Extended Reality

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User interface evolution – from the floor to the head

User Interface

Command Line Interface CLI - Abstract	Graphical User Interface GUI- Indirect	Natural User Interface NUI - Direct
• Textual • Keyboard	• Mouse point click • Keyboard	• Speech • Hand gesture • ... • ... • Visual markers • Body

Devices

Floortops

Desktops

Laptops

Palmtops

Headtops

Terminology

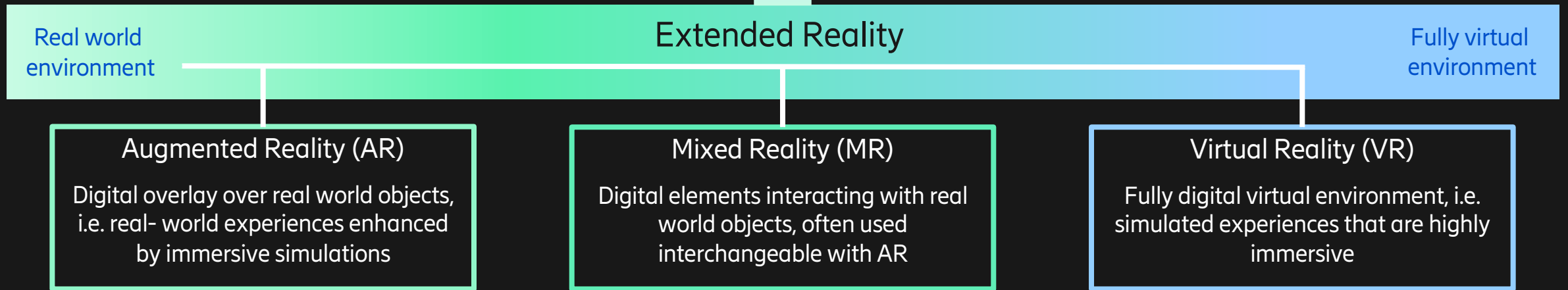**Real-time interaction**

Multiple users
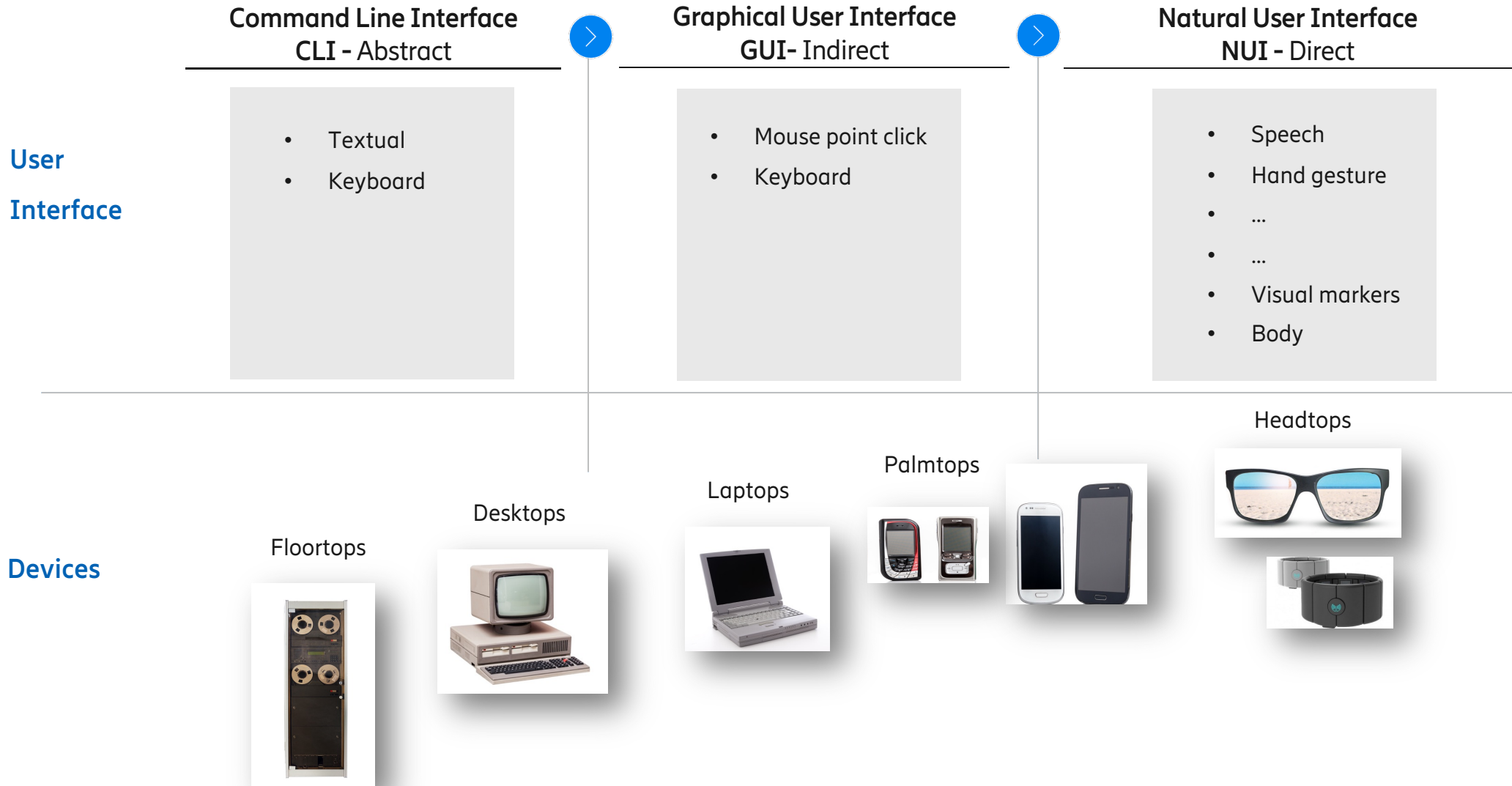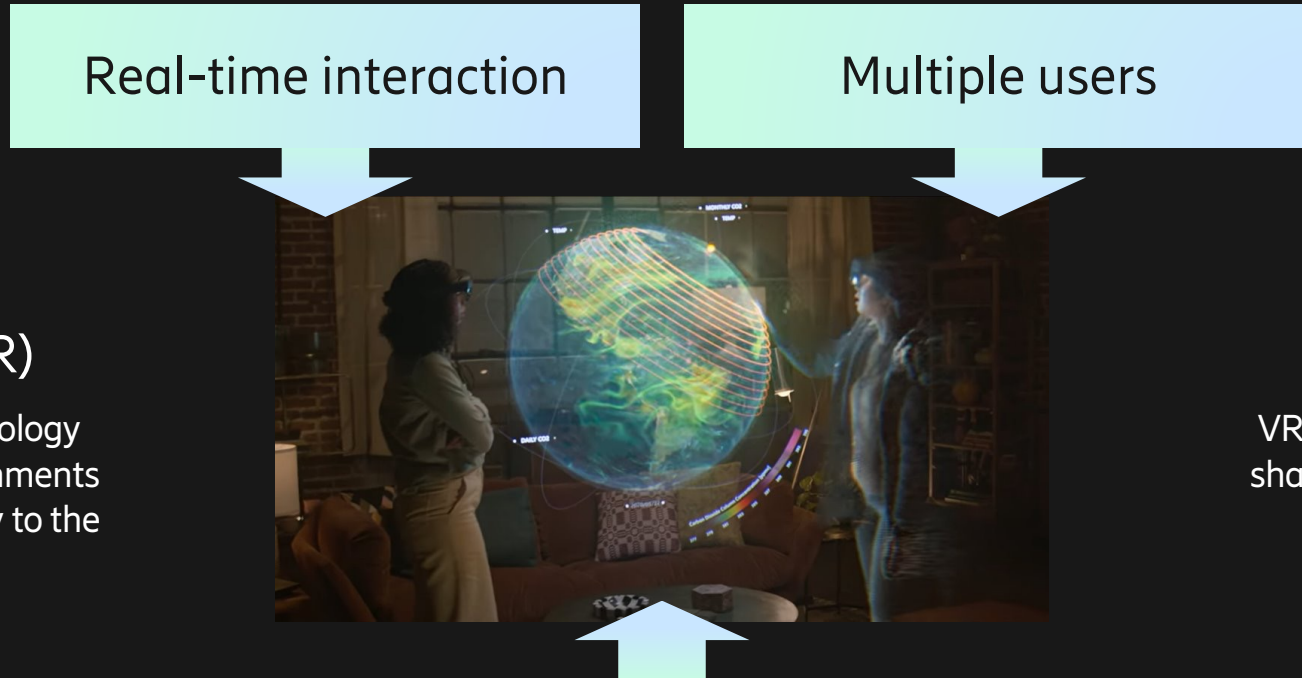
Extended Reality (XR)

