Point, Pinch, Blink

A meta analysis of interaction paradigms in
wearable and ambient compute experiences

CS 139: Human-Centered AI
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Agenda

Study Scope

Analysis Across 4 Key Dimensions

Implications for Future Product Development

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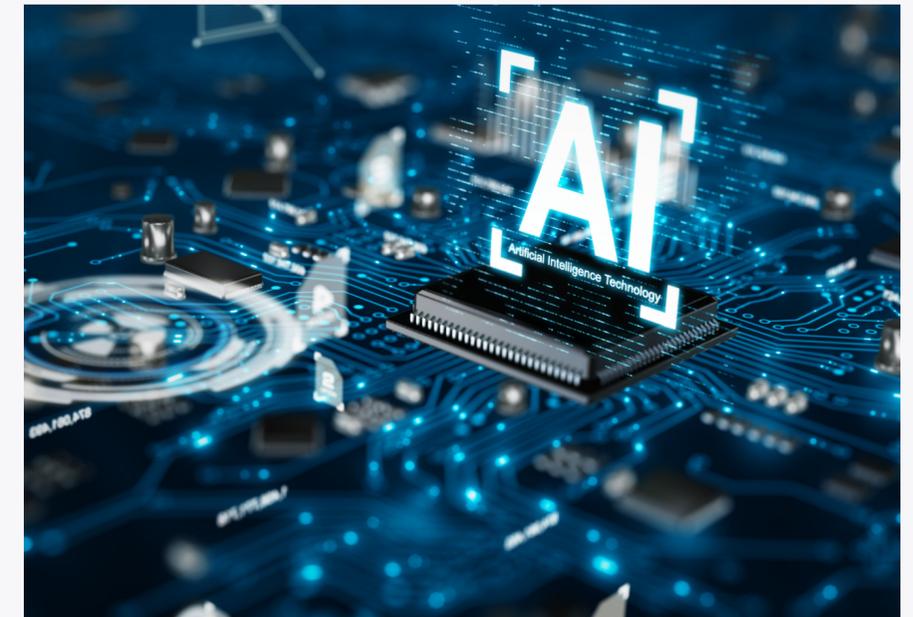Wyeth Coulter
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Study Scope

Devices we considered for this study are:

Wearable

Gesture and/or voice-controlled

AI-enabled

Analysis Across 4 Dimensions

Surfacing possibilities

How does the product tell the user what they can do with it? What is the ambient compute equivalent of a menu?

Controlling the device

How do users provide input to the device? What gestures or mediums are used most frequently? What patterns emerge?

Handling failure

How do these devices signal errors or failures to the user? Are failure states overt or hidden?

Unique features

What unique insight did the manufacturer have that they incorporated into the product?
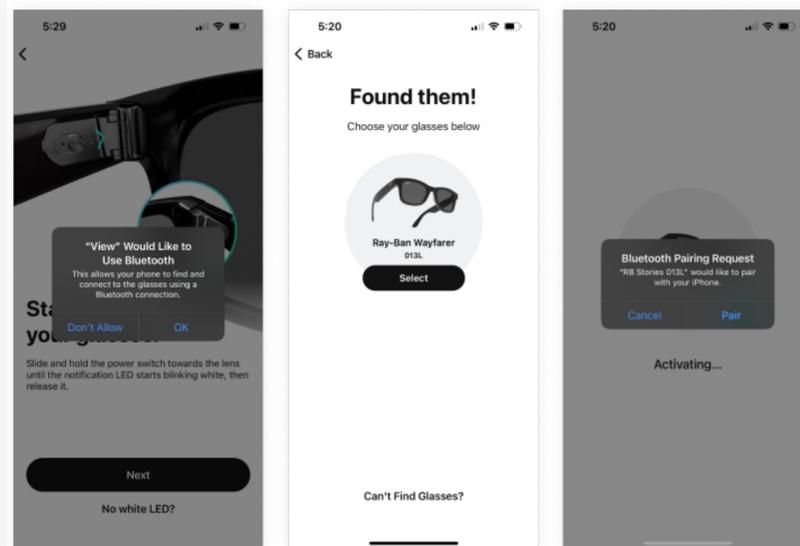
Surfacing Possibilities

