HUMAN COMPUTER INTERACTION

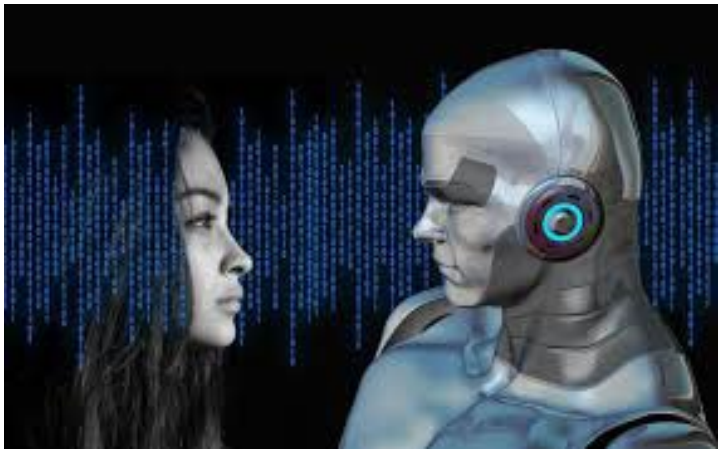
Lecture 11 Overview:

Future Interactions?

- Interactions with? Agents, Avatars, Robots, IOT
- Web 3.0
- XR: AR-MR-VR
- Affective Computing

AGENTS

- Agents: autonomous, active computer processes; communicate with people/agents; adapt their behaviour
- Computers have access to very limited view of people's activities: mouse, keyboard movements?
- Make inferences from collected data
- Metaphors for "agents": travel, real-estate, secret, professional agent, slave
- Two types of Agent:
  - Personalisation agents
  - Domain knowledge agents



AVATARS

- Avatars: translated from *Sanskrit* as incarnation
- Graphical representation of the user or the user's alter ego or character
- 2D: icons in online communities; 3D in games or virtual worlds
- Originated in 1985 by Richard Garriott for the computer game Ultima IV: Quest of the Avatar
- User has emotional, social & ethical connection and responsibility for Avatar