Umbrella concept covering technology that alters reality or virtual environments by adding digital objects (gateway to the metaverse)

Metaverse

VR and AR/MR experiences within a shared and persistent virtual universe

Extended Reality

Real world environment

Fully virtual environment

Augmented Reality (AR)

Digital overlay over real world objects, i.e. real- world experiences enhanced by immersive simulations

Mixed Reality (MR)

Digital elements interacting with real world objects, often used interchangeable with AR

Virtual Reality (VR)

Fully digital virtual environment, i.e. simulated experiences that are highly immersive

XR can be the next paradigm shift after the smartphone

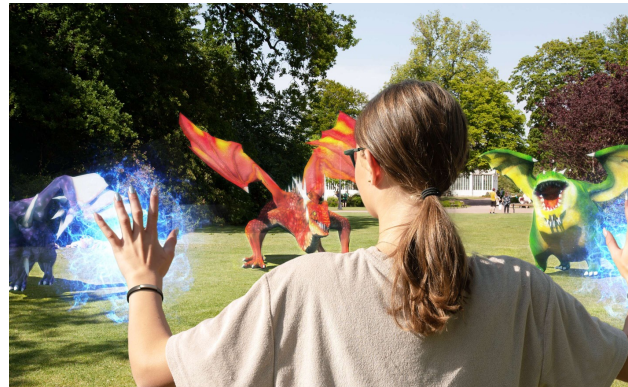| **VR to AR** Short term	**AR takes lead** Mid term	**All day XR** Long term

Head-Up-Display, blended information   **Recognize surroundings, geo-specific**   **Fully immersive**

Likely scenario development

- VR (video pass-through), simple AR / HUD
- Local area
- Static, on device, tethered
- Best effort MBB services

- Glasses-style
- 5G AR takes lead
- Local → wide area
- Shared spatial maps → uplink

- Global adoption
- Stand-alone, multi-user
- Privacy key
- Cloud compute → Low latency connectivity (UL/DL)

