GRACE HOPPER CELEBRATION

ANITA B.ORG

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The Revolution of Spatial Computing: Emerging Design Frontiers in VR/AR

#GHC19

About Me

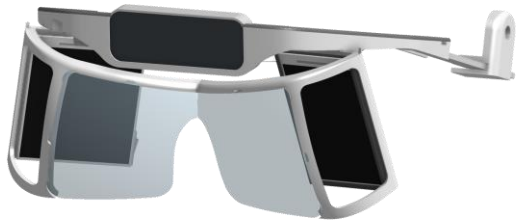
I currently work as a UI/UX, Visual Designer at Magic Leap Studios.

The past couple years I have devoted myself to researching, developing, and publishing multiple projects on the intersection of human-computer interaction (HCI) as it relates to VR/AR experiences. Prior to this, I graduated from Indiana University majoring in Computer Science with a specialization in HCI.

ali_heston

Alexandria Heston

The Rise of Immersive Technology



Leap Motion Project North Star

Windows MR

Magic Leap One

Microsoft Hololens 2

Oculus Quest

Incorporating the Physical and Digital Worlds

VR:

Digital Environments that shut out the physical world, and create a new environment around you.

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AR:

Digital Content overlayed on top of the physical world.

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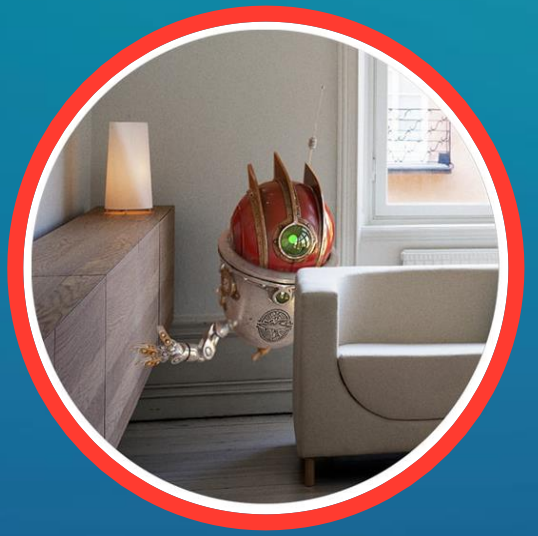
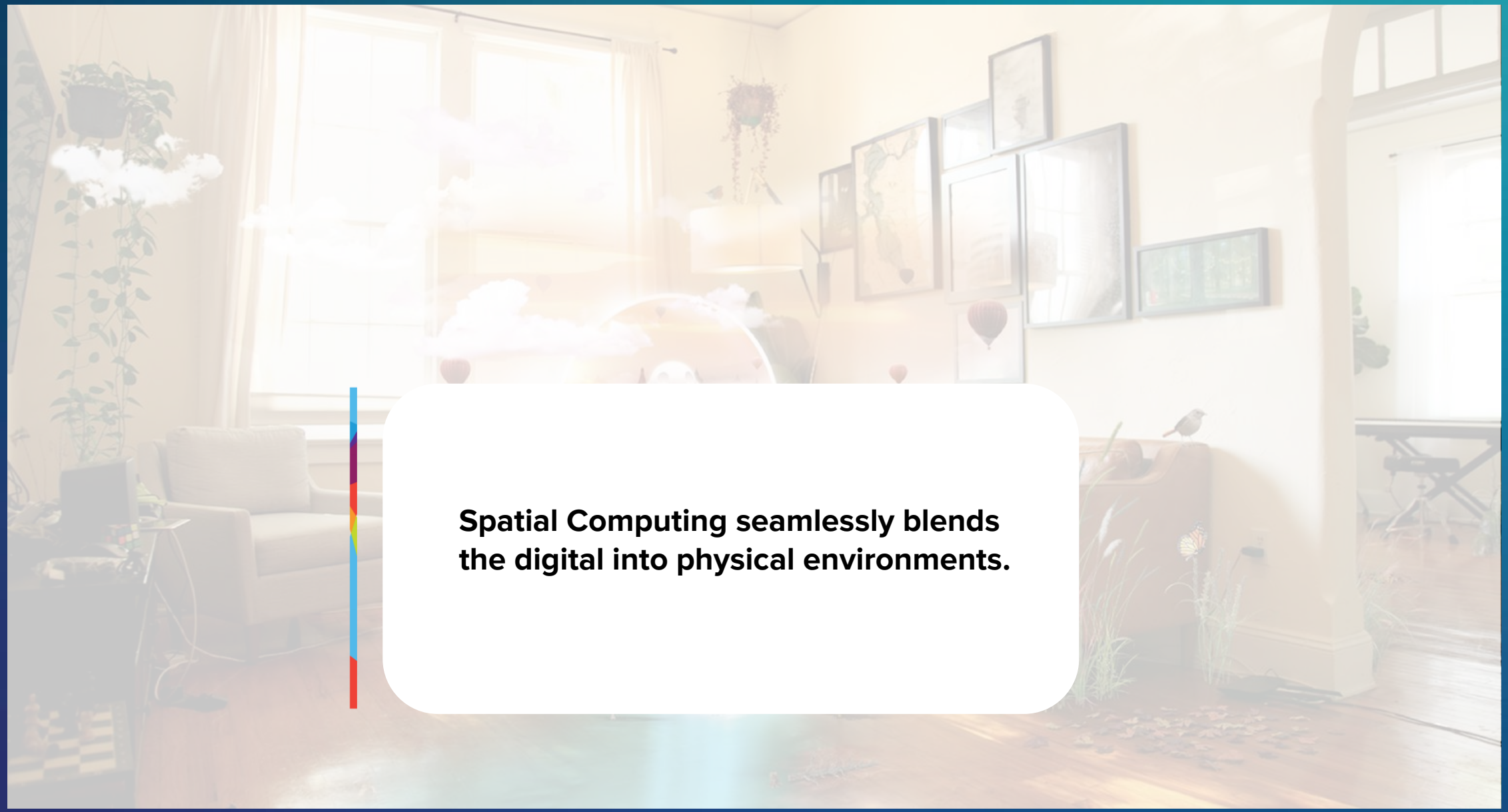


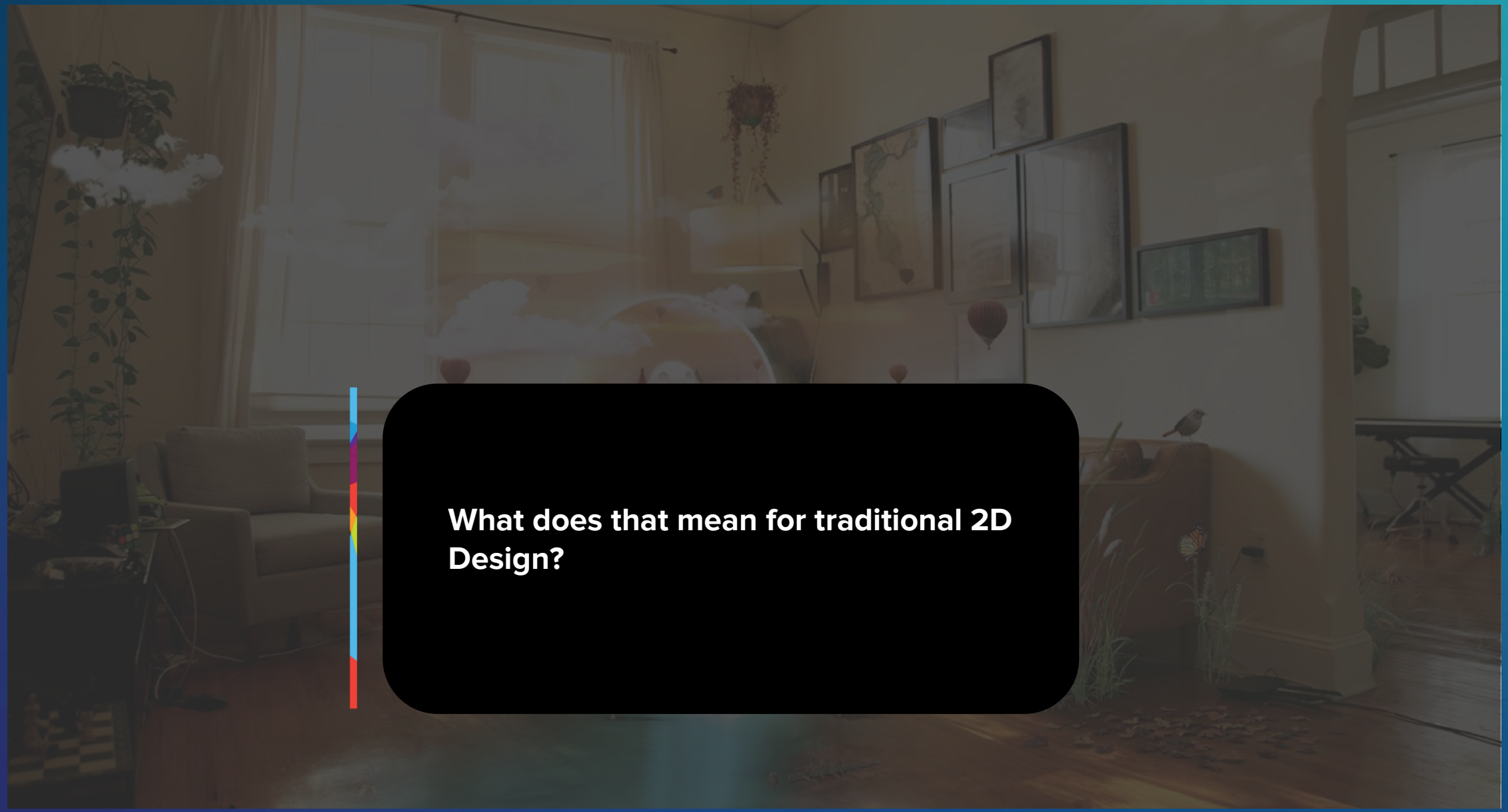
SC:

Digital Content interacts with physical world - and you.


Welcome



Spatial Computing seamlessly blends the digital into physical environments.


What does that mean for traditional 2D Design?

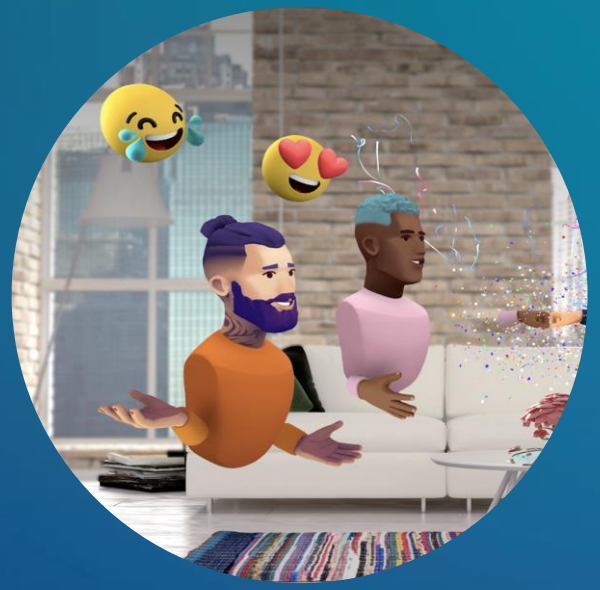
What Makes Up Spatial Computing Technology?

What Makes Up Spatial Computing Technology?

Digital Content Environment

What Makes Up Spatial Computing Technology?

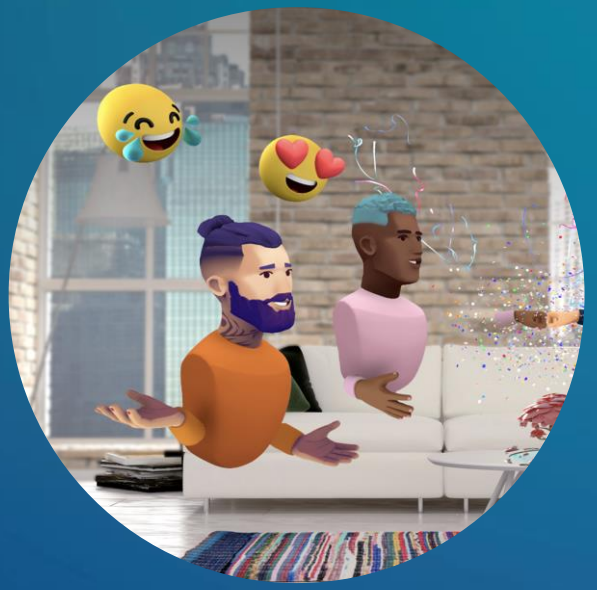
Digital Content Environment



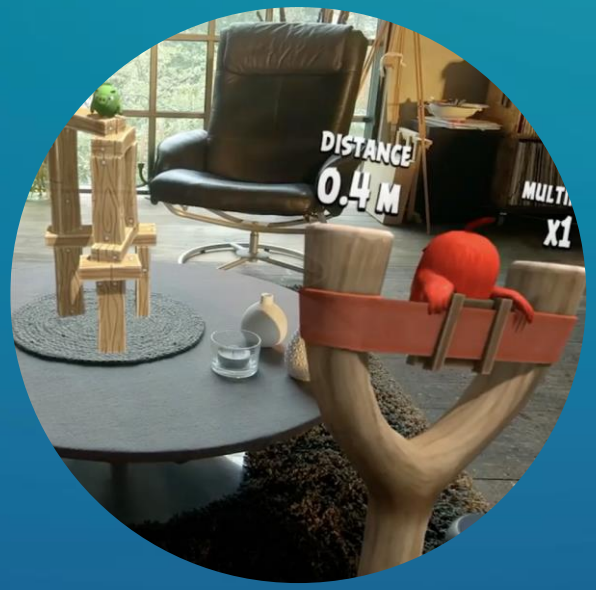
Digital Content Mixed with Physical Presence

What Makes Up Spatial Computing Technology?

