How to Design for Augmented and Virtual Reality

Getting in the space (3D UX)

Usability of virtual environments is essential. **Users should never have to figure out how to interact with VR interfaces**. While today's immersive experience design is a new skill for many practicing UX, anyone with a foundation of usability can easily transfer 2D thinking and skills to learn 3D UI design.

Contrary to what many developers, designers and UX people think, **much is known about 3D interface usability**. While new hardware is pushing new boundaries, there are usability principles and patterns that apply to VR regarding how to approach building effective navigation, collaboration and presence, for example.

To be clear, the goal of VR/AR UX is to **expand the "superpowers" of perception or imagination** (for both designers and users) and allow new ways to see, hear, feel and think about information, tasks and human experiences.

VR/AR extend users' imagination.
3D interaction Design involves a 1st person exploration/narration /perspective, with real-time interaction.
We are co-authoring. (normally it's 3rd person, and the users is following what was prepared for them)

https://www.foundry.com/industries/virtual-reality/vr-mr-ar-confused

Vision of VR = story inside you. Our experience must transform the user.
MR = mixed reality

They all imagine something that is not there
AR (least immersive), it's extending and enhancing what's there, overlay visualisation with real world)
MR (imagination) is manipulating it, extends what's here or not, enhance what's there within the physics of what's there.
VR (most immersive) is co-authoring interaction/narrative, imagine extend/enhance what's not there,

Augmented reality is an overlay of content on the real world, but that content is not anchored to or part of it. The real-world content and the CG content are not able to respond to each other.

Mixed reality is an overlay of synthetic content on the real world that is anchored to and interacts with the real world—picture surgeons overlaying virtual ultrasound images on their patient while performing an operation, for example. The key characteristic of MR is that the synthetic content and the real-world content are able to react to each other in real time.

with AR/VR we leave the world of logic and enter imagination.
Start with presence: you need to feel like you are somewhere.
Immersion is how deep you are AR > MR > VR

Presence is how "pulled in" you feel...It's the feeling that you are there, even when one is physically situated in another.
It needs place illusion and plausibility illusion.
You can quantify, measure your presence index.

Factors that can impact presence:
degree of control

immediacy of control
anticipation of event
mode of control
physical environment modifiability
sensory modality (it can't only be visual, you need more), **better if it is multi modal** (gesture, movement, speech, sounds) this adds a level of reality.

Fear is the easier feeling to trigger to motivate people.

Augmented: having a meshed relationship with virtual and real

- maintaining contact with real space
- using real space as a canvas
- working around the physics of physical spaces
- user objects/experiences feels meshed or fully augmented

First 30 seconds experience
B2B: business to business experience - it doesn't have to be boring
Narrative can focused attention.
Getting the first 30 seconds (F30) experience right. It's critical . Users will loose the plot or the interaction co-authorship. with VR/AR, the character is YOU.
Avoid: disorientation, low engagement and lack of affordance.
You need to stimulate the curiosity

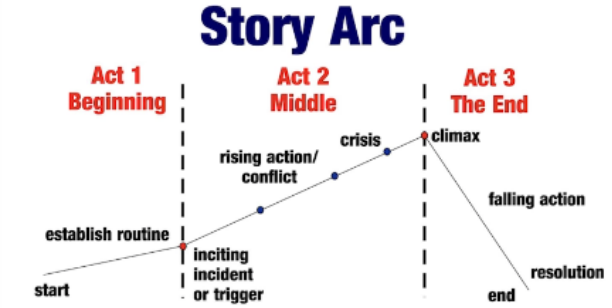
Exploring spatial interfaces
Less is more: don't use the whole canvas, focus the users attention.
Users should know what to do without help (**affordance**)
Designing for 360º could lead to neck stiffness, so need to be tested
Big icons floating on an overlay is simple and usually well received
Think of the scene as an affordance canvas
Menus, Dialogs, Visualisation pieces, affordance cues.
Just because you can doesn't mean you should use 360º
Study: audiences with a 90º range of vision could recall nearly every event in the story.
The more field you use, the less comprehension.
Foveated rendering: focus the user on a 96º viewing angle, and within this gives a higher resolution to the fovea angle (about 20º in the middle)

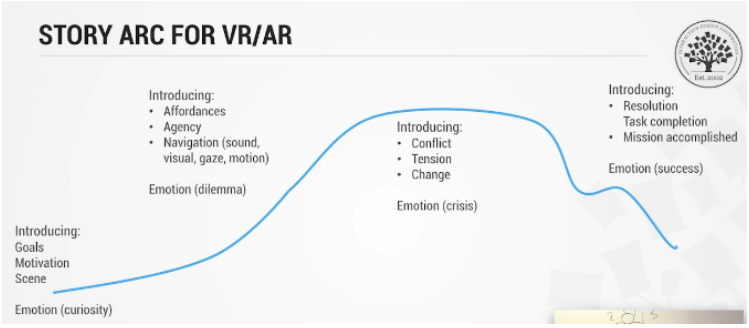
If you don't do that:
HDM limitation : having access to foveated rendering or inside out tracking
You should make sure your affordance Canvas is focused (less is more) and not 360 or always 360 (unless you want your user to look behind them)

Storytelling essentials
Story - Improvisation - imagination
Using narrative to **unfold the scene** design / affordance canvas
Narrative as the **task flow / story flow** guidance system
Using narrative mechanics to **shape the experience**:

- give cues
- spark emotions
- guide discovery
- induce immersion

This leads to **presence**





What: Design with storytelling (spatial, narrative, emotional)
Story as Design tool = narrative mechanics (impacting story flow, navigation and engagement).
How: story-sketching; improvisation

Start with brainstorming sessions (note cards, quick sketches and push pins) - capture first thoughts, ideas, images, and feelings about the story/experience you are creating.
Story sketch that up.

Improvisation essentials
Yes, and - meaning an actor accepts whatever is given to her by her fellow actor, at face value, **without changing it**, negating it, or disagreeing with it. She then turns around and **adds something** of value to what she was given. In an improv scene, this is how an actor creates stimulating action.

Complimentary + Open communication
Fluid listening and creating ...
Fluid (any direction) vs Flexible

Bodystorming: improvising everyday user scenarios (performances)... relies on interaction designers translating observational data to a simulated environment.

- get in the context where the task is performed. Use environment as a prop.
- acting out - with or without (participatory Design)

Embodied Design improvisation, which alternates rapidly and fluidly between storyboarding, Wizard of Oz physical prototyping, domain expert improvisation, video prototyping and crowd sourced experimentation.

- hands-on prototyping in your physical space
- act it out (have users walk through your scene)

Designers cannot design an experience in a literal sense. Rather, designers create an **experience frame** for people to shape their own experiences. This kind of framework acts as guidance for the participant to follow through with its affordances, constrains, goals, and mechanics.

Improv tips:

- withhold judgment (yes and...)
- build on the ideas of others
- generate a large quantities of ideas (like a design studio)
- free-wheel (= fluid - play "presents" game - designer pass an object generating alternative uses for a familiar object)
- identify a leader (facilitator or improv coach) - like a focus group
- brainstorm structure and place (use warm up improv exercises ; take breaks to review; focus on group dynamics not location, do it in any location)

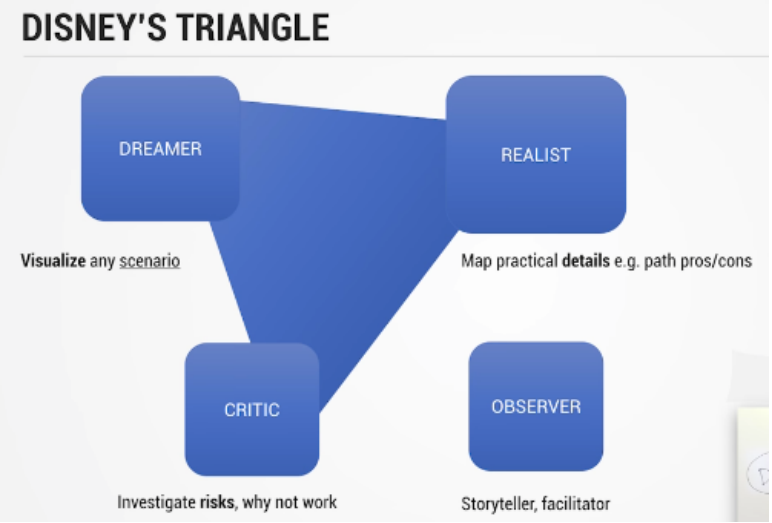
Using improvisation can enhance the effectiveness of brainstorming and imagineering.

Imagineering essentials

imagine + engineer = creative visualisation technique
intentional approach to creative engagement and delight
use of sound and motion
interact back with the user

Imagineering with immersive and mixed reality

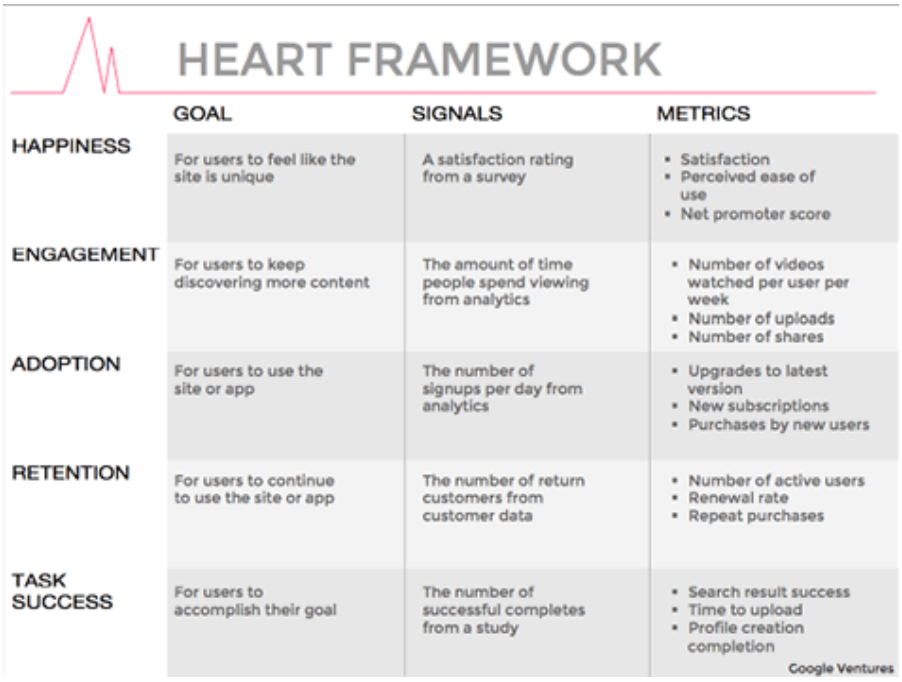
What: Design with imagination (spatial, narrative, emotional)
design for aid imagining (impact clarity, engagement and surpise)
How : use the Disney triangle ()... imagine what users will feel (map the emotions) that will delight, stop users, move them along.
Map the affordance need to help users move forward. Apply the Story Arc to the user scenario



Getting familiar with 3D UI's

Specifying your experience design plan

what is the goal of the experience (for you, for your user)
what are your HEART metrics
who is the audience (who are your personas)
what is the basis of your content experience
what can your users achieve
what are limits / boundaries imposed or technical that compromise or limit their experience, how will you cover for it
what's the narrative
what is the intended emotional experience, how are emotional interactions used
what's the intended social experience, how are social interaction or self identity used
how deep is your presence



The reality of your user's brain in 3D

Multi-modal interactions win.

