Human-Computer Interaction

Ubiquitous, Mobile & Tangible Computing

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Today's Agenda

- Topic overview: *Ubiquitous, Mobile & Tangible Computing*
- The frame: *enduring fundamental → how AI changes it*
- Provocation: *Re-founded, or just better sensing?*
- Discussion

This term's frame

Enduring fundamental → *How AI is changing it* → *Depth (a claim to argue with)*

Fundamentals are not a relic to move past — they are the **instrument** you use to read the AI moment.

- **Today's fundamentals:** *attention* as the scarce resource, with *calm, context-aware design* as the response · *embodiment*
- **Depth: Light** — the **"least transformed by AI"** week

Topic overview: *Ubiquitous, Mobile & Tangible Computing*

Three visions

Three visions that shaped the area:

1. **Communication is mobile & ubiquitous** — small networked handhelds ↠ *Mobile Computing*
2. **Computing is pervasive & embedded** — specialized, networked, invisible computers ↠ *Ubiquitous Computing / IoT*
3. **Computing is physical & manipulable** — platforms that read human intent & expression ↠ *Tangible Computing*

The three visions contrasted

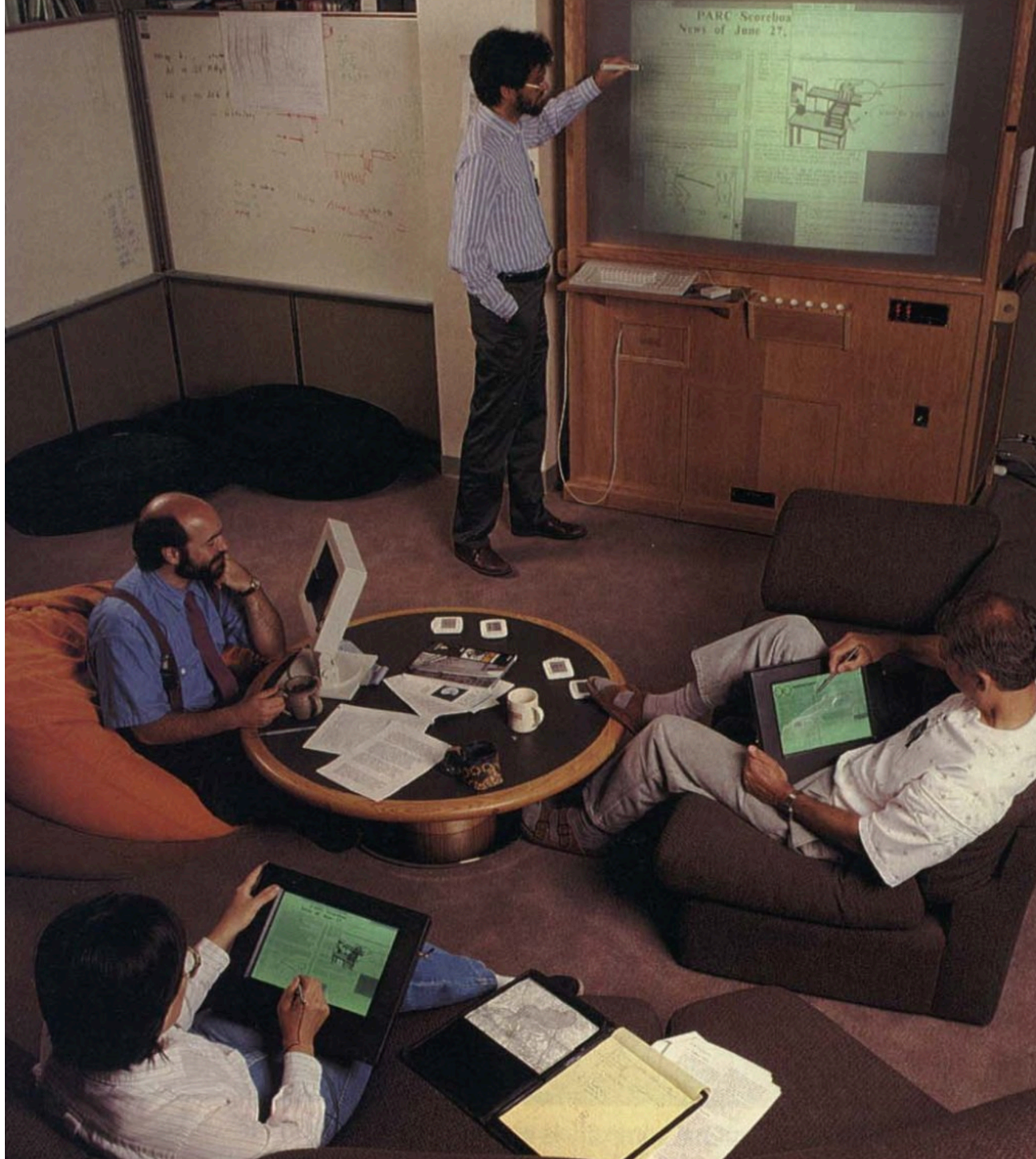
Dimension	Mobile	Ubiquitous	Tangible
Device role	Central, personal	Invisible, embedded	Peripheral, shared
Interaction	Screen-tapping	Sensing, responding	Grasping, moving
Focus	Efficiency	Seamlessness	Embodiment
Mobility	Device mobility	Spatial diffusion	Human mobility