Digital Content Environment



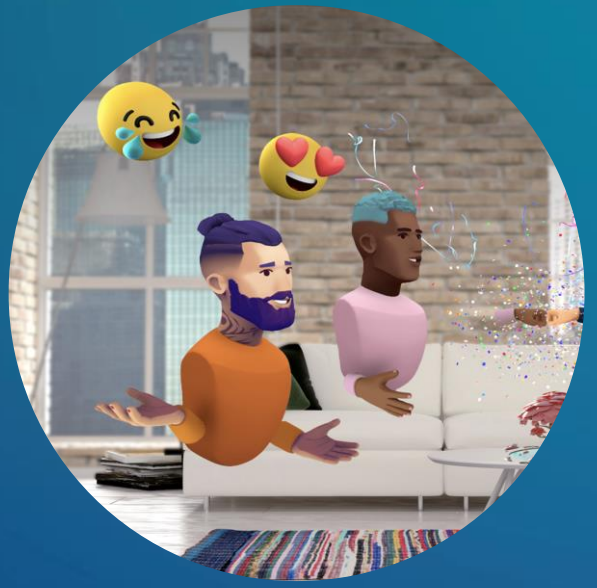
Digital Content
Mixed with
Physical Presence



Physical Ability and Presence

Topic Breakdown

Digital Content Environment



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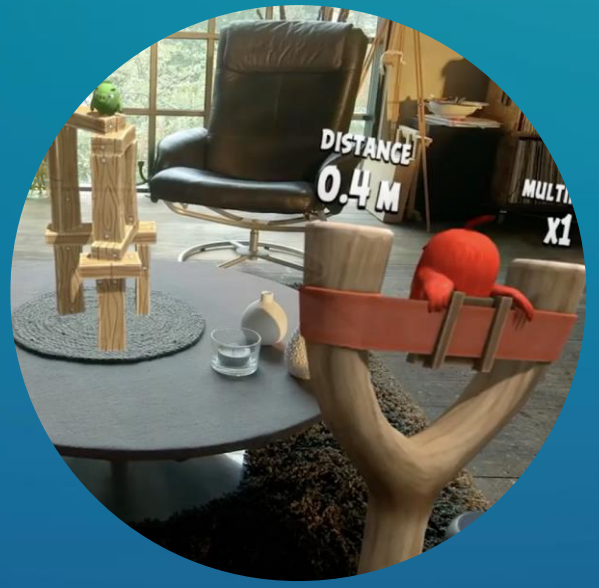
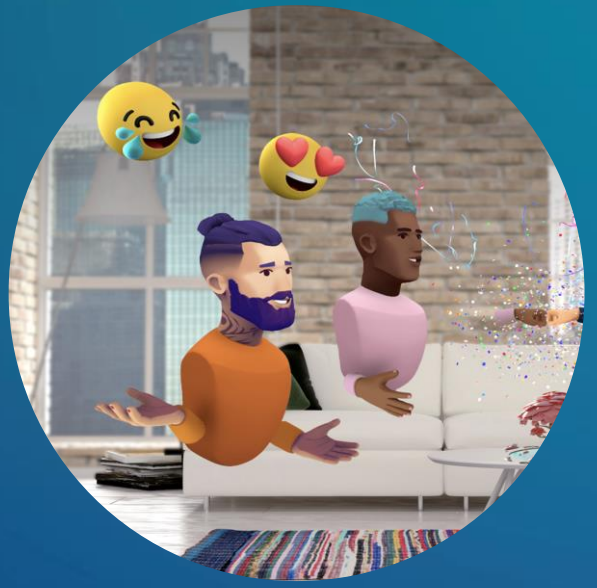


Physical Ability and Presence

Topic Breakdown

Object Integrity



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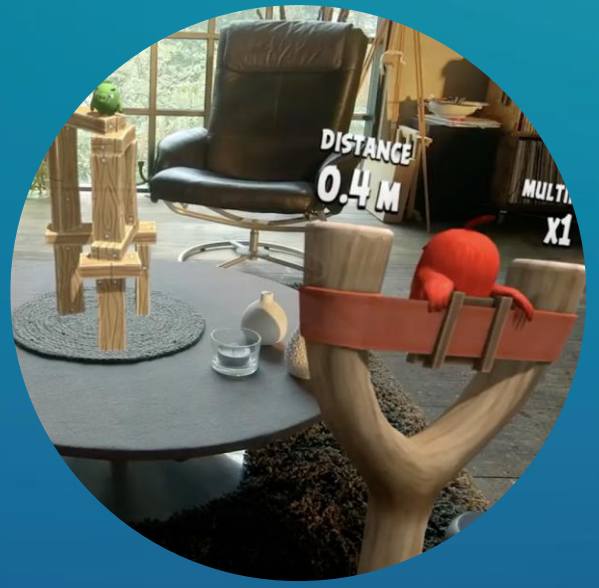

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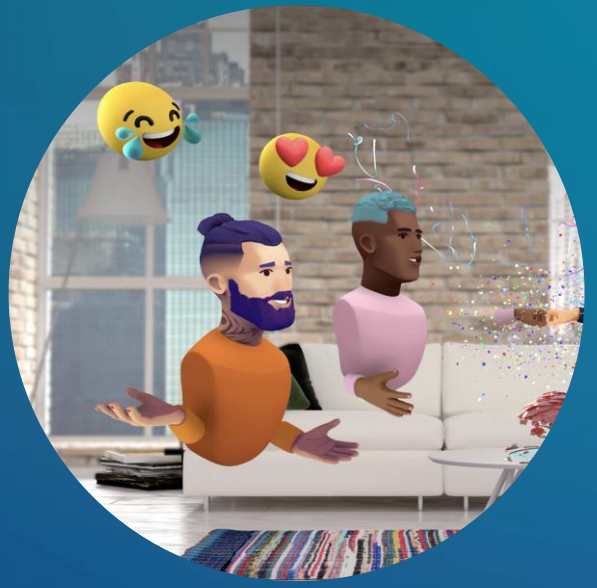
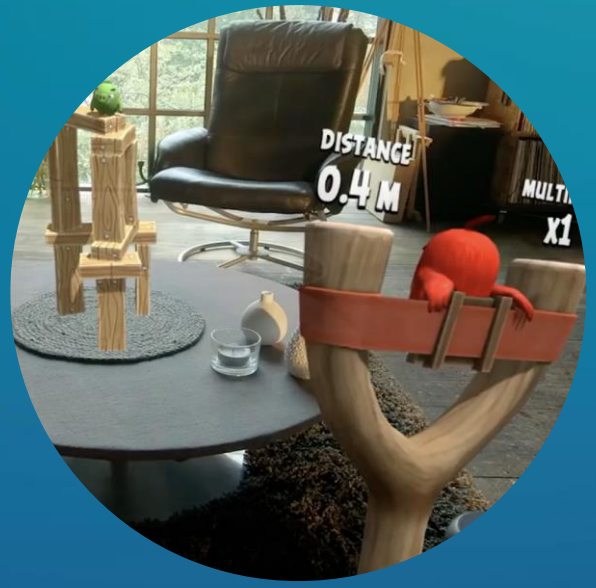


Multi-User Experiences



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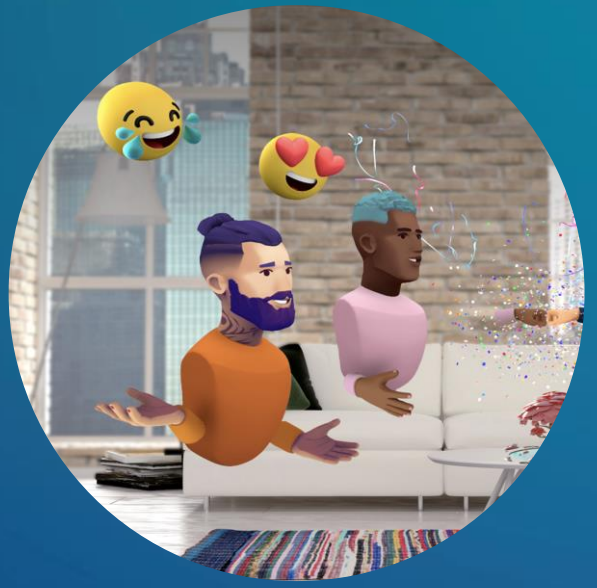

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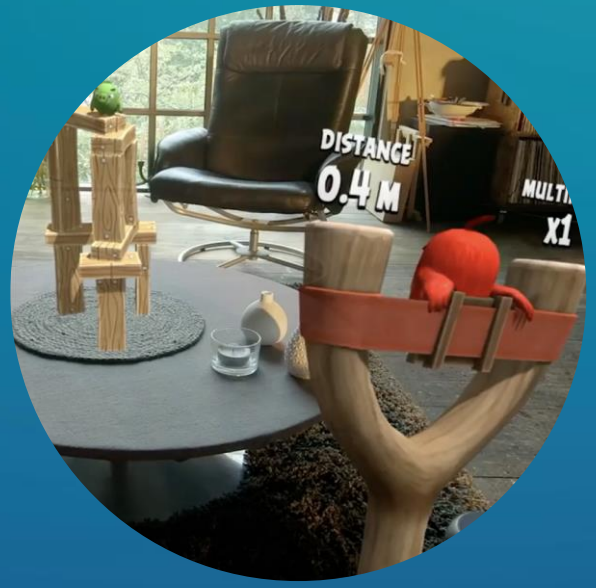


Accessibility & Flexibility

Topic Breakdown

Object Integrity

Multi-User Experiences

Accessibility & Flexibility

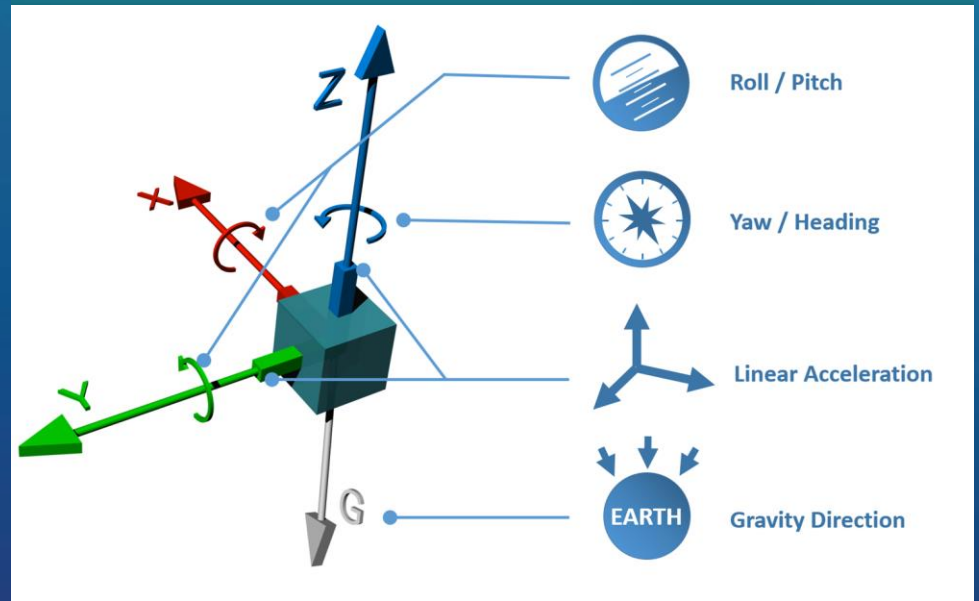

Object Integrity

Object Integrity

Need to design against a user's critical faculties to convince them that a 3D digital content environment is believable.

