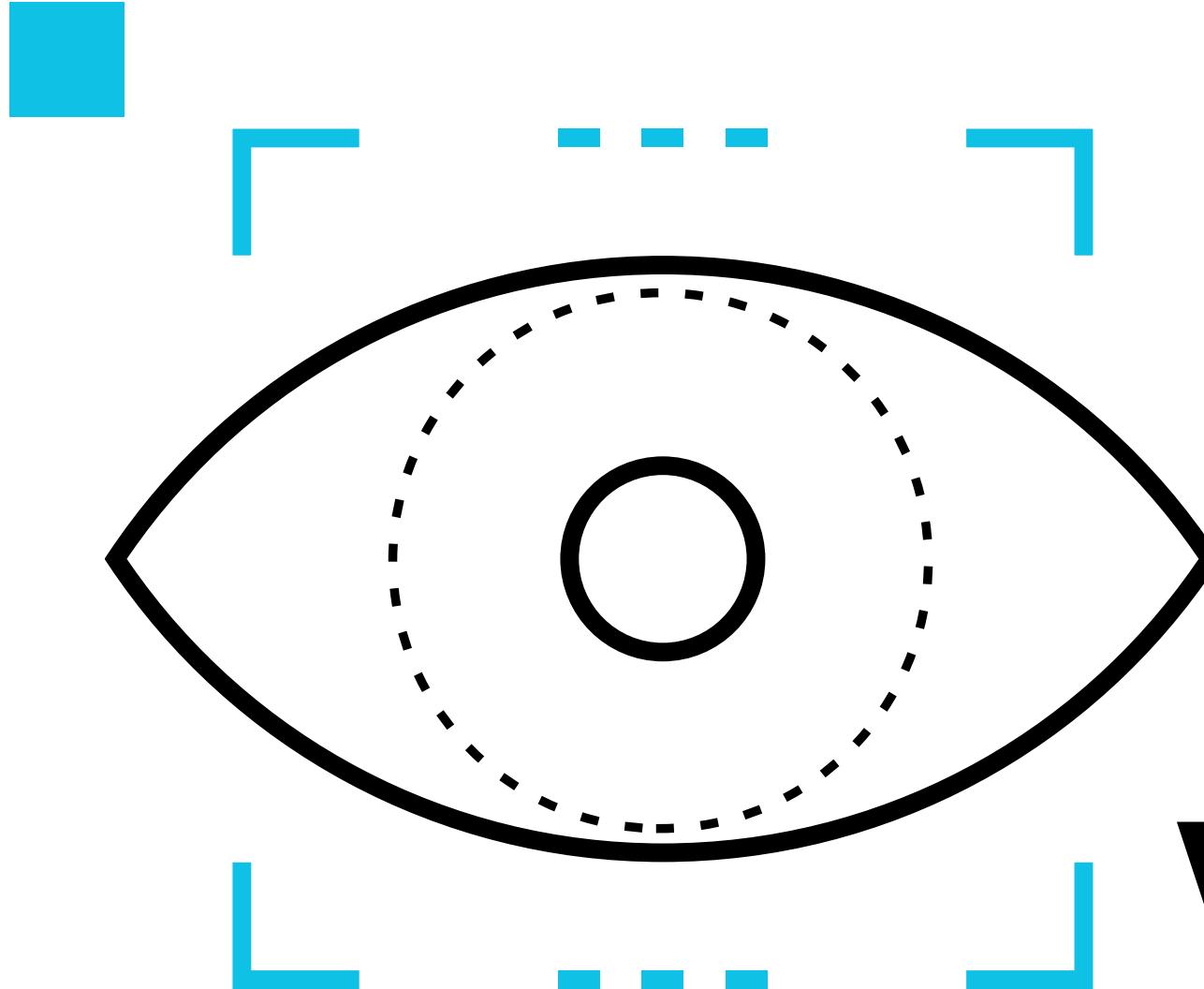
Visualizing Virtual Objects

Theme _Two_

■ **5.**

During pre-production, directors face difficulty *experimenting with the movement, scale, and position* **of characters using current 2D pre-visualization tools.**