VR usage study

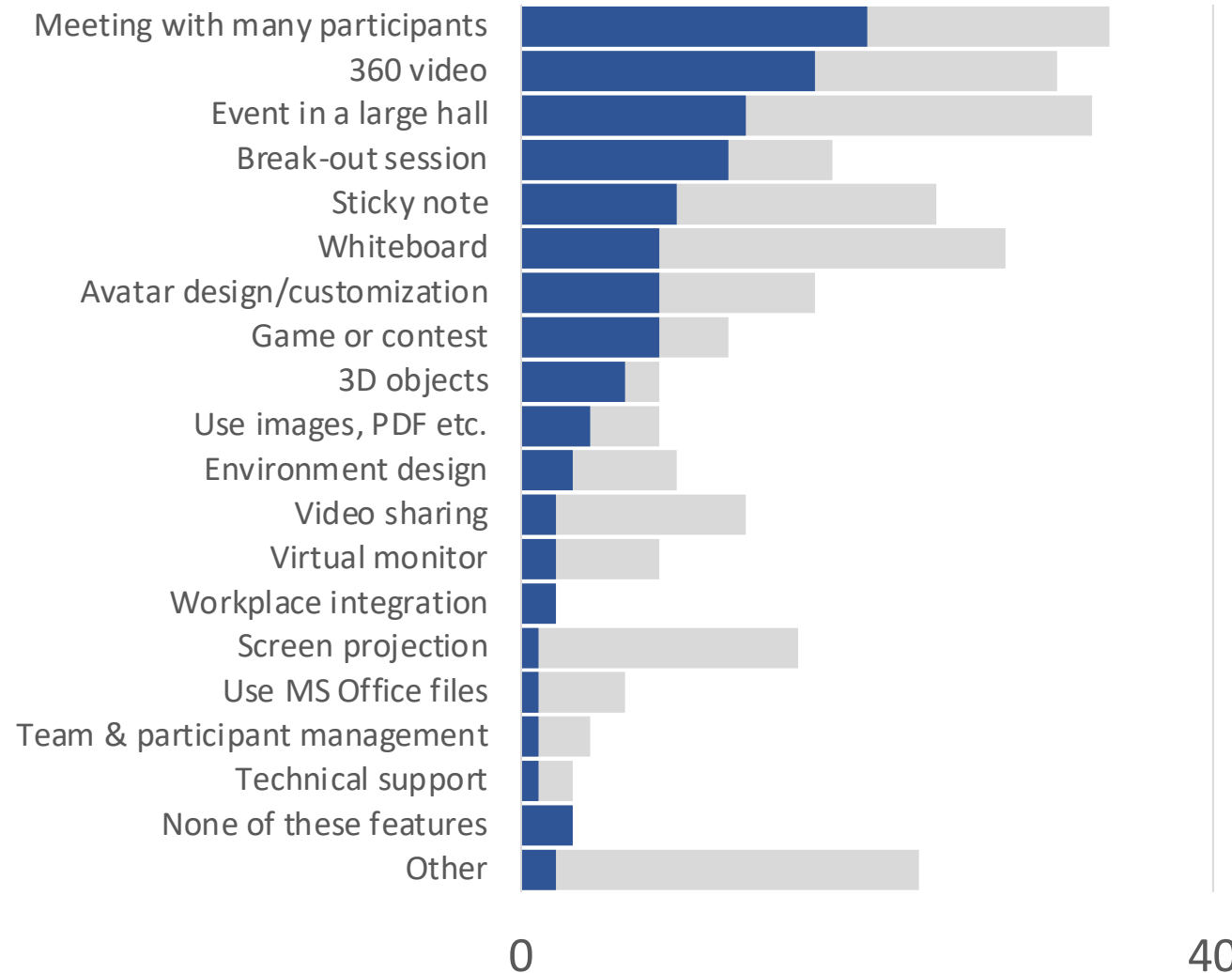5 weeks trial, 10 persons in total using VR