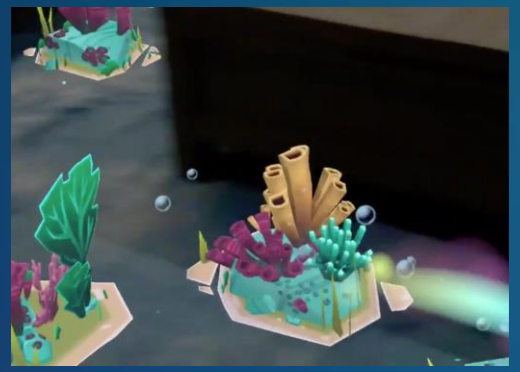
Beyond the Screen

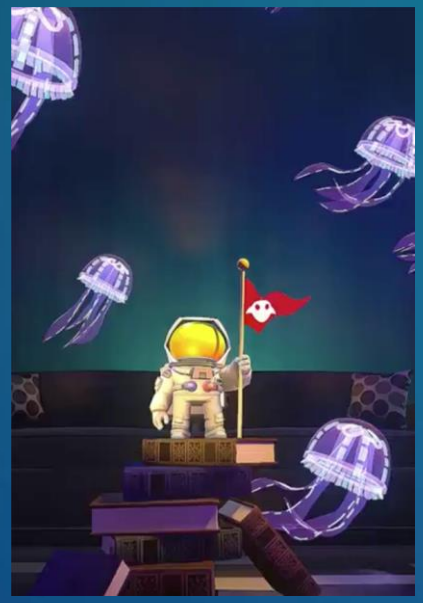
- As digital content creators we have to expand past the idea of the 2D plane.
- One of the most difficult obstacles for 2D content creators transitioning to 3D VR/AR is that 3D content is not just adding another plane of direction (Z), we're adding rotation in all those directions as well.
- Environments have a foreground, midground, and background. Squares become cubes, and users will want to explore this.
- 3D objects are now tangible and designers need to create them with certain affordances and constraints in mind for user interaction.

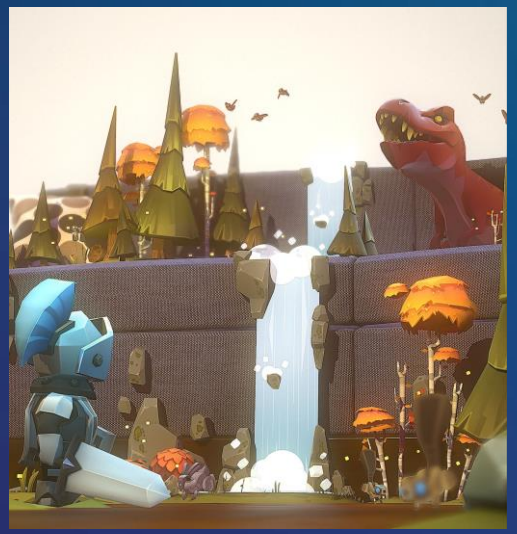


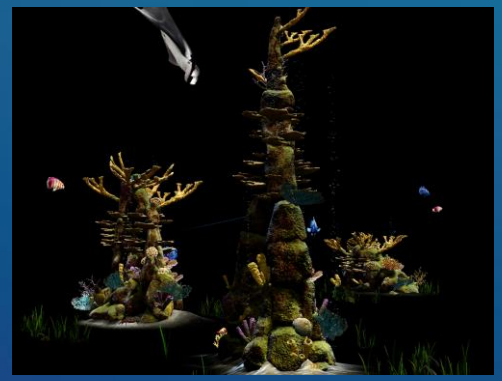
PROJECT CREATE

studios UNDERSEA



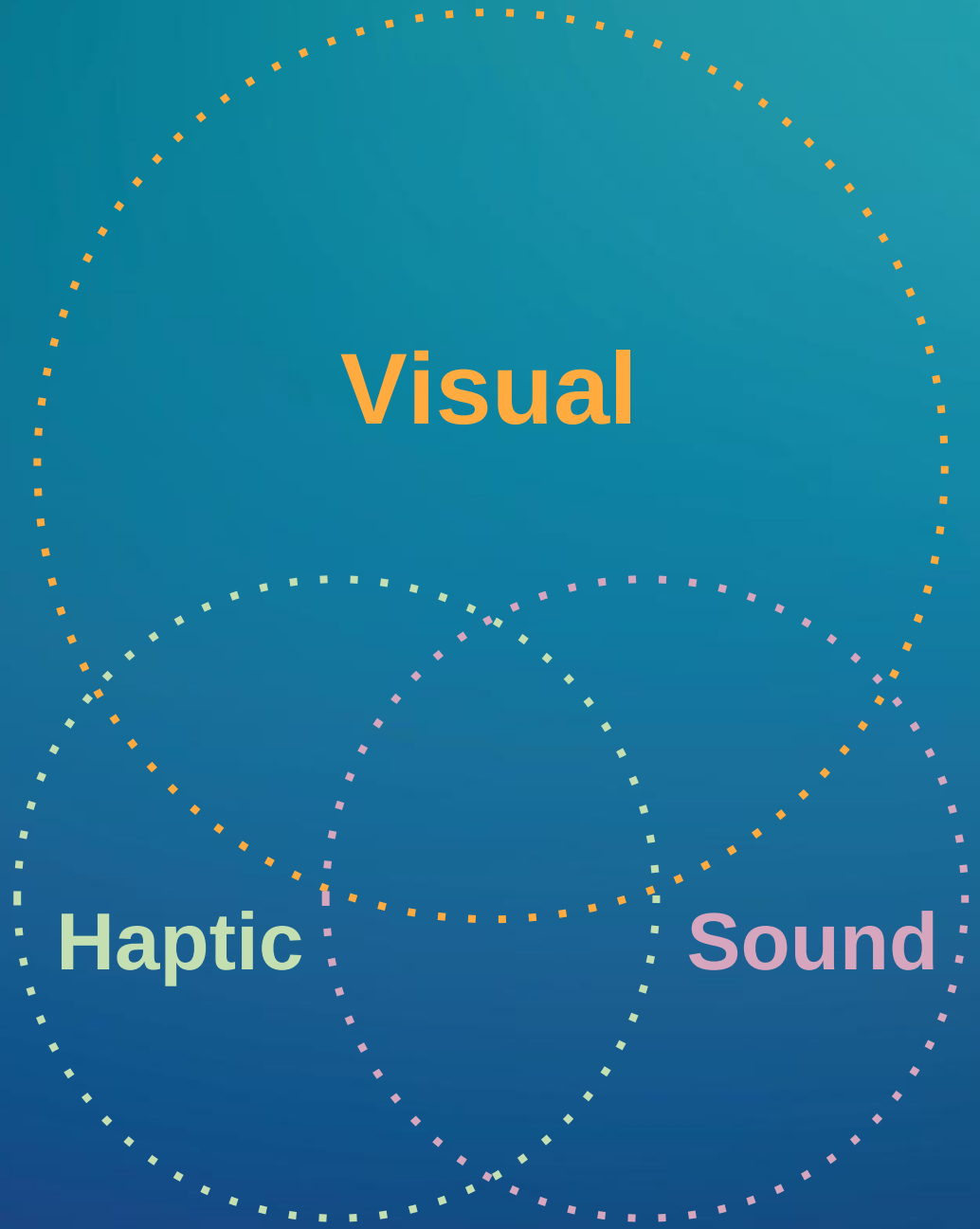






Beyond the Plane

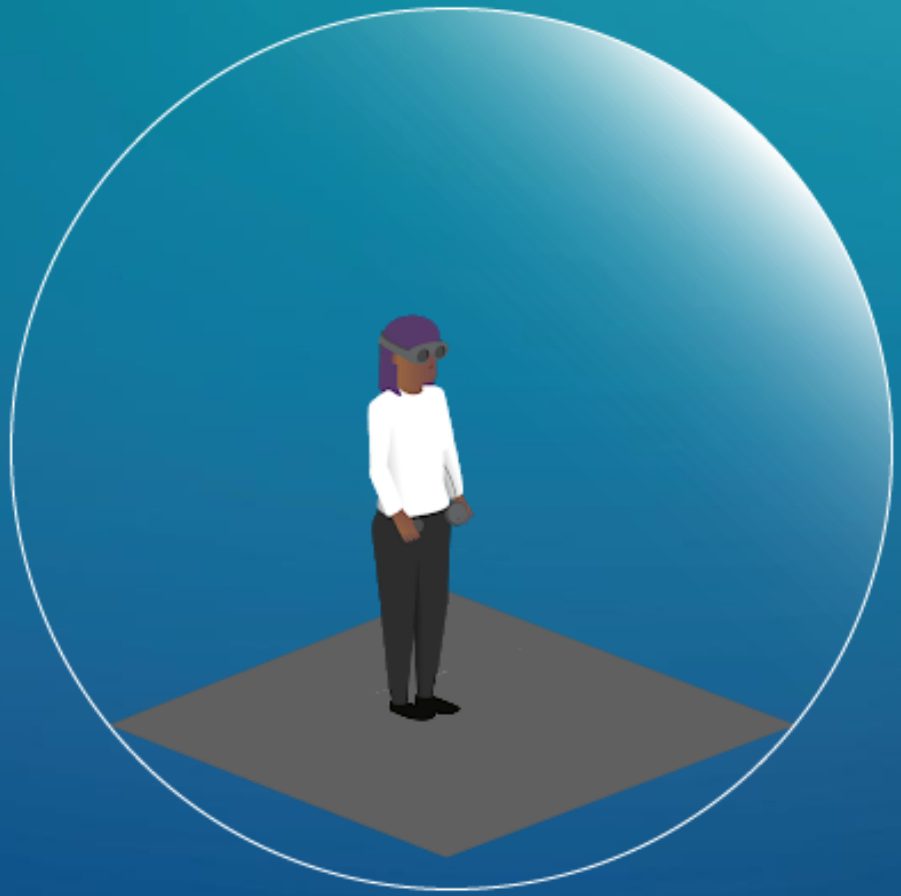
- Another obstacle to overcome is that most creators have been taught to overlay digital content in a visual sense, but tangible 3D objects require a combination of Visual, Haptic, and Sound in order for them to be believable in a 3D environment.
- Users now have digital objects that persist in the real world, but are very uncertain how to interact with these objects because they have no mental model of previous encounter - so we must entice them with strategic design choices.



Digital Content should respect the other digital content in the environment, the physical world, and the user themself.

Beyond the Surface

- As creators, we must remember that 3D Content now exists in a potential of 360 degrees around the user.
- However 3D Content, regardless of whether VR or AR, has a limitation to the amount of space it could potentially occupy.
- There are five main zones to this structure:



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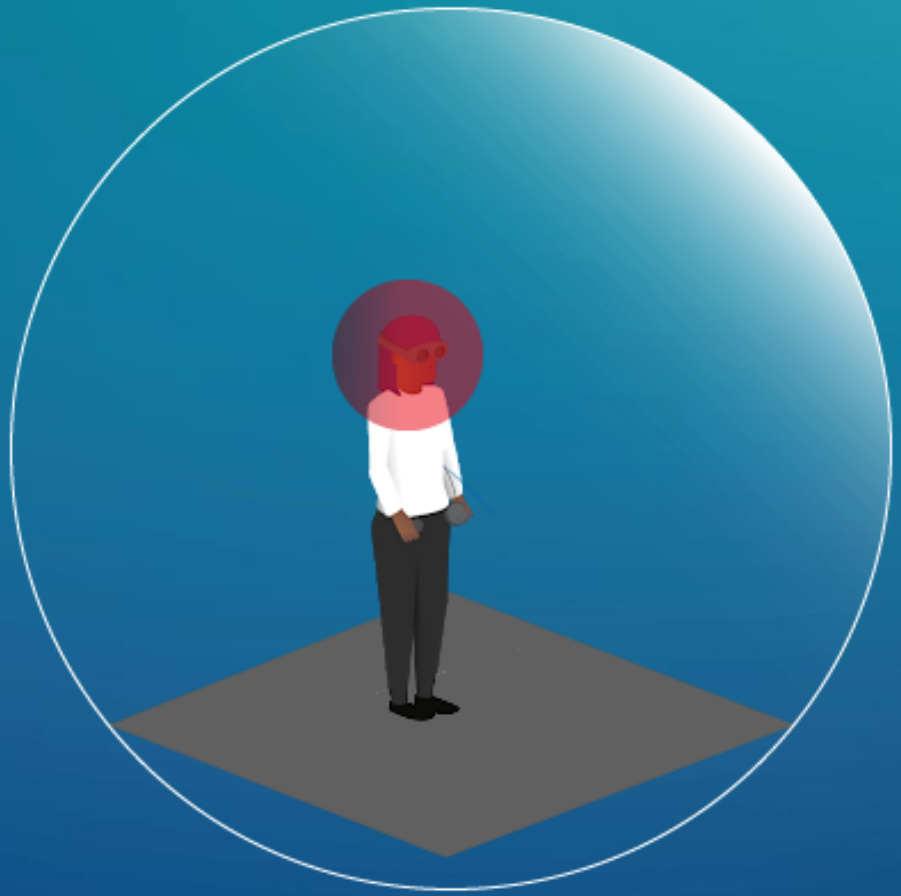

