Understanding the Human Perception System

Lessons learnt from prototyping and research for VR and AR

Hello!

- Chandan Singh, Head of VR at SmartVizX
- Working on Trezi, an immersive collaboration platform for the AEC industry
- 10+ years working with real-time rendering engines

What this talk is about

- Discussing the lessons learnt by prototyping and research
- Understanding why that works by understanding perception
- Examples and guides to use these lessons in various use cases

Why?

Making a believable XR experience

VR

Convince the brain that you are present somewhere

AR

Convince the brain that something is present in your world

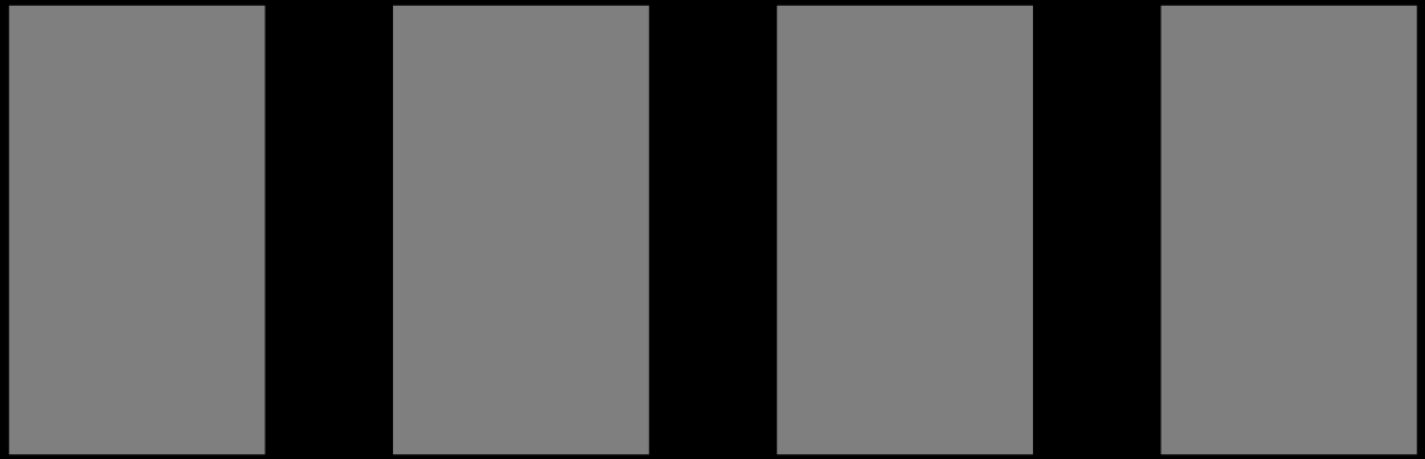
Fooling the brain is a difficult task

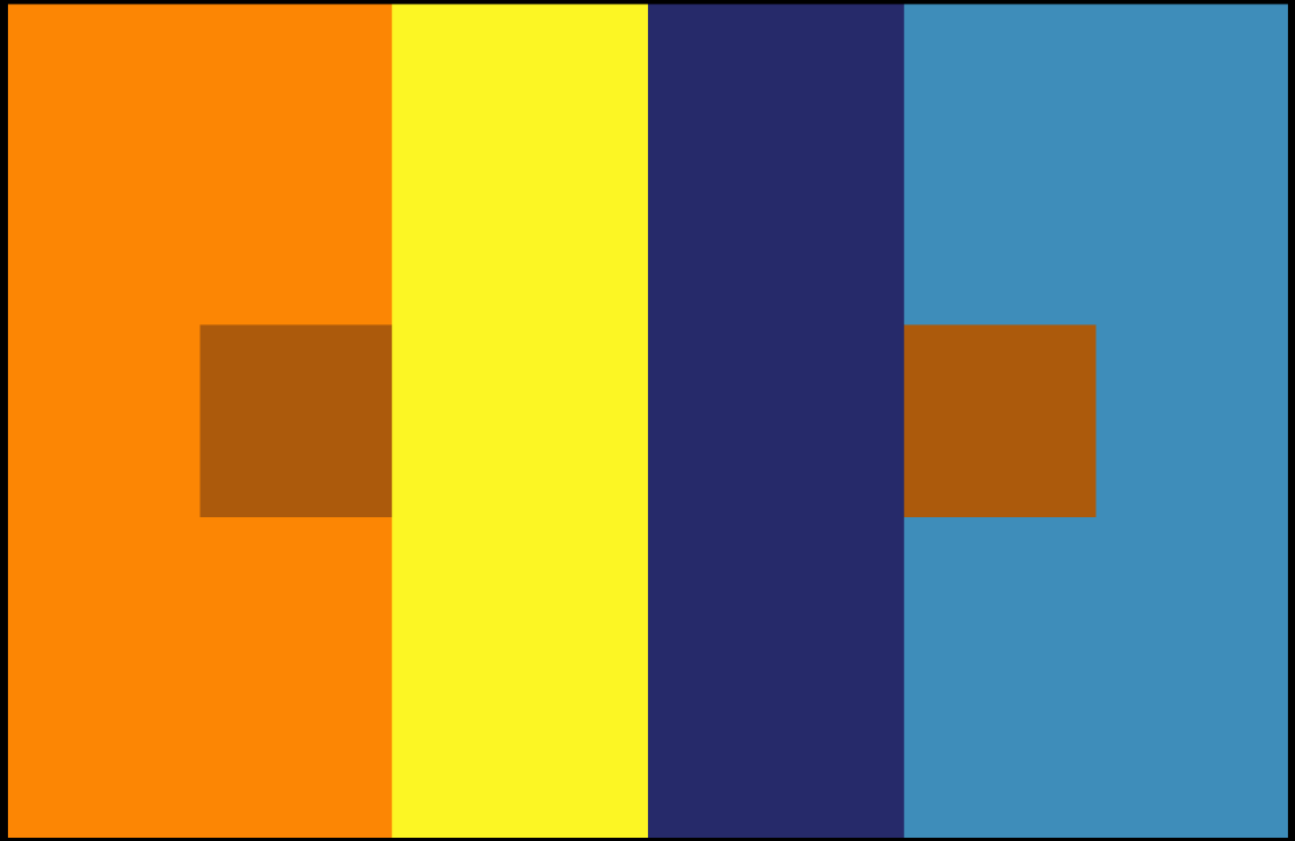
- Extremely sensitive to even the tiniest of details
- Smallest of errors can break the illusion of ‘presence’
- Very sensitive to things like shading and framerate