for all meetings possible
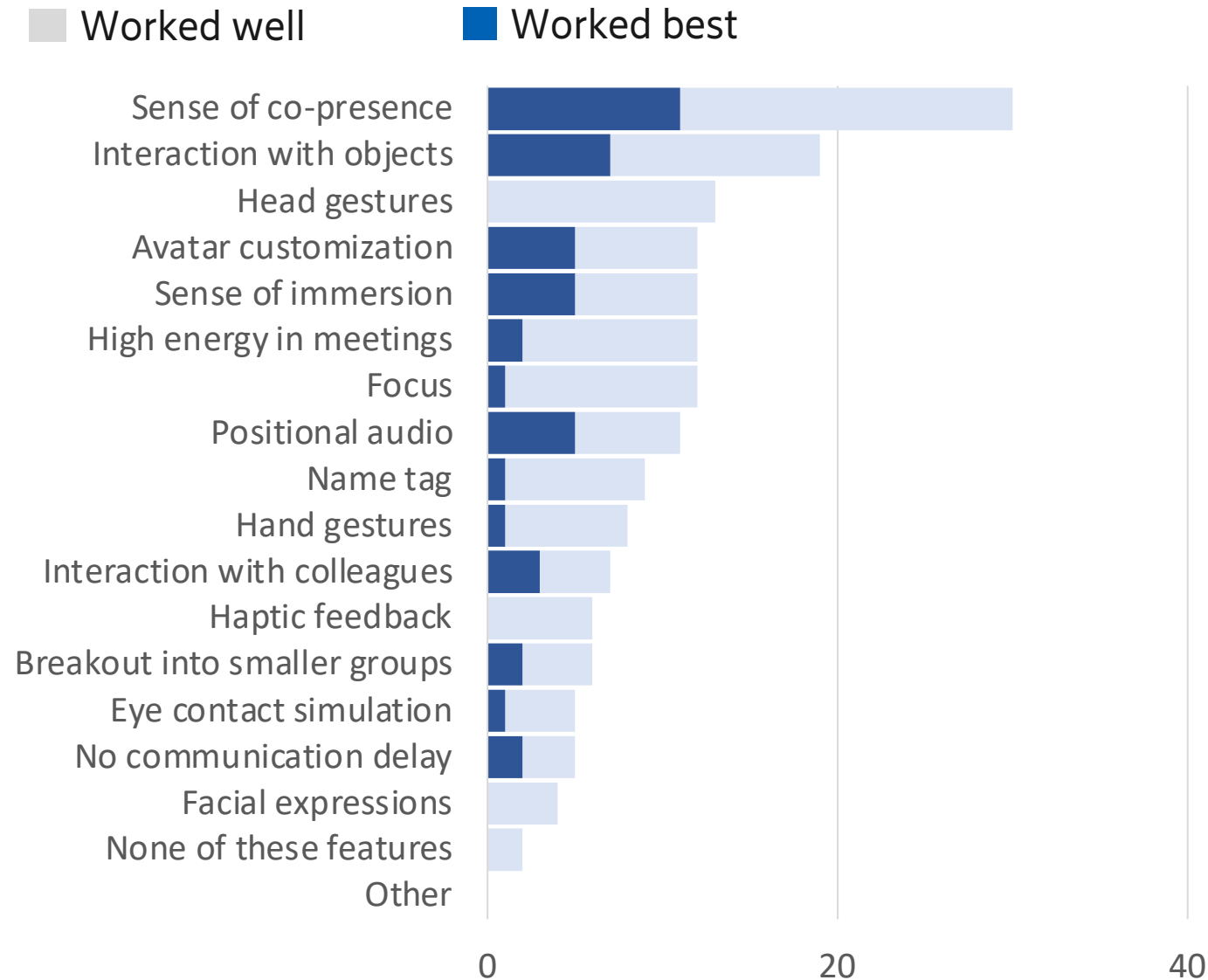
Quantitative survey of 48 VR users