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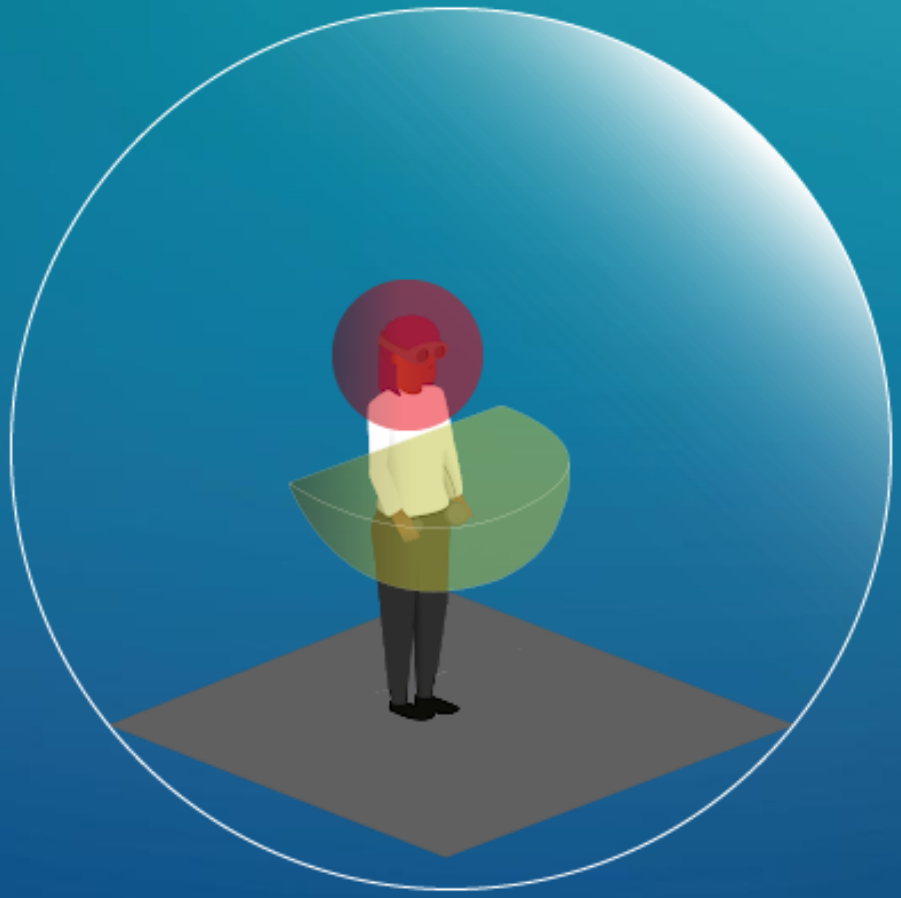

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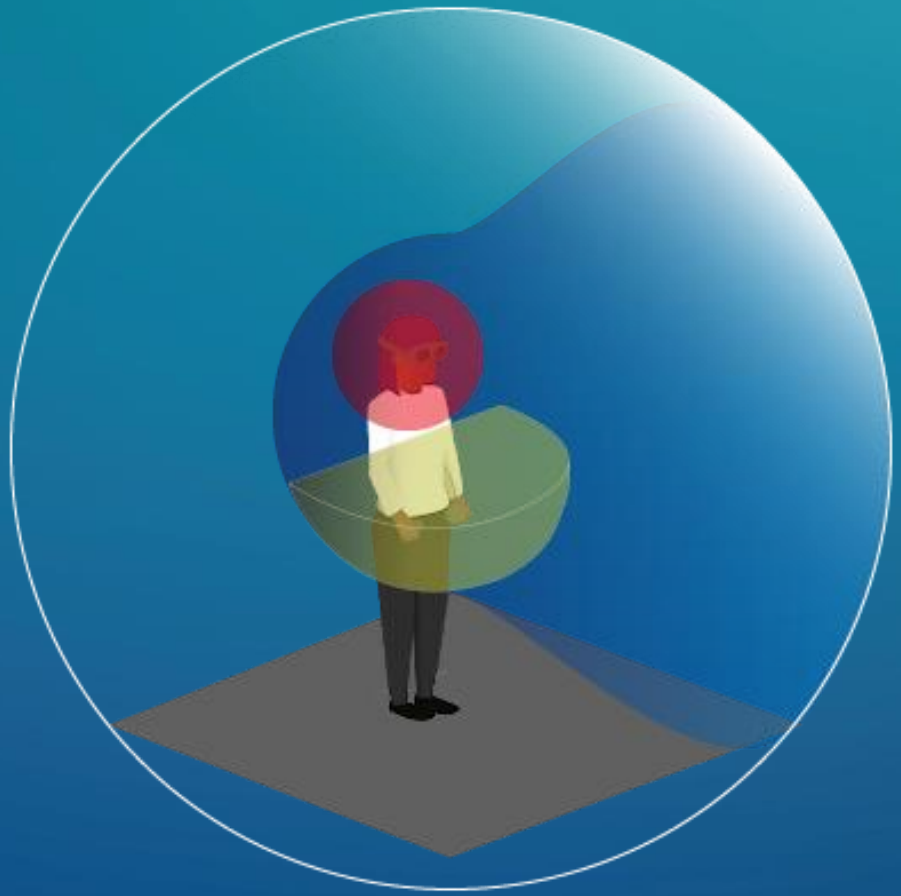
    - **Content Zone:** the zone in which people can see content comfortably without straining



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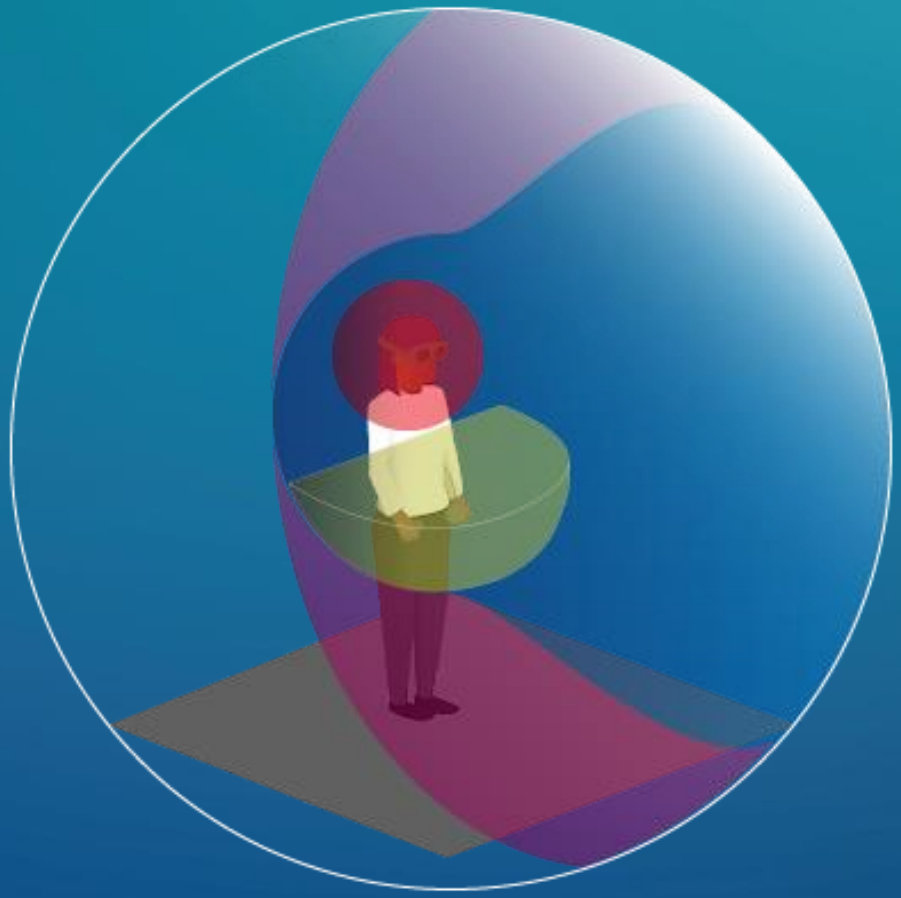
  - **Periphery Zone:** the zone in which users can see content at the periphery of their comfortable line of sight