Research shows:

- overloading one sensory system is a bad idea
- users perform better with multi-sensory UI's
- error handling and multitasking are easier with shared sensory inputs

Design for input methods:

speech, gaze, gesture, 6-dof controllers (degree of freedom) - gloves or direct interaction (leap motion controller)

can give a more intuitive and idrect connection with virtual objects.

3D space can overwhelm: (from the occulus research guidelines)

Gaze as a cursor but ... in testing, implementations of gaze selection without a cursor or crosshair have been reported as more difficult to use and less grounded.

Gaze as a cursor but with movement... this can allow the user to lose the interface and not realise it is still available and consuming their input, which can further result in confusion when the application doesn't handle input as the user expects (because they do not see a menu in their current view).

Think of users point of view.

Some questions to ask:

- is the user sitting, reclining, standing, or walking while using your experience?
- how does your content adjust to different positions?
- can the user adjust it?
- will the user be comfortable using your app?

Best practices

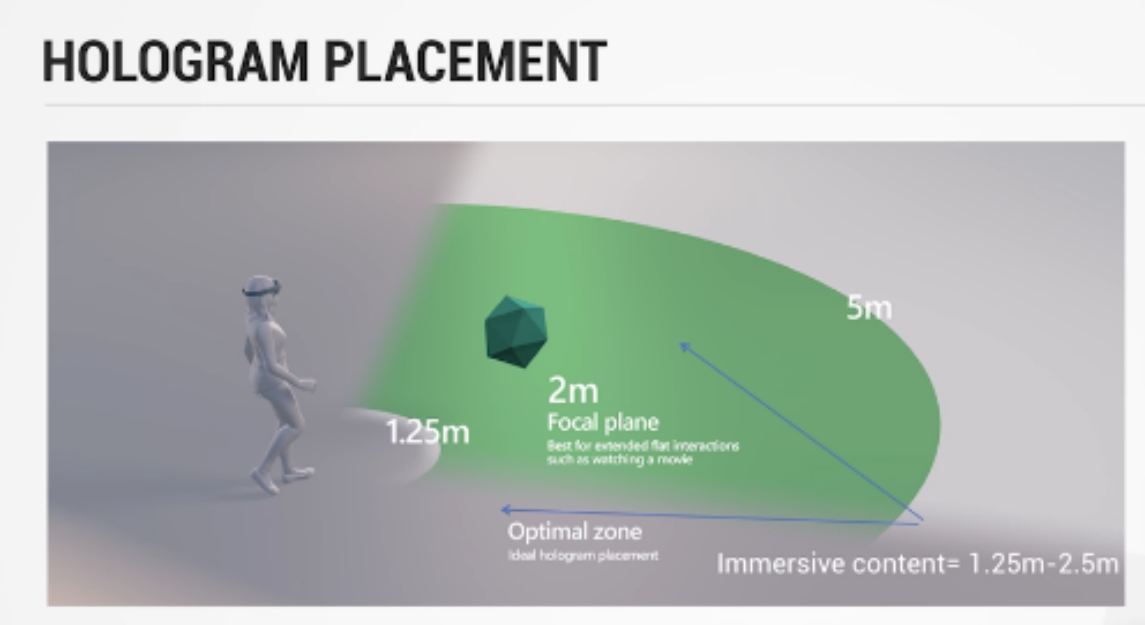
- the user is the camera and they control the movement, let them drive
- if you need to virtually transport the user, be sensitive to issues around vestibular discomfort
- users will react to large menus coming at them
- use shorter animations
- animate from down/left/right or fade in instead of Z
- slow down timing
- allow user to see the world in the background

What to avoid

- don't shake the camera or purposely lock it to 3Dof (only orientation no translation) it can make the users feel uncomfortable
- no abrupt movement. If you need to bring content to or from the user, move it slowly and smoothly toward them for maximum comfort.
- users are sensitive to acceleration (both angular and translational). Do not accelerate or turn the user's camera

Fit the field of view

- On hololens, holograms feel real when they fit with the field of view they don't get cut off.
- Users will move in order to see the bounds of a hologram within their field of view.
- Simplify your UI to fit within the user's field of view and keep your focus on the main action.
- For immersive headsets, it's important to maintain the illusion of a persistent
- You can use arrows, light trails, character head movement, thought bubbles, pointers, spatial sound, and voice prompts to help guide the user to important content in your app,



Locomotion and self motion

- always put the user in control of their movements; unexpected self motion is particularly problematic
- humans are very sensitive to the direction of gravity. Therefore, non-user-initiated vertical motions especially should be avoided.

For holographic devices - give the impression they're moving a small object in the scene. This effect can be achieved as follow:

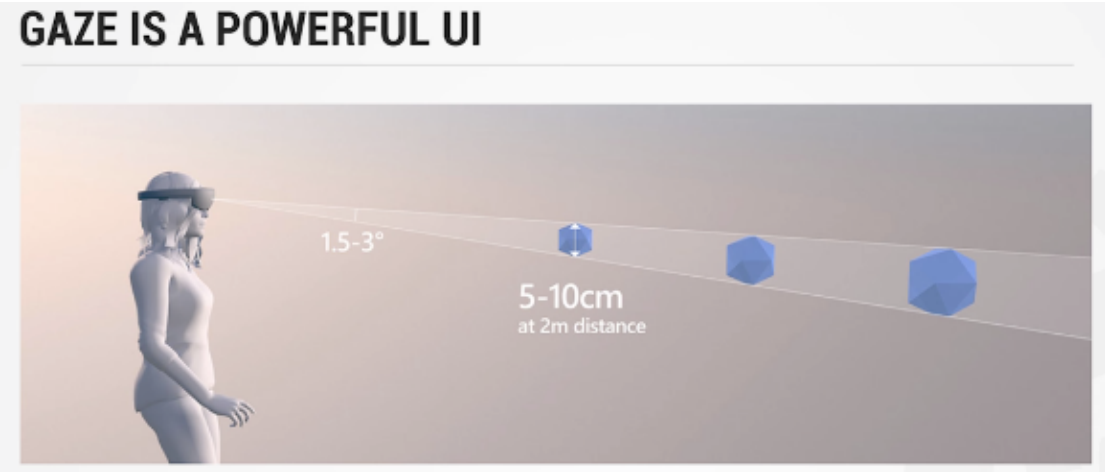
- provide an interface where the user can select a spot in the virtual environment where they want to move
- upon selection, shrink the scene rendering down to a disk around the desired spot
- while keeping the spot selected, allow the user to move it as though it were a small object.
- upon deselection, resume rendering the entire scene.

For immersive devices - mixed reality above disrupt immersion - instead: one trick for user locomotion in an immersive headset is the blink approach. This implementation provides the user with control over their motion and gives a brief impression of movement, but makes it so brief that the user is less liekly to feel disoriented by the purely virtual self-motion:

- provide an interface where the user can select a spot in the virtual environment where they want to move
- upon selection, begin a very rapid simulated (100m/s) motion towards that location while quickly fading out the rendering.

- Fade the rendering back in after finishing the translation.

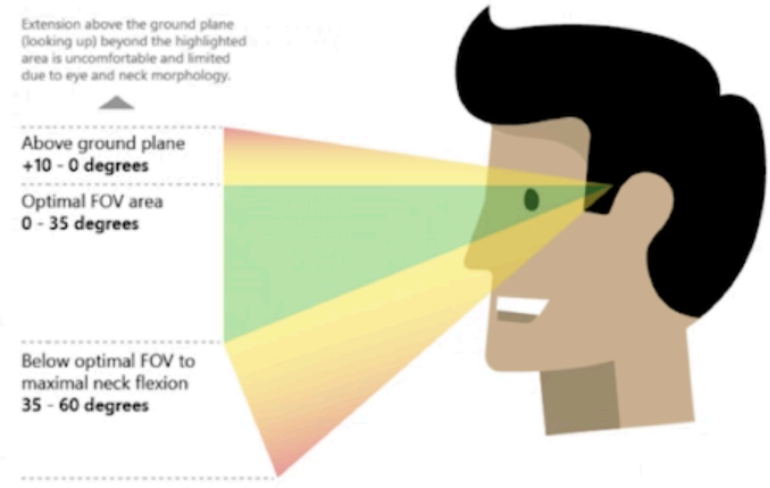
The reality of your user's brain in 3D: Gaze and gesture



Gaze guidelines:

- avoid gaze angles more than 10º above the horizon (vertical movement)
- avoid gaze angles more than 60º below the horizon (vertical movement
- avoid neck rotations more than 45º off centre` (horizontal movement)

The optimal (resting) gaze angle is considered between 10-20 degrees below horizontal, as the head tends to tilt downward slightly, especially during activities



Gaze tips:

highlighting a gaze target: make affordance apparent, providing some salient cue that an element is "active" (that the user is targeting it) is extremely helpful - this can include treatment like visible "hover" effects, audio highlights or clicks, or clear alignment of a cursor with an element.

Gesture: keep it **very simple,** you don't want them to learn a new language
Watch out for **'arm fatigue'**: muscle fatigue can accumulate when users are expected to keep a hand raised throughout the duration of an experience. It can also be fatiguing to require the user to repeatedly make air tap gestures over long durations.
We therefore recommend that experiences avoid requiring constant, repeated gesture input. This goal can be achieved by incorporating short breaks or offering a mixture of gesture and speech input to interact with the app.

Occulus touch: when touching the object, getting haptic and audio feedback adds to the immersion and creates a connection between the virtual and physical hands.
LeapMotion: hands as natural interaction.