The anchor: Weiser's vision[1]

The Computer for the 21st Century – Mark Weiser, Xerox PARC (1991)

"The most profound technologies are those that disappear."

- A *fabric of computation*: tabs, pads, boards
- Computers must *know where they are*
- Computing recedes into the **periphery**



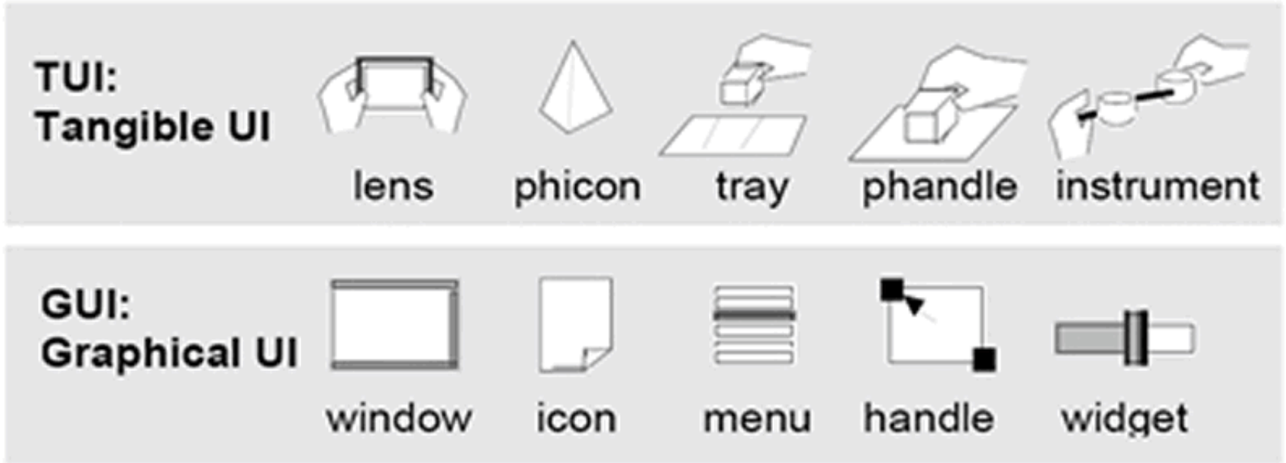
[1] Weiser, M. (1991). The Computer for the 21st Century. *Scientific American*, 265(3), 94–104.

Tangible computing[2]

Tangible Bits – Hiroshi Ishii & Brygg Ullmer, MIT Media Lab (1997)

"…allows users to 'grasp & manipulate' bits in the center of users' attention."

- Thinking *with the body*, thinking *in space* – epistemic action
- But: **tangible ≠ natural** – mappings are learned, socially interpreted



[2] Ishii, H. & Ullmer, B. (1997). Tangible Bits: Towards Seamless Interfaces between People, Bits and Atoms. *CHI 1997*.

Why *calm*? Attention is the bottleneck[3]

"...a wealth of information creates a poverty of attention..."

- Ubicomp: "many computers share each of us"
- We "compute while doing something else"

👉 "Calmness is a new challenge that UC brings to computing."[4]

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[3] Simon, H.A. (1971). Designing Organizations for an Information-Rich World. In *Computers, Communications, and the Public Interest* (pp. 37–72).