Visualization

■
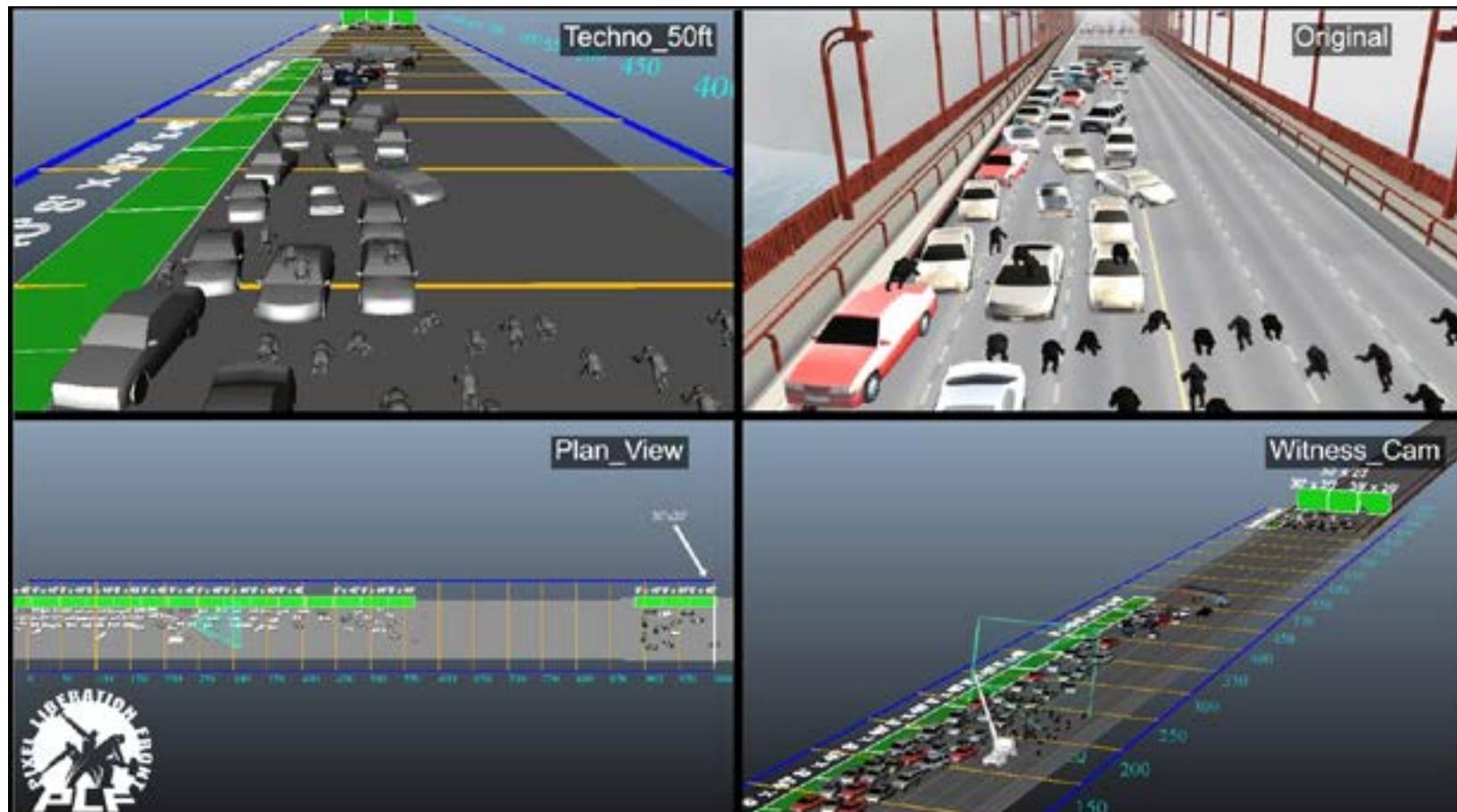
Previs breakdown of the Golden Gate sequence in *Rise of the Planet of the Apes*

Insights

Previsualization is the visualizing of complex scenes in a movie usually done during the pre-production phase. This helps with the iteration of location, scale, and movement of characters and cameras while also communicating the director's vision to the entire crew.

However, previs today is done using tools like Maya, Unity, and UnReal which are still 2D environments mapping 3D content. This makes it difficult for the directors to visualize the positioning, scale, and movement of characters. It doesn't accurately represent the artistic spatial vision. Moreover, this tools have a steep learning curve which makes it often impossible for directors to play around with.

Furthermore, this process is highly iterative with a lot of feedback communicated between the animators, previs artists, and the director. But this feedback is usually provided verbally which makes the entire process inefficient and time-consuming.

"

Communicating to the 3D and previs animators what kind of shots they [director] want to see can be a frustrating and slow process from their [director's] perspective. They [director] wish for the control to let them create the shots themselves in an intuitive way without having to know how to operate 3D software.
Marijn Eken (Founder, ScreenSpace Lab) [55]

The previs process is extremely iterative. The director can give vague directions and feedback. Like 'make this cooler' or 'change the shot angle.
Sura Kalyan (VFX, Detective Pikachu)

6.

While shooting on set, actors and camera crew cannot *envision computer-generated characters* and objects.

Scene from *Game of Thrones* where the dire wolf is added in post-production

While interviewing cameramen who work on sets involving computer-generated (CG) objects and characters, we discerned a repeating remark about the ambiguity in visualizing the position and scale of such objects. For instance, while taking plate shots, cameramen find it remarkably challenging to understand how far the CG objects, which are added in post-production, are from the camera. This ambiguity makes it difficult for them to decide the focal settings of the camera leading to them taking numerous shots.

Our secondary research also helped us realize that this was an issue faced by actors as well. There has been the use of physical props to provide guidance to the actors to visualize eyelines with these virtual entities. These props are later replaced with CG objects in post-production. However, this process doesn't work in cases of imagining their scale and spatial position. Especially if they need to act according to the movement of these characters.

"

*They're like 'look out to the castle' and you just think 'well, how far away is it? Is it right here?' and although you can ask all of those questions it never looks right.*
Maisie Williams (Actor, Game of Thrones) [62]

Actors can't interact with the composited items. They don't see it. Neither do the director or cameraman.
Thomas Furness (VR Pioneer)
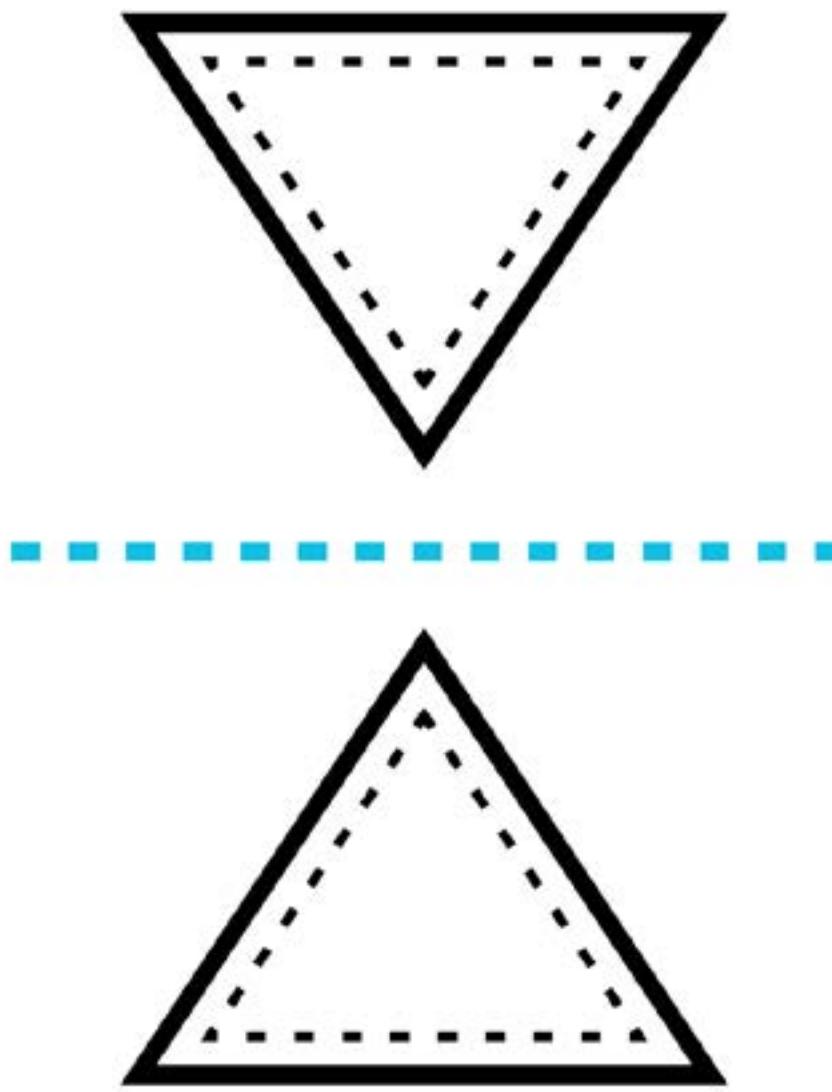
Vision
Alignment