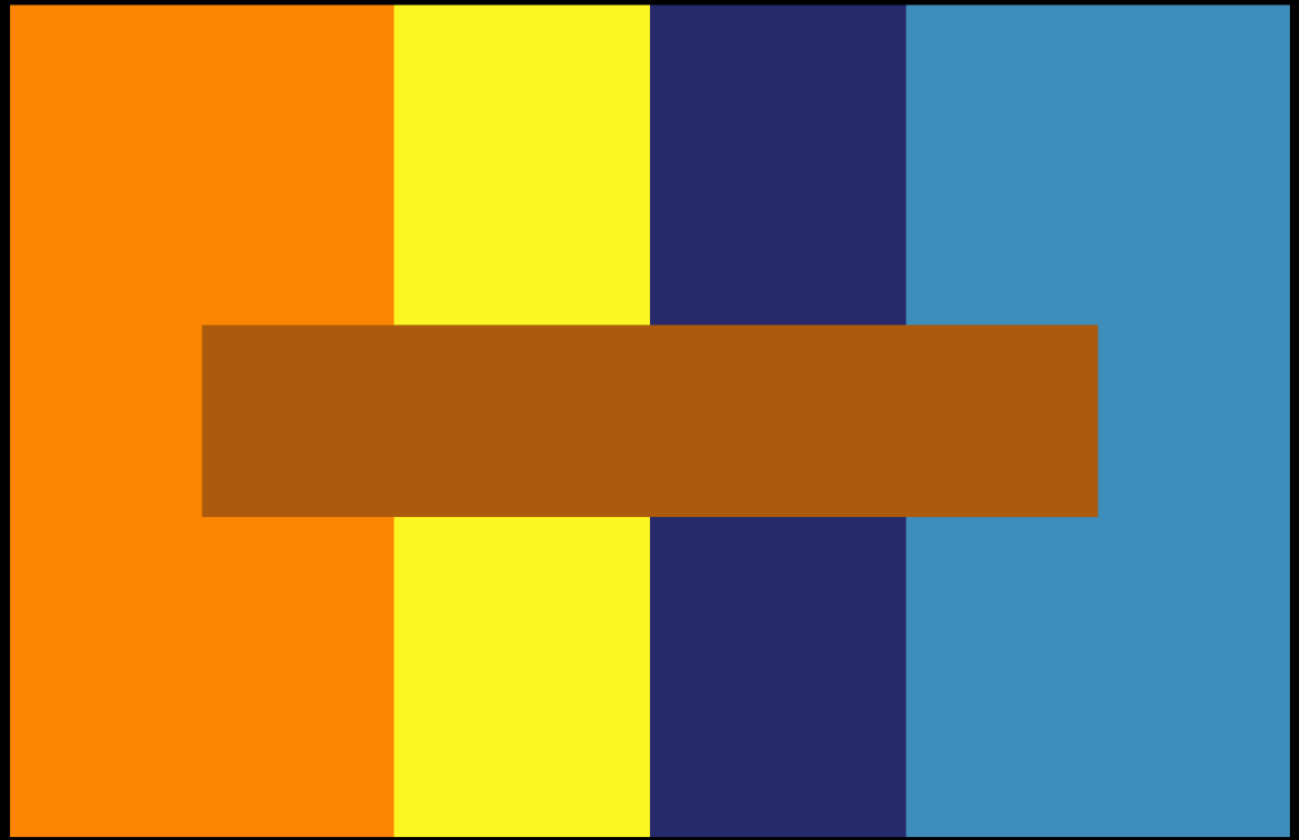
Current XR devices are very primitive

- VR devices need more resolution, higher refresh rates, higher FOV
- AR devices need bigger FOV, more resolution
- Better world lighting information, world depth data

