Designing for Accessibility in AR & VR

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HANDSOME

What Are We Talking About?

We want to address accessibility in AR & VR; let's make sure we're all talking about the same thing.

Fully immersive. Takes over vision & hearing (mostly), often provides haptic feedback. Ready Player One is a good example.

Allows you to still see and hear the world around you, but augments it with additional visual, auditory, and sometimes haptic content. Pokemon Go or Amazon's shopping experience are good examples.

XR

XR is an umbrella term that includes a variety of immersive technologies.

Why Should I Care About Accessibility?

You're good-hearted people, so an obvious answer comes to mind: "Help blind people." Of course! But at agencies, that's sometimes a hard sell for clients. Ultimately, this obvious answer isn't the most compelling one.

Because It Makes You a Better Designer

Elise Roy is a deaf lawyer, artist, artisan, and human rights advocate who works in the vanguard of the social design movement.

Share her Army Air Corps average pilot story. Lots of crashes in 1930s as the Corps transitioned to jet engines. (https://www.eliseroy.org/blog/2018/1/9/why-companies-should-be-looking-to-people-with-disabilities-to-solve-their-greatest-problems) Designing for the median user leaves us with lots of problems. Designing for extremes helps everyone.

Principles of Inclusive Design

This stems from Kat Holmes' work at Microsoft, which has spawned a wealth of excellent resources on Inclusive Design.

From their manifesto

"Designing for people with permanent disabilities can seem like a significant constraint, but the resulting designs can actually benefit a much larger number of people. For example, closed captioning was created for the hard of hearing community. But, there are many benefits of captioning such as reading in a crowded airport or teaching children how to read.

"Similarly, high-contrast screen settings were initially made to benefit people with vision impairments. But today, many people benefit from high-contrast settings when they use a device in bright sunlight. The same is true for remote controls, automatic door openers, audiobooks, email, and much more. Designing with constraints in mind is simply designing well."

Kat and the Inclusive Design organization at MS recognize three principles of ID:

1.

Recognize Exclusion

Exclusion happens when we solve problems using our own biases. As designers, we seek out those exclusions, and use them as opportunities to create new ideas and inclusive designs.

Exclusion is not all about disabilities; it's sometimes situational (loud room) or temporary (arm in cast).

2.
Learn from Diversity

Human beings are the real experts in adapting to diversity. Inclusive design puts people in the center from the very start of the process, and those fresh, diverse perspectives are the key to true insight.

Early testing (or creative involvement) by folks with disabilities will help.

Get people with disabilities to help with the design.

3.
Solve For One, Extend To Many

Everyone has abilities and limits to those abilities. Designing for people with permanent disabilities actually results in designs that benefit people universally. Constraints are a beautiful thing.

