Virtual Reality
Production & Design Processes

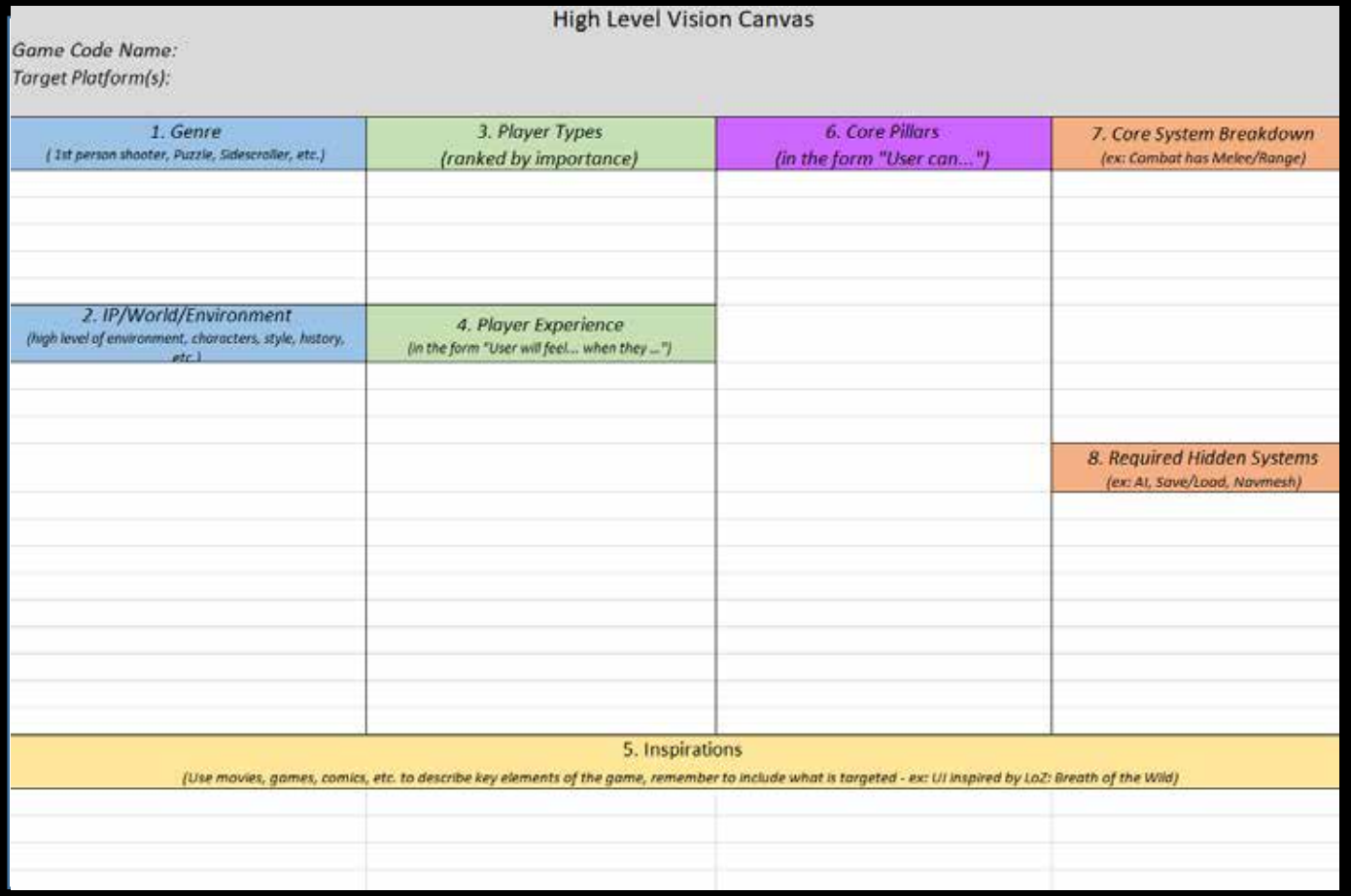
(For internal use only)

Now that you have your vision, what next

Review the features and systems that support them

- Core Pillars (features)
- Core Gameplay Systems
- Hidden Systems

These become your feature list



High Level Vision Canvas

Game Code Name:
Target Platform(s):