ROBOTS

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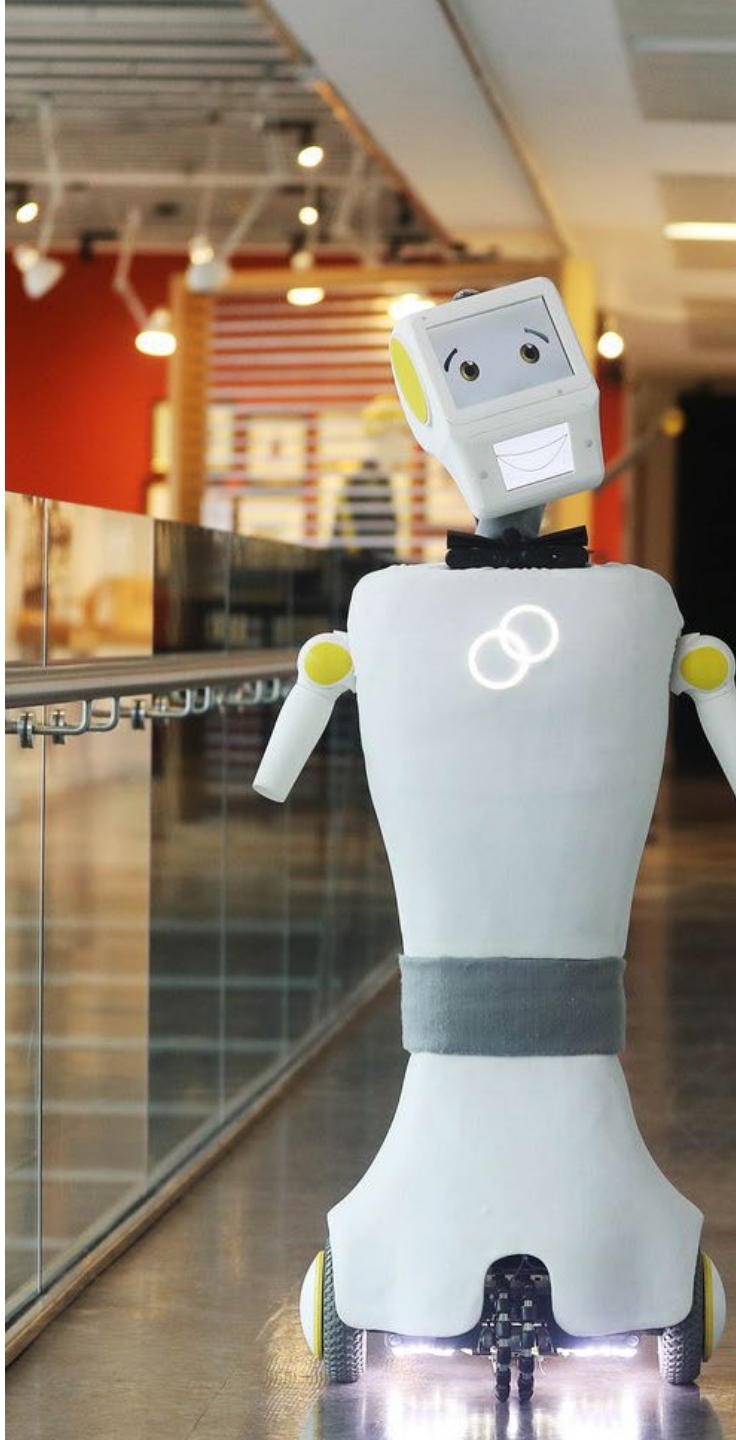
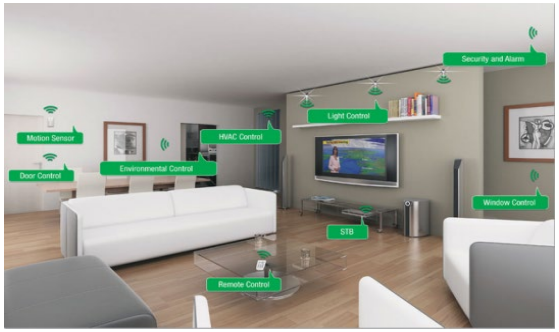
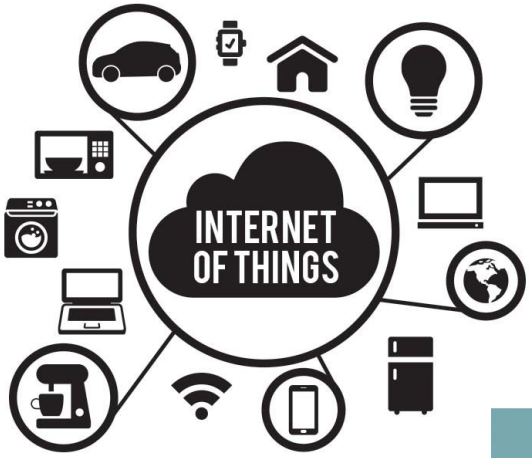
ROBOTS

- Robots: moving target
- Human-Robot interaction?(HRI)
  - Remote investigators of hazardous locations (nuclear power stations, bomb disposal); search & rescue helpers (fires) and far-away places (Mars)
  - Domestic robots that give assistance: robot lawnmowers or vacuum cleaners
  - Provide companionship: Nursebot “Pearl”, TCD Stevie (RTE Nov. 2017); Service provision (elderly care) or Social mediation (e.g. autism)
- Ethics of robots that exhibit human-like behaviours?
- TCD Stevie
- Developed to augment not replace human care



Internet of Things





IOT INTERACTIONS

1. Short Form: immediate, urgent issue; 5-15 secs: quick resolution

2. Medium Form: two goals: planning for future events, or changing recurring scheduling; 15-30 secs – more user mental effort

3. Long Form: rare if ever, ideally only performed on initial setup; longer than 30 secs

WEB3?

