

## Immersive 3D worlds Evolutions of the Web platform

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### The promised wand



- Social interactions
  - Creativity boost 🎭
  - 🜼 🛛 Inclusiveness 🧮 🐂
- Natural interactions
  - Gestures 👋 🤙
  - Voice 🦜
- One metaverse
  - 🜼 🛛 Any device 👓 📱 💻 🚿
  - URLs FTW 🌐
- Physical & virtual
  - How many people to change a bulb in the metaverse?
    Only two, you and your digital twin
- Safety at all levels
  - Privacy enforced 🔒
  - Anonymity preserved whenever possible 🥷
- Distance no longer matters
  - No more business trips I (\$)

### Hurdles along the way

#### • Platforms create silos

- Restricted set of proprietary platforms 💰
- Restricted set of authorized devices •••
- No way to share content 🔒
- ... could know everything about you
  - Your moves, where you look, what you say 🕵
- ... all the time
  - o 🛛 Always on 🔆
- ... insisting on social experience
  - Anonymity, what for? Bye, privacy!
- ... powered by ads
  - Dreadful user experience 🙀
- ... and inclusiveness is a vague concept
  - Accessibility? On the TODO list, promised! 3
  - Police everywhere means openness, right? 👮





#### Focus at W3C so far: Enabling technologies



#### Needed

- Some way to render 3D
- Spatial audio
- VR/AR devices support
- (Lots of) Computing power
- Real-time communications

#### On the web

- WebGL (Khronos), WebGPU, WGSL
- Web Audio API
- WebXR set of specifications
- WebGPU, WebNN, WebAssembly
- WebRTC

#### **Example of a recent discussion:**

Interoperability between WebGL and WebGPU in WebXR https://github.com/immersive-web/WebXR-WebGPU-Binding/issues/7



### Needs beyond foundations

• 3D objects

. . .

- Avatar description
- Animations and their transmission in real time
- Volumetric video
- Affordances and user interactions
- World physics and defaults
- Level of Detail (LoD) and incremental streaming
- Handling of transient network failures (UX)



#### The web does not understand 3D

- <canvas> draw your own pixels!
- We'll help, GPU APIs to draw triangles:
  - <u>WebGL</u>
  - WebGPU / WebGPU Shading Language

Some areas that are not covered:

- 3D asset/texture/scene formats
- User interaction
- Text 😲





1. Draw some triangles





2. Draw the rest of the owl

#### Core web principles

- Accessibility
- Internationalization
- Privacy
- Security
- Ubiquity











### Accessibility



#### Example: The Last of Us II

- **60+** accessibility settings
- Controls
- Magnification and Visual Aids
- Motion Sickness
- Navigation and Traversal
- Text-to-Speech and audio cues
- Subtitles

https://blog.playstation.com/2020/06/09/the-last-of-us-part-ii-accessibility-features-detailed/



### Accessibility

- ➤ Short-term:
  - API-based hooks to provide semantics, e.g., Accessibility Object Model (AOM)
  - Developers guidelines on how to describe & design immersive experiences to make them accessible
  - Push for the adoption of semantic-rich 3D formats
- ► Long-term:
  - Declarative semantics.
    - The user agent can control all rendered objects and provide accessibility features
    - (e.g., zoom, color enhancement, text description, audio cues, etc.)
  - Safe defaults (world physics, locomotion mechanisms)

... and "Provide **text alternatives** for any **non-text content**..." WCAG 2.2 - Guideline 1.1 - Text Alternatives

### Privacy

#### • The web defaults to anonymity

- Nothing to hide?
- Nothing to show!
- Identity encompasses many dimensions in an immersive context:
  - Your physical appearance (height, weight, sex, skin color, etc.)
  - $\circ$  What you're looking at
  - What gestures you make
  - What you say
  - $\circ$   $\,$   $\,$  And, of course, who you are  $\,$



### Privacy - Safe and sane defaults?

What **positions** should the app know about before user **interacts** with the content?