Discoverability is shifting from visual menus to layered, context-aware cues, but there is no standard yet
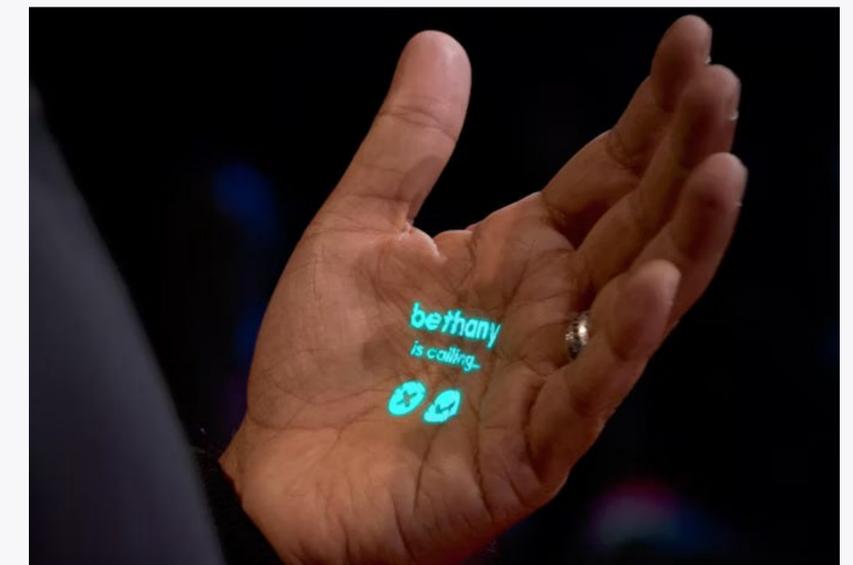

Guided onboarding

Onboarding must show feature set and define interaction language in context in the product experience

Proactive voice

Minimal UI = low friction, but risks user confusion or feature invisibility

Language-led interfaces flip the script: the interface speaks first

Multi-modal affordances

Audio, visual, and haptic feedback to surface options and provide feedback on action success
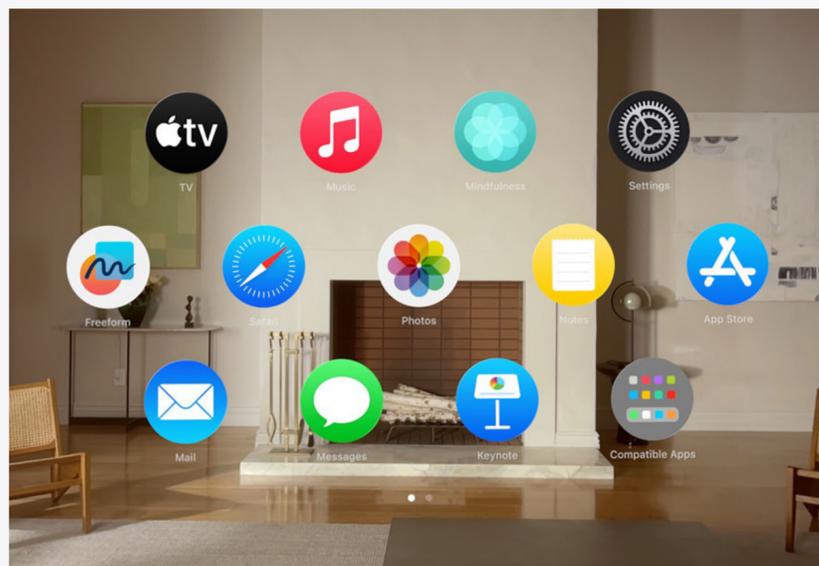
Multimodal control is expected — but each device privileges one mode based on its form factor and use case