Gesture tips:

- the higher the person has to raise their arm to perform an interaction, the faster that interaction should be in order to avoid fatigue
- raising your arm high enough that your elbow is no longer in contact with your body can be tiring
- interacting with a moving interface (for example, a UI attached to the secondary hand, like a watch) can be challenging and should be primarily used for quick actions
- some people have trouble visually reading depth, and may need some time and practice in order to learn how far they have to reach out to manipulate objects in VR.
- when sitting, reaching out towards objects that are too close to your virtual body can be challenging
- hands that visually look realistic can be creepy. They give people a feeling of being inside someone else's body. They can also break the immersion when those same hands go through what appears to be a physical object, like a table
- a familiar object often communicates how it should be picked up, held and used. For example, people expect to use a gun-shaped prop to aim at things
- a physical object may need to have different physics when being held. If you're holding a pen and go through the table, you probably don't want the pen to hit the table and bounce, but rather go through the table with your hand
- people lose track of their real world physical surrounding when in VR. Hand gesture can result in them hitting a wall or throwing the controller away
- hand gestures are inherently social. When your friend is interacting with virtual objects in VR, having a visual indication of what they're interacting with removes the potential awkwardness of seeing their hands move in mid-air with no understanding of what they are performing

The reality of your user's brain in 3D: Voice

voice UI - see it, say it

How using voice can benefit the user

- reduces time - it should make the end goal more efficient
- minimise effort - it should make tasks more fluid and effortless
- reduces cognitive load - it's intuitive, easy to learn, and remember
- it's socially acceptable - it should fit in with societal norms in terms of behaviour
- it's routine - voice can readily become an habitual behaviour

Voice also has some weaknesses

- fine grained control is one of them (for example a user might say "louder", but can't say how much. "A little" is hard to quantify. Moving or scaling things with voice is also difficult (voice doesn't offer the granularity of control).
- voice can also be imperfect. Sometimes a voice system incorrectly hears a command or fails to hear a command. Recovering from such an error is a challenge in any interface.
- lastly, voice may not be socially acceptable in public places.

Voice UI tips:

- use concise commands: choose keywords when possible. one syllable to avoid (not great for accent) two syllable or more.
- use simple vocabulary
- make sure commands are non destructive - make sure any action that can be taken by a speech command is non destructible and can easily be undone in case another person speaking near the user accidentally triggers a command.
- avoid similar sounding commands - avoid registering multiple speech commands that sound very similar.
- unregister your app when not in use - when your app is not a state in which a particular speech command is valid, consider unregistering it so that other commands are not confused for that one.

- test with different accents - test your app with users of different accents
- maintain voice command consistency - if "Go back" goes to the previous page, maintain this behaviour in your applications.
- avoid using system commands - the following voice commands are reserved for the system. These should not be used by applications.

The reality of your user's brain in 3D: What you (designer) need to know

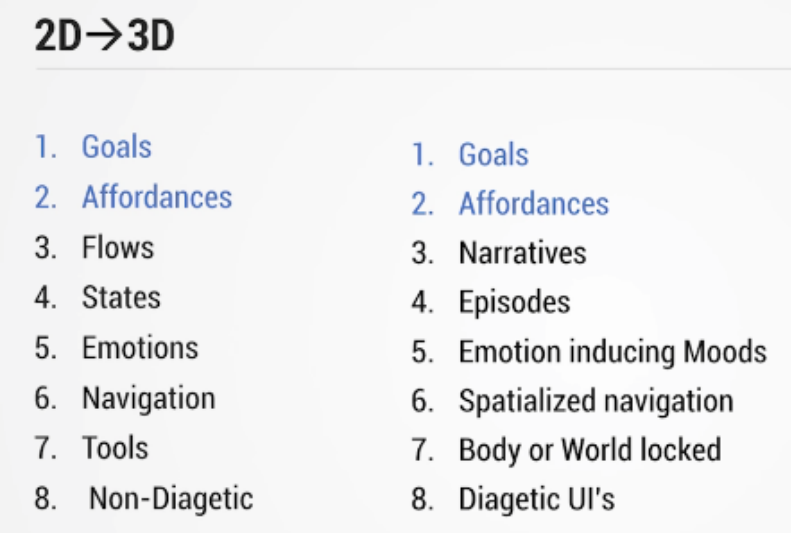
Believability is a core design principle in Mixed Reality
Less is more (depending on your PCT (persona, contaxt, task)
1. discovery (not too much)
2. menu density (less)
3. less movement
4. less visual input
5. less multi tasking

3D interaction designer bias

- your comfort vs your users
- your familiarity vs your users
- the same UX rules still apply

(Never assume; user data to decide ; Empathy as guide; test, test, test)

Transitioning From 2D UI's to 3D UI's



The big shift is also moving from 3rd person experiences to **1st person experiences**
In 3D there is no canvas, no frame, no keyboard/mouse
Sound as part of the environment
Speech
space has relationship
no familiar spaces (or are there?)
view change (based on user's head movement) and different requirement for user comfort (based on the properties of the devices and the human using them)

VR/AR emotions - common:

Surpise is the number 1 emotion
discovery - intrigue , excitement
suspense, thrill
delight, pleasure

Tag along tool that stays with you is possible in VR, or **body lock tool**.
non-diagetic UI = overlay (soundtrack, narration (feels 3rd person))
diagetic: embedded (into world, story, task) - increase immersion (feels 1st person) (for example footsteps or birds flying or voices)

a diagetic UI: a UI element that gets fully integrated with the fictional setting.

For locomotion, provide an interface where the users can select a spot in the virtual environment where they want to move.

Design 3D story flows

Storytelling in VR & MR: 7 Essential Musts

- craft your story arc
- use story structure
- determine agency limits (god or not?)
- develop empathy (allow the user to deepen in)
- determine immersion with story vs world/hologram (using space wisely)
- focus on intentional interactions
- design deliberate first person vs third person experiences

Empathy vs interactivity

(TED talk : How VR can make the ultimate empathy machine)
I felt most empathy were ones where I'm merely witnessing a scene unfold as if I were a ghost because there's a different quality of experience when I'm being directly addressed as a character in the story.
There is a tradeoff between interactivity and empathy. Not having my ego involved in the story does indeed allow me to receive the story of other characters without worrying how I should respond. There's nothing to do but just receive the story in an observant passive / ghost without impact" experience.

Story arc fundamentals

Plot is defined as the events that make up the story, particularly as they relate to one another through cause and effect
Arc is defined as an extended or continuing storyline. In other words, the driving force that runs throughout the book
The purpose of a **story arc** is to move a character or a situation from one state to another, in other words, to effect change
Where you have **change**, you have **conflict.** Something happens to ignite that change.

Developing your story arc:

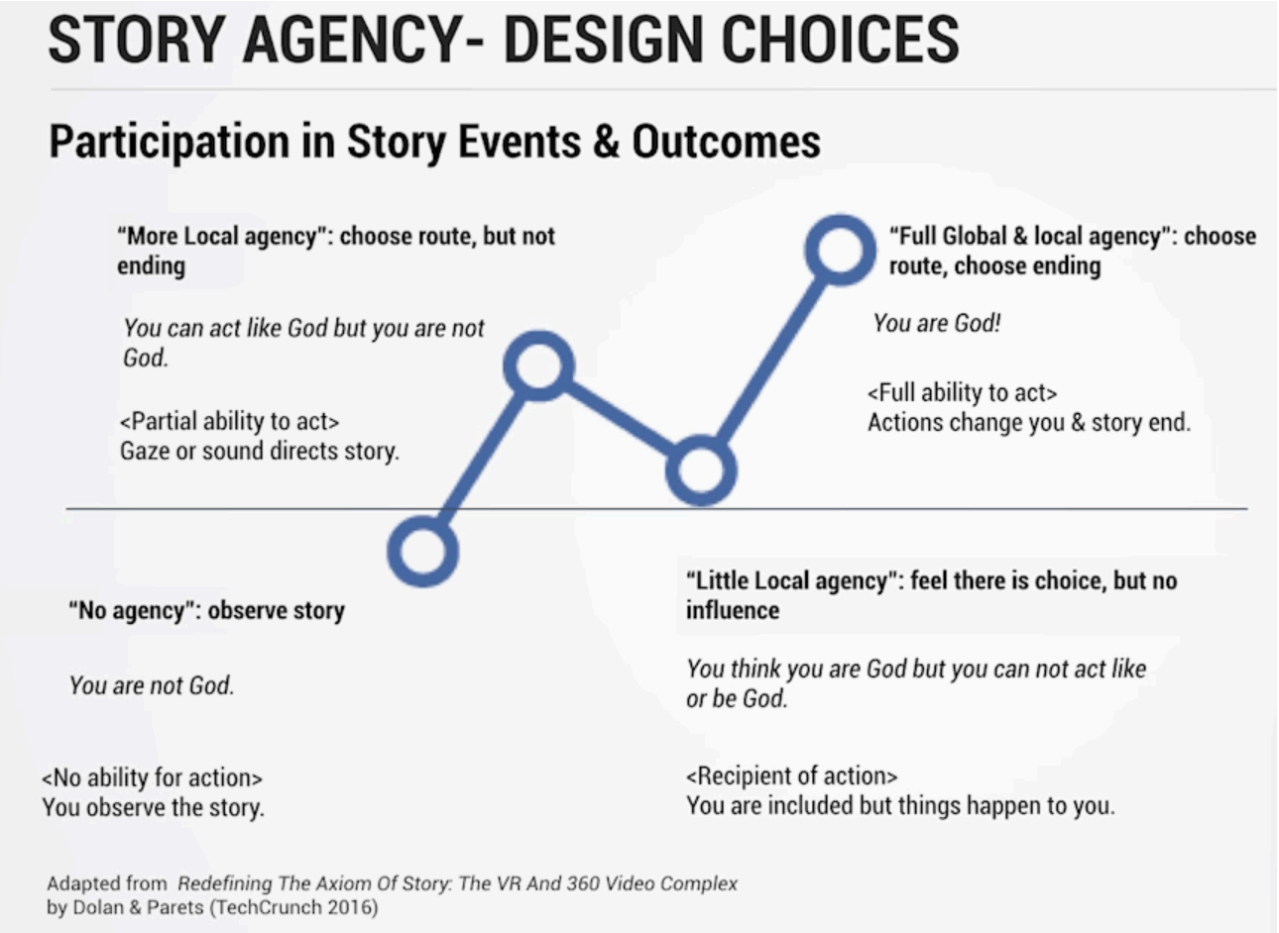
5W's Who, what, why, where, and when + change
Interaction Design essential for story flow:
goal orientation: What do they need to know
procedure orientation: how do I make the story unfold
feedback: confirmation of progressive or regressive actions

Use Narrative Essentials

Gaze Voice Gesture, for Presence Immersion and Engagement

need to level the Agency (how much control the user has) and Diagetic (how immersive the narrative action/character are)

Agency: is like letting users adjust the room temperature (impacting the whole house or a room)
Global agency means impact an episode; Local means impact a scene.



consider the story beat (something is changing (action-reaction)
every affordance should be there to support user expectation.