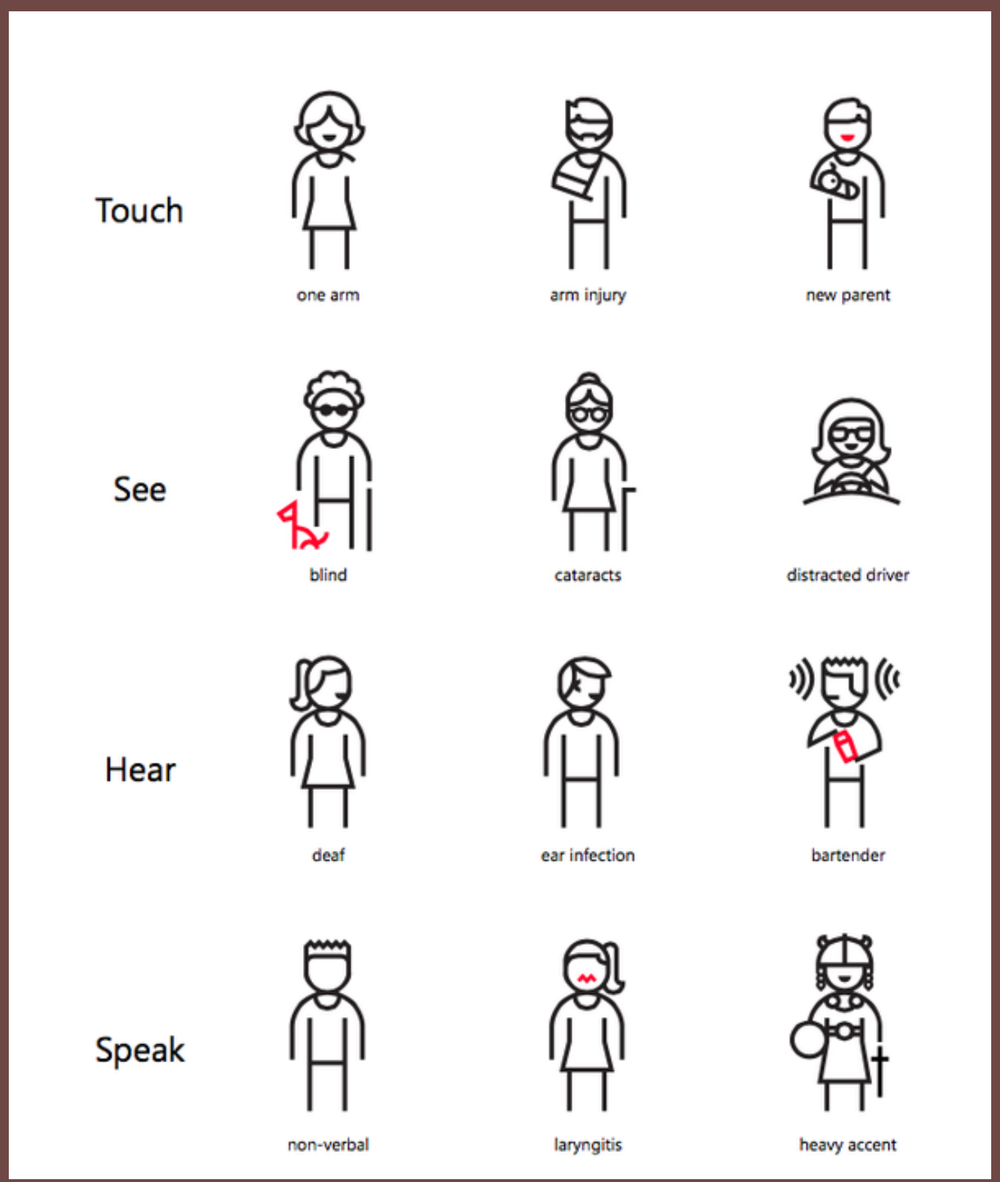


Image credit: Microsoft

...when thinking about designing for disabilities you shouldn't think about designing for the 'other' but instead designing for your potential future.

— Alexandria Heston

What Can We Do?

As we design experiences, we can apply these principles to make our designs better and more usable by a broader range of people. We'll apply these principles to AR & VR specifically here, but the principles themselves can inform mobile, web, or most any other kind of technology design.

There are several great products that are designed specifically for the needs of users with disabilities. The Canetroller, AR sign readers, etc. They're wonderful, but outside the scope of this talk. We focus here on making the things that *we* design and build as widely useful as possible.


Y
X
B
A

Control Challenges

- **Extremes**: Dyspraxia, cerebral palsy, multiple-sclerosis, muscular dystrophy
- **Extend to Many**: stiffness in joints, swelling and bruising of appendages, broken arms

Control Affordances

- Don't rely exclusively on motion controllers; support gamepads/other input too.
- Eliminate time limits or make them adjustable.
- Make UI interactions as forgiving as possible. (Use big buttons, etc.)
- 6dof controllers can make for more immersive experiences, but 3dof can be used in a broader range of situations.

Worth noting: lots of adaptive devices simulate gamepads, so by adding support for that, we extend our reach substantially.

Explain degrees of freedom.

Haptic Challenges

- **Extremes**: Sensory processing disorder, congenital insensitivity to pain, central touch disorders
- **Extend to Many**: Nerve damage, extensive burns, bruises, or swelling

Haptic Affordances

- Add ability to turn off vibrations or unnecessary hardware movement.
- Invest in more comfortable hardware/software that can relieve or distract from pain.
- Associate haptic cues with audio/visual cues whenever possible, providing multimodal channels for delivering that info.