Theme *Three*

■ 7.

■

Visual incoherence emerges from pre to post-production as a result of misaligned visions.

(1st Assistant Camera)

The filmmaking process from pre-production to the production phase requires many stakeholders. And every production team has their own artistic vision, their own style, and their own process. These differences create a misalignment in the stylistic continuity. Even the tools used by these teams differ making the pipeline for information transfer extremely inefficient.

A common visual language must be established across concept art, pre-production design, pre-visualization, and post-production VFX in order to enable effective visual communication and collaboration. There is a need for an effective strategy to help facilitate stylistic continuity and visual integrity from pre-production to post.

"

During Jungle Book we realized how important virtual production is and we embarked on this new adventure. Tracking all the assets, the scenes, the cameras, the animations and all of the modifications is key. We couldn't find any available third-party solution that could give us that.

Francesco Giordana (Realtime Software Architect) [56]

There is a mismatch in the storyboard and what is possible during shoot. For example, the artist's rendition of a CGI character may be too large to fit through the actual physical door.

Tracy Nystrom (1st Assistant Camera)

The match between physical sets and virtual sets was so successful because everyone was working from the same tools, right from the start.

K.K. Barrett (Production Designer, Her)
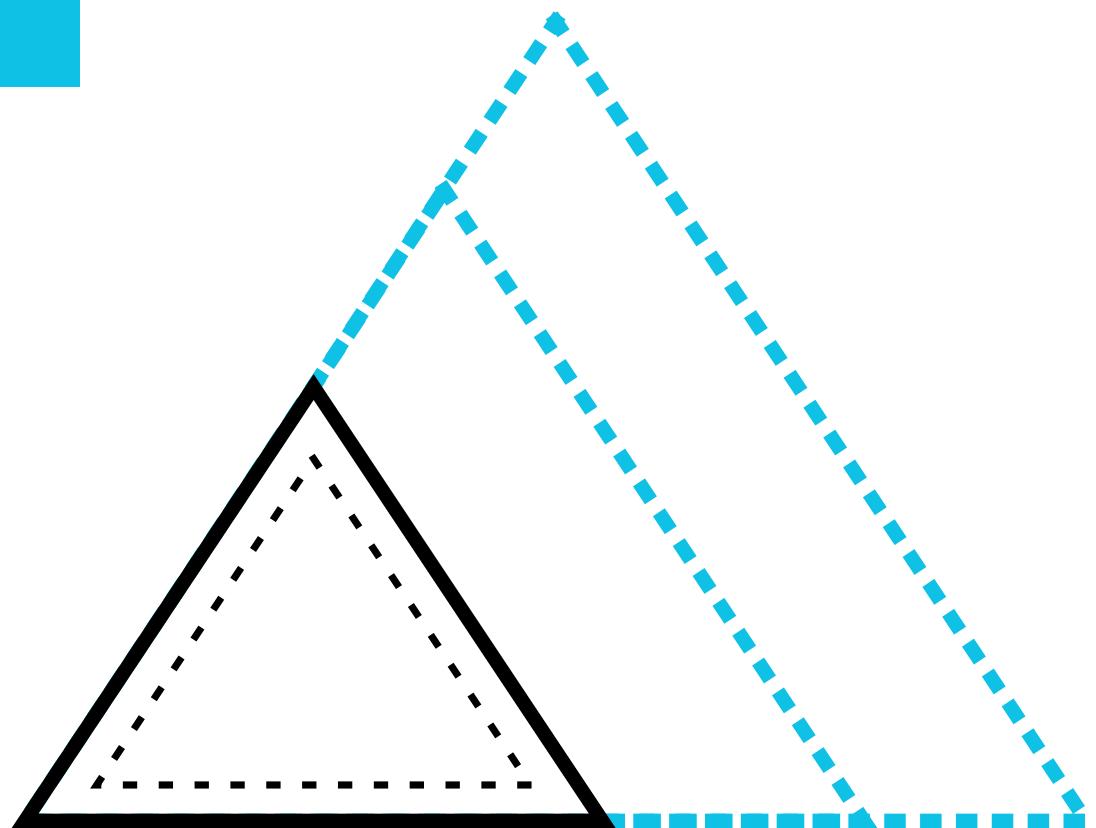
Business Viability

Theme *Four*

8.

Creative freedom during filmmaking is oftentimes *constrained* *by time and budget.*

In today's world, the films produced tend to have a stronger push towards commercial success. As the production cost of movies has progressed exponentially in the past decade, the complete process of filmmaking leaves very little room for error.

Contingencies during production can be devastating. Hence, time and budgets are paramount, which leaves limited room for experimentation of techniques and tools. Moreover, the value of new tools and technologies need to be self-apparent.

These constraints are a causal nexus to imbalances in decision-making power and creative stakeholders are often not getting enough time with the director. This leads to misalignment in creative vision and inefficiency in communication.