Plotting Asynchronous Narrative

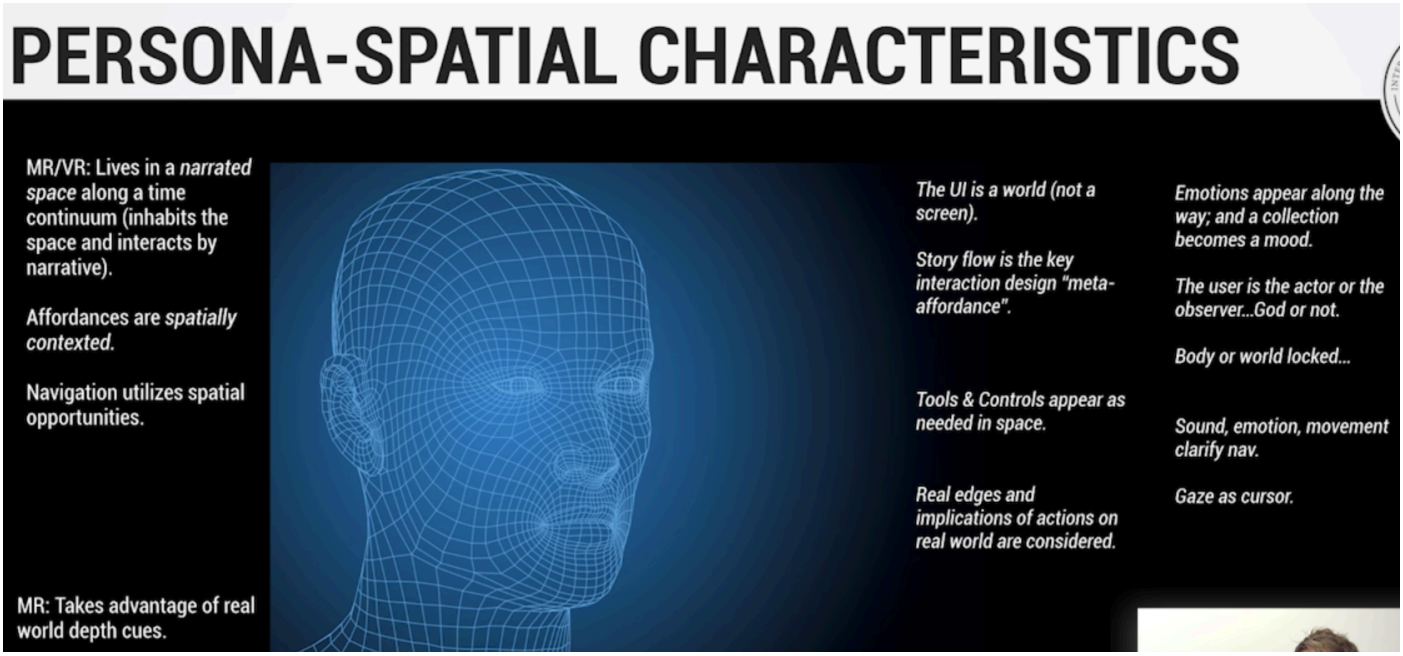
Don't assume it's a big flow, as the user might be interrupted in the 'real' life.

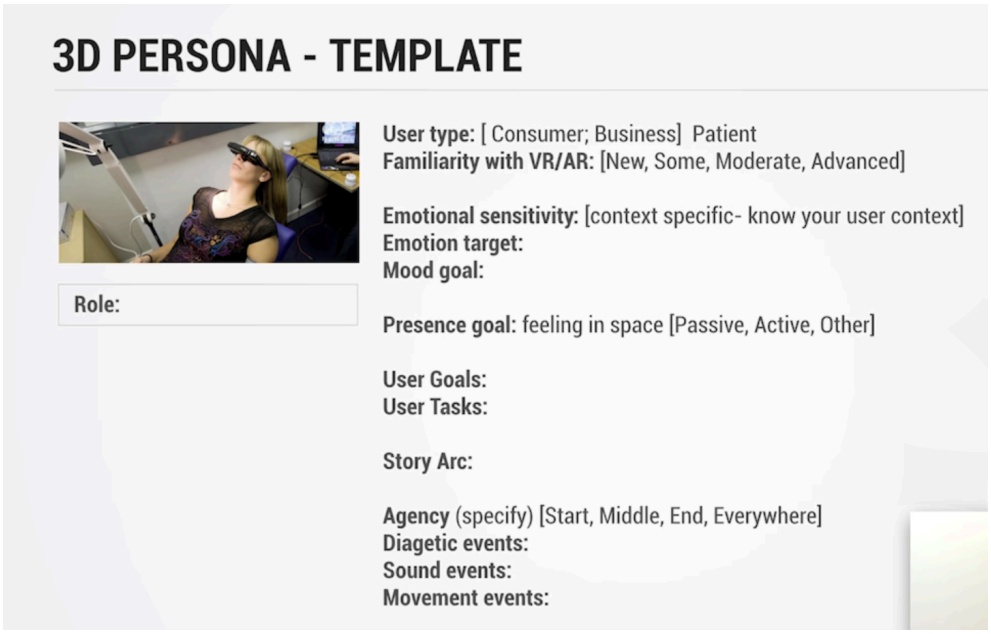
- AR by it's "reverse immersion" can mean story-telling skips a beat from scene/action to scene/action
- AR may have short "hits" and tends to not sustain episodes (time length)
- MR is changing this but still, careful not to absorb users too much or they might get into physical or social danger

Black outs / gray outs in VR: game can crashed or bug

Developing Your Personas

One thing that is important is to use role-based personas and define spatial characteristics
Personas provide empathy, insights and design direction, to get in the user's brain in 3D



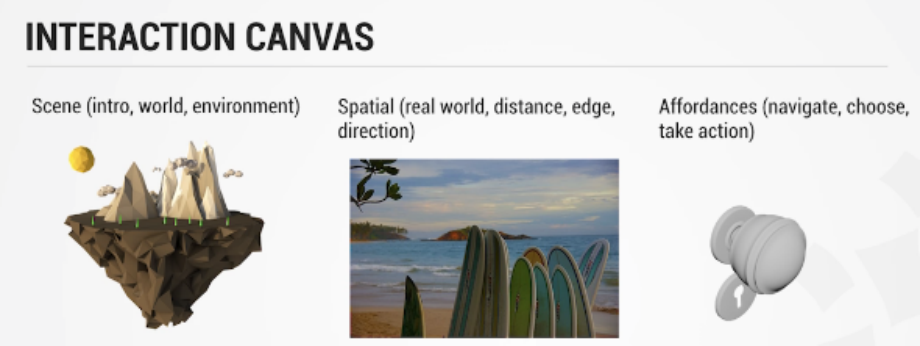


Designing Around Hardware and Technology Limits

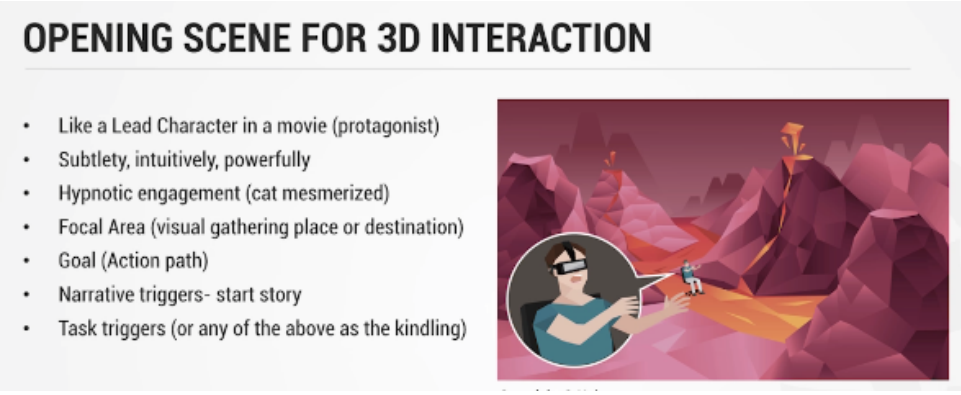
To meet hardware limits, Interaction Designers should pay attention to the platform constraints and follow UI style guides

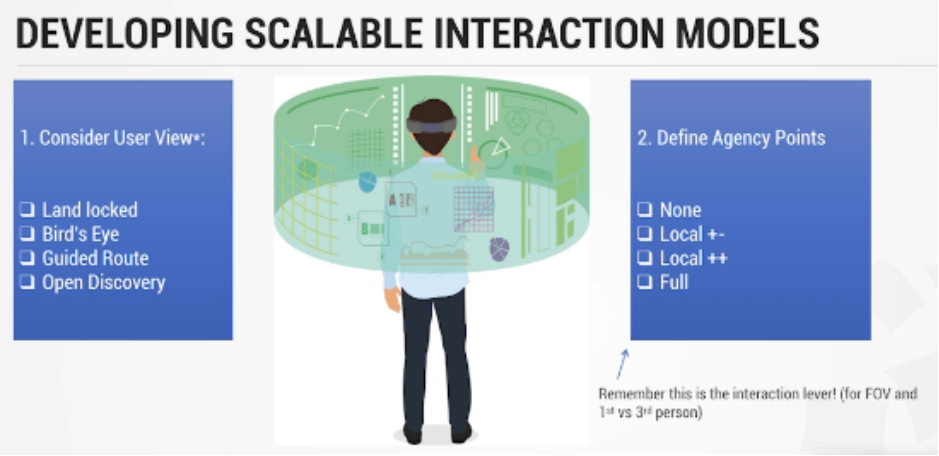
How to wireframes 3D interactions

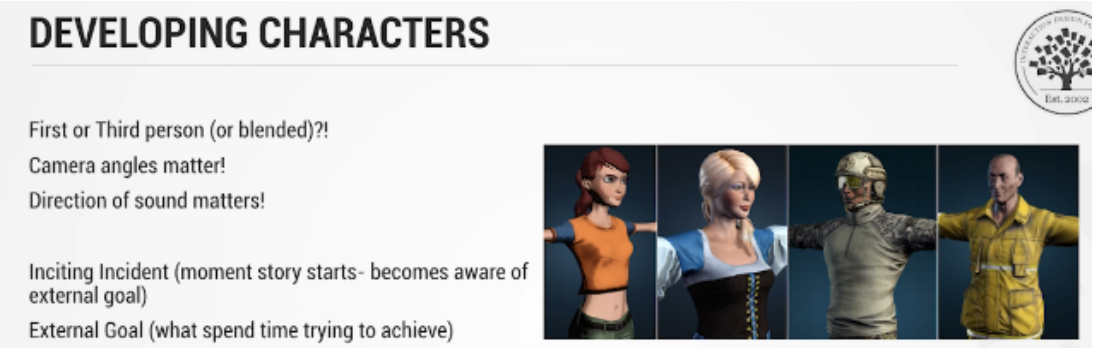
Developing Your Interaction Models for VR, MR, AR