Vision is perceived as differences, not absolute values

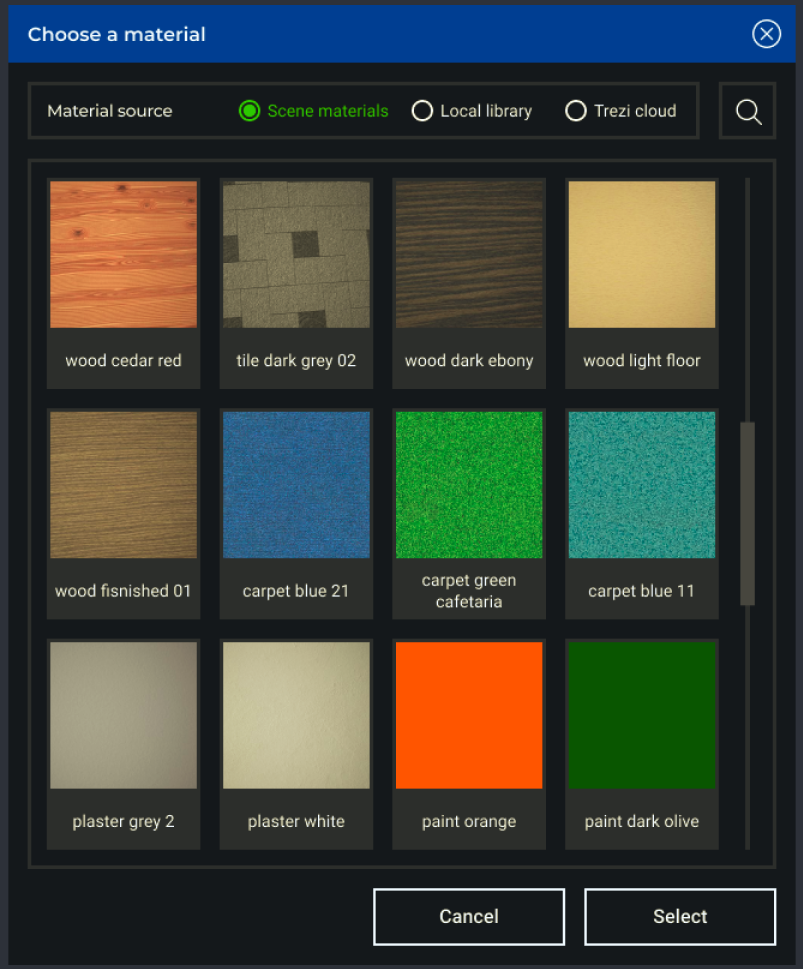






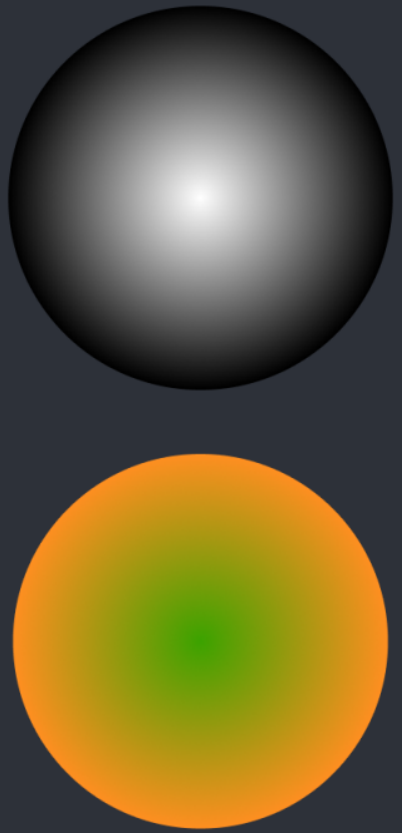
Application

- Ensure that there's a constant neutral color area around colored content
- Especially important for user generated content