[4] Weiser, M. & Brown, J.S. (1997). The Coming Age of Calm Technology. In *Beyond Calculation* (pp. 75–85). Copernicus.

Calm technology: *the response*[5]

- Engages the **center** and the **periphery** of attention, moving easily between them
- The periphery gives **locatedness**: a connection to the world around us
- Invisible in *use*, not by design: **unremarkable**[6]

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[5] Weiser & Brown (1997), as above.

[6] Tolmie, P., Pycock, J., Diggins, T., MacLean, A., & Karsenty, A. (2002). Unremarkable Computing. *CHI 2002*, 399–406.

Calm needs *context*

To stay in the periphery and come forward at the right moment, a system has to know the situation. How do we **represent** that?

- **Schilit & Theimer (1994):** "location and the identity of nearby people and objects"[7]
- **Dey et al. (2001):** "any information that can be used to characterise the situation of entities"[8]

👉 If context is *information*, the job is to **sense more of it**.

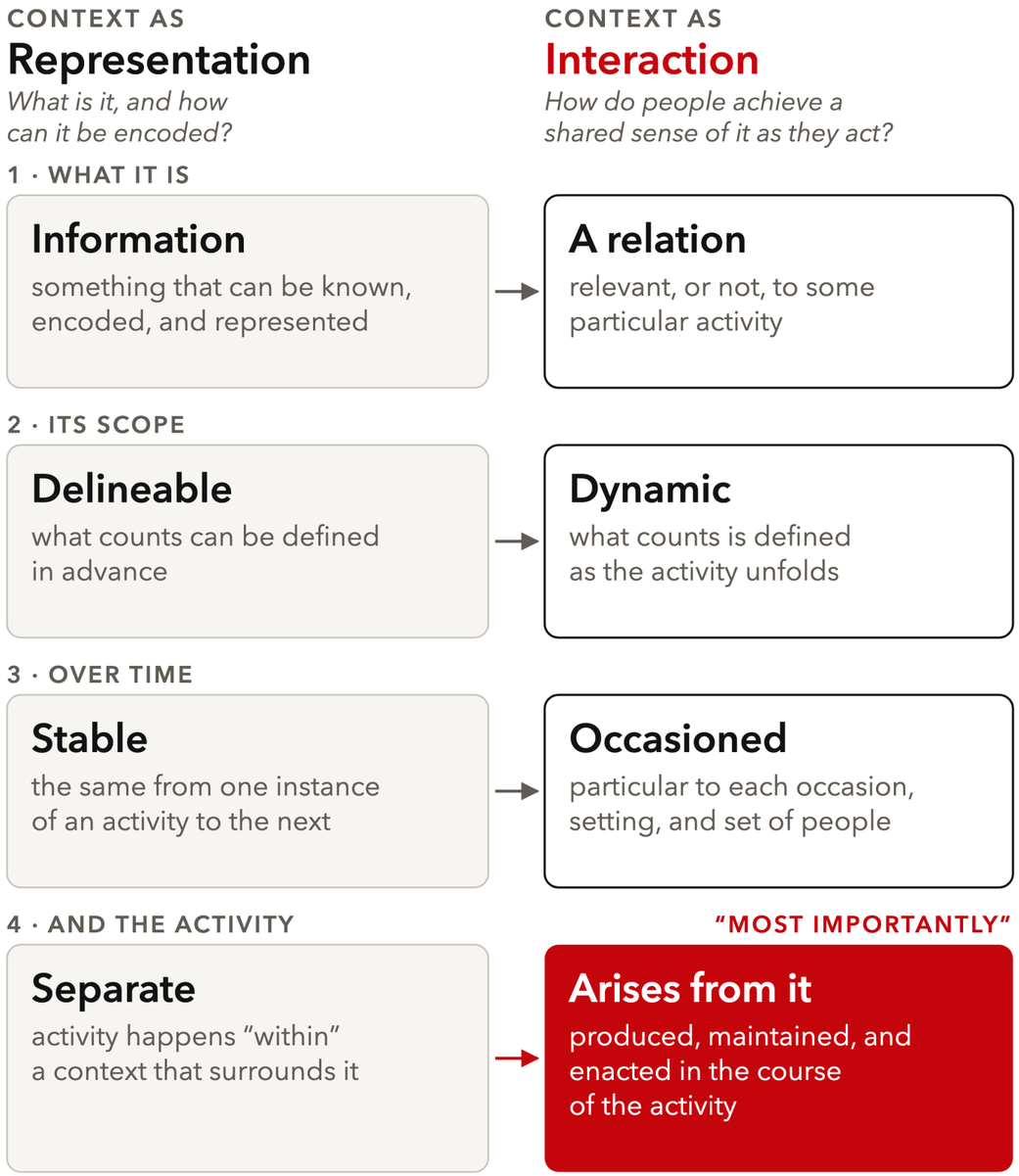
[7] Schilit, B. & Theimer, M. (1994). Disseminating Active Map Information to Mobile Hosts. *IEEE Network*, 8(5), 22–32.