"

I storyboarded in a way that completely blew up the budget of the film

Ryan Woodward (Storyboard Artist, Thor: Dark World)

I make compromises to do things in less time. There's always ten folds more work than you want

Kevin Philbin (Independent Filmmaker)

Achieving your exact vision without enormous budgets is very difficult. Higher budget films are strangled by producers and execs.

Kwame Braun (Film Professor, UW)

Insights

9.

Big budget productions are innovating and *adopting new media technology.* However, small production studios display a cautious attitude towards adopting these technologies due to the lack of resources, knowledge, and best practices.

There is a noticeable inequality across the scale of production studios and their adoption of new media technologies. Access to time, knowledge, resources, and room for experimentation with this tech is directly correlated to the size of the budget. The use of this tech in filmmaking is not a standardized process across the industry. The precedence has been set by Steven Spielberg, James Cameron, and other few directors in Hollywood. But the knowledge of these tools is limited to these few production houses. This lack of understanding of how new media technology functions and its benefits is not apparent to smaller production houses, leading to less adoption.

At the same time, there are a lot many examples of how obsession over technical details results in a weaker film and takes away from the creative expression which drives the success of the movie.

"

The VFX industry is catered towards studios, not indie filmmakers and smaller studios [...] most directors aren't really aware of what technology can do for them

Sura Kalyan (VFX Artist, Detective Pikachu)

Insights

Design Principles

By combining the insights we found and the core product qualities from competitive analysis, we generated a list of five principles that we believe the end product should embrace.

These five design principles that best encapsulated our accumulated experiences and will serve as guidelines for decision making moving into the next phase.
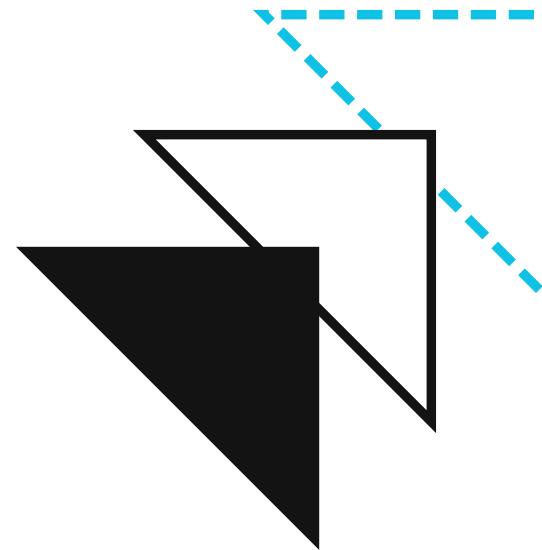
Prioritize velocity over fidelity

Allow for rapid prototyping of ideas, built for velocity over fidelity.
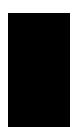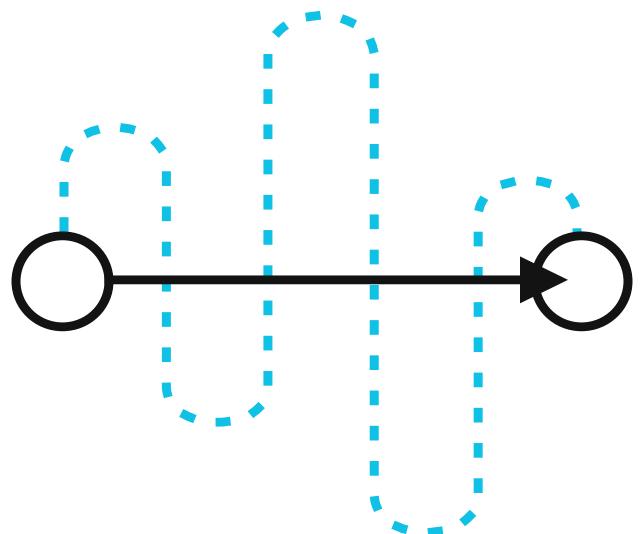
Acknowledge
resource constraints

Enable creative expression while saving time and budget,
as resource management is paramount in film production.
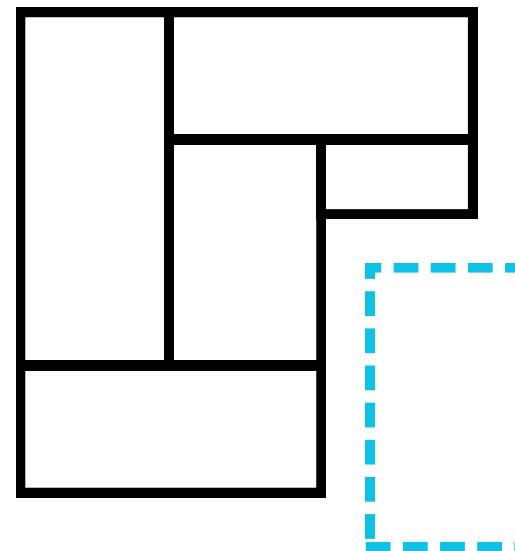
Provide
easy integration

Accommodate the needs of different roles and provide easy
integration with existing workflows, tools, and processes.
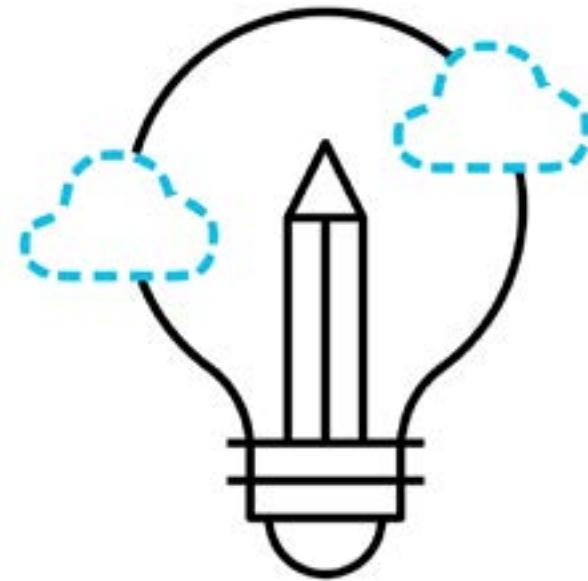
Explore
creative ideas