Web 1.0

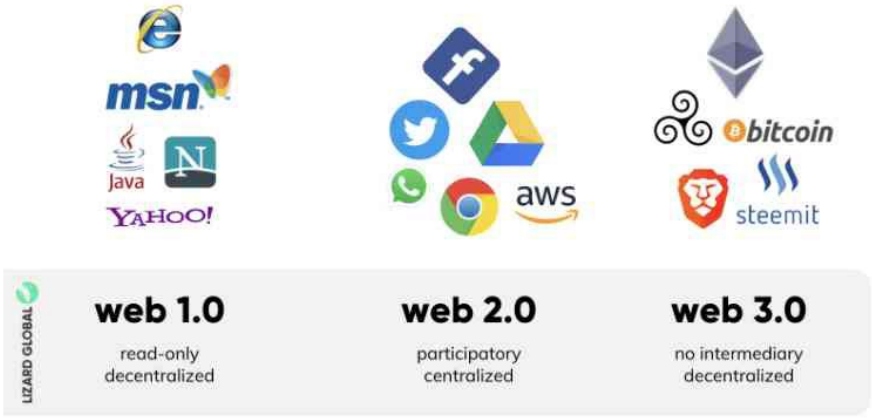
Digital Filing cabinet

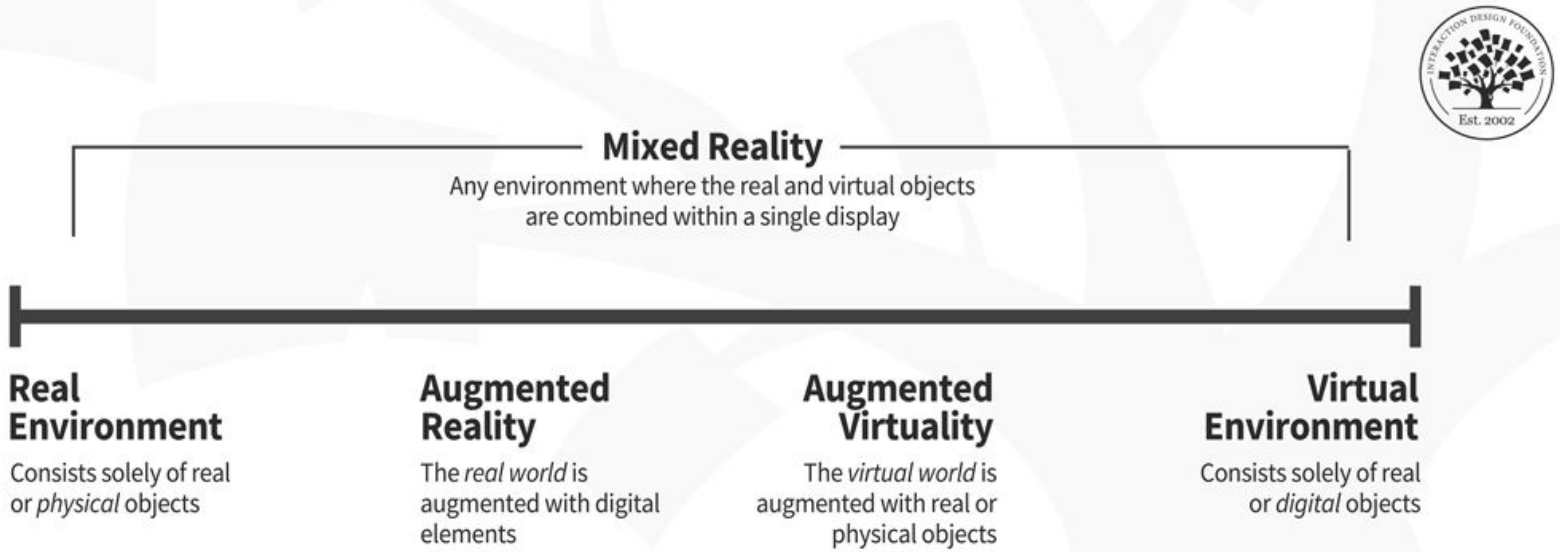
Web 2.0

Social Media (2D)