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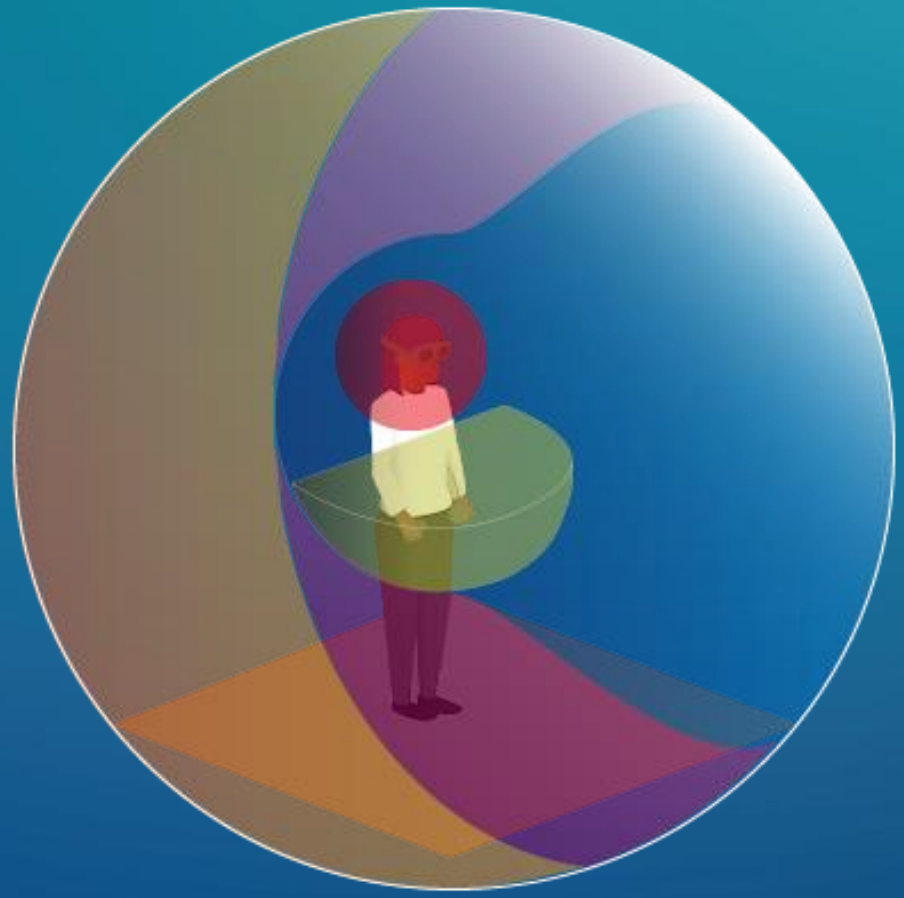
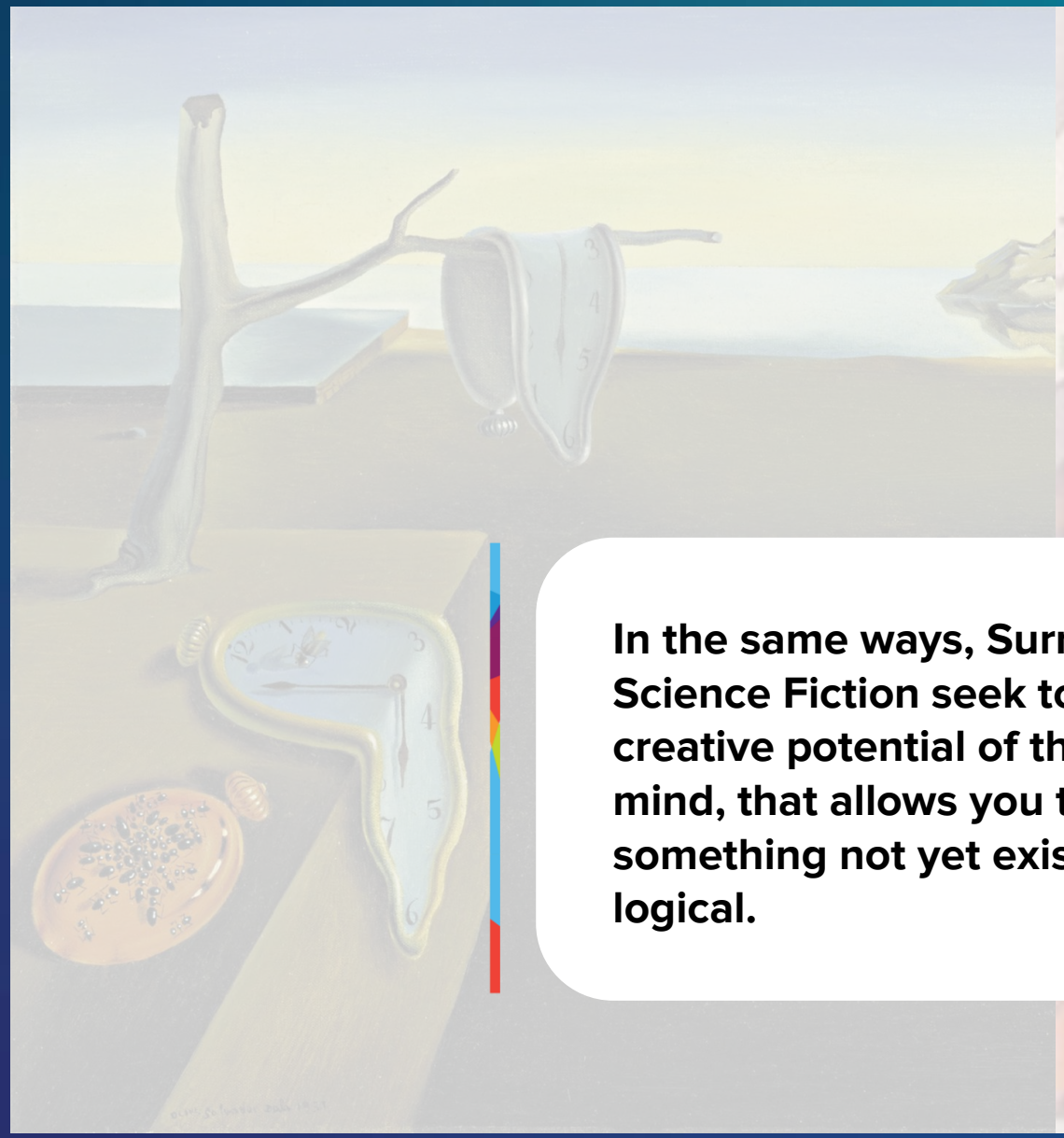
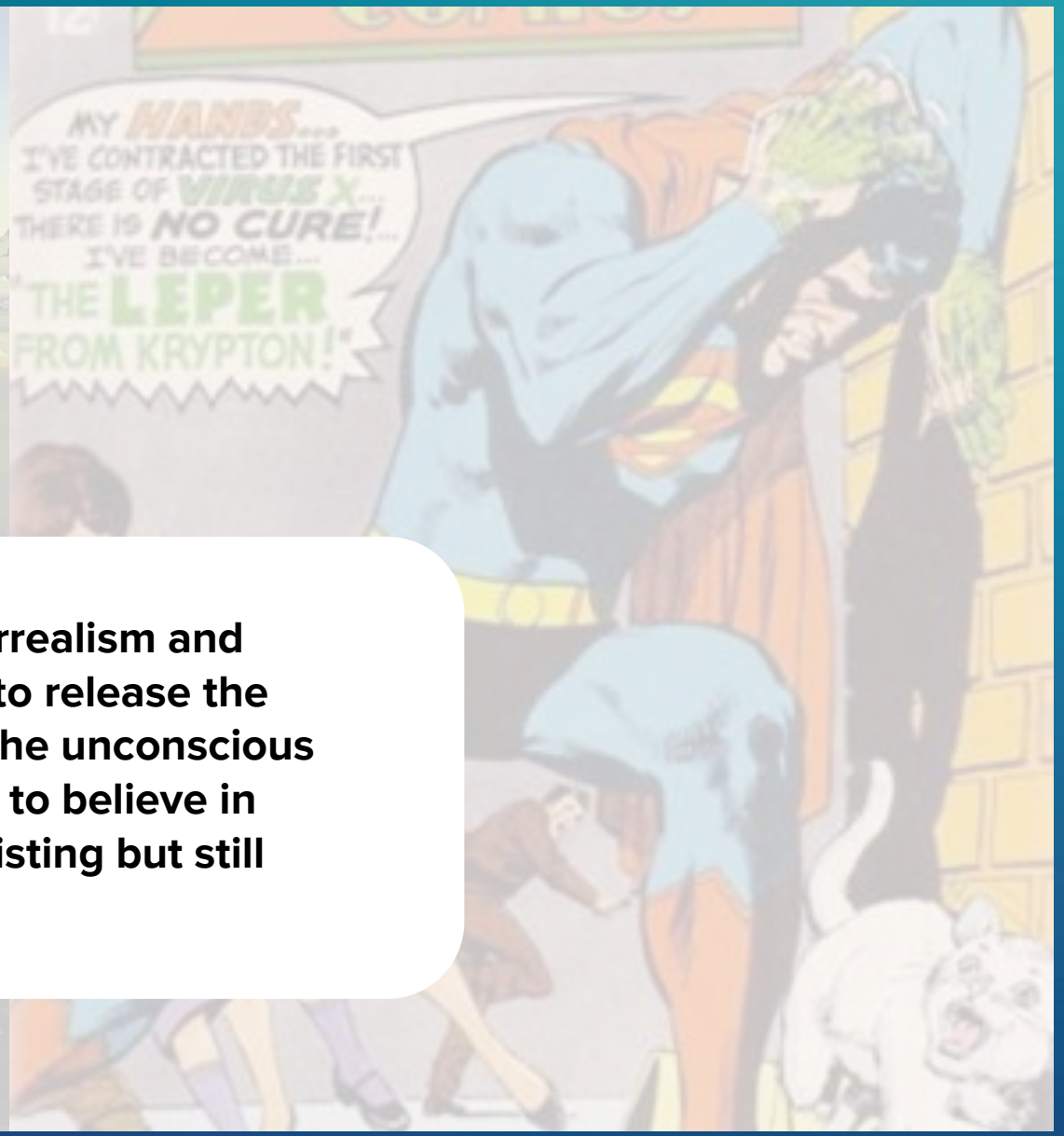
  - **Periphery Zone:** the zone in which users can see content at the periphery of their comfortable line of sight
  - **Curiosity Zone:** the zone in which content has to be discovered by moving around



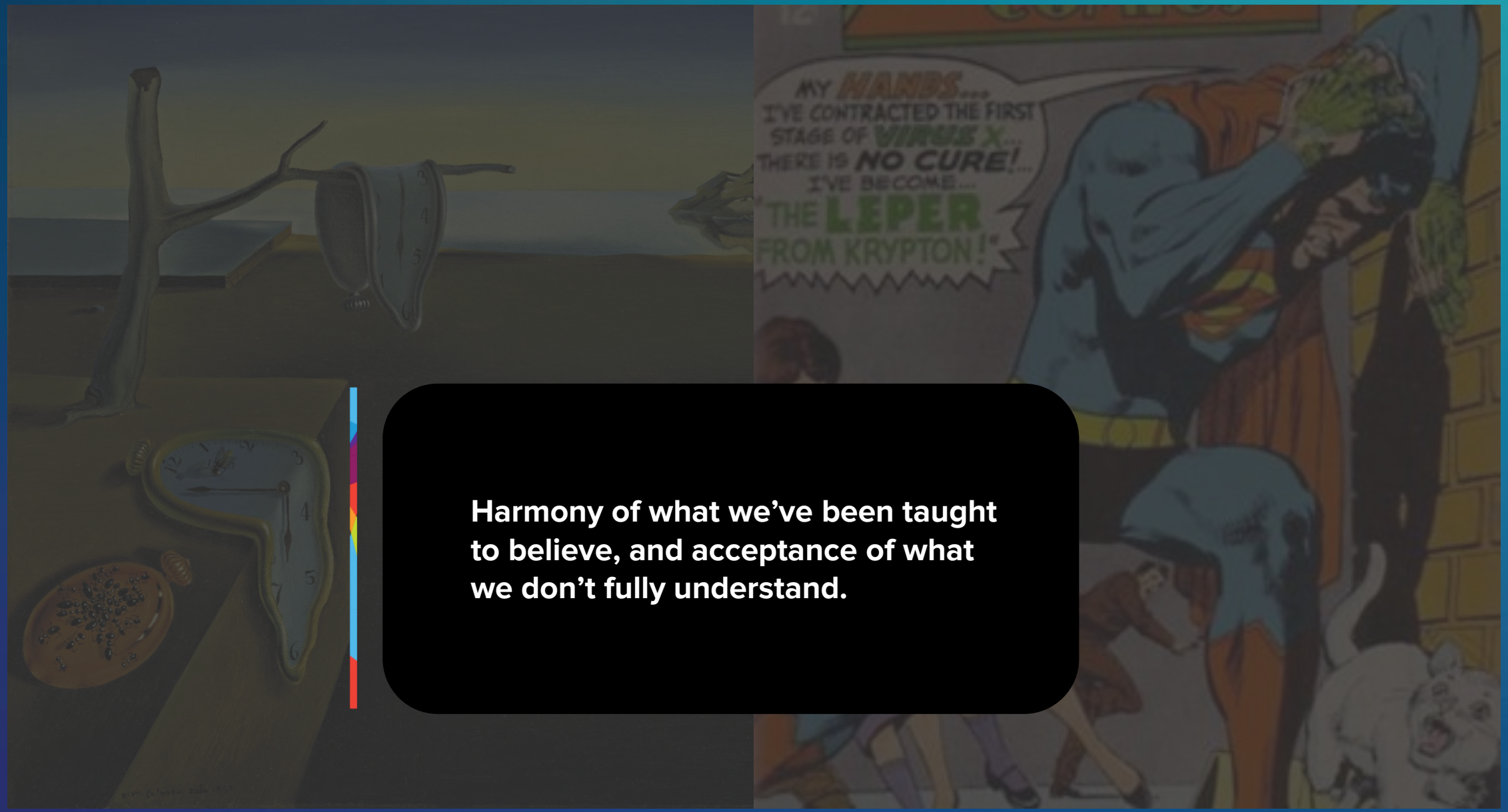
Suspension of Disbelief

- This process of design in suspension of disbelief specifically includes pushing beyond simple two dimensional interfaces and integrating spatialized audio & haptics, which many creators have never had to do previously.
- Users now have digital objects that persist in the real world, but users consider this to be a new hybrid environment. They are often very uncertain how to interact with these objects because they have no mental model of previous encounter.





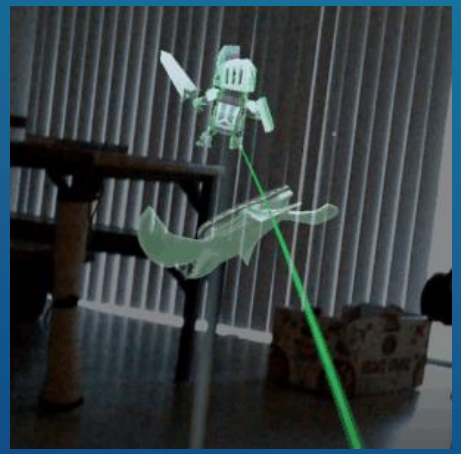
In the same ways, Surrealism and Science Fiction seek to release the creative potential of the unconscious mind, that allows you to believe in something not yet existing but still logical.



Harmony of what we've been taught to believe, and acceptance of what we don't fully understand.

Mitigating Freeze Factor

- By way of other's research and my own personal implementation, I've found multiple ways to mitigate this 'freeze factor'.
- This includes:
  - Onboarding cues to help users understand the input schema (gesture, controller, etc),
  - Visual affordances that distinguish how to interact with content
  - Auditory feedback to encourage valid input (both positive and negative)
- Without these aspects there can be a disconnect between the expectations that users have being new to this kind of experience.

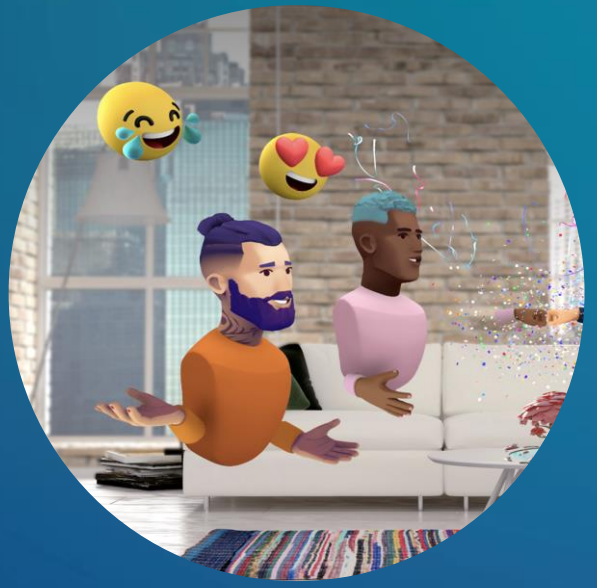


Creating Engaging Content

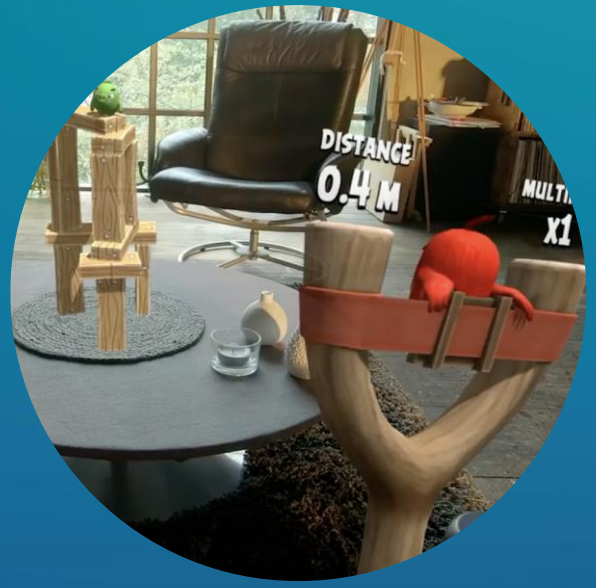
- Intent is one of the most important aspects to world building.
- The intent of the digital environment relies upon and interacts with the physical one, but also creates rules for the user to understand - visual, haptic, and auditory.
- This new merged environment lends itself to cues that help users understand the input schema (gesture, controller, etc), visual affordances that distinguish it from the physical scene, and auditory feedback to encourage valid input (both positive and negative).