Give people room to experiment and explore creative ideas in a new environment with the least amount of friction.
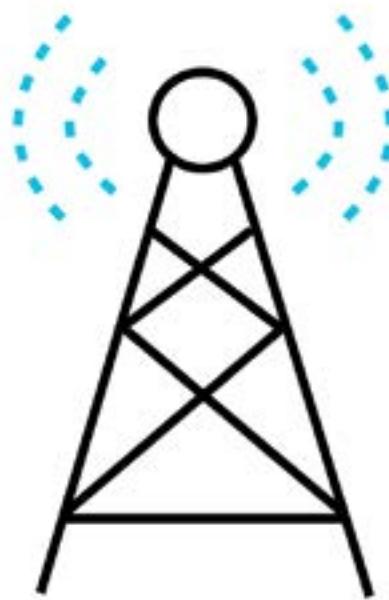
Facilitate
communication
and feedback

Acknowledge the difficulty in communication across teams and create a framework for facilitating feedback.

Design Opportunities

After speaking with experts from a number of different roles within the filmmaking industry, as well as generating research insights, we were able to identify three distinct opportunity spaces where we believe mixed reality could serve as a potential intervention. The opportunities map directly to the insight themes of "understanding space", "visualization", and "vision alignment, while keeping "viability" in mind.

Miniature 3D Set

Visualizing CGI

Spatial Mapping of Location

1. Miniature 3D Set
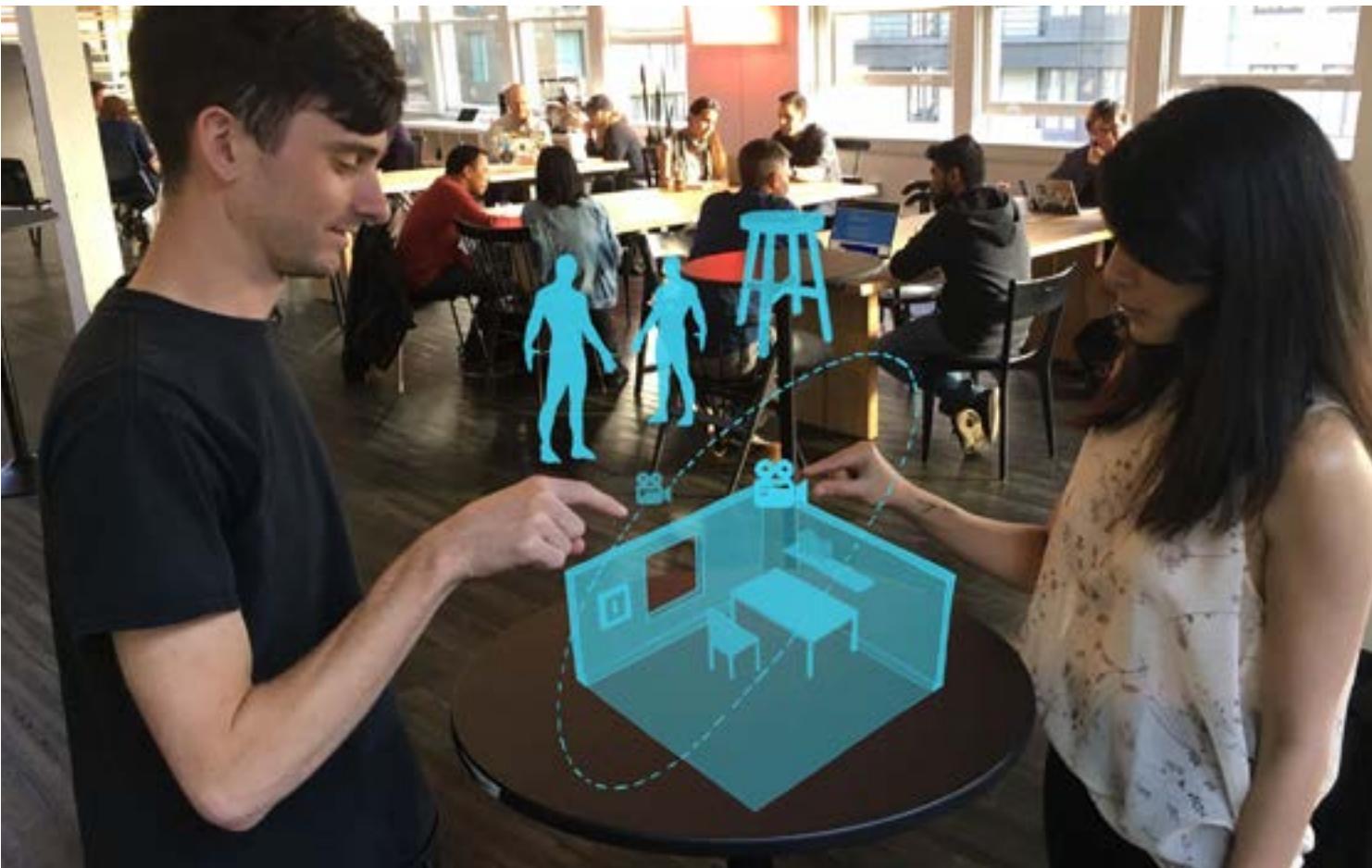
People see the world in 3D. Current pre-visualization tools used on computers and phones only depict a 2D version of this 3D world. We see a huge opportunity in the form of a holographic tabletop miniature 3D model of the set that could be used in pre-production. We envision a Hololens application that would provide the director with a birds-eye view of the production setup in order to plan the movement, scale, and positioning of characters, objects within a scene. Furthermore, the setup of equipment like cameras and lighting could be planned, just as you would with a 2D previs tool. Camera positions can be directly manipulated and can be animated to pan across space or follow a character. Additionally, the director would have access to a 2D display of camera feed in order to plan what the final shot would look like. Using this application the director export images, videos or the 3d model and share it with the crew.