- Nothing
- Head position
- Head orientation
- Eye tracking
- Hands tracking
- Full body tracking

Also, default **user interaction mechanisms**?



Apple Vision Pro - Design for Spatial Input https://developer.apple.com/videos/play/wwdc2023/10073/?time=69

#### Privacy - Safe and sane defaults?

What should the app know about the user's **appearance** by default?

- Nothing, anonymous panda
- User-chosen avatar
- Whatever the user's device captures



### Privacy - Default agora?



- Public space not under anyone's control
- How to agree on a common code of ethics and conduct?
- How to **encode** that code of ethics and conduct?
- Or can an agora be designed in such a way that users may choose different safety settings?





- ➤ Short-term:
  - More privacy-respectful interaction paradigms such as gaze and pinch
  - The web needs to look into avatars
- ► Long-term:
  - The browser needs to be in charge of the rendering!



### Is there a 3D user agent in the room?

Web browsers are 2D user agents.

For the web to morph into the metaverse, user agents need to morph into **3D user agents**.

They do not necessarily need/want that for now... but new devices may change the *statu quo*.



### XR experiences on the web



- 2 <canvas> one per eye
- + Device APIs to track the user's pose and gestures
  - WebXR Device API
  - WebXR Gamepad Module
  - WebXR Hand Input Module
- + AR features for blending with the physical world
  - WebXR Augmented Reality Module
  - WebXR Depth Sensing Module
  - <u>WebXR Hit Test Module</u>
  - WebXR Lightning Estimation Module
  - WebXR Anchor Module
  - WebXR Raw Camera Access Module
- What about accessibility?
  - XR Accessibility User Requirements

#### The <model> element proposal

- Make 3D a first class citizen on the Web
- New explainer prepared in September 2024: https://github.com/immersive-web/model-element/blob/explainer\_demo/explainer.md
- Discussed at W3C TPAC 2024:

https://github.com/w3c/tpac2024-breakouts/issues/33

# Accessible Extended Reality and the Immersive Web

**Open Standards and Open Source** 

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- Recruit partners interested in launching a proposed *W3C Accessible Extended Reality Omniverse* (AERO) CG\* and active participation in associated open source projects, see:
  - <u>W3C Community Group Process</u>
- Coordination with <u>W3C Immersive Web CG</u>
  - Focussed on WebXR API, see explainer
  - Not working on VR/AR browsers and building "The Metaverse"
- Coordination with <u>XR Access</u>
  - See <u>Accessible Development for XR</u>
- Coordination with <u>WAI Accessible Platform Architectures</u> (APA)
  - See WG Note on <u>XR Accessibility Requirement</u>
- Further reading:
  - Extending WWW to support Platform Independent Virtual Reality, May 1994
  - Open Standards for the Immersive Web, ERCIM News, April 2024
  - Microsoft Teams enters the metaverse race with 3D avatars and immersive meetings

\* The *omniverse* encompasses all universes, real and imagined, including the IoT and all metaverses.

#### Blending Realities: Building An Open Web Wide World

- Breakout session 25 September 2024, at W3C TPAC 2024: https://github.com/w3c/tpac2024-breakouts/issues/61
- Proposed by Tencent

"Now may be an opportune moment to discuss how all parties can collaborate to co-create a tangible virtual world that connects, enhances, and assists humanity as a whole. We need a set of construction standards that enable the integration of each party's efforts, fostering prosperity through cooperation rather than competition."

# Thank you!



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#### Attributions

#### Icons from <u>www.flaticon.com</u>:

- <u>Virtual reality icons</u> created by Nikita Golubev
- <u>Secret agent</u>, <u>Brickwall</u>, <u>Question mark</u>, <u>Must have</u>, <u>Medal</u>, <u>Website</u>, <u>BFF</u>, <u>Cube</u>, <u>VR</u>, <u>Hard work</u>, <u>Timeline</u>, <u>2D</u> icons created by Freepik
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