1. Genre (1st person shooter, Puzzle, Sidescroller, etc.)	3. Player Types (ranked by importance)	6. Core Pillars (in the form "User can... ")	7. Core System Breakdown (ex: Combat has Melee/Range)
2. IP/World/Environment (high level of environment, characters, style, history, etc.)	4. Player Experience (in the form "User will feel... when they ...")		
			8. Required Hidden Systems (ex: AI, Save/Load, Navmesh)
5. Inspirations (Use movies, games, comics, etc. to describe key elements of the game, remember to include what is targeted - ex: UI inspired by LoZ: Breath of the Wild)			

Simple Feature List

Reference #	Feature Name	Top Level Description	Priority	Risk	Comments
F001	Melee Combat	Primary combat system	High	Animations require modifications to the animation system	
				Camera system needs to pan relative to the attack type	
				VFX needs to differ for each weapon (may impact schedule)	
F002	Quadripeds	We want to support enemies with 4 legs	High	The volume of animations	We may be able to use the regular system and fake it
F003	Clouds	Add moving clouds to the sky dome	Low	New system	Nice to have if possible
				Players may expect weather	
F004	Cover	Ability to hide behind objects	Med	Objects need to be of certain heights, specs need to be created	Would make the combat system more interesting
				May add complexity to the combat swings	

Technical Design Document: Built from the Feature List

Breaks down the Feature List into technically appropriate segments

Specifics will be programming elements

- Systems (combinations of related tasks/features)
- One-off features

Clarifies the priorities, risks and dependencies

1	Ver 1.1	Modified 9/11/2018					
2	Ref #	System Name	Feature Supported	Feature Specifics	Priority	Difficulty	Risk	Comments
3	F001	Traversal						
4	F001a		Camera		High	Med	Low	
5				View Frustum				To Be determined
6				Viewing Distance (Scale)				Based on Frustrum
7	F001b		Controls		Med	Low	Low	Timing based on Environmental layout
8				Walk				
9				Run				
10				Jump				
11				Crouch				
12	F001c		Determine Player Location		Low	Low	Low	
13								
14	F002	Melee Combat						
15	F002a		Camera		High	Med	Med	
16				Over the Shoulder				
17	F002b		Controls		High	Med	Low	
18				Thrust				
19				Swing				
20				Counter				
21				Block				
22								
23	F003	Enemy AI						
24	F003a		Senses		Med	Med	Med	Based on Environment, layout and gameplay style
25				Hearing				
26				Sight				
27				Speaking				

Milestone Plan for each phase

Weekly or Bi-weekly set of tasks to be done by the team

- Tracked to:
  - Show progress
  - Expose scope issues
  - Determine risks
  - Ensure that the correct dependencies are being considered

Simplified Project Plan

Project:		Your Project name goes here							
Date	Ref #	Milestone	Milestone Goal	Task	Task #	Responsible Team Member	Dependencies	% Completed	Comments
1/30/2020	D1	Design					None		Don't forget the asset list for each feature
			Complete the High level design document	Create Vision Canvas	D1a	Joe			
				Create Tone Target	D1b	Sue			
				Create Art Spectrum	D1c	Sharon			
2/15/2020	D2	Design II	Finalize the high level design doc and add mid level design						
				Create Feature List	D2a	Sue	D1a		Need the vision doc to finish this
				Create Tech Design Doc	D2b	Sharon	D2a		Based on the Feature List
	F001	Feature 1 (Traversal)	Develop the core set of game elements to a demostrable state.						
				Character Model	F1a	Sue			
				Animation Set	F1b	Sue	F1a		
				Control Set programmed	F1c	Sharon	F1a, F1b		
nsert New Dates		Insert new Milestones		Insert New Tasks					Add new rows to include new milestones, add as many as you nee

Asset List

Details out the assets needed by each task and all milestones

Milestone	Feature Ref #	Feature Name	Asset	Asset Notes
Discovery				
		Art Design Document		
			Environment Art Examples	
			Main Character Examples	
			NPC Examples	
			Weapons Examples	
			UI Examples	
			Audio examples	
		Music		
			Score Style Example	
Pre-Pro1	F001a	Camera	None	
	F001b	Controls		
		Models	Main Character Model	See the art design document for main character style
		Animations	Walk animation set	should include the transition to run, jump and crouch
			Run animation set	
			Jump animation set	
			Crouch animation set	
	F003c	Melee Combat		
		Animations	Stab animation	
			Slash animation	
			Parry animation	
		Weapon Models	Cutlass	Similar to pirate weapons
			Broad sword	one handed
			Rapier	Musketeer style
		Audio	Stab animation sound	
			Slash animation sound	
			Parry animation sound	