Luminance is more important than color

We see depth in luminance, not color



We are naturally drawn to areas of contrast

Our gaze is drawn to high contrast areas

Madame Henriot by Auguste Renoir

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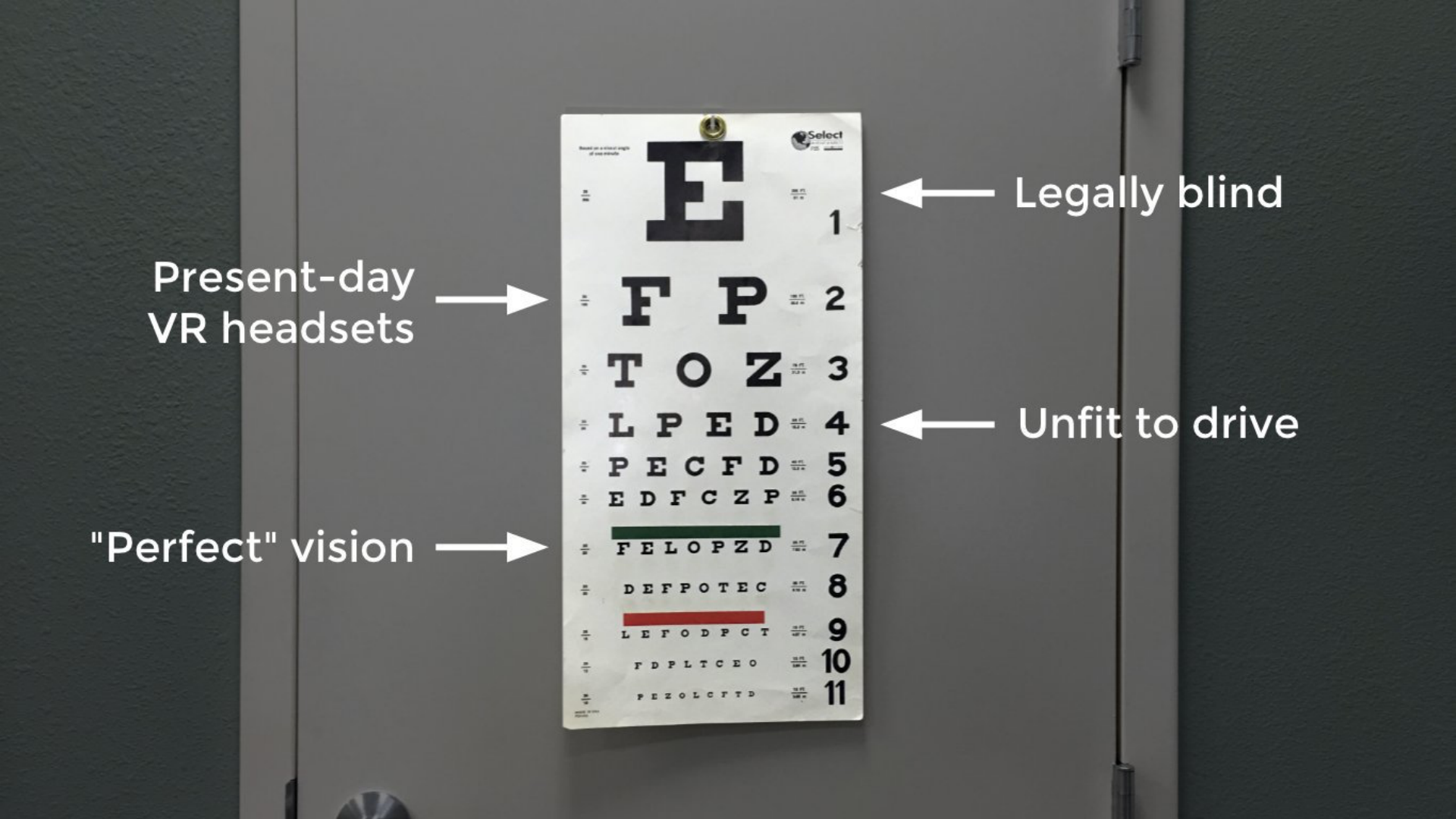
Application

- Trezi uses a high luminance contrast color system
- Minimum contrast of 5 : 1
- For text we use a minimum of 10 : 1

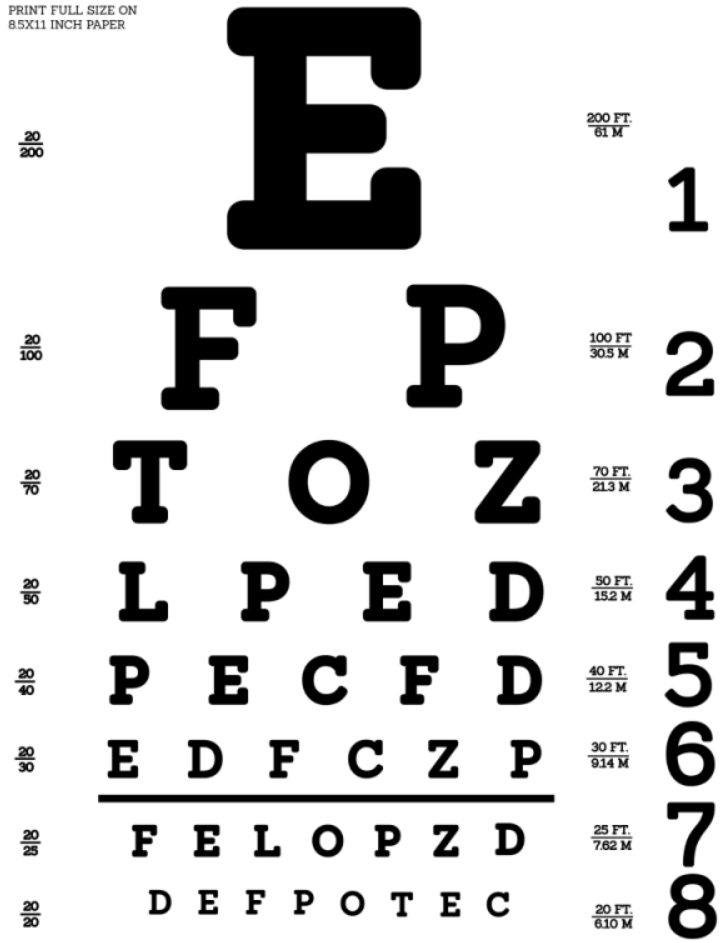
Orange 1	HEX #FFD76B	Lab 98, 42, 72	15.2 : 1
Orange 2	HEX #FFB247	Lab 85, 42, 72	11.7 : 1
Orange 3	HEX #FF8F21	Lab 72, 42, 72	9.2 : 1
Orange 4	HEX #DE6C00	Lab 59, 42, 72	6.3 : 1
Orange 5	HEX #B64A00	Lab 46, 42, 72	5.3 : 1
Orange 6	HEX #8E2900	Lab 33, 42, 72	8.5 : 1
Orange 7	HEX #670000	Lab 20, 42, 72	13.3 : 1
Orange 8	HEX #430000	HSB 30, 96, 32	17 : 1