We'll see this last theme recur. Providing cues across senses is a great way to allow users with a deficit in one sense to continue to enjoy an experience.

Hearing Challenges

- **Extremes**: Auditory Processing Disorders, Deafness (profound hearing loss)
- **Extend to Many**: Mild to severe hearing loss, high tonal loss, low tonal loss, noise-induced hearing loss, ear infections, single-sided deafness

Hearing Affordances

- Include subtitles for spoken text and sound effects.
  - Make subtitles spatial if possible (there's work to do here).
- Make audio volume adjustable.
  - Adjust mix of different components individually; e.g. add ability to turn off ambient sound so can hear UI better.
- Make audio equalization adjustable (or at least respect platform settings).
- Provide visual/haptic equivalents for audio cues.

Visual Challenges

- **Extremes**: Blindness (profound vision loss), Monochromacy (seeing no color), Dichromacy (only two cones that perceive color)
- **Extend to Many**: Visual Fatigue, Nearsightedness, Cataracts, Glaucoma, Farsightedness, Anomalous Trichromacy (one of the three cones that perceive color is out of alignment), astigmatism

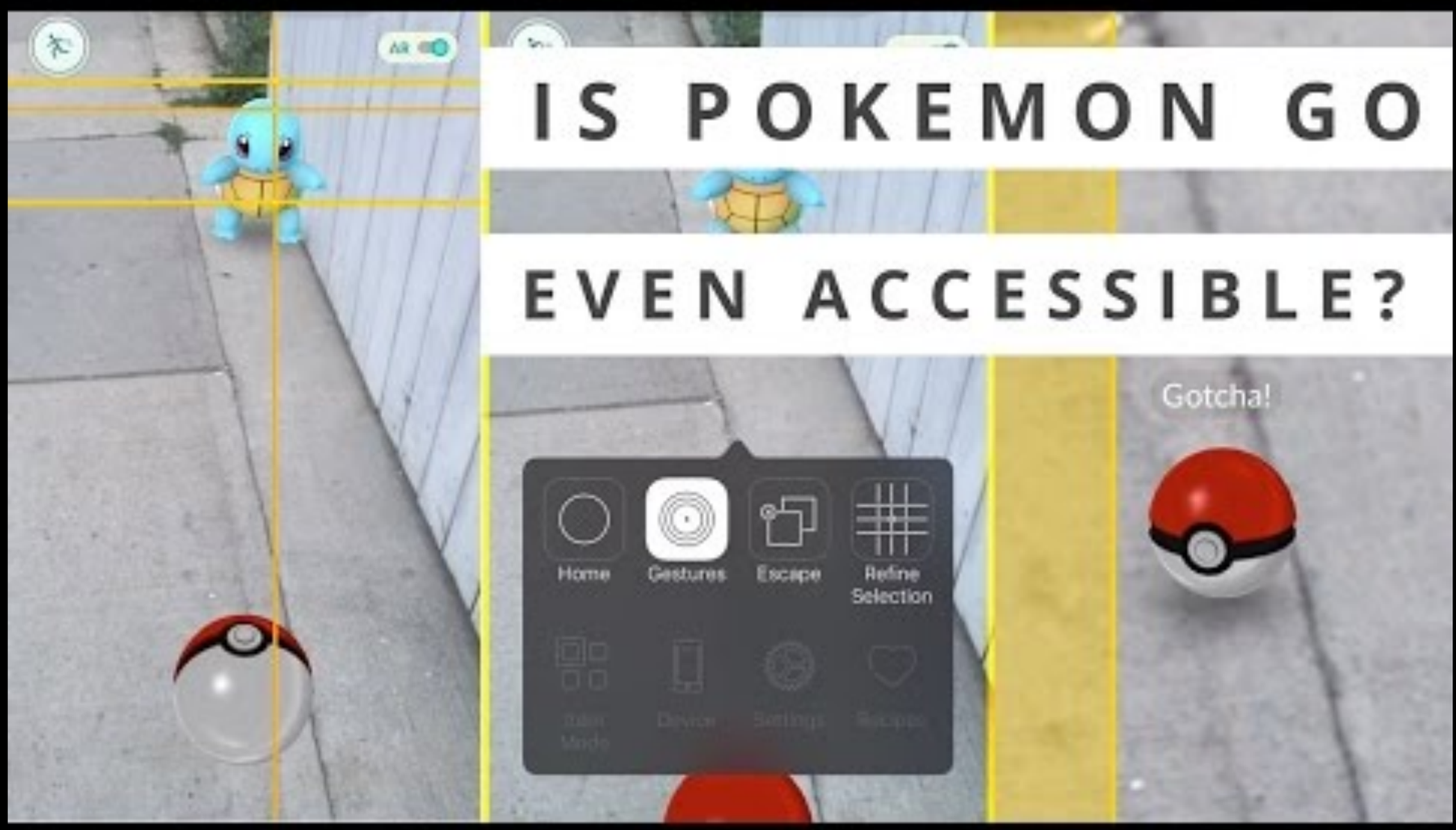
Visual Affordances

- Make text size adjustable.
- Ensure sufficient contrast between text and background.
- Provide verbal descriptions of environments, objects.
- Prioritize Content.
- Pay particular attention to audio design. Users with limited vision rely on their hearing even more than most.

I didn't have a good sense of direction where I was [as in the real world]. I can hear roughly where the wall is at, by the way it blocks off sound in the real world. I didn't have that in the VR world.

Note: there are several audio spatialization engines that provide varying degrees of fidelity. In addition to the built-in engines that come with Unity and Unreal Engine, the most widely used are Resonance Audio, Oculus Spatializer, and Steam Audio. http://designingsound.org/2018/03/29/lets-test-3d-audio-spatialization-plugins/

I've been droning on for a while, so let's change gears for a moment.



Pokemon go is one of the most widely recognized examples of AR.

Apple makes iOS entirely accessible with a single switch controller, but app creators have to support Apple's accessibility framework.

Here's an example of the challenges a user like Stephen Hawking, who gets around in a wheelchair fine but who has very limited motor control, might face when playing Pokemon Go.