Quality Assurance (QA) Test Plan

Details out the elements of each feature to ensure it is working properly

- As you complete each pre-pro milestone and Alpha the test plan becomes key
- Have someone not on the team, run through the test plan
- Remember to test integration, where system interact and work together
    - Most often failures occur here

QA Test Plan		Project:_____	
Date	Build #	Tester Name	
1/14/2019			
Test #	Unit/Feature	Item to be Tested	Success/Fail
1	*Main Screen*		
1a		Game Loads properly to Main Screen	
1b		UI elements change focus correctly	
1c		Choosing <Start Game> functions correctly by placing the player in the game at the beginning of the first element	
1d		Choosing <Exit Game> functions correctly closing out the game cleanly and places the player back in the platform interface	
1e		Choosing <Load Saved Game> functions correctly takes the player to the <Save/Load Game system	
1f		Choosing <Settings> functions correctly by taking you to the Player Setting System	
2	*Performance*		
2a		Game loading time is within spec (loads within XX seconds)	
2b		General game play shows no hitching or graphic errors	
3	*Save Game*		
3a		Game save time is within spec (saves within XX seconds)	
3b		Saved Game can be reloaded immediately	
3c		Saved Game Data is correct on reloading	

User Interactions in VR

Yasser Malaika (Valve)

Common Interactions are: Object interactions, system commands & navigation

VR related terminology for input devices	Maps to
• 6 DOF (Degrees of Freedom):	Within Reach
• Pointing	Reach & beyond
• Hand Control	Activation elements (buttons, swiping etc.)
• Ambient Invocation: things like voice	Indirect & infrequent
• Subconscious (your location in space, direction, rotation, etc.)	Background

- Affordance: aspect of an object that hints at function
  - Abstract affordances are important in User Comfort
  - In a person's mind abstract affordances will lose out to concrete affordances
  - The more real the look of an affordance the higher the user expectations
  - If a gesture has meaning it can override the kinematic issues

User Interactions

- The ideal interaction set
  - https://www.youtube.com/watch?v=FheQe8rfIWQ&t=43s
  - The goal:
    - Natural & intuitive, gesture driven interactions

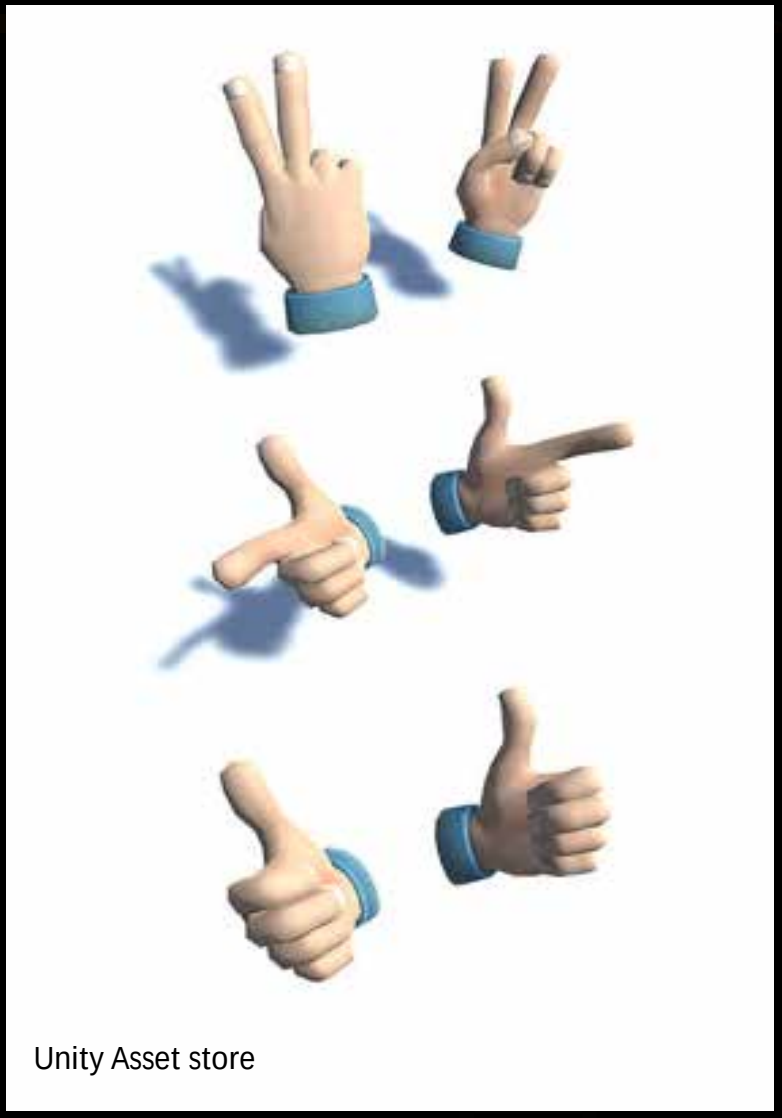
- Current state of interactions
  - https://www.youtube.com/watch?v=65u3W7wjXs0
  - The reality:
    - Limited input devices, limited range of motion, limited FOV, 2D interfaces in 3D
  - Another example: https://www.youtube.com/watch?v=FOTGv2WxhXQ&feature=emb_logo