Useful features

Legend: Functionality used (gray), Highest value (blue)

High value features
- Meeting several people
- 360 video
- Large event
- Break-out sessions
- Sticky note/Whiteboard

Chart categories (top to bottom):
- Meeting with many participants
- 360 video
- Event in a large hall
- Break-out session
- Sticky note
- Whiteboard
- Avatar design/customization
- Game or contest
- 3D objects
- Use images, PDF etc.
- Environment design
- Video sharing
- Virtual monitor
- Workplace integration
- Screen projection
- Use MS Office files
- Team & participant management
- Technical support
- None of these features
- Other

Axis: 0 — 40

Features that work well

Legend: ▨ Worked well ■ Worked best

Feature	
Sense of co-presence	
Interaction with objects	
Head gestures	
Avatar customization	
Sense of immersion	
High energy in meetings	
Focus	
Positional audio	
Name tag	
Hand gestures	
Interaction with colleagues	
Haptic feedback	
Breakout into smaller groups	
Eye contact simulation	
No communication delay	
Facial expressions	
None of these features	
Other	

Axis: 0 — 20 — 40

What works well
- Co-presence
- Object interaction
- Avatar customization
- Immersion
- Positional audio

Features needing improvement

■ Needs improvement   ■ Needs most improvement
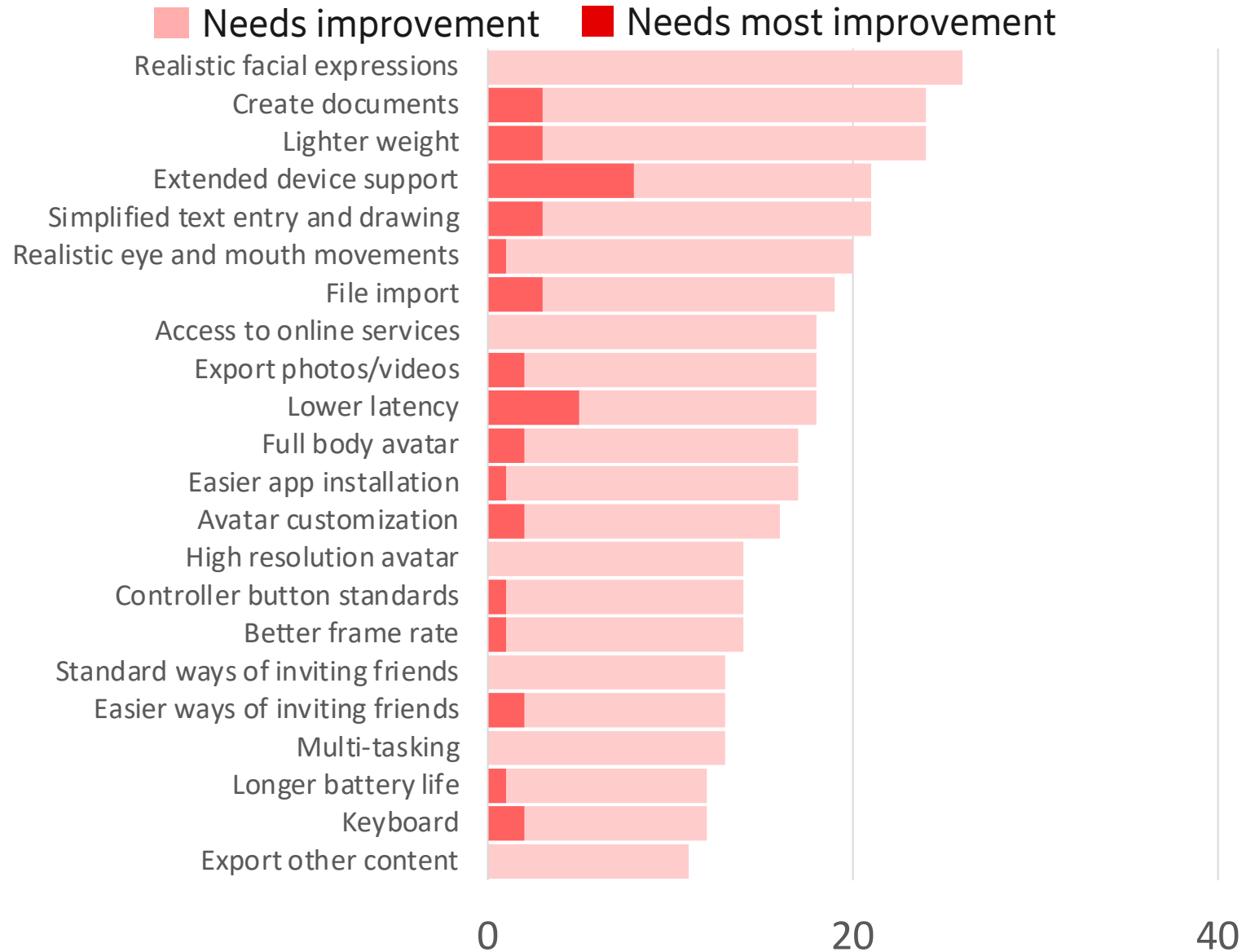
Needs improvement
- o Document creation
- o Lighter weight
- o Device support
- o Text entry & drawing
- o Realistic eye & mouth movement

Conclusion & summary

| Collaborative meetings, workshops & social interaction | Higher attention & energy level, improved communication | Intuitive – short time to learn | Movement during working from home |

- Workshops, brain storming sessions, discussions,
- Team building activities and regular team meetings.
- Interactive and conversation type of meetings, break-out sessions.

- We noticed improved attention & energy level in meetings
- Improved communication & understanding
- Sense of presence

- Short time to learn also among those who were less eager to try

- Better posture & more movement when working from home

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