Use n+2 on the eye chart to define text size in world space

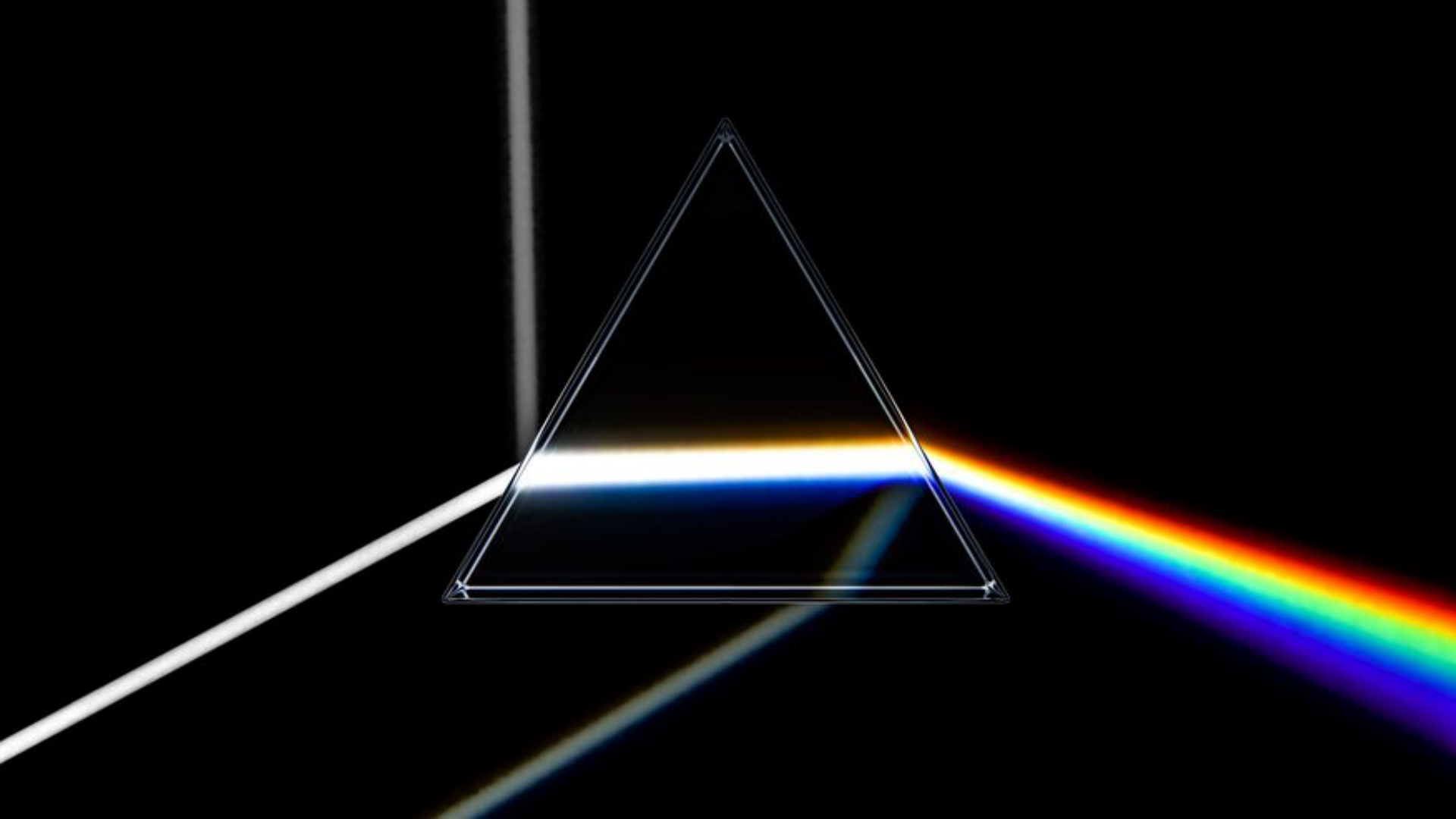

Legally blind
Present-day
VR headsets
Unfit to drive
"Perfect" vision
E
F P
T O Z
L P E D
P E C F D
E D F C Z P
F E L O P Z D
D E F P O T E C
L E F O D P C T
F D P L T C E O
P E Z O L C F T D
1
2
3
4
5
6
7
8
9
10
11