Object Interactions: Selection

Yasser Malaika (Valve)

VR input systems map naturally to the human form

- Visual (looking around) maps to the head
- Movement maps to the legs
- Selection/input maps to the arms/hands
  - Uncanny Valley: When things appear human but not quite, it creates a revulsion in the person.
  - In VR it actually applies to yourself
    - Hands are the best example of this
- Don ‘t mix them up
  - Don’t use hands for movement
  - Head pointing/gaze for selection can be problematic
  - § There are exceptions, teleportation for example
    - § Technology is improving here



Unity Asset store

User Intent: How do we get their Input and give Feedback

Yasser Malaika (Valve)

Input devices are fairly consistent through the Vive, Rift/Quest and PSVR

- They offer 6 degrees of freedom and excellent 1 to 1 position tracking
- Give developers advantages
  - Able to target multiple platforms
  - Set conventions that will develop into standards
  - Allows the development cultural to borrow from each other quickly

There are a multitude of other devices out there

- Hand tracking
- Haptic feedback via gloves, and other wearables
- Foot devices
- Voice command systems

Object Interaction: Considerations when using the hands as input devices

Leapmotion.com: design best practices

Interactive elements should be scaled to the expected interaction (e.g. full hand or finger/pointer size).

- *One finger/pointer targets should be no smaller than 20 mm in real-world size.*
  - *This ensures the user can accurately hit the target without accidentally triggering targets next to it.*

Keep in mind that human hands naturally move in arcs, rather than straight lines.

Limit the number of gestures that users are required to learn.

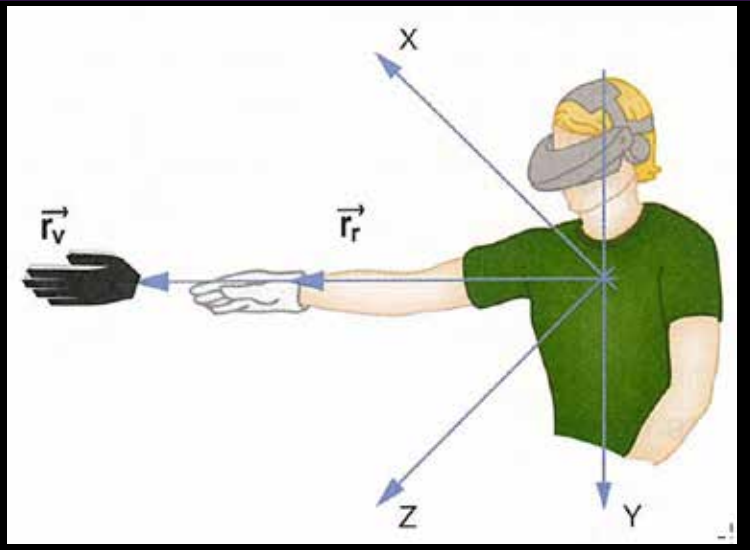
All interactions should have a distinct initiation and completion state.