Utilize existing designs/paradigms

iOS app ecosystem and design language

Skeuomorphic gesture control
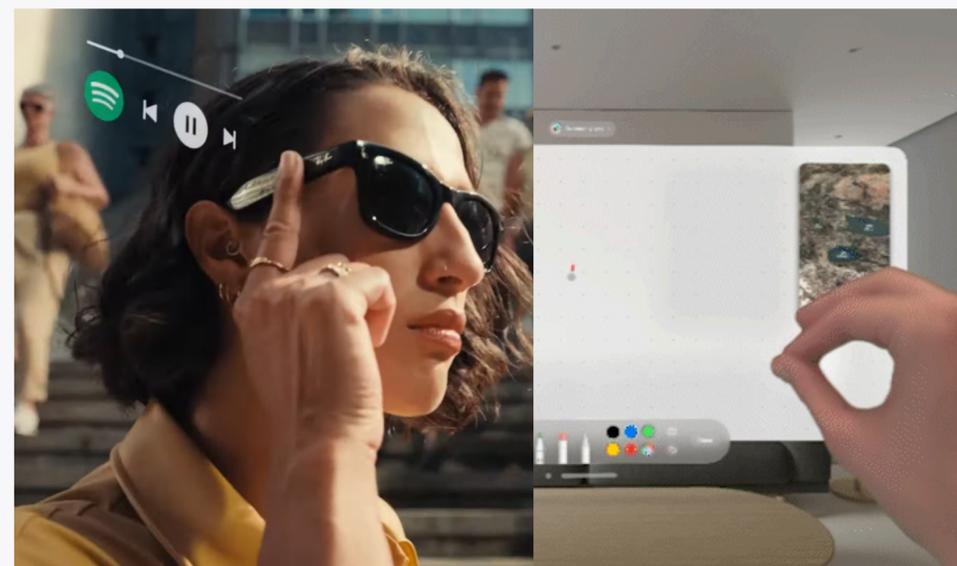
Use case dictates interaction modality

Hands most precise, voice least disruptive

Simpler devices limit input, encourage more passive use

Gaze, hand, voice standard

Dominate over camera, remote, or neuro

Audio input/output has many options, higher risk of violating social norms

Find your stay

...urself to a stunning stay with an eclectic and
...ourtyard. Trust us, your social media followers

Read More

Curated City
Guides

Tea and
Coffee

Common

Luggage

All iCloud

Search

Today

Proposed plan for Day 1:
8:41 AM · Arrive in at hotel...

Yesterday

Idea for screenplay
Yesterday · Buddy comedy with two st...

Tennis scorekeeping
Yesterday · Game v. Tag 3–1
Notes

Grocery list
Yesterday · Milk, tomatoes, pancetta...
To Do

Self-evaluation notes
Yesterday · Need to work on organizati...
Work

Eragrostis pectinacea
Yesterday · Tufted lovegrass...
Work

Ideas for programming
Yesterday · Intro to Field Recording in...

12 Notes

Proposed plan for Day 1:
- Arrive in at hotel and check-in
- Coffee and pastries in the park
- Self-guided walkthrough
- Meeting + bridge walkthrough with fabricators

Major question for this concept: how does it mesh with its surroundings? It's a big departure from the current look and feel of the park. I love the design and I'm comfortable presenting something challenging, but let's be thoughtful about its proposed placement.