Topic Breakdown

Object Integrity



Multi-User Experiences



Accessibility & Flexibility

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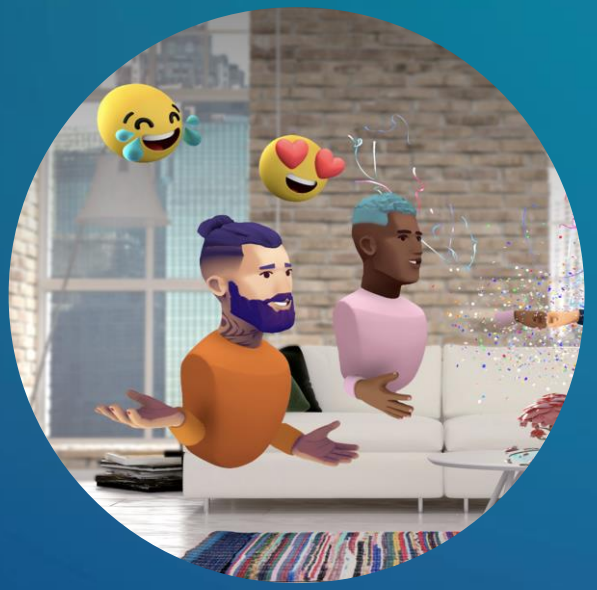

Multi-User Experiences

Accessibility & Flexibility

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Multi-User Experiences

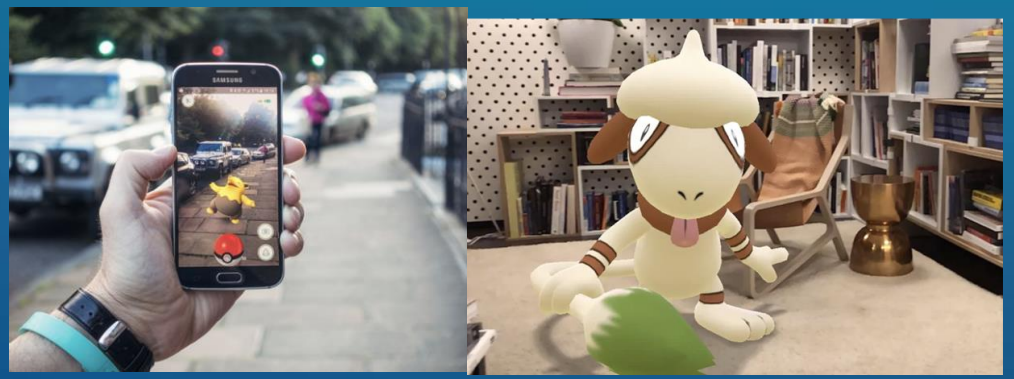
Multi-User Experiences

Need to design in harmony of the Digital Flexibility that computers provide us with Physical Presence afforded through face to face communication.

Digital Sharing and Co-presence

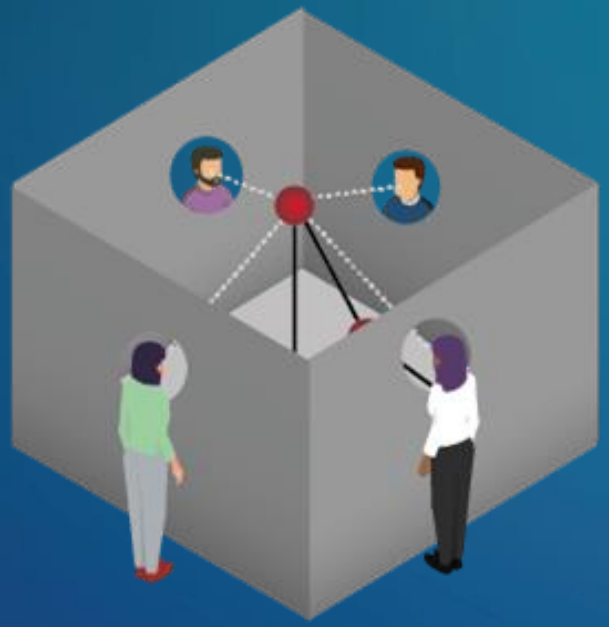
- Digital Sharing and Co-presence can manifest in a multitude of ways with relaying the exact same information to different or the same person but in a potential of different or the same time, place, or device.
- The goal of Social experiences is not necessarily to replicate that which exists in the real world, but to give people the opportunity to express themselves in new and different ways.

Asymmetric Multi-User

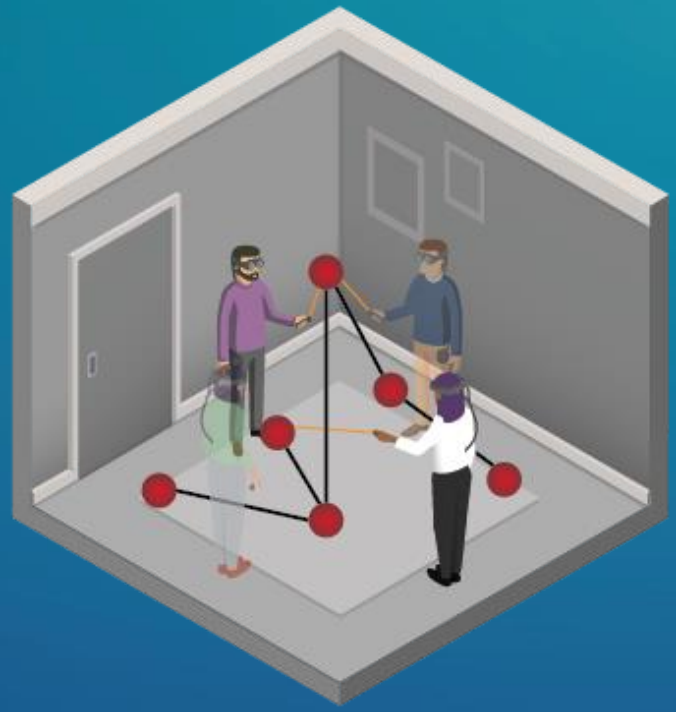


Remote Asynchronous Sharing

How does this differ in a 3D Digital World?

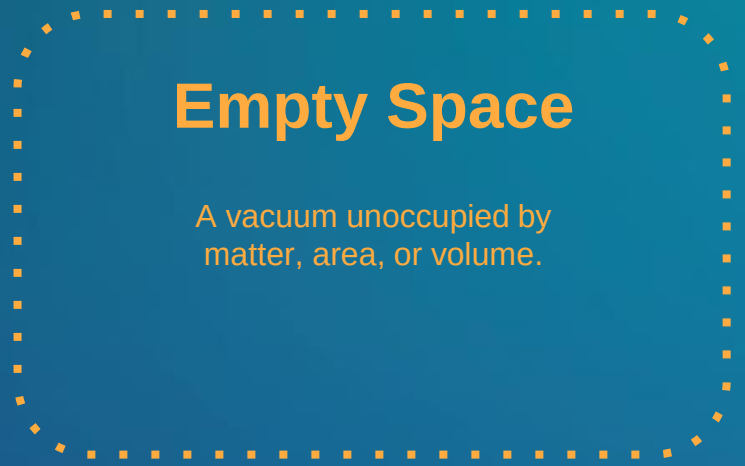


- Everyone views a different perspective of the content
- Hard to share digital systems, especially 3D content
- Fragmented analysis of the world around us

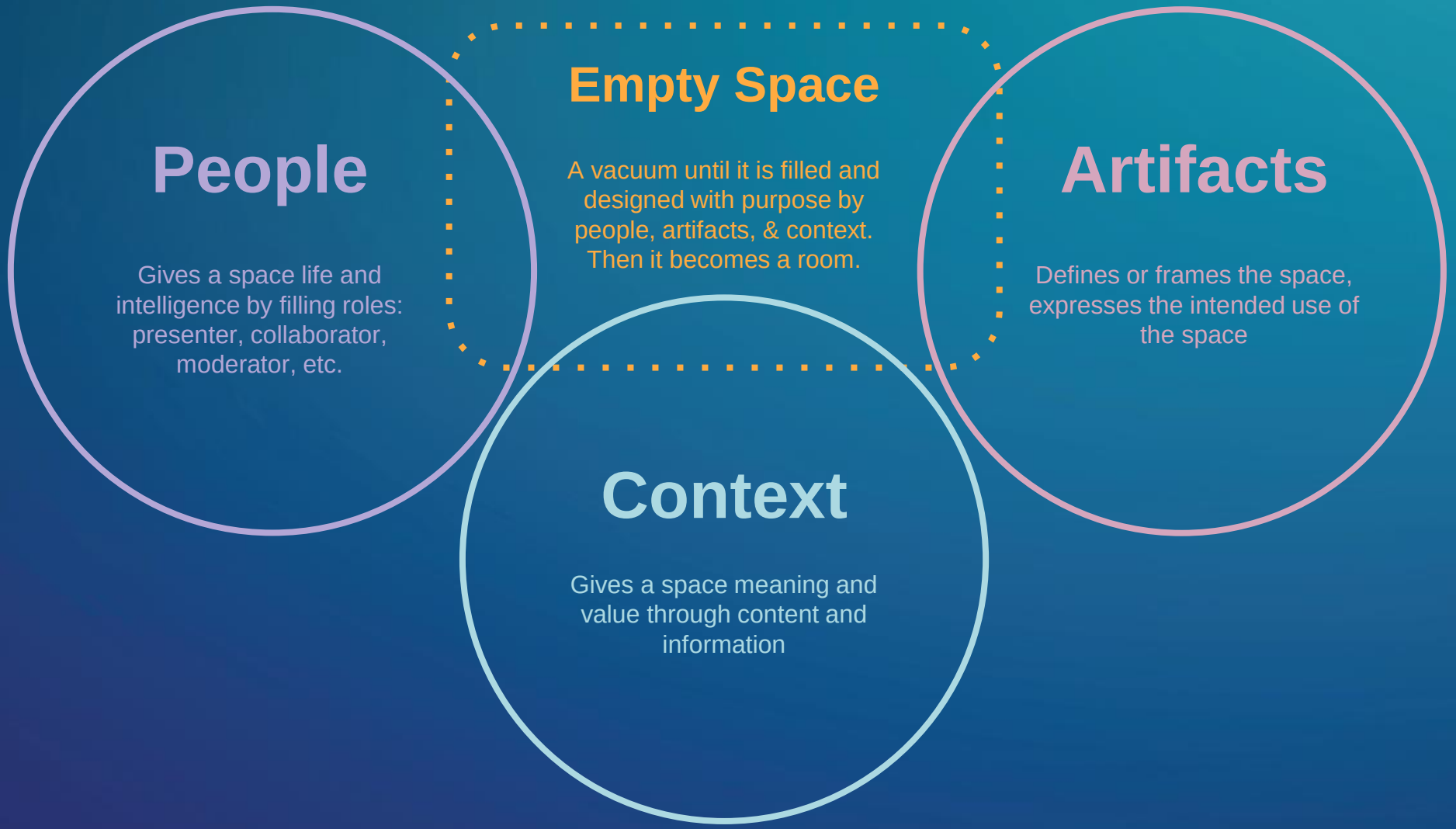


- Everyone views the same content, with more ability to manipulate this content
- Collaborative sharing
- Holistic understanding

What is Space?



What is in a Room?



Collaboration Style

Campfire
A group of equals is circled around a campfire or common ground.

Debate
Several debaters take opposing views and a moderator controls the flow, pace, and direction of the interaction, many spectators watch.

Auction
An auctioneer will facilitate bidding on a item to establish the highest price.