Figuring text size

- Print on A4 paper
- Place at the required distance
- Pick two steps up of what is the last readable
- That is your minimum text size for in world UI



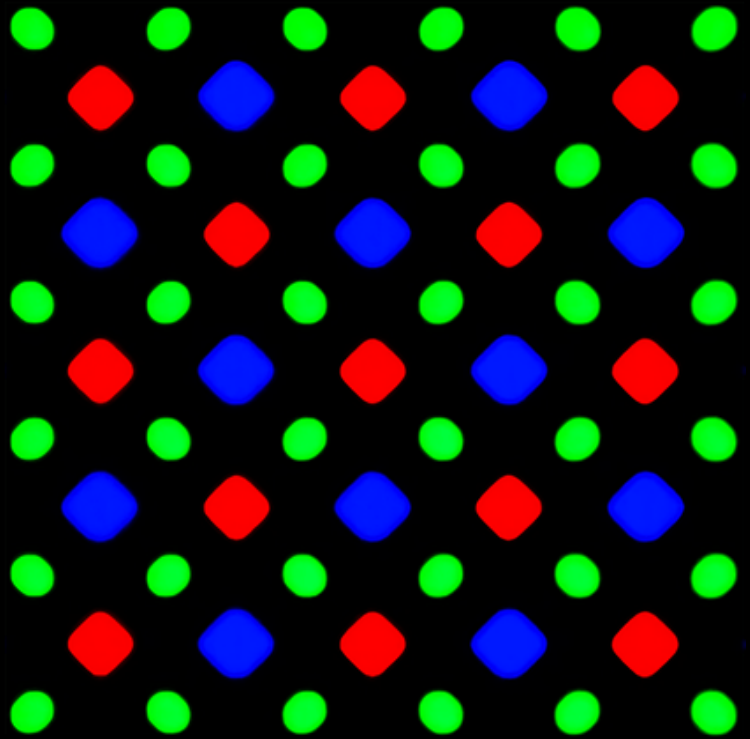
Green on black is the best for text rendering in VR



Most people see red closer than the blue but some see the exactly opposite effect

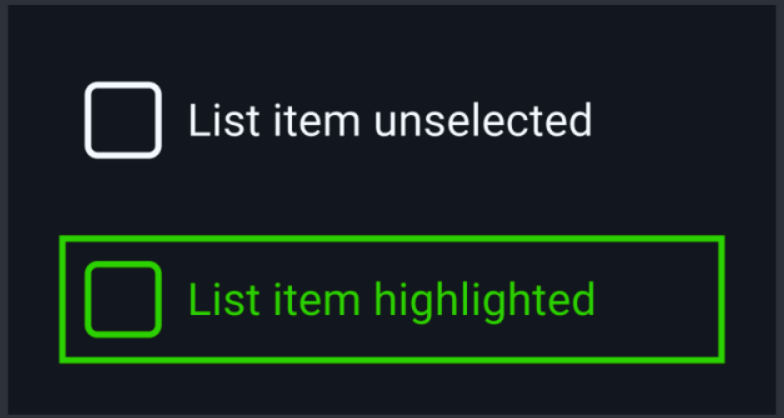
VR text rendering

- No chromatic aberration
- Full pentile resolution
- Less noticable screen-door effect
- Our visual system is more sensitive to green

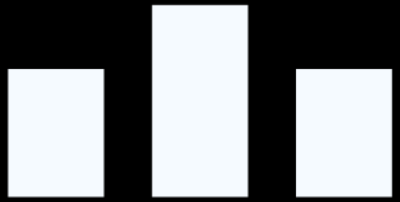


Example

- Trezi uses Green to denote highlighted and selected UI elements
- Very pronounced effect, super crisp text