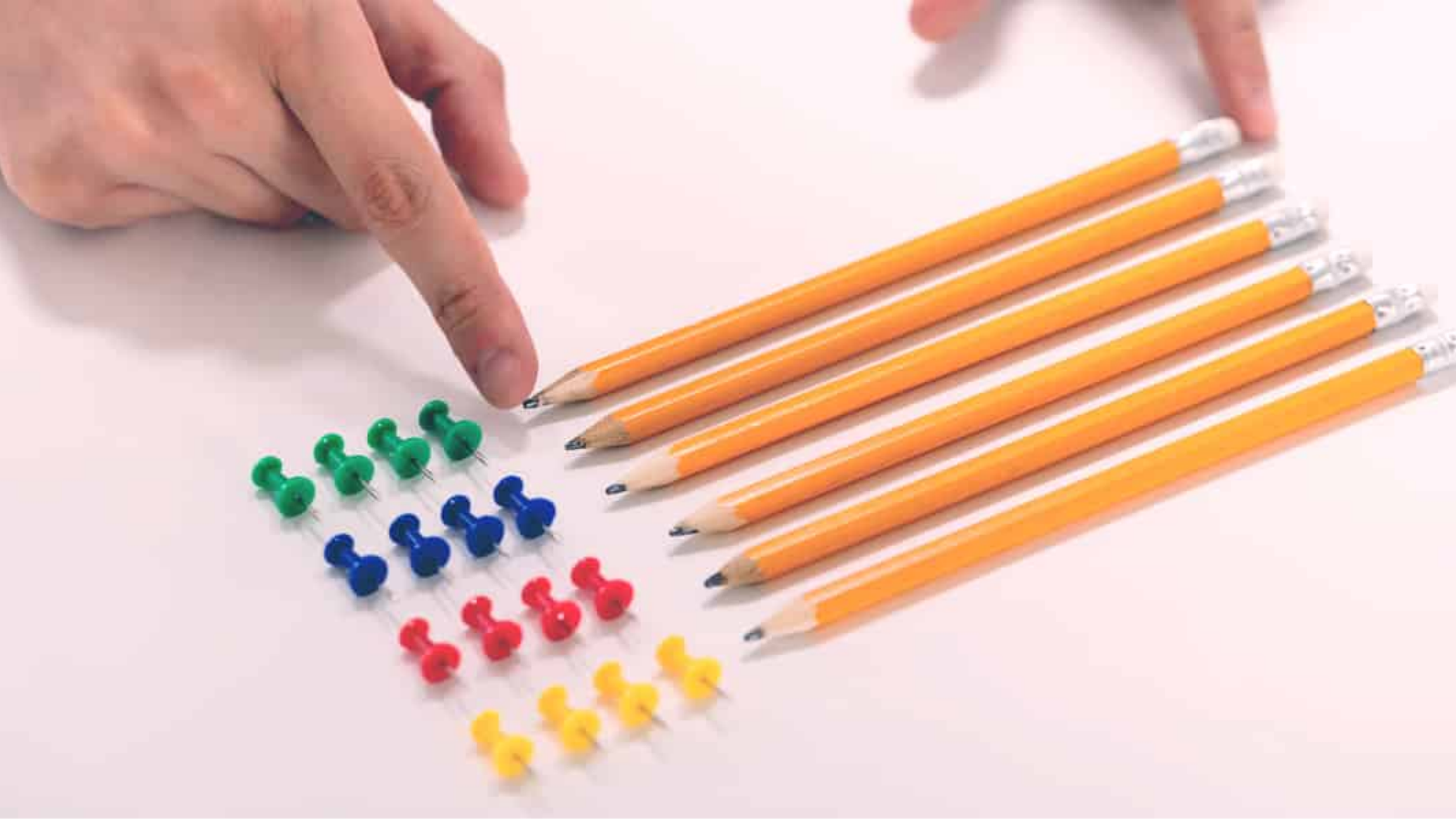

Rollin'
HORNET

Posture Challenges

- **Extremes**: acquired spinal injury, post-polio syndrome, spina bifida
- **Extend to Many**: broken legs, arthritis, lack of sleep

Posture Affordances

- Don't require a particular position: accomodate playing sitting as well as standing.
- Design for extremes of stature.
- Spatial audio can be helpful here too, as it helps players locate events and objects in space without needing to move.



Experience Challenges

- **Extremes**: obsessive-compulsive disorder (OCD), passive aggressive disorder
- **Extend to Many**: bad day, hungry, oversocialized

Experience Affordances

» Make interactions optional.

» Provide periods of time for relaxation, contemplation, and knowledge transfer.

» Sometimes making a very immersive experience is enough.

Depending on your design goals, interaction may not be necessary. In studies using VR for pain therapy, simply creating a relaxing, high-fidelity environment was sufficient to provide theapeutic benefit.

Content Sensitivity Challenges

- **Extremes**: Panic attacks, abnormal fears and phobias
- **Extend to Many**: Sight of blood unsettling

Content Sensitivity Affordances

- Content disclaimers and descriptions of potential trigger warnings.
- Option to disable content that might be unsettling.
- Avoid closed in, high virtual spaces.


GUNJACK
social
Ansnar Wars 2

Stimulation Sensitivity Challenges

- Outliers: severe motion sickness, autism
- Extend to many: illness, agitated

Stimulation Sensitivity Affordances

» Use relaxing sounds, or allow the user to turn off stress-inducing sounds.

» Design to minimize motion sickness.

In our project, the player controls the movement, which teleports them from one spot to another...and involves no acceleration, which is generally what induces motion sickness in VR. Our player found no ill effects from her test time in the game.

Other ways to help include reference frames (cockpits), eliminating motion.

Points to Remember

1.
Design for Extremes

2.
Your Designs will be Better for Everyone

3.
Digest the Microsoft Inclusive Design Manual

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Q&A

Thank You