[8] Dey, A.K., Abowd, G.D., & Salber, D. (2001). A Conceptual Framework and a Toolkit for … Context-Aware Applications. *HCI*, 16(2–4), 97–166.

The counter-lens: what *is* context?[9]

Paul Dourish, *What We Talk About When We Talk About Context* (2004)

- Four assumptions behind context-aware systems, each turned around
- Why sensing more won't make a system *understand* context



[9] Dourish, P. (2004). What We Talk About When We Talk About Context. *Personal and Ubiquitous Computing*, 8(1), 19–30.

Bring back: situated action[10]

Lucy Suchman – *Plans and Situated Actions* (1987) *(you read this Wk 3)*

- Action is not the *execution of a plan* – it is **situated**, improvised in context
- At the center of this week's tension: *sense and infer the situation* vs. *context as achieved*

[10] Suchman, L. (1987). *Plans and Situated Actions*. Cambridge Univ. Press. (Intro + ch. 1)

But what about *AI*?

So what changes? *Not much*

AI sharpens **sensing**; it does **not re-found** the area.

- Weiser's questions *predate and survive* the model
- Context is still *achieved*, not sensed
- Today's pitch: an AI that sees and hears **"to understand context"**[11]. But sensing ≠ understanding.

👉 Better sensing, same questions.

[11] Hassabis, D. (2024, May 14). Google Gemini updates: Flash 1.5, Gemma 2 and Project Astra. *Google Blog*.

Attention: *still* the scarce resource

Calm was the answer to scarce attention. Better context inference cuts two ways:

- **Calm:** hold back; come forward only when it matters[12]
- **Capture:** come forward *exactly* when you're most likely to engage

👉 Same sensing, opposite goals. Who keeps *attention* in charge?

[12] Yang, Q., Steinfeld, A., & Zimmerman, J. (2019). Unremarkable AI. *CHI 2019*. doi:10.1145/3290605.3300468

Why compare with *XR*?

Weiser defined ubicomp *against* virtual reality: simulating a world vs. "invisibly enhancing the world that already exists."

- **Ubicomp (today):** AI improves *sensing*; calm, attention, and context are unchanged
- **XR (Week 10):** AI turns *building 3D worlds* from months of work into a prompt; *presence* is unchanged

👉 Both: AI changes *how it's built*, not *what it is*. In XR that change is far bigger.

Your provocation: *pick one*

1. **Provocation:** does AI *re-found* this area, or only *sharpen its sensing*? Ground it in the readings.
2. **Critical artifact:** an AI product that claims to understand your context. Mark what is *sensed* vs. *achieved*.
3. **Design or policy:** one principle that keeps *attention*, not the model, in charge.

Discussion

Today's roles

Reporter	Skeptic	Connector
Seat 6	**Seat 1**	**Seat 2**

Same in every pod. **Seats 3, 4 and 5** have no role today – you are still in the argument.

Discussion Format

In your pod, on your pod monitor — ~30 minutes.

- **Everyone shows their slide** — about 2 minutes each, cast from your own laptop
- **Skeptic** puts a counterargument on the table · **Connector** ties it to an earlier week
- **Reporter** writes the pod's three lines — agreed, split, unresolved — and delivers them to the room

What's Next?

- **Friday – Methods: Qualitative Analysis (Grounded Theory / Open-Coding + AI-Assisted)**
  - **Read:** Muller (2014) on grounded theory · Xiao et al. (2023) on codebook-driven LLM coding
  - **If you can:** the textbook **Chapter 11** (analyzing qualitative data)
  - Post your team's **3-line project status** (done / blocker / next)