Differentiate patterns using just one metric type



Size

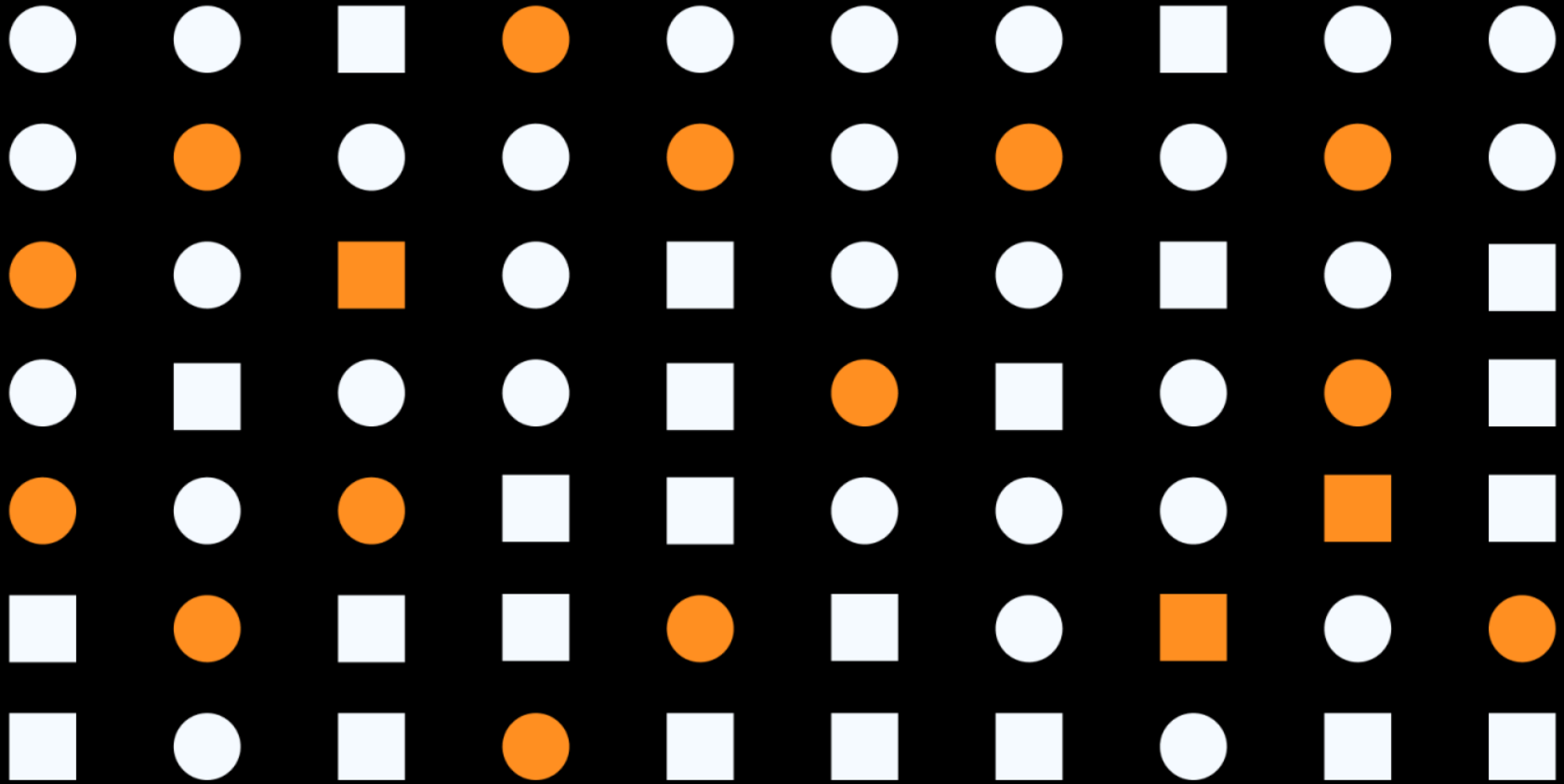
Texture

Position

Shape

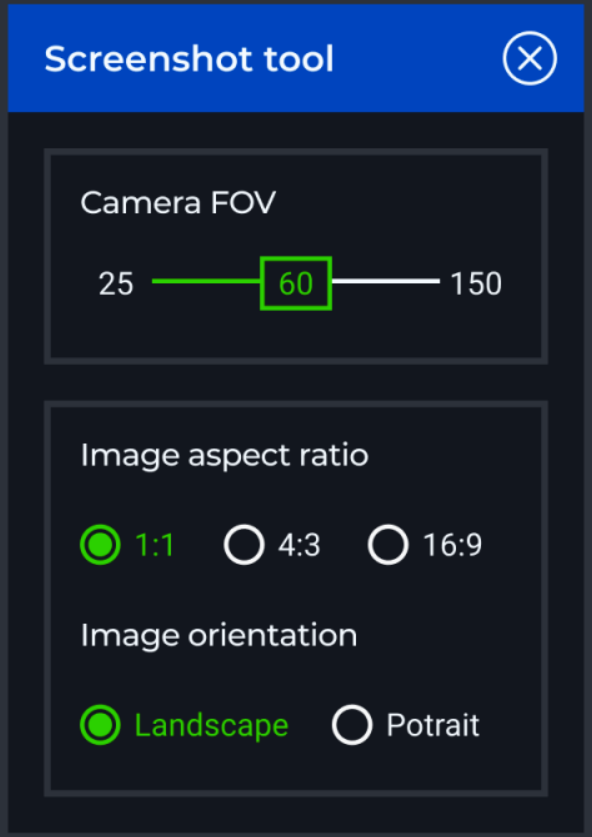
Color

Orientation



Application

- Trezi uses color as the primary metric
- Easy to scan the UI and figure elements of interest



DIY

- It is really easy to prototype today with Unity
- Set up a test environment that mimics your end use case
- Unity provides really easy ways to set up test functionality
- Take content from SDK examples, tweak them to your requirements
- They take care of most of the common requirements