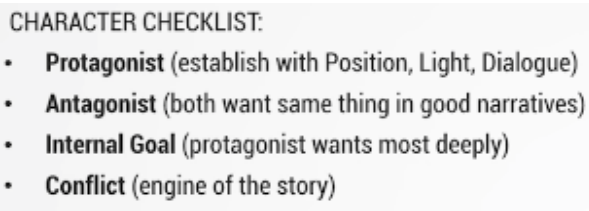


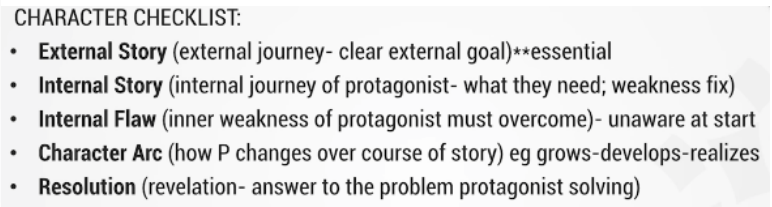
How the scene opens, what users can do and how the world or narrative fits the space, is what is important in designing 3D interaction.









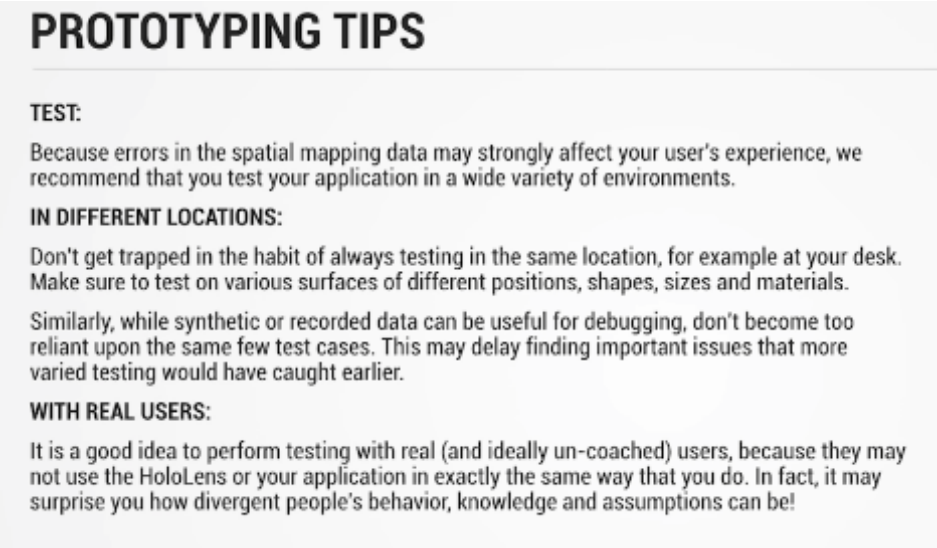


Holographic Interface Storyboarding Techniques
4.2 à faire + video 22min

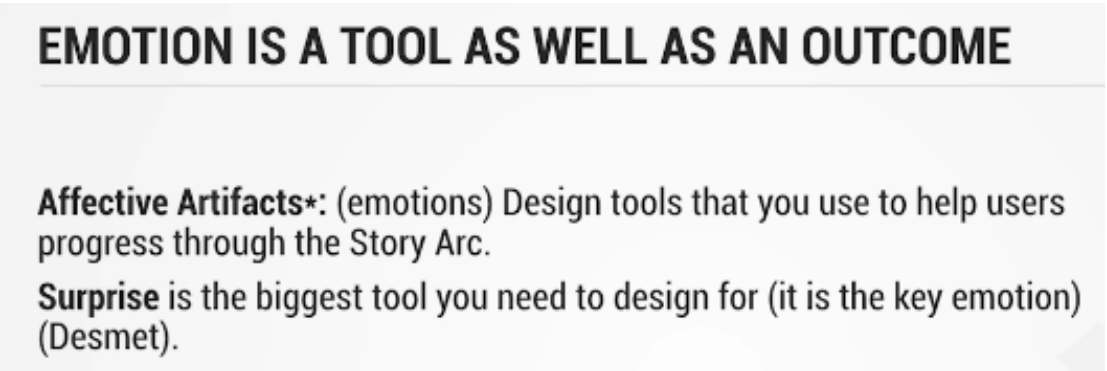
Wireframing Immersive Interactions 4.4 1h
The 3 factors that deepen **immersion** are: **emotion, sound and movement**.
Get physical for concepting. Gives you a better feel for the space for example. Walk the scene, use props, move around.
Do some **quick testing** with users:

- give the user scenario
- ask them to perform the task
- think aloud
- observe and incorporate in your prototype

Get out of your comfort space



Emotion:
pros: aids immersion, deepens presence, diagetic (presence) narrative aid, story arc essential, mood inducing



Sound:
pros: can be a navigation aid, aids mmersion, deepens presence, diagetic, ambiance, believable, mod inducing
cons

3D spatial sound:

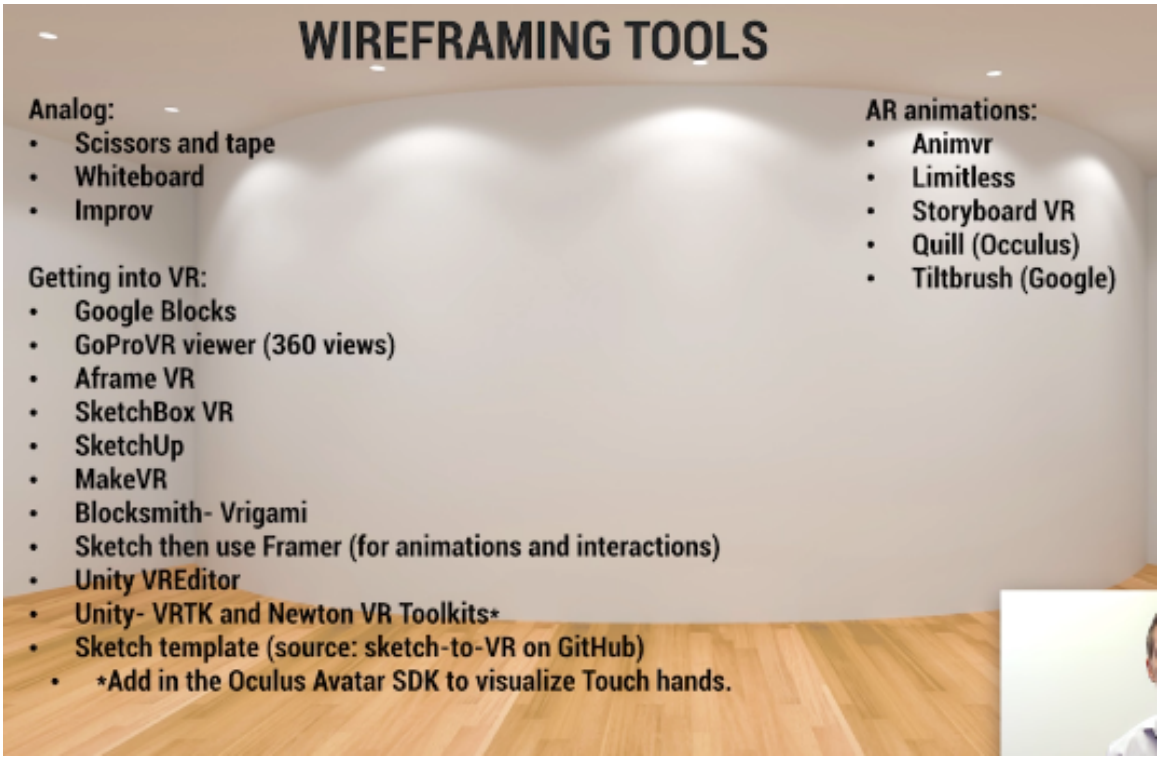
- important for immersion
- deepens presence

- important for navigation
- cheap UI aid for graphics trade off

Movement:
pros: part of navigation (eg teleportation), immersion (walking), change of direction, 6 DOF

Haptic feedback (force on a glove for example)
- can anchor body awareness
- touch controller feedback eg vive controller (like mouse over - press release)
- help improve spatial awareness (give a little bump when you land after jumping, or vibrate when something is bad..)
- free up or focus auditory and visual channels
- trigger a "pulse" (rythm)
- vibrate like a phone

3D Wireframing Tools



Social VR and collaborative virtual environments

Important Social UI Characteristics
social signifiers: is either created or interpreted by people or society. Signifying social activity or appropriate social behaviour. This is different to an affordance. Bookmarks

social focus: informal coordination point. Consider the role of focal points in coordinating behaviour. No rule or enforcer. Set expectations of cooperation, informal organisation. This differ to orientation or focal points.

social behaviours: do something with social consequences for example cloak or invisible to that user, profile like interest, follow or unfollow, fly together, anywhere chat (any space or anytime, trade contact token, indicate mood (glow orange), shared context (artefacts), awareness of others (status), negotiation and communication (avatar gesture, gaze, eyebrow, head nod), flexible and multiple viewpoints (role-switching)

social tasks: do something for the community (get points) do something together, indicate understanding via collaborating, get help from info point or another, help another,

social presence: being together with another, avatar (seeing each other gives social sense), enhance with intimacy (eye contact and physical proximity) and immediacy (psychological distance between sender and receiver), verbal and non verbal communication, feeling want to or safe to socialise, privacy in VR.