For the elevated, stepped benches, let's make sure to spend time thinking about sight lines and getting a feel for how it will feel to sit on these benches at different times of day. Where does one get the clearest view of the sunset? Where would you sit if you wanted direct sunlight early in the...
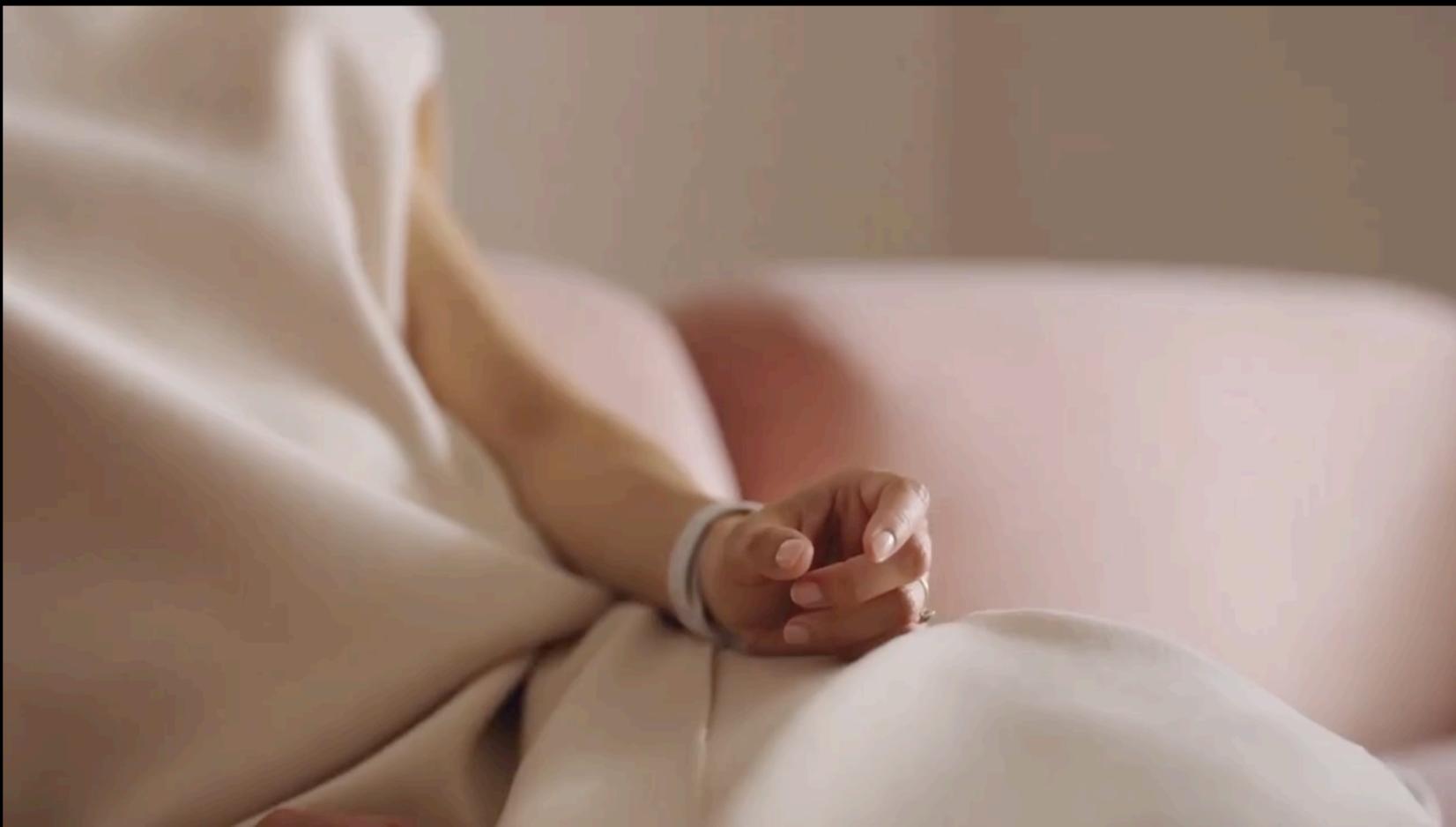
Most devices still meet failure with absence rather than a teachable moment. This is a missed opportunity

Silence after failure

Opportunity for user education, redirection

Voice assistants perform better at redirection/ correction explanation

Failure needs fallbacks

Manual or hardware input if failure in core feature

Multimodal error escalation

Bring user on journey

Subtle signaling can reinforce next step

Use cases drive input design

Productivity

Needs precision
(Vision Pro, HoloLens)

Entertainment

Needs fluid, hybrid control
(Quest, Samsung XR)

Everyday ambient use

Needs low-friction, discrete input
(Meta Glasses, Humane Pin)