Conclusion

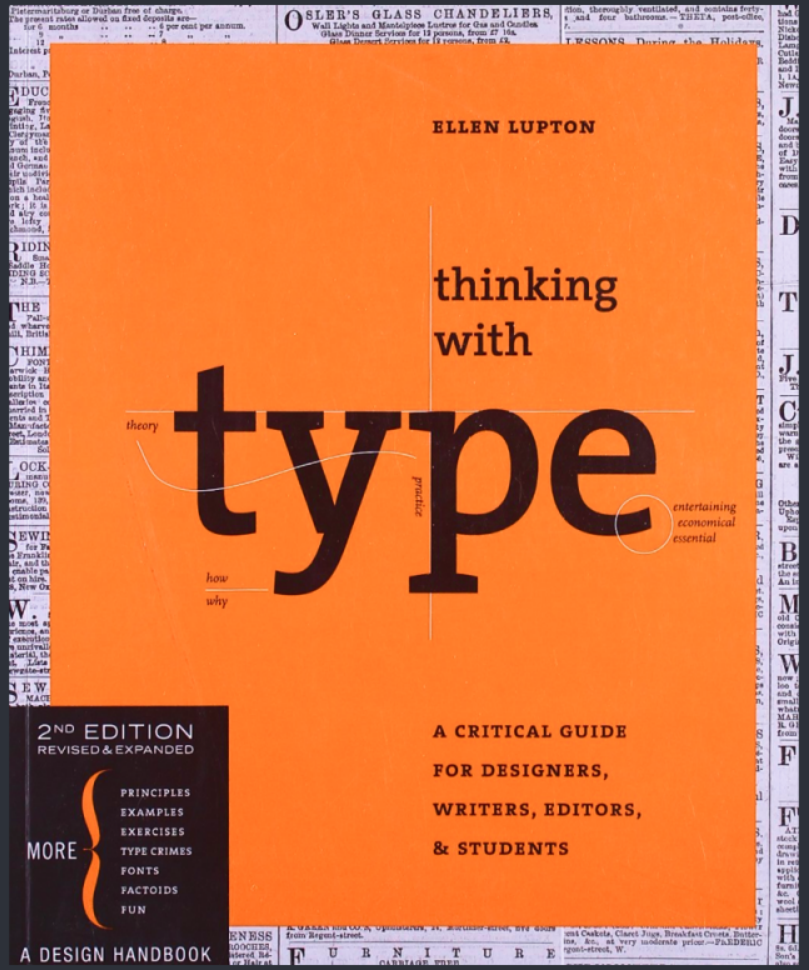
- AR / VR are undefined and unexplored mediums
- We need to understand what works
- Understanding perception helps in making informed decisions
- Lots of prior research data on human perception is available
- Prototype, test and validate your designs

Further reading

Interaction of Color by Josef Albers

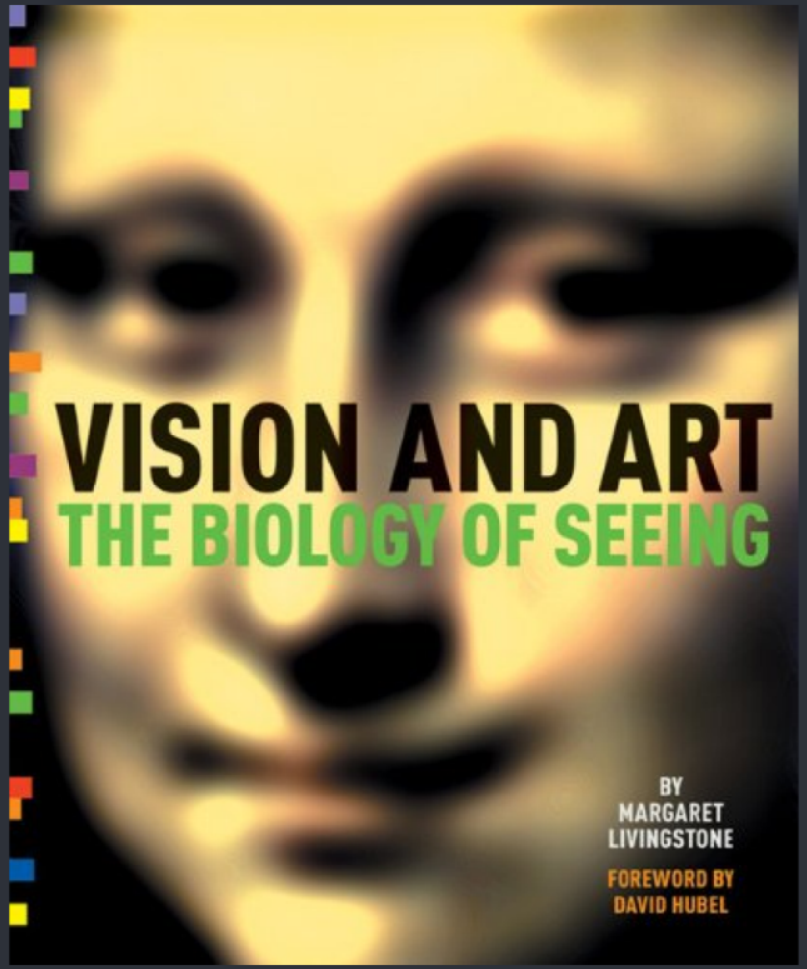
Further reading

Thinking with type by Ellen Lupton



Further reading

Vision and Art: The Biology of Seeing by Margaret Livingstone



Questions?

Thanks!