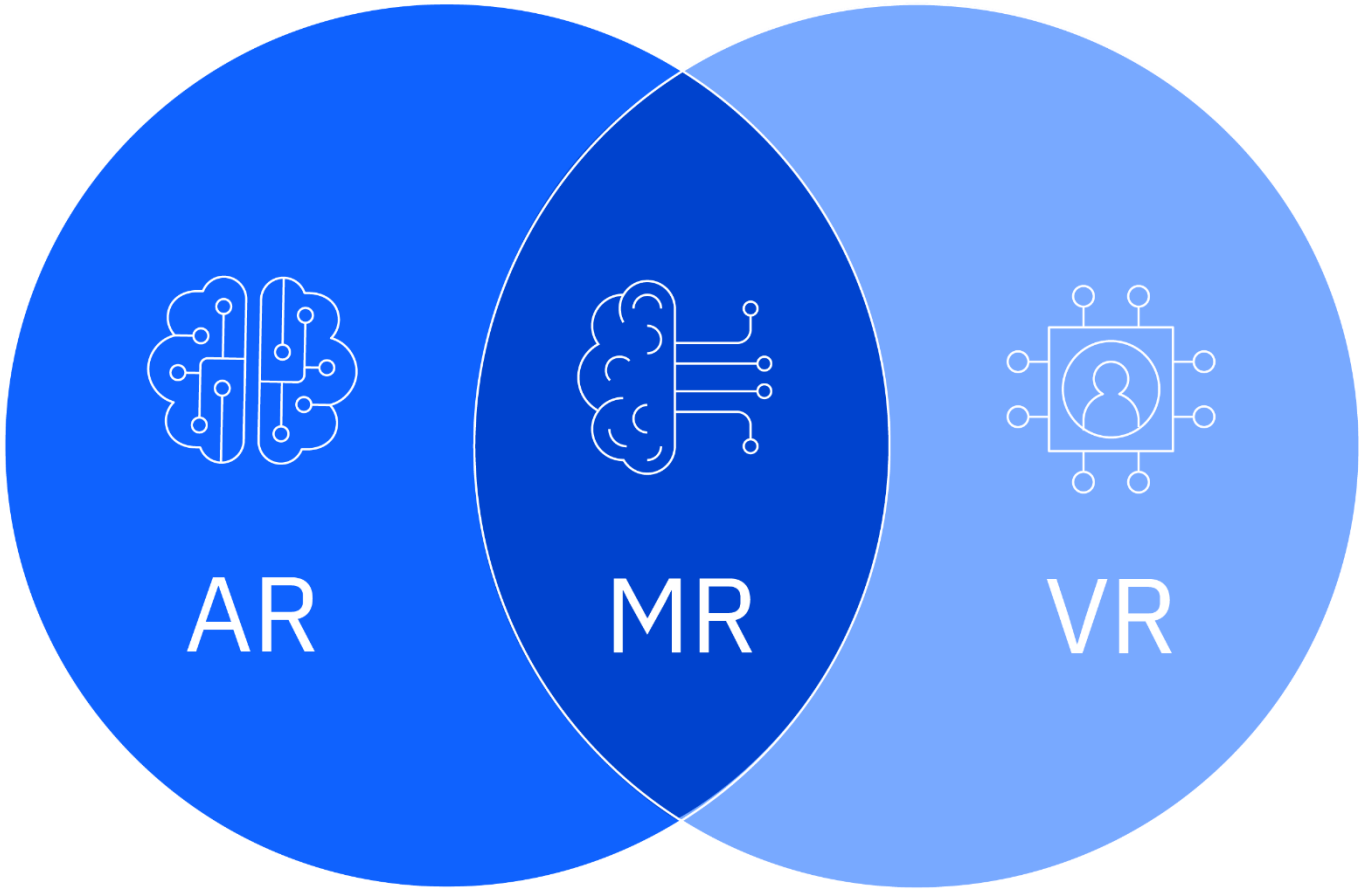
Web 3.0

3D, XR: VR, AR, Digital Twins, Smart Spaces, Virtual Assistants





VIRTUALITY CONTINUUM