Implications for leaders building future XR/wearable hardware

01   Every device uses some combination of voice, hand tracking, gaze, spatial audio

_____ Standard interaction language is emerging; core functionality is table stakes

02   Use case drives input

_____ Match form factor, interaction model, and functionality to core use case

03   AI is the new interface

_____ AI (voice, text) is the interaction layer, so treat it as an operating system, not bolt-on feature

04   Discoverability is the wild card

_____ The biggest challenge across the board is helping users know what to do and when

Device Deep Dive

Vision Pro

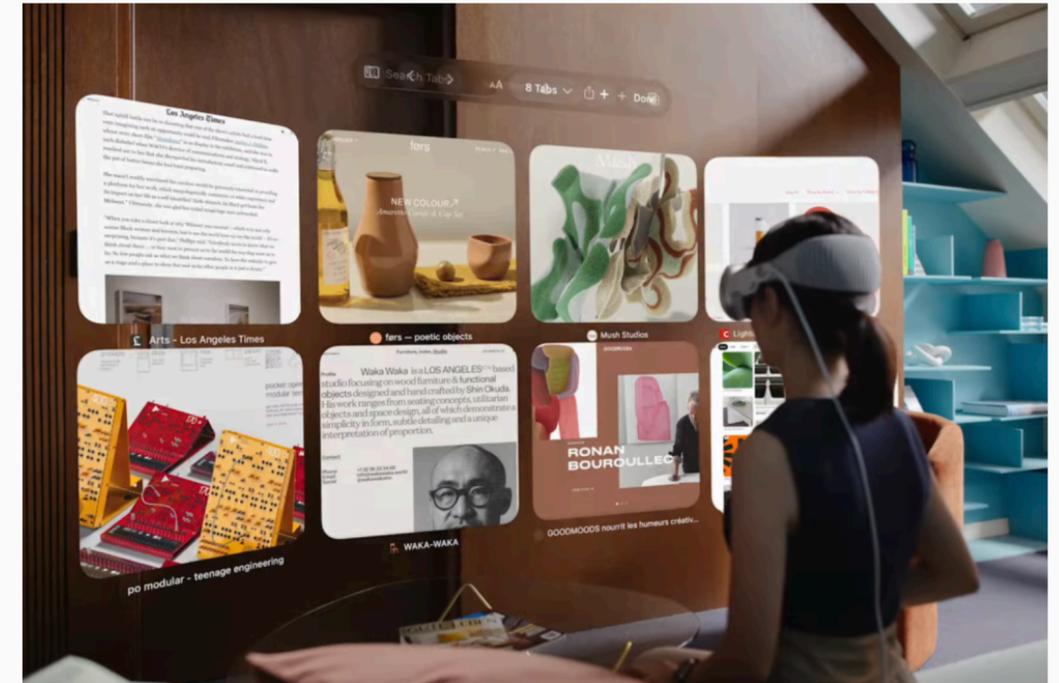| Manufacturer	Apple
Launch Date	February 2024
Form Factor	Headset (AR/VR/MR hybrid)
Price	$3,499
Weight	800 grams
App Ecosystem	iOS

Discoverability

- Utilizing standard iOS UI/UX
- Spatial app grid ("spatial computing")
- Gaze reveals interactivity

Control

- Extend familiar Apple app interactions into a unified, immersive experience
- Attention = intent
- Control by gaze and pinching

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"Just as the Mac introduced us to personal computing, and iPhone to mobile computing, Apple Vision Pro introduces us to spatial computing."

Tim Cook
Apple CEO

Meta Quest 3

Manufacturer	Meta
Launch Date	October 2023
Form Factor	Mixed-reality (MR/VR) headset
Price	Starting at $499.99
Weight	515 grams
App Ecosystem	Meta Horizon OS+

Discoverability

- Floating universal menu
- Full-color MR passthrough with scene understanding
- Automatic boundary setup
- Controller + hand-tracking onboarding tutorials

Control

- Hand-tracking 2.0 gestures
- Touch Plus controllers with improved haptics
- Gaze-based targeting in some apps
- Voice commands via Meta Assistant (optional)

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"The Meta Quest 3 is the first mainstream mixed–reality device — blending your physical space with digital worlds in ways that feel intuitive, powerful, and accessible to everyone."