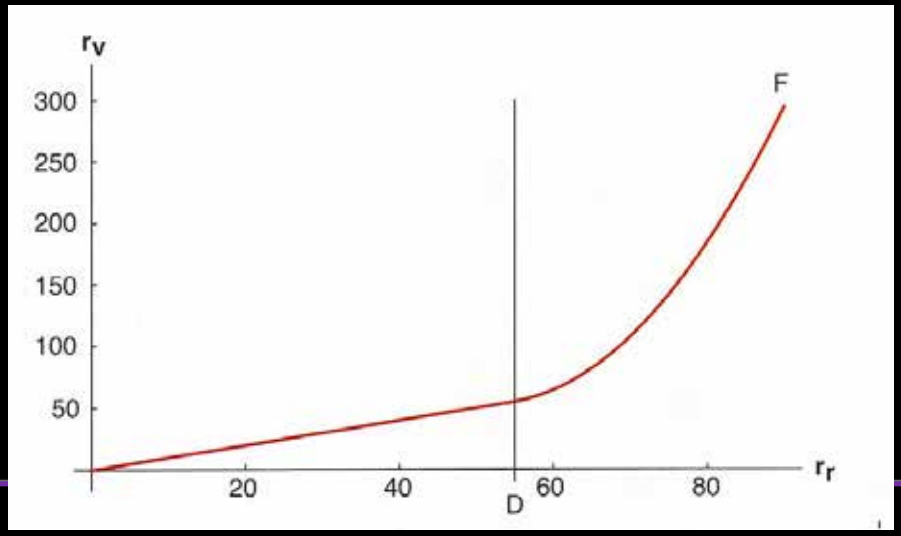
Ensure that users can interact with objects occluded by their hands.

Object Interactions: Selection methodologies

Arm Extension Selection

- Go Go Technique
  - Non-linear mapping between physical and virtual hand position
  - Local and distant regions (linear < D, non-linear > D)





Poupyrev, I., Billinghurst, M., Weghorst, S., & Ichikawa, T. (1996). The Go-Go Interaction Technique: Non-linear Mapping for Direct Manipulation in VR. *Proceedings of the ACM Symposium on User Interface Software and Technology,* 79-80.