Collaboration Interaction

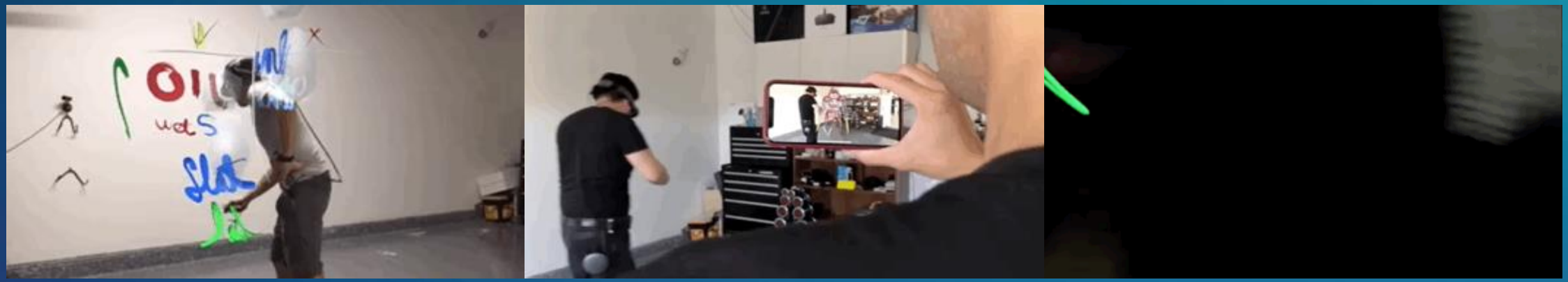
Handoff
Handoff collaborating with others physically, requires something that affords human grip

Toss
Physical collaboration where open space exists between people, objects are durable, and tasks are repetitive often result in objects being tossed to cover the distance.

Playing Music
playing a percussion instrument requires many precise time rapid taps

The Future of Communication

Content Source: Spatiate App



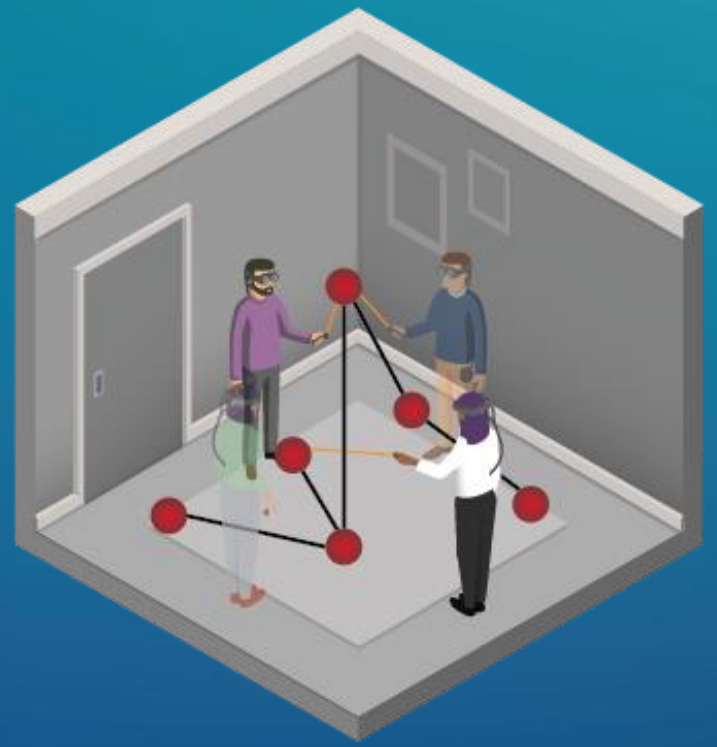
Multi-User Presence
The application allows users both remote and locally to enter your space and create with you, removing the necessity for in-person interaction

Cross-Platform Accessibility
This democratizes the platform and allows users who would prefer their smartphones, but also contribute and interface with other devices.

Multimodal Interaction
These allow users to use multiple different inputs to interact with objects in ways that they prefer (gesture, 6DoF Raycast, or 3Dof Touchpad)

A Whole Universe of Exploration

	Same Time	Same Place	Different Time
Same Place	Co-Located Sharing	Co-Located Multi-User	Local Content Persistence
Different Place	Remote Sharing	Remote Multi-User	Remote Content Persistence
Different Platform	Asymmetric Sharing	Asymmetric Multi-User	Asymmetric Asynchronous



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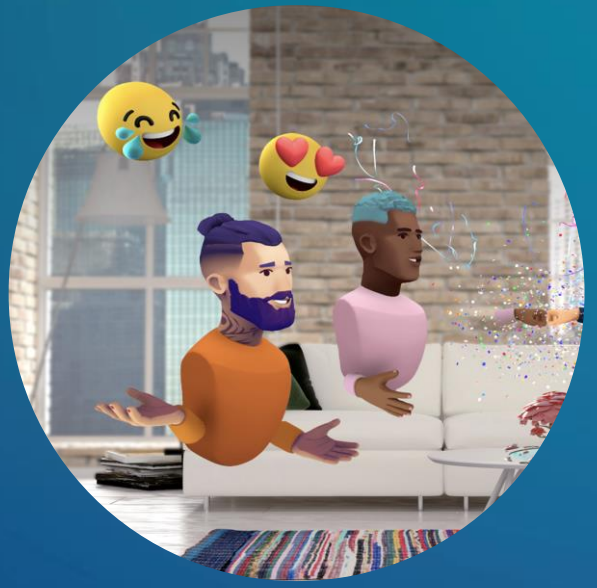
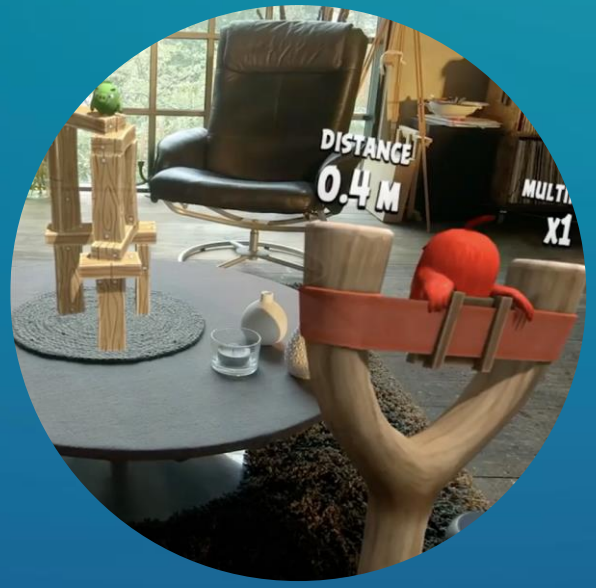


Multi-User Experiences

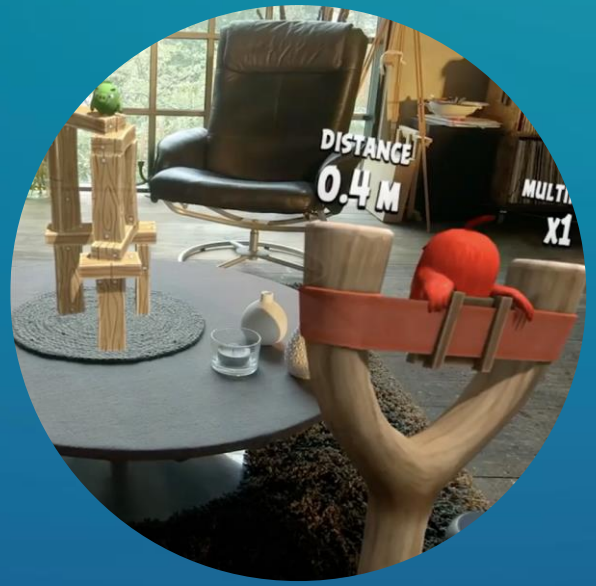


Accessibility & Flexibility

Topic Breakdown

Object Integrity

Multi-User Experiences



Accessibility & Flexibility


DISTANCE
0.4 M
MULTIPLIER
X1

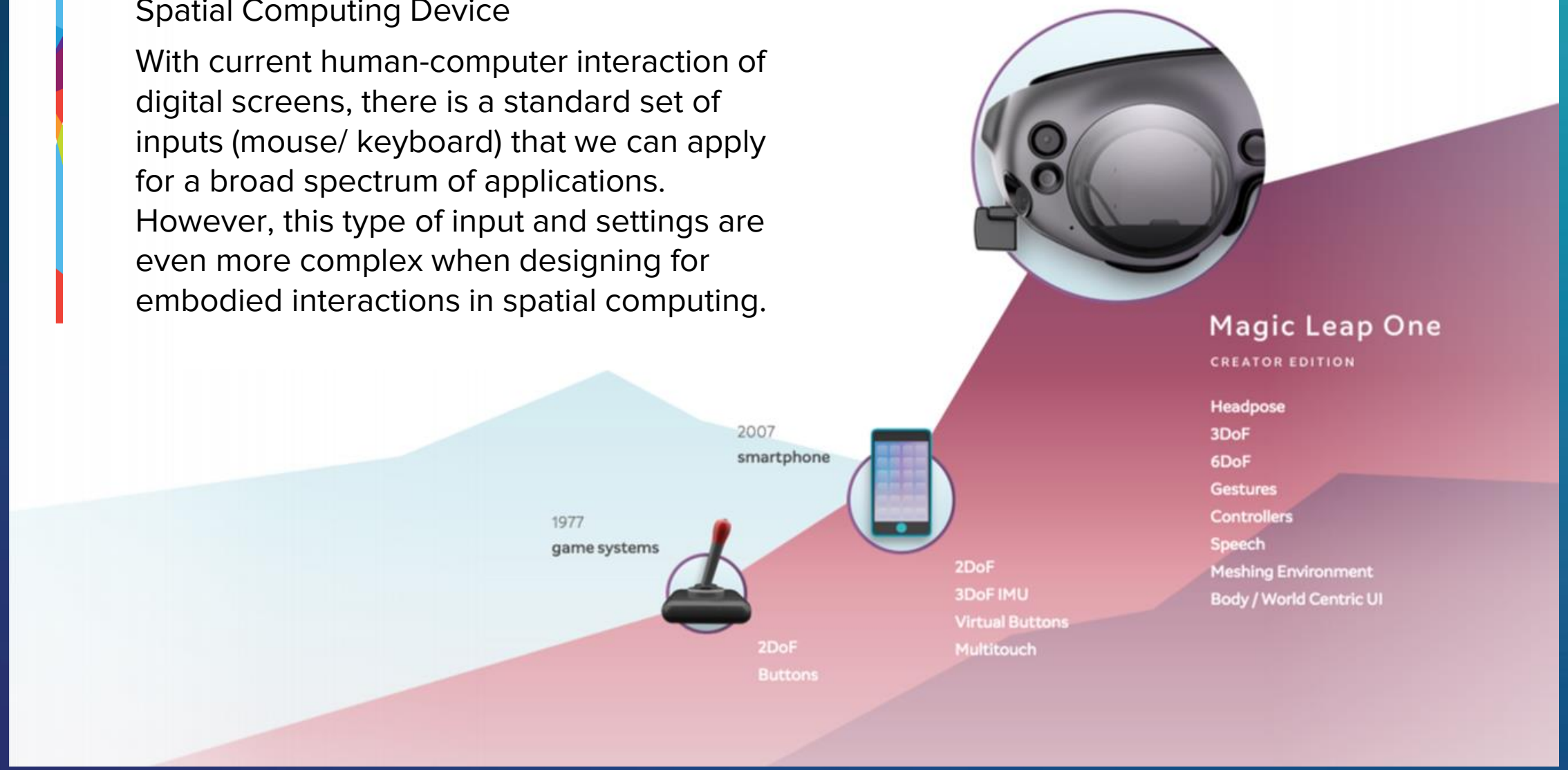
Accessibility & Flexibility

Accessibility & Flexibility

Need to design with the understanding that users have to respect the laws of the physical world, even if our content does not.

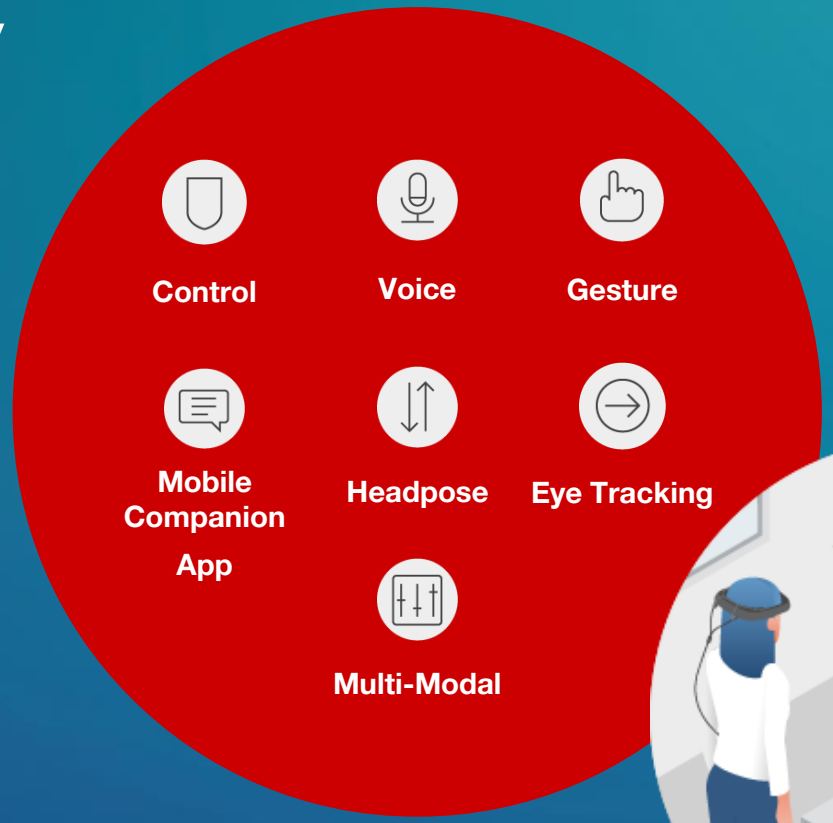
Spatial Computing Device

With current human-computer interaction of digital screens, there is a standard set of inputs (mouse/ keyboard) that we can apply for a broad spectrum of applications. However, this type of input and settings are even more complex when designing for embodied interactions in spatial computing.