Mark Zuckerberg,
Meta CEO

Microsoft HoloLens 2
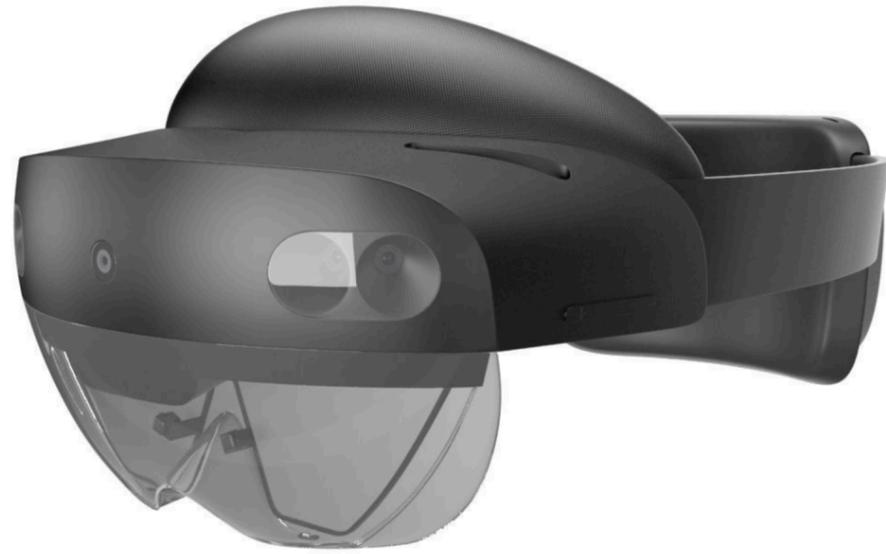
Manufacturer	Microsoft
Launch Date	November 2019
Form Factor	Optical AR headset
Price	$3,500
Weight	566 grams
App Ecosystem	Microsoft Mesh + Windows Holographic + Azure enterprise AR

Discoverability

- Spatial tooltips + gaze-based hints
- Floating Start Menu shell
- Onboarding teaches hand-gesture vocabulary
- Eye-tracking reinforces "look-then-act" interaction model

Control

- Fully articulated hand-tracking (grab, drag, tap, air-tap)
- Gaze for targeting & cursor placement
- Voice commands via Cortana + system-level speech input
- Optional clicker accessory for industrial environments

"Mixed reality is the next wave in computing — unlocking new ways to visualize work, collaborate, and solve problems."

Satya Nadella,
Microsoft CEO

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Galaxy XR

Manufacturer	Samsung
Launch Date	October 2025
Form Factor	Stand-alone mixed-reality
Price	$1,799
Weight	545 grams
App Ecosystem	Android XR platform

Discoverability

- Floating universal menu + multitask workspace
- Full-colour mixed-reality passthrough and spatial awareness
- On-boarding supports voice, eye-tracking & hand-tracking controls

Control

- Hand-tracking gestures (hover, pinch, swipe)

- Eye-tracking for menu/selection
- Voice commands via embedded mics and AI assistant
- Optional controllers for gaming/interaction

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"With the Galaxy XR, we're putting immersive computing into a form you can use daily — bridging productivity, entertainment and presence in a way that frees you from screens.""

DJ Koh
Samsung Electronics Head
of Mobile Experience

Ray-Ban Meta Display

Discoverability

- Voice onboarding via Meta AI
- Audio feedback for actions
- "Hey Meta, what can you do?" prompts

Control

- Voice commands
- Tap/swipe on temple
- Capture button (photo/video)

Manufacturer	Meta + Essilor Luxottica
Launch Date	September 30, 2025
Form Factor	Wayfarer style, 69-70g
Price	$799 USD (Incl. Neural Band)
Weight	69g standard / 70g large
App Ecosystem	Meta View (iOS/Android)

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"Smart glasses are going to be the next major platform in computing."

Mark Zuckerberg
Meta CEO

Humane Pin

Manufacturer	Humane Inc.
Launch Date	April 2024
Form Factor	Wearable AI-pin
Price	$699 + $24/month subscription
Weight	55 grams
App Ecosystem	Proprietary CosmOS

Discoverability

– Attaches magnetically to clothing and activates voice/gesture interface

– Projection "Laser Ink" display onto user's hand or surface for UI visuals

– On-boarding explains gesture grabbing, voice commands, and projection cues

Control

– Voice commands and AI assistant — queries, reminders, capture

– Tap & swipe gesture sensor on device front + projection display interaction

– Camera + built-in mic + directional speaker for hands-free operation

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"We designed the AI Pin to free you from your phone — making technology more human–centered, always present, yet out of the way."

Imran Chaudhri,
Co-Founder Humane, Inc.