Communication, Coordination and Collaboration

Communication: social effects, what group effect or social behaviours accompany an activity. What are natural social behaviours?
Collaboration: emotion effects: what makes a task compelling, how can the group or team solve a problem, achieve a goal and sense of accomplishment?
Coordination: what tasks, artefacts or work are shared? what needs to be done and by whom and when>

Communication: chat, verbal, nonverbal, emotion, mood
Coordination: goal awareness, shared goals, tasks, problems, shared artefacts, shared status, story flow
Collaboration: clear boundaries, what input expects and from whom, when they had to expect it, when deliver output and timing, immersive collaborative story, use both speech and gesture rather than speech alone as the interaction modality for faster task times.

Tips for Better Social UX

1- Match real world social behaviours, don't make it up.
2- Align with relevant social triggers. Find the social/emotional charge that is relevant to your field
3- support social interactions by design: be socially sensitive (don't be a creep), BigScreen's Personal social bubble avoid avatar collision (goes invisible when getting close)

SDK: software development kit.

Bringing it all together

Designing Your 3D Experience

3D UX Checklist

- Experience Design Plan
- Heart Metrics
- Scene approach
- Scene as affordance canvas
- Menus
- Dialogs
- Visualisation pieces
- Affordance cues
- First 30 seconds experience
- Story Arc, story flow (narrative) story beat (action-reaction)

Give cues
spark emotions
guide discovery
induce immersion

Think about the users point of view

- is the user sitting, reclining, standing, or walking while using the experience?
- how does your content adjust to different positions?
- Can the user adjust it
- will the user be comfortable using your app

Define persona, context and tasks

Goals
Affordances
Narratives
Episodes
Emotion inducing moods
Spatialised navigation
Body or world locked
Diagetic UI's

7 storytelling Musts:

- craft your story arc
- use story structure
- determine agency limits (god or not)
- develop empathy (allow the user to deepen in)
- determine immersion with story vs world/hologram (using space wisely)
- focus on intentional interactions
- design deliberate first person vs 3rd person experiences

Consider your physics (real and emotional) , sound and gaze

Interaction level
direct interaction = direct manipulation (don't make me think principle)
indirect interaction = more steps
semi-direct interaction (blends)

Key questions:
What is right for the task, for the flow ? for the story flow ?

Body movement:

- Expansive body positions (open limbs) activate hormones
- Restrict movement or not? (diagetic)
- How distracting is the movement to engagement, immersion, presence?
- ease neck strain

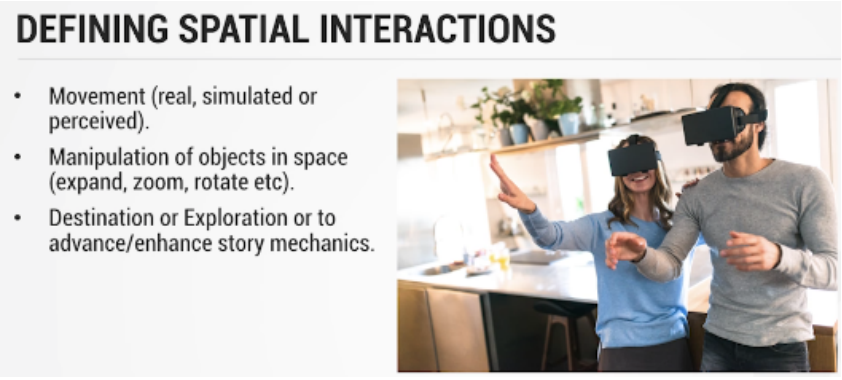
Remember hover, pointers and hints
Be forgiving with selecting an object (area where you can pick it or select it for example)

Quick 2D mock ups:
in Illustrator:

- make a canvas 360cm wide, 90cm tall
- put on canvas 50cm radius cylinder
- tranpsarent background - rectangular image
- uses CSS£D transforms

Sketch but think spatially

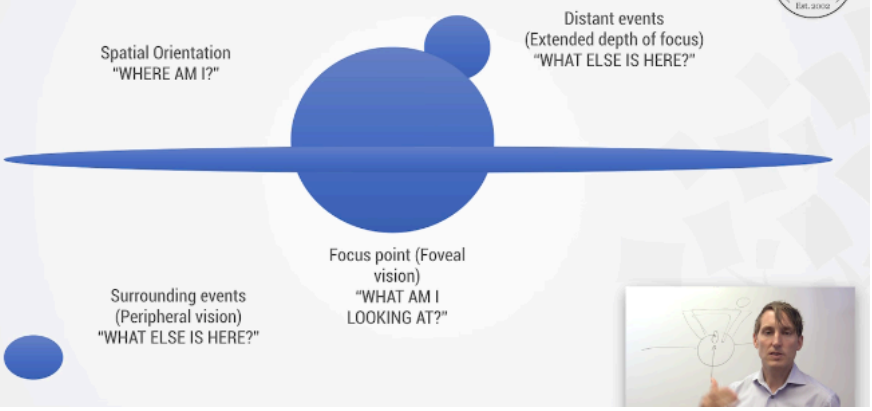
Defining Spatial Interactions



spatial orientation - basics
Giving users cues in the space for navigation, manipulation and discovery will help user with spatial orientation in 3D.

- Spatial cues /perception
- spatial navigation
- impacted by gesture, gaze, action (tap, hold, manipulate)
- affordance (move or not)

SPATIAL VISION FOR UI EVENTS



SCALE QUESTION

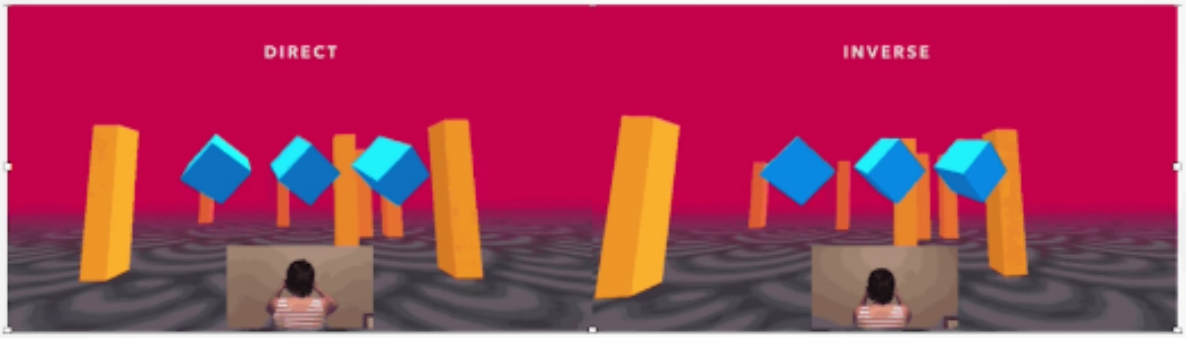
Scale: grow or shrink an object equally in all directions (ie. enlarge or shrink something).

- Room scale?; Standing or sitting?
- Scale and distance are difficult to perceive in VR (MR is easier, but...)
- Face the user? (Pinch and zoom eg reading)
- Shrink an object (or viewpoint)
- Guide eyes/mind (Depth context)
- Lighting/Shadows (object shape detection)
- Opacity (use Fesnel effect– if facing= less opaque)

Smooth surfaces will present a stronger Fresnel, totally rough surfaces will have no Fresnel.

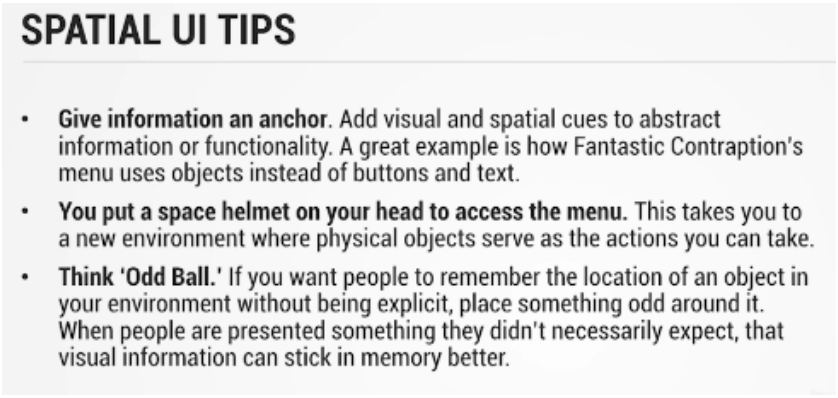
INVERSE SCALING

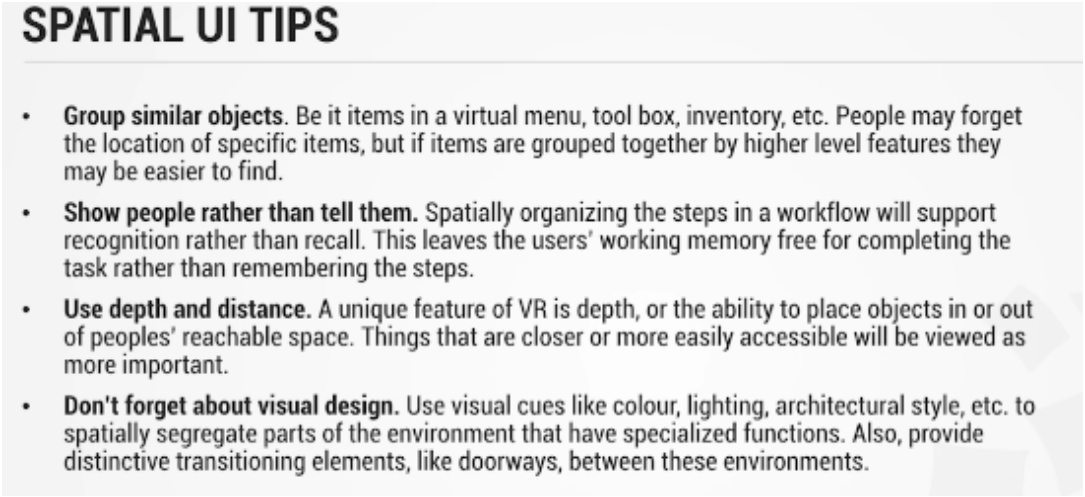
How do you look behind an object in VR if you can't walk around it?



Direct means that when you look right, the right blue box comes towards you (use the above image as a reference). When you look down, you see the bottom of the blocks. It is as if your head is a direct controller of the boxes.

An inverse connection means that **when you look right, the left box comes toward you.** Looking down, you see the top of the blocks. It is as if you are walking around the object, looking at it as you move.