During the blocking phase of production, the director can expand the previs 3d model to scale in order to convey to the crew the set up of cameras, actors, and objects accordingly. This platform bridges the gap in communication of the spatial information of the set.

Insights

Directors face difficulty in visualizing and exploring the movement, scale, and positioning of characters using current pre-visualization tools.

The production crew relies on written documents or 2D artifacts for blocking a scene in 3D, which results in gaps in communication of spatial information.

Lower fidelity of computer-generated characters and objects allows for faster experimentation of its location, scale, and movement.

2. Visualizing CGI

Another promising opportunity we identified is helping actors and the camera crew visualize computer generated characters and objects that would be added in post-production. Actors could wear the Hololens to rehearse with a CGI hologram and match eye-lines before shooting a scene. Actors wouldn't have to solely rely on their imagination or cues from the director. This application of the Hololens could also be used by the camera crew to pull focus on a CGI character or object and reduce the number of plate shots captured.

Opportunities

Insights

Actors struggle to match eyelines with computer generated characters and objects that are added in post-production.

Cameramen have trouble envisioning the position of computer generated characters and objects while capturing plate shots.

3. Spatial Mapping of Location
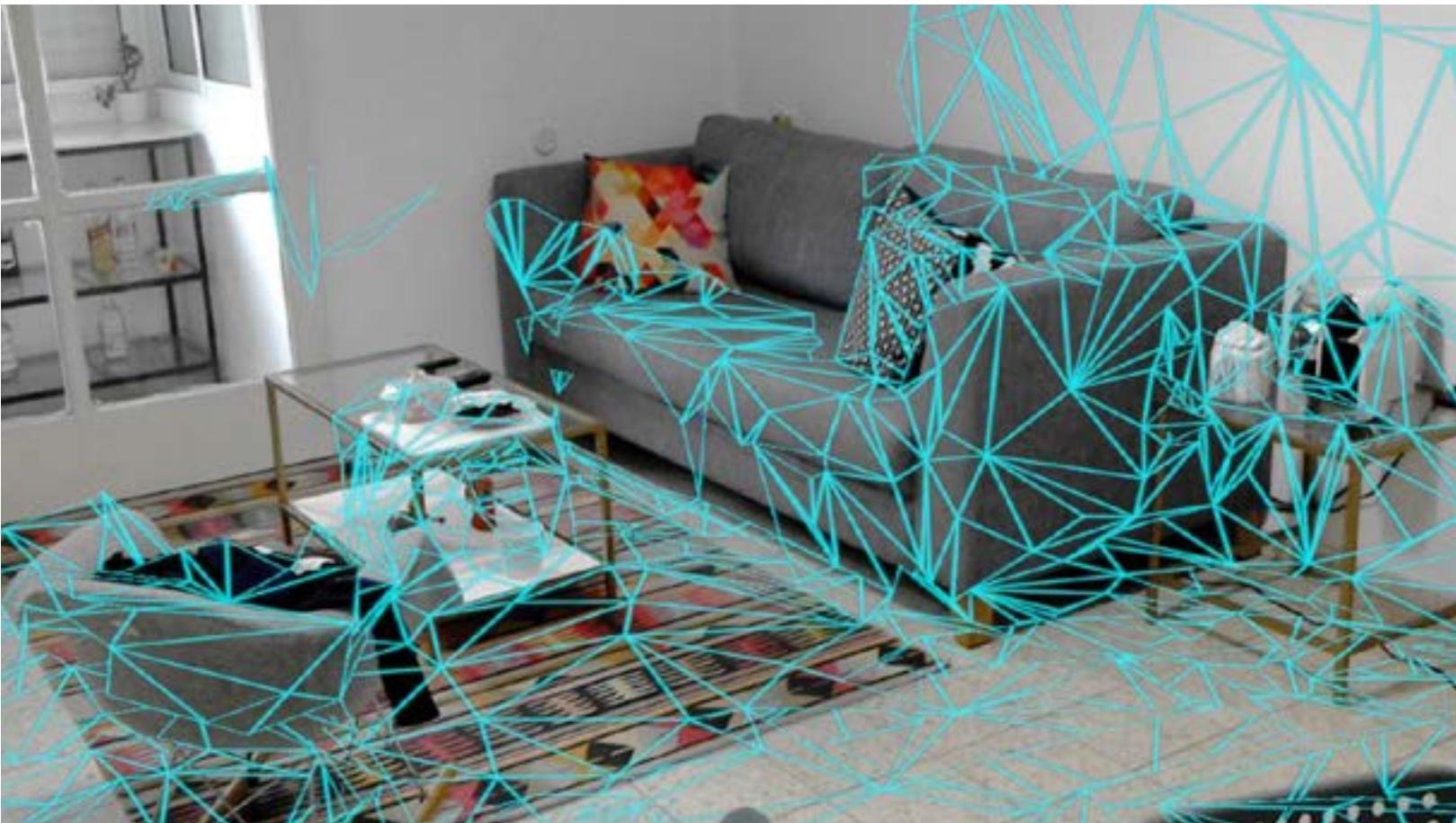
There is an opportunity to assist the Art Department in the construction and dressing of sets and locations. While location scouting, production designers and location managers can scan a space using the Hololens or capture 360 video and photos of the location and from this render a 3D model of the indoor or outdoor space. This built to scale 3D model serves as a communication for the film crew by showcasing the spatial limitations of the set, leading to better alignment, planning, and organization during production.

Viewing a 3D model of the space would provide the production crew with an overview of the location so they can plan and estimate the work required for building, furnishing and dressing the set. The producer and financial administrators would receive the same overview to help them assess costs. The production team can also calculate how many sets they can fit in one location, which helps save costs. Using holographic props and furnishings, set decorators can "dress" the set or location before they purchase or create items thereby helping with budgeting.

Insights

Set decorators require access to filming locations in order to transform the set before the shoot. Reserving the location for long periods of time increases production costs.

Production designers use real locations as reference for designing studio sets. The photos and videos they capture do not provide spatial context.