Design for Flexibility

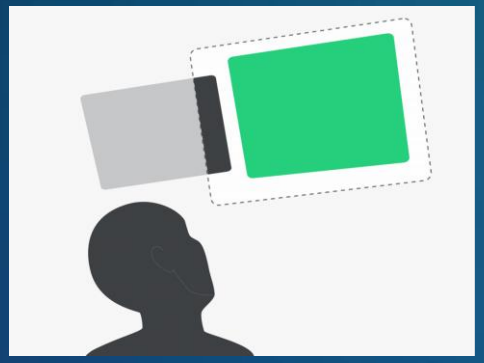
- In spatial computing there is no place for rigidity of input because humans have preferences and needs in the way we interact with objects.
- Interaction with physical objects isn't just based off of a learned experience, but is also largely based off of ableness (rotation of object, weight, etc), genetic tendency (left vs right handedness), and the size of the space (scalability).
- This means that products designed with embodied interactions in mind need to consider user preference and accessibility in their own physical space.



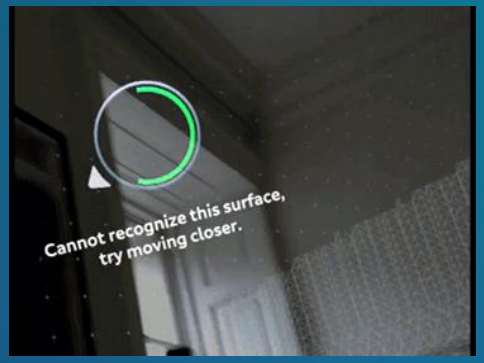
Variety of Input Methods

Variety of Software Settings

Design for Multimodal Inputs

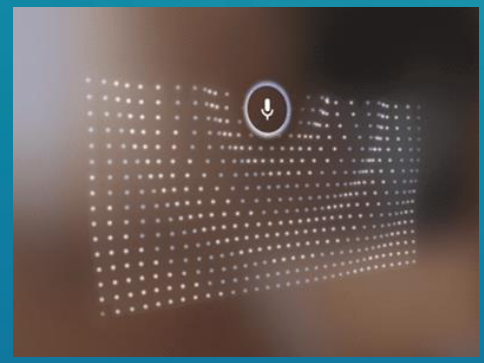


Headpose

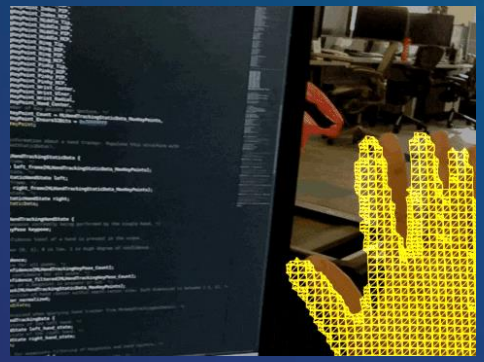


Eye Tracking

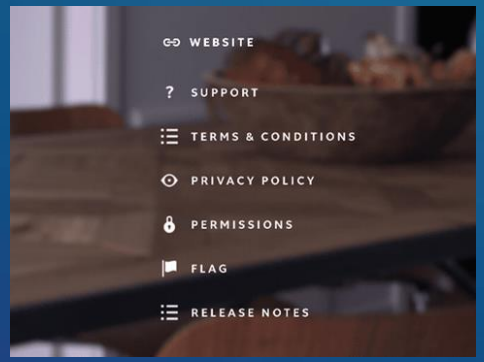
Voice Dictation



Voice Commands

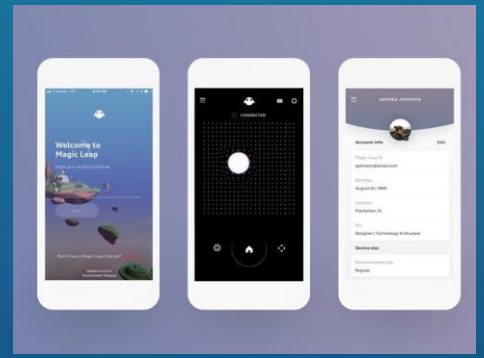


Hand Tracking



Gestures

6 DoF Control



Mobile Companion App

Design for User Needs

- Flexibility includes the settings and options for users to interact with the world in their own preferential ways - especially for users with specific needs.
- The flexibility of hardware means designing interactions around different types of input schemas available be it hand gesture, head pose, gaze, controllers, etc.
- The flexibility of content includes brightness, clarity, text size, color schema, etc.
- There are many ways for a product to be flexible, however the key to flexibility in design is to consider it early and often.

Mobility & Dexterity

Blind

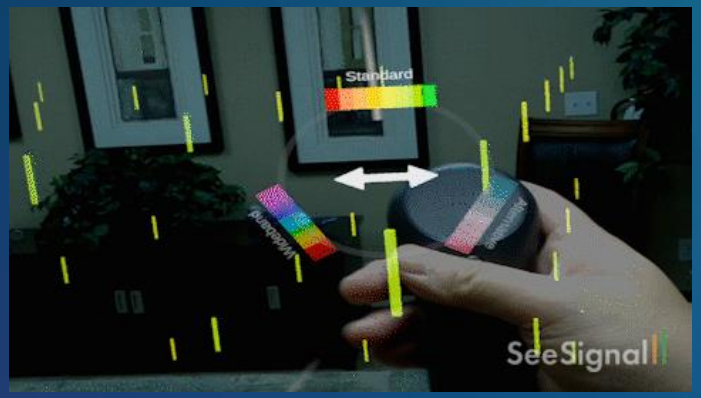
Deaf or Hard of Hearing

Low Vision / Colorblind

Cognitive

Design for The Experience

Flexible Options



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Assistive Technologies

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There is a gradient in types of accessibility and flexibility that could appear within an application, and should at every point in time include the perspectives, expertise, and known best practices from individuals who are disabled.

Design for Our Own Needs

- I want to be able to use the products I work on tomorrow, 5 - 10 - 50 years from now
- The most important aspect of designing for accessibility is that we don't consider these users as this finite "other" but as a gradient that we could potentially fit ourselves into.
- Good examples of this include sidewalk curbs, subtitles for movies or tv shows, rubber-based kitchen utensils, etc.
- In the end this flexibility benefits all users of an end product because it gives them the freedom and agency to choose their own form of engagement.

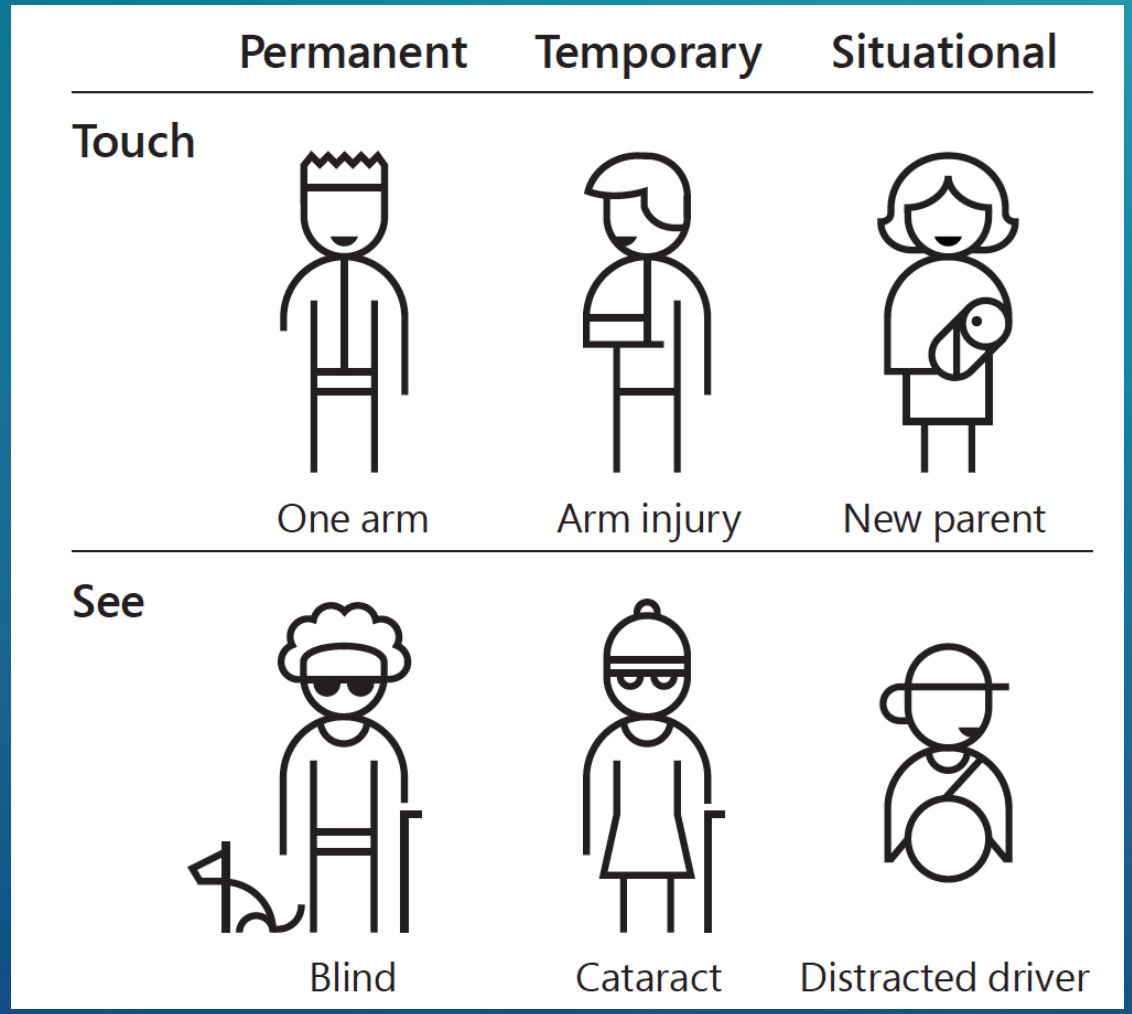
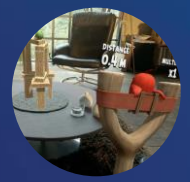


Photo courtesy Microsoft Inclusive Design Framework.

Topic Takeaways:

The real world is difficult, messy, and beautiful. Creators need to design against a user's critical faculties to convince them that a 3D digital content environment is believable.

In a constantly changing digital landscape we must be prepared. Creators need to design in harmony of the digital flexibility that computers provide us with physical presence afforded through face to face communication.



For our own futures, and others, we must remain flexible. Creators need to design with the understanding that users have to respect the laws of the physical world, even if our content does not.

Please remember to complete the session survey in the mobile app.

THANK YOU
YOU CAN *FOLLOW ME* @

ali_heston

Alexandria Heston

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Q&A

Four years ago I was sitting exactly where you are, wondering how I could get more experience in the industry. Here are my tips for you:

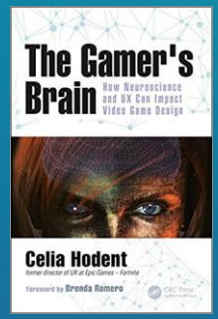
1. Participate in social media, go to conferences, go to hackathons, and network with industry experts to learn (not just to get a job).
2. Get Practice with the following systems
   a. **2D Design:** Adobe Illustrator/Photoshop, etc.
   b. **3D Art:** Blender, Maya, Sketchup, 3DS Max, etc.
   c. **Game Engines:** Unity, Unreal, etc.
3. Make Experiences. Build Apps. Ship Products. Then talk about them and what you learned from it.
4. Understand that real-world design has constraints and limits that depend on time, resources, and scope. The perfect app does not exist.

Basics of HCI:

The Design of Everyday Things
by Don Norman

User Agency in UX Design:

The Gamer's Brain
by Celia Hodent



Intro to VR/AR:

Creating Augmented and Virtual Realities
published by O'Reilly Media