Spatial UI Considerations

Space and UI orientation:
give affordance cues
give directional cues
give grounding elements (eg table)
give controller guidelines
give presence cues (mirror can be one)

Obstacle: judging closeness
figuring out how close object appear to the user
what is your intended viewing distance
what needs to be first and what is background
what's in view and what's out of view

Spatial orientation
hologram behaviour
game mechanics

WEB VR issues (Mozilla)

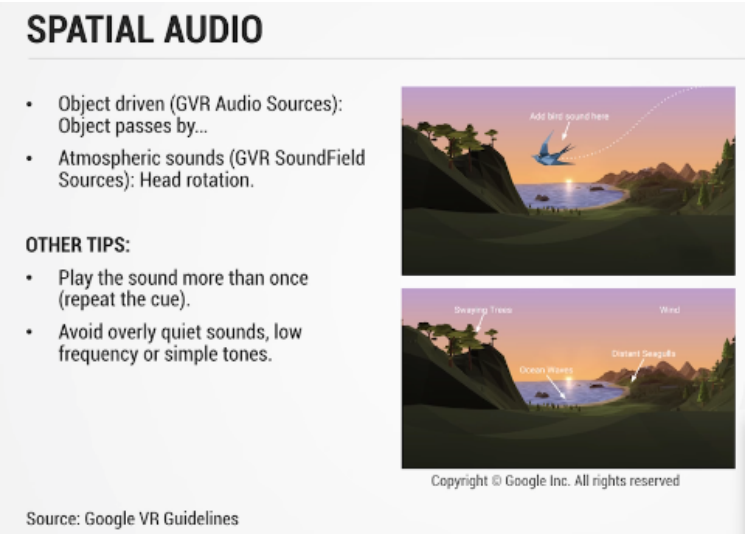
sitting or standing
headset on/off / mouse / blend
transitions between 2D and 3D content
overwhelming users with web-made content
caution of designing on the desktop can bias content / 3D UI

need to be responsive WebVR content creation is a must
much more inclusive of any headset (some don't support it)
design spatially sensitive content/ text

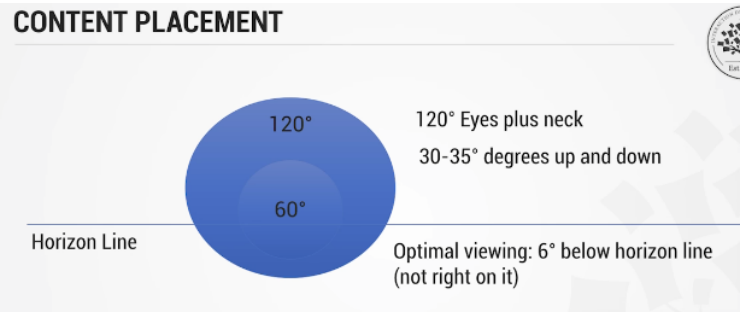
3D navigation

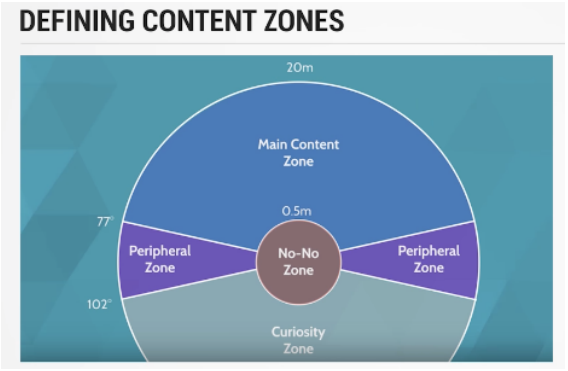
- break into zone of action
- way finding aids
- you are here maps or scaled view of large environments
- place landmark strategically
- minimize sickness inducing effects
- use characters to point the way
- use edges to deter travel
- use grid-like patterns for spatial organisation
- offer user placed markers (breadcrumbs) ; trail marking
- avoid showing legs (awkward movements)

Skeumorphism as default for navigating
don't overdo menus just because we're in VR
gaze time and fixation
sitting better fro higher concentration (mousing, typing, math), problem solving, and memory
standing better for focused tasks (highly verbal tasks) insight/learning
transitions are important
Radial menus are ideal



Designing Immersive Content

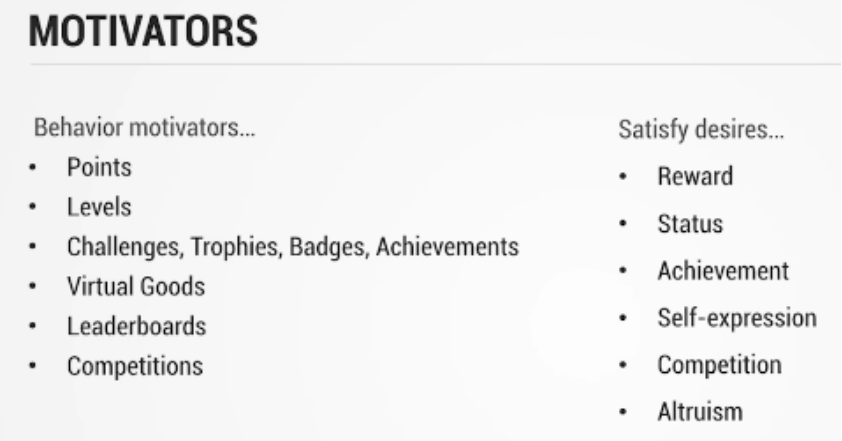


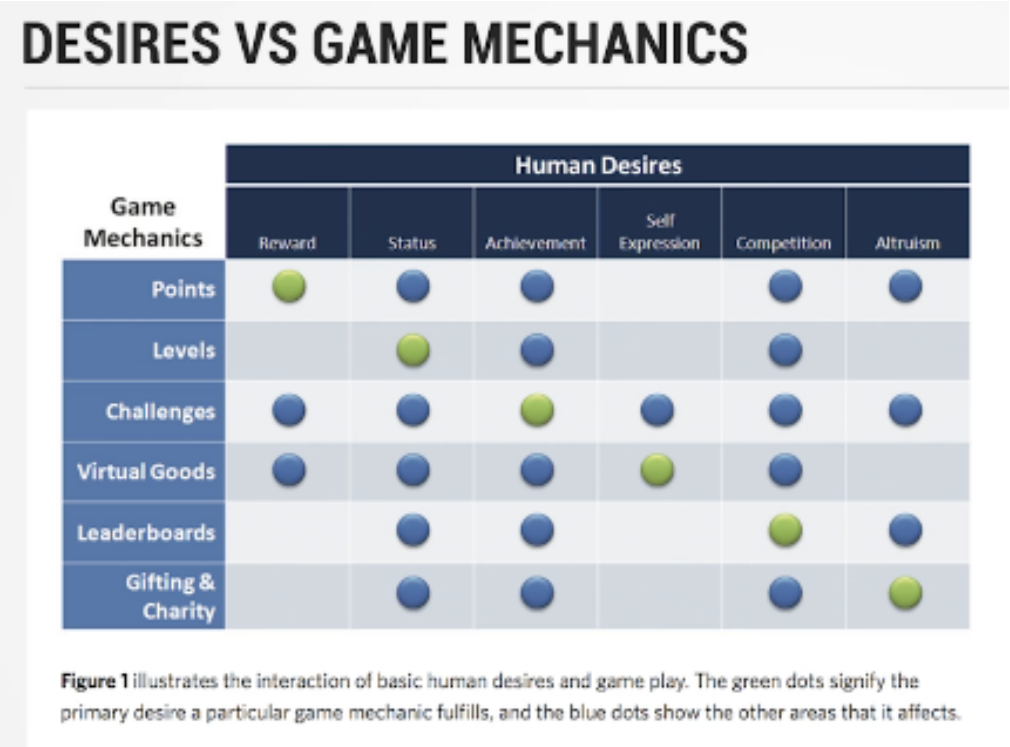


give users context sensitive menus and controls (should only appear when needed)
make UI decisions point mesh with story flow (or narrative mechanics)
remember spatial tension can add or alter context

6.6 Holographic UI design - not done

Gamification for Any Immersive Experience





Player-centred design

Know your user
Identify the mission
Understand human motivation (and your user's motivation specifically)
Apply mechanics
Manage, monitor and measure

Validating your 3D experience

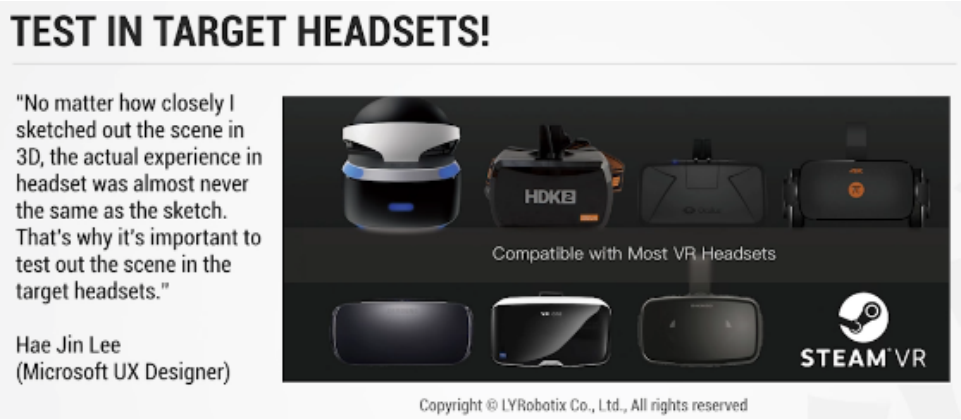
Evaluating Your Design

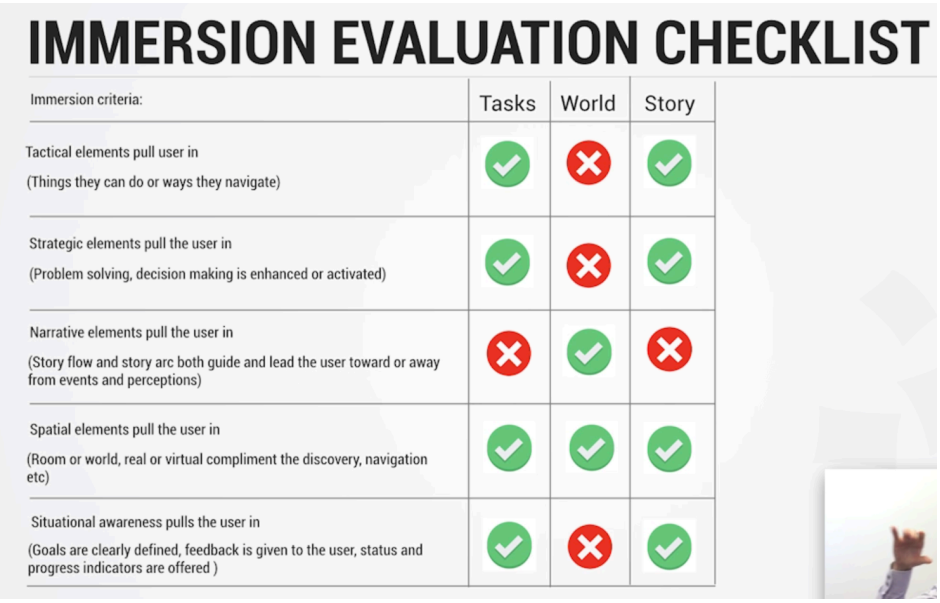
usability testing:

- observe your users interacting with your design or concept
- TIP - recruit target user /players if Play testing (no down the hallway users!)
- remember emodied improv (bodystorming) test or video tape the scenario as part of prototyping - test as you go along
- TIP - if testing multi player (simulate the 2nd users or have two players to test

top metric = ease of use

success rate - do they get the task
failure rate - do they not get it
partial success - do they get part of it





Measuring Presence

defining presence:

- presence is a matter of focus (where attention is directed)
- there are varying degrees of presence
- broad focus on all aspects of the environment necessary (versus focusing on one thing or area)
- more immersion = more presence

place illusion (feeling like you are in the place/narrative)
plausibility illusion (think what's going on is real: event refer directly to you even if you're not in control

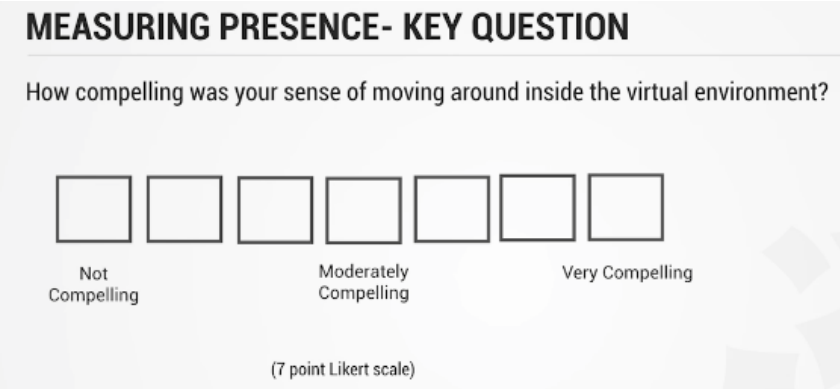
Measuring presence

- Subjective measure (questionaire)
- emotion / physiological (sweat, heartbeat)
- behaviour / performance

What impacts presence:

presence is deepened with :

- degree of control (world, story arc)
- immediacy of control (action are apparent - delay in cause/effect = bad)
- anticipation (anticipate or predict)
- mode of control (acts like natural expected work, if learn new ways = diminished)
- physical environment modifiability (ability to modify objects as if real eg open door)
- sensory modality
- environment richness (lots of sensory stimulation)
- degree of movement perception
- meaningfulness of experience
- separation anxiety/disorientation



Distraction & realism factors

Distraction factors:

- isolation (more the real world is blocked out more presence potentially) (MR potentially changes this
- selective attention: user willingness to focus on task, world or room
- interface awareness: un-natural, clumsy or feature-heavy UI's hinder interaction and presence

Realism factors:

- scene realism: core to presence (context, texture, resolution, light source, FOV)
- consistency of info with the objective world

PRESENCE QUESTIONNAIRE 1/2

Use 7 point scale per above

- **How much were you able to control events?**
- **How responsive was the environment to actions that you initiated (or performed)?**
- **How natural did your interactions with the environment seem?**
- **How completely were all of your senses engaged?**
- How much did the visual aspects of the environment involve you?
- How much did the auditory aspects of the environment involve you?
- How natural was the mechanism which controlled movement through the virtual environment?
- How aware were you of events occurring in the real world around you?
- **How aware were you of your display and control devices?**
- How compelling was your sense of objects moving through space?
- **How inconsistent or disconnected was the information coming from your various senses?**
- How much did your experiences in the virtual environment seem consistent with your real-world experiences?
- **Were you able to anticipate what would happen next in response to the actions that you performed?**
- How completely were you able to actively survey or search the environment using vision?
- How well could you identify sounds?
- How well could you actively survey or search the virtual environment using touch?

See: Whitmer and Singer 1998

PRESENCE QUESTIONNAIRE 2/2

- **How compelling was your sense of moving around inside the virtual environment?**
- How closely were you able to examine objects?
- How well could you examine objects from multiple viewpoints?
- **How well could you move or manipulate objects in the virtual environment?**
- **To what degree did you feel confused or disoriented at the beginning of breaks or at the end of the experimental session?**
- **How involved were you in the virtual environment experience?**
- How distracting was the control mechanism?
- How much delay did you experience between your actions and expected outcomes?
- **How proficient in moving and interacting with the virtual environment did you feel at the end of the experience?**
- How much did the visual display quality interfere or distract you from performing assigned tasks or required activities?
- **How much did the control devices interfere with the performance of assigned tasks or with other activities?**
- How well could you concentrate on the assigned tasks or required activities rather than on the mechanisms used to perform those tasks or activities?
- Did you learn new techniques that enabled you to improve your performance?
- Were you involved in the experimental task to the extent that you lost track of time?

See: Whitmer and Singer 1998

Tools for Evaluating VR/AR Experience

VR "JOY OF USE"

- Experience generates good feelings
- Experience sustains good feelings
- Experience puts a smile on users face
- Experience is fun to use, delightful, exciting
- Experience feels good, works well, joy to own
- Interface 'friction' is minimal
- Can sustain Presence
- Good use of Agency can intensify
- Part of 3D Storytelling ("Flow" or "cognitive absorption")

TESTING TOOLS- QUANTIFYING UX

1

Emotion Measurement

Quantifies what most believe to be subjective and unmeasurable.

Non-Verbal• instrument teases out bias.

Physiological emotion measurement (heart rate, Galvanic Skin Response, Facial expression)

2

EyeTracking

Quantify where users are looking (gazing, fixating and missing). Brings "hard science" to stakeholders.

3

Usability Testing

Low-fidelity vs High fidelity

Formative (concept validation) vs. Summative (stats on task performance)

4

Play Testing

Leveraging Game Design heuristics and testing

5

Score card

USE Scorecard

Evaluating strengths of features.

template to take notes:

QUICK TEST- NOTE TAKER

Name:
Date:
Familiarity:

FIRST 30 SECONDS

WEIRD STUFF/ BUGS

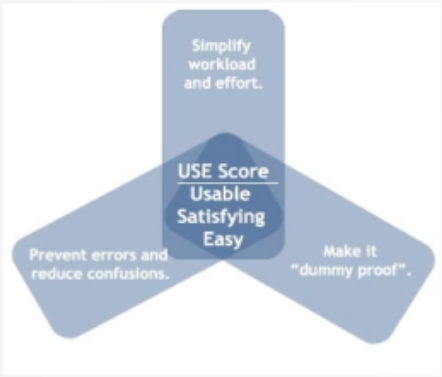
BEST THING

WISH IT HAD/ DID

FAVORITE PART

OVERALL IMPRESSION

EVALUATING USE- SCORECARD



Purpose: Quickly evaluate usability of a feature with your team to gain priority and tease out usability issues.

test with 8 to 10 users, not just 5

READ: VR/ MR UX GUIDELINES

- Occulus VR UI Guidelines
- Hololens: Microsoft Holographic - Mixed Reality UI Guidelines
- Meta 2 Guidelines
- Designing for Mixed Reality (Hololens)
- Microsoft Kinect for Windows Human Interface Guidelines v1.8.0 UX Guidelines
- Leap Motion UX Guidelines
- Unreal Engine VR UX Guidelines
- Unity VR UX Guidelines
- Google Cardboard VR UX Guidelines

Inclusive Design: Accessibility, Gender, Localisation

Some people with mobility are very keen to use VR, so we need to think about this.

Caption for deaf can be challenging
VR is a good tool for people with mental issue like phobia, post traumatic stress
dyslexia could impact the experience, to be tested
avoid height bias (user can't reach some shelves (too high)
try to remove the limitations, include super powers
sounds as a navigation aid

Gender.... but I'm not convinced ;) try testing with various gender though

Localisation: not just translation, also culture)

- clarify your persona
- design for cultural sensitivity
- translation
- literacy
- test speech across accents
- gazing might not work with culture who are more private (Scandinavian for example)

User research

- conduct user research to learn about the domain, goals, tasks of your users
- get ideas by observing what works and what affordances or skeuomorphic ideas might translate
- find your story arc in your user's work, lives and struggles

VR is an open door

- choose your narratives carefully!
- bring your values to work

To learn more:

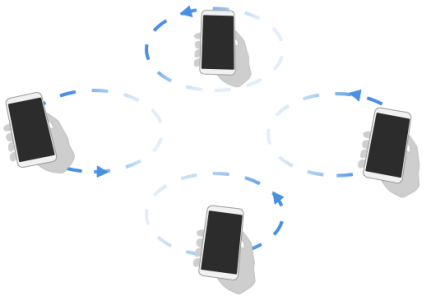
Pluralsight paths:
3Ds max - Unity - ZBrush
https://app.pluralsight.com/paths/skill/3ds-max-environment-modeling
https://app.pluralsight.com/paths/skill/unity-game-development-core-skills
https://app.pluralsight.com/paths/skill/zbrush-core-skills

https://uxdesign.cc/immersive-design-the-next-10-years-of-interfaces-16122cb6eae6

Plane Discovery & Object Placement

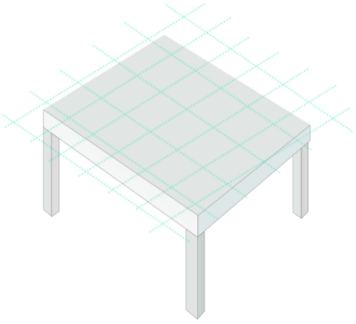
Finding Surface - Instruct users to scan

- Animate movement
- Instruct users to take action
- Provide users feedback if there isnt enough lighting, fast ovement, ect.
- Decide on device orientaion support.



Surface detection- Feedback

- Provide enough contrast in the UI
- Decide if the app will auto or manually place virtual object.
- Decide if the app will detect vertical and/ or horizontal planes.



Move object - visual feedback

- Create touch targets zones large enough for object manipulation.
- Drop virtual object with a CTA.
- State change - Object is selected
- Use lighting & shadows