Opportunities
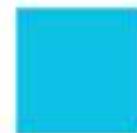
Glossary

Animatics

Preliminary version of a movie, produced by shooting successive sections of a storyboard and adding a soundtrack.

Blocking

Deciding where actors will move and stand so that lighting and camera placement can be set.

Blue/Green screen

A blue or green backdrop that actors are filmed in front of. Later the screen can be filled with digitally generated images to complete the background.

Call Sheet

A listing of which actors will be required for which scenes, and when they will be required.

CGI (Computer Generated Imagery)

The use of 3D graphics and technology to enhance special effects.

Compositing

Combining visual elements from separate sources into single images, often to create the illusion that all those elements are parts of the same scene.

Continuity

Film continuity maintains the same look and position of characters, objects, costumes for scenes shot over multiple days.

Coverage

Collection of different camera setups used to capture the action of a scene from different angles.

Dolly

Any platform with wheels that allows the camera to be moved. It could also roll along dolly tracks carrying the camera, some of the camera crew and occasionally the director.

Eyeline

Matching eyelines in a technique used to maintain continuity to ensure that the camera follows the gaze of the character on-screen is seeing.

Gaffer

Chief lighting technician who is responsible for designing and creating a lighting plan.

Grip

Person responsible for the set-up, adjustment and maintenance of production equipment on the set

Location scouting

Finding locations that match script and storyboard in pre-production.

Glossary

Motion capture (mo-cap)	Used to digitally record actor performances by tracking the movement of the actor. It can be used to create a digital 3D character.
Pre-production	Planning that takes place before the camera rolls and sets the overall vision of the project. It also includes working out the shoot location and casting.
Previsualization (previs)	Computer imaging that is used for visualizing complex scenes in a movie before filming.
Post-production	Work performed on a movie after the end of principal photography. Usually involves picture and sound editing and effects.
Post-visualization (postvis)	The process of assembling the visual effects of a film.
Rig	Modular equipment used to extend the usefulness of a camera, by allowing additional gear to be mounted, increasing movement flexibility of the camera, or smoothing out the motion of the camera.
Scene	A series of shots taking place in one location dealing with one action.
Simulcam	A fusion of physical and virtual cameras. It superimposes real actors wearing mo-cap bodysuits onto a virtual set in real-time, and displays motion tracking results as they are captured.
Shot	The section of unedited film from the time the camera starts to the time it stops.; in other words, continuous footage with no cuts.
Shotlist	A list given to the film crew of all the shots to be filmed during that workday.
Sound stage	A large area (usually in a studio) where elaborate sets may be constructed.
Storyboard	Sequence of pictures created to describe each scene in the film production. Usually indicates camera angle and movement, blocking of actors, and size of the frame.
Tech. visualization (techvis)	A technical analysis performed to tell the team how the film can be physically shot in real life.
Virtual cameras	Enables directors to experiment with different angles and shots in a virtual environment.
VFX	Visual effects/VFX describes any imagery created, altered, or enhanced for a film that cannot be accomplished during live-action shooting.

DEVELOPMENT

▼

PRE-PRODUCTION

▼

PRODUCTION

▼

POST-PRODUCTION

▼

DISTRIBUTION
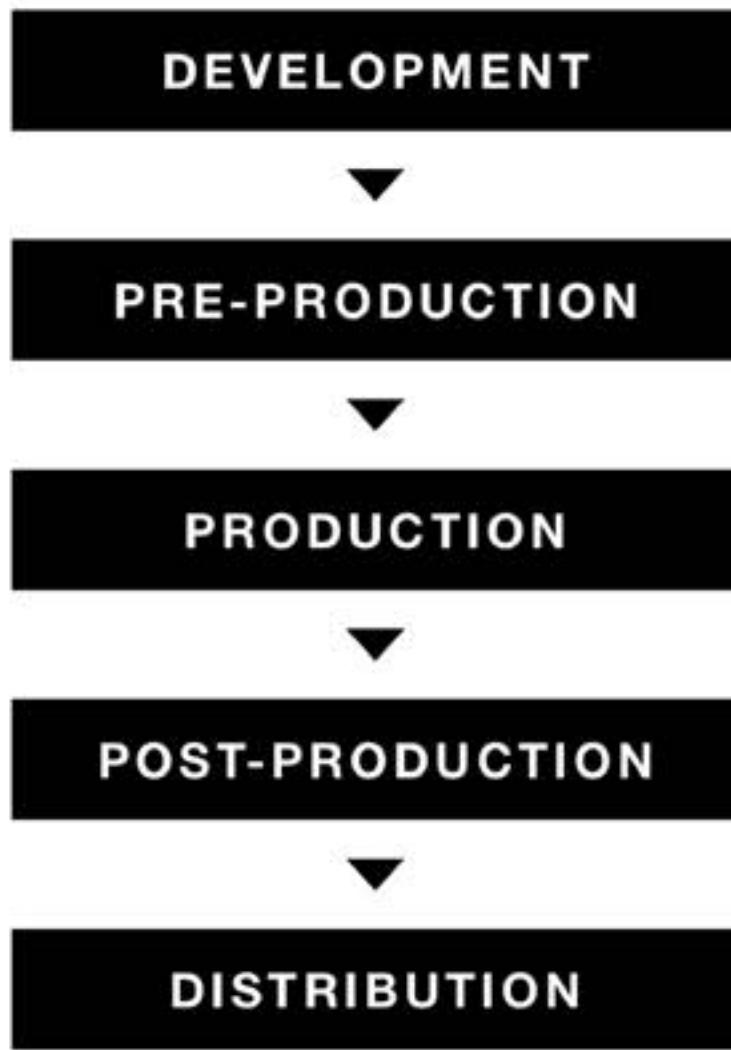
Filmmaking
Process

** Processes involved only in films working with CGI and heavy VFX

DEVELOPMENT

Movie pitch | Script writing

SCREENWRITER

PRODUCTION

Blocking

STAGE MANAGER
CINEMATOGRAPHER

Light setup

CINEMATOGRAPHER

Rehearsing

ACTOR / STAGE MANAGER / AD

Adjustments

ASSISTANT DIRECTOR

Principal
Photography

Coverage

Continuity

SCRIPTEE
CINEMATOGRAPHER
STAGE MANAGER

Voice recording

SOUND MIXER

PRE PRODUCTION

Storyboarding	Casting	Dialogue writing	Costume Design	Graphic Design	Concept Design	Light Design	Scheduling/ Budgeting
STORYBOARDER	CASTING DIRECTOR		COSTUME DESIGNER	GRAPHIC ARTIST	CONCEPT ARTIST	CINEMATOGRAPHER	PRODUCER
	PRODUCER		PRODUCTION DESIGNER	PRODUCTION DESIGNER	VFX ARTIST	PRODUCTION DESIGNER	
					PRODUCTION DESIGNER		

Shot list / Tech Viz

ART DIRECTOR

Rehearsing

SCREENWRITER

DIRECTOR

Animatics

ANIMATIC ARTIST / ANIMATOR

Pre Visualization**

PREVIZ ARTIST / 3D ANIMATOR

Location Scouting

LOCATION MANAGER

Set Design

DRAUGHTSMAN

CONSTRUCTION COORDINATOR

Blue printing

DRAUGHTSMAN

Other stakeholders in pre-production

ART DIRECTOR
PRODUCTION DESIGNER
CINEMATOGRAPHER
CARPENTER
PAINTER
SET DECORATOR
MODEL MAKER
SCULPTOR
PROPS MASTER

Glossary

POST PRODUCTION

Post Visualization**

POST-VIZ ARTISTS
VFX ARTISTS
EDITOR

Video Editing

Sound Editing

Motion Graphics

Music

Visual Effects

Sound mixing

Conforming

Mastering

Color grading

Finishing & Mastering

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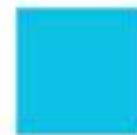
Appendices

Outreach templates

Facilitation guides

Outreach templates

Direct Message

Hi ___,

We are a team of master students at the University of Washington's Human-Computer Interaction and Design program that have partnered with Microsoft to conduct design research. We were hoping to borrow 1 hour of your time to learn more about your process and expertise in filmmaking and production. [Referral] mentioned you'd be great candidate to speak to about this subject.

Please let us know if you would be interested in speaking with us, we will try to accommodate your schedule as much as possible. We look forward to hearing back from you soon.

Best,

[Name]

Forwarded message (if we want to pass this blurb off to a third party)

Hi ___,

We are Masters students from the University of Washington that have partnered with Microsoft to conduct design research on the filmmaking process.

We're looking to conduct interviews over the next two weeks with experienced professionals that have worked on either big motion picture productions or independent films.

It would be great if you could connect us with directors, storyboard artists, cinematographers, production designers, special effects artists or actors. We look forward to hearing back from you soon.

Best,

[Name]

Casual outreach (Reddit, Facebook, Discord, DUB Slack, IxDA etc)

Hey guys, we are looking for participants for a Masters design research project. We are looking to speak with independent filmmakers, film students, or anyone that works for major filmmaking studios. We will be offering a small gratuity for their participation in the study.

Message me if you know anyone that fits the bill!

Facilitation guides

Introduction [10 mins]

Thank you for meeting us today, my name is [interviewer] and I'm working with [note taker]. We are masters of HCI and design students at the University of Washington interested in investigating the creative and collaborative process in filmmaking. For the first phase of the project, we are researching the opportunity space to get a clear understanding of how emerging technologies can be used to improve and streamline the filmmaking process. That said, we hope to learn more about your role in filmmaking. Your inputs will help inform the design of a future technology product.

This session will be an 80 minute interview. During the interview we will ask you to walk us through the tools and technologies you see as important for collaboration and creation.

Before we begin, we would like to walk you through the consent form. Feel free to interrupt and ask questions at any time. <hand consent form and go over the terms>
If you agree to the terms outlined, please sign the form and let us know if you have any questions.

Additionally, we want to reiterate that you reserve the right to refuse to answer any questions or end the interview at any time. You may also ask that we stop recording at any time. Please let us know if you need a break.

Do you have any other questions before we start?

Semi-structured interview part 1 [25 mins]

Can you tell us a little bit about yourself?
What is your current role in filmmaking?
What projects have you worked on in the past?
What kind of work have you done for these projects?
Based on the projects you've worked on, could you briefly describe the filmmaking process to us?
At what stage do you get involved?
I What is provided to you before you start?
Who provides these artifacts to you?
How?/In what form?
What do you do with these artifacts?

Personal inventory [15 mins]
[Director, Producer, Cinematographer, Storyboard artist]

Could you describe how you go about conceptualizing a shot?
What tools do you use?
At what stage in the process do you use it?
How does this tool help you?
How do you test your idea?

What hardware do you use to achieve this?
What softwares do you use to help with this?
How do you determine the conditions of a scene when you're setting up a shot?
What information do you find important to save when you finalize a shot (for example lighting, camera angles)?
How do you record this information?
How do you communicate this information to others?

[Actor]

5. Could you describe how you go about preparing for a scene?
What tools do you use?
At what stage in the process do you use it?
How does that tool help you?
How do you go about rehearsing your lines?

Semi-structured interview part 2 [25 mins]

What deliverables do you produce once you're done with your part?
How?/In what form?
Who do you submit the deliverables to?
Have you worked with characters, objects or locations that were added to the scene in post-production?
What sort of details do you receive about such a scene before it is shot?
How did you prepare such a scene?
Do you face difficulties while preparing for/ acting in such a scene?
In what way?/ How so?
What type of information do you need to pass off to the artists working in post-production?
How many people do you closely work with?
What are their roles?
How do you collaborate with [Role 1]?
How do you communicate with them?
What artifacts do you share with them?
How do you collaborate with [Role 2]?
How do you communicate with them?
What artifacts do you share with them?
How do you collaborate with [Role 3]?
How do you communicate with them?
What artifacts do you share with them?
Who do you report to for your work?
How often do you communicate with [Stakeholders]?
How do you communicate with them?
What sort of artifacts do you provide them with?