Object Interactions: Selection methodologies

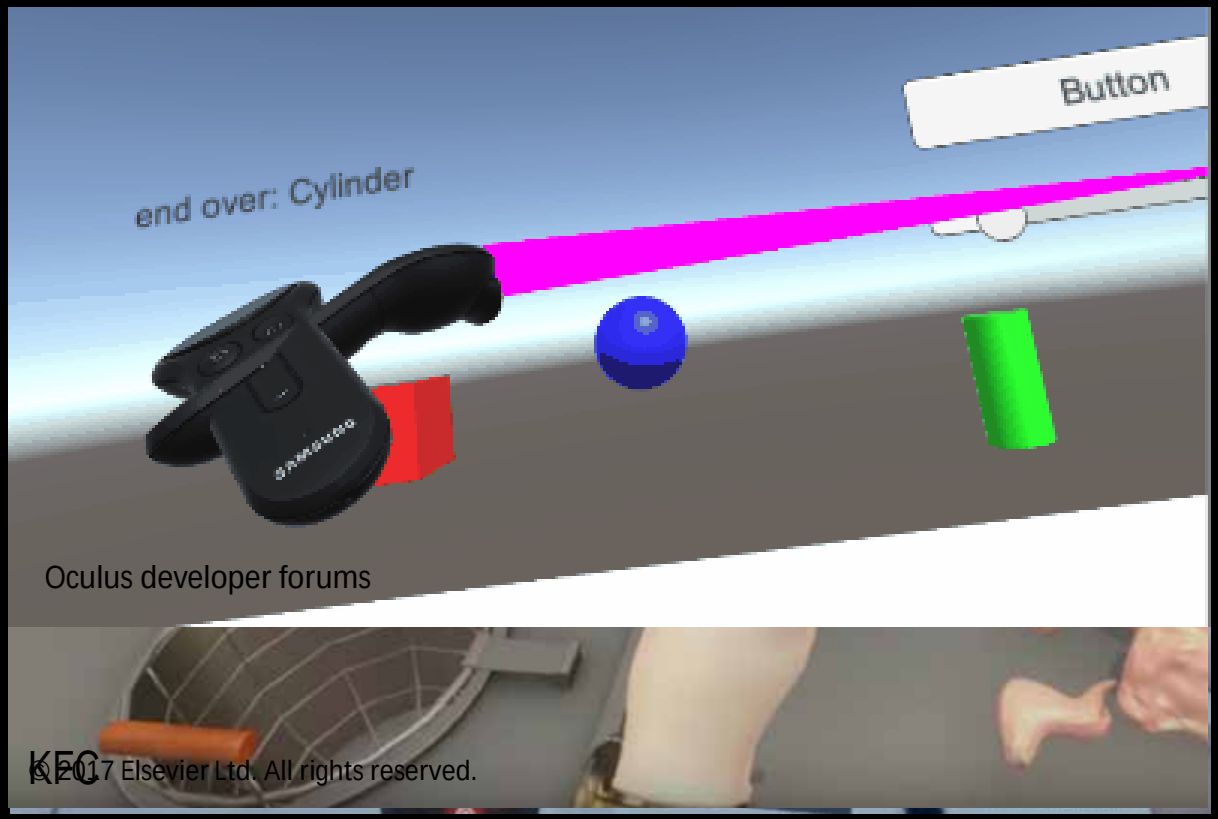
Touching

- Within reach (Local zone)
- Hands are naturally mapped
- You can also use a local pointer

- Occlusion
- Pretty much your standard 2D menu

Ray Cast (Mid/long range pointing)

- Accurate method to choose
- Paper Beast
  https://www.youtube.com/watch?v=R_ICEC30H3A
- Variants include
  - Cone casting
  - Snap to (for teleportation)

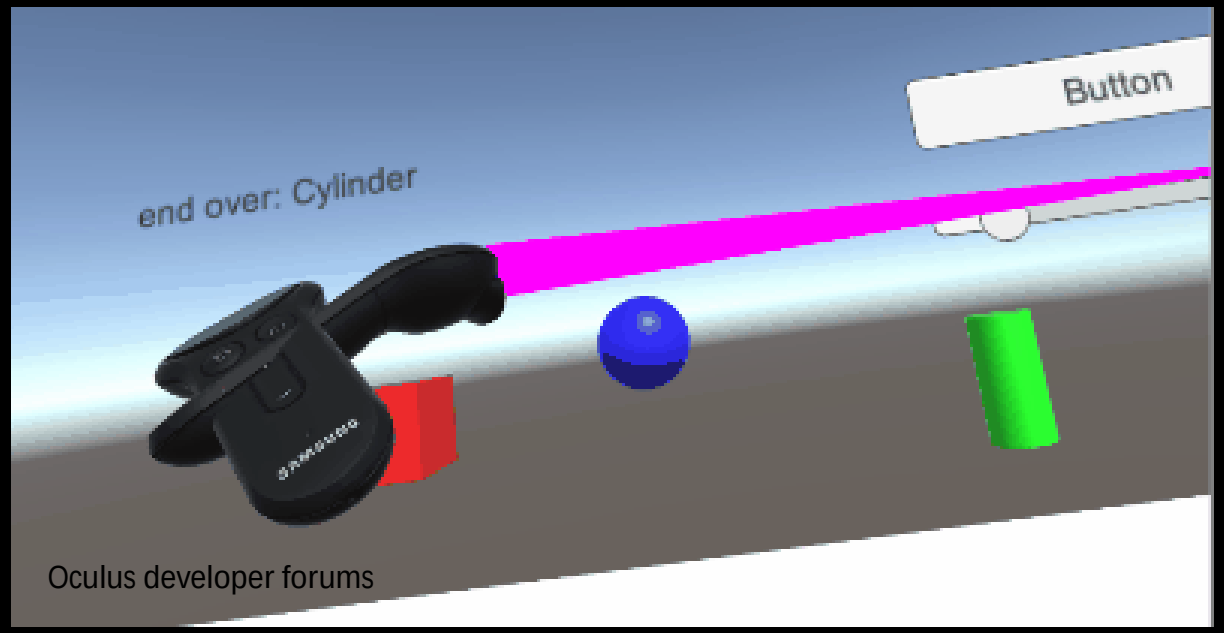


Oculus developer forums

Object Interactions: Selection Feedback

Feedback methods for selection available

- Graphical Change
- Voice
- Color Change



Feedback method for selection made

- Audio
- Voice
- Color Change
- Graphic Change

Object Interactions: Manipulation

- Manipulations, change:
  - Attachments
  - Position
  - Rotation
  - Size

- Examples: https://www.forrestthewoods.com/blog/the_vr_interface_of_dino_frontier/

VR Design Specifics: Examples

Hands & local interactions (reaching out to grab and touch):

Oculus' Lone Echo's 2: 1:40 https://www.youtube.com/watch?v=O6zIrKhNSM4

Affordances:

Job Simulator: Gourmet Chef https://www.youtube.com/watch?v=qZX_WVhL3eg

KFC Job Training: 2:00 https://www.youtube.com/watch?v=LritONRSiXc

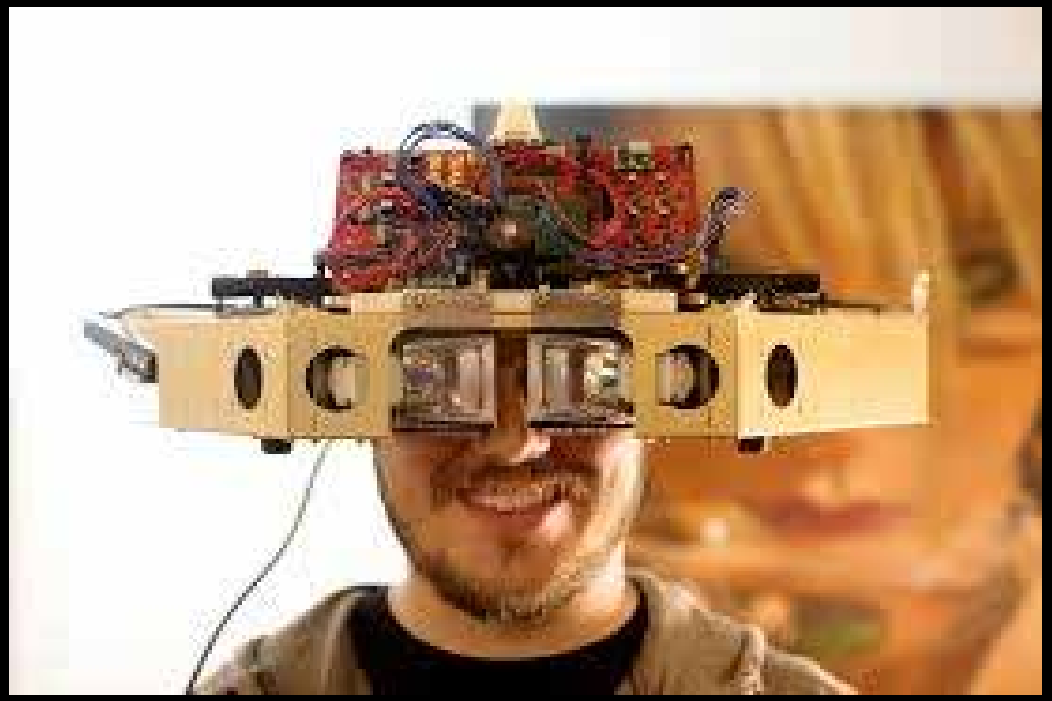
Augmented Reality Experiences and their Interactions

Window on the World (seen through a phone or tablet)

- Passive
  - Adding elements to a photo
- Active
  - Overlaying elements to the real world
    - Marker Driven
    - Non-Maker Driven

Immersive AR (seen through glasses or HMD)

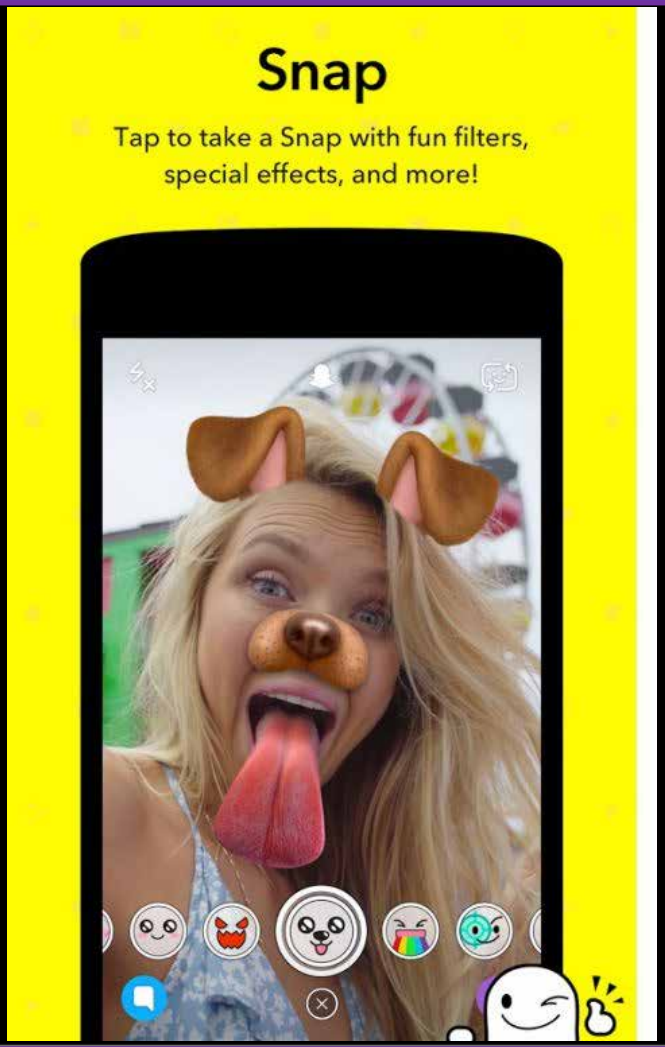
- Overlaid elements become part of the user's reality



Copyright Magic Leap: Prototype Headset

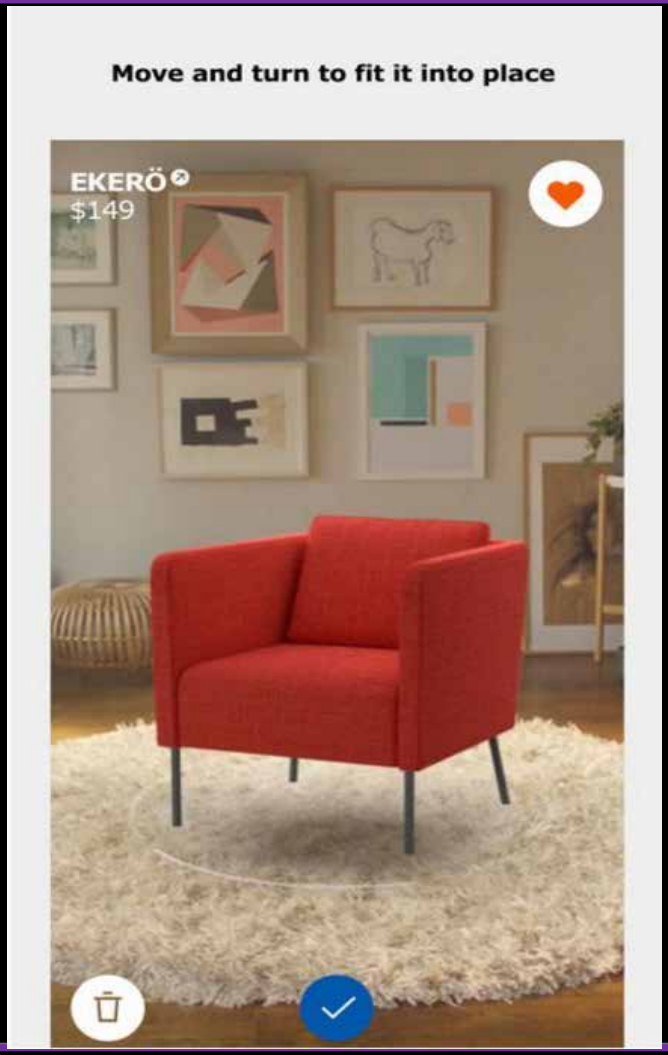
Augmented Reality UI: Passive WoW

- Audience is likely mass market
  - UI should be very simple
- Standard UI methods
  - Buttons
  - Swipes



Augmented Reality UI: Active WoW

- Audience is likely mass market
  - UI still needs to be very simple
  - Hide most of it, offer access to higher end users
- Markers and surfaces
  - Consideration for space and marker placement
- Standard UI methods
  - Buttons
  - Swipes
- Consideration for Error Detection
- Google’s path (Glasses to Lenses)



Augmented Reality UI: Immersive

- Very interesting opportunities
- Interface options are like VR
  - Hardware makes a difference
    - Hand and/or Eye Tracking
      - Interface via device
        - Tilt Five https://www.kickstarter.com/projects/tiltfive/holographic-tabletop-gaming
      - Interface via visual/auditory feedback
        - Hololens 2 https://www.cnet.com/videos/watch-microsoft-demo-hololens-2-at-mwc/
          - 3.55
      - Real World Tactile Feedback
- MR – interacting with an overlay of the real world https://www.youtube.com/watch?time_continue=10&v=sv6T-tg6RL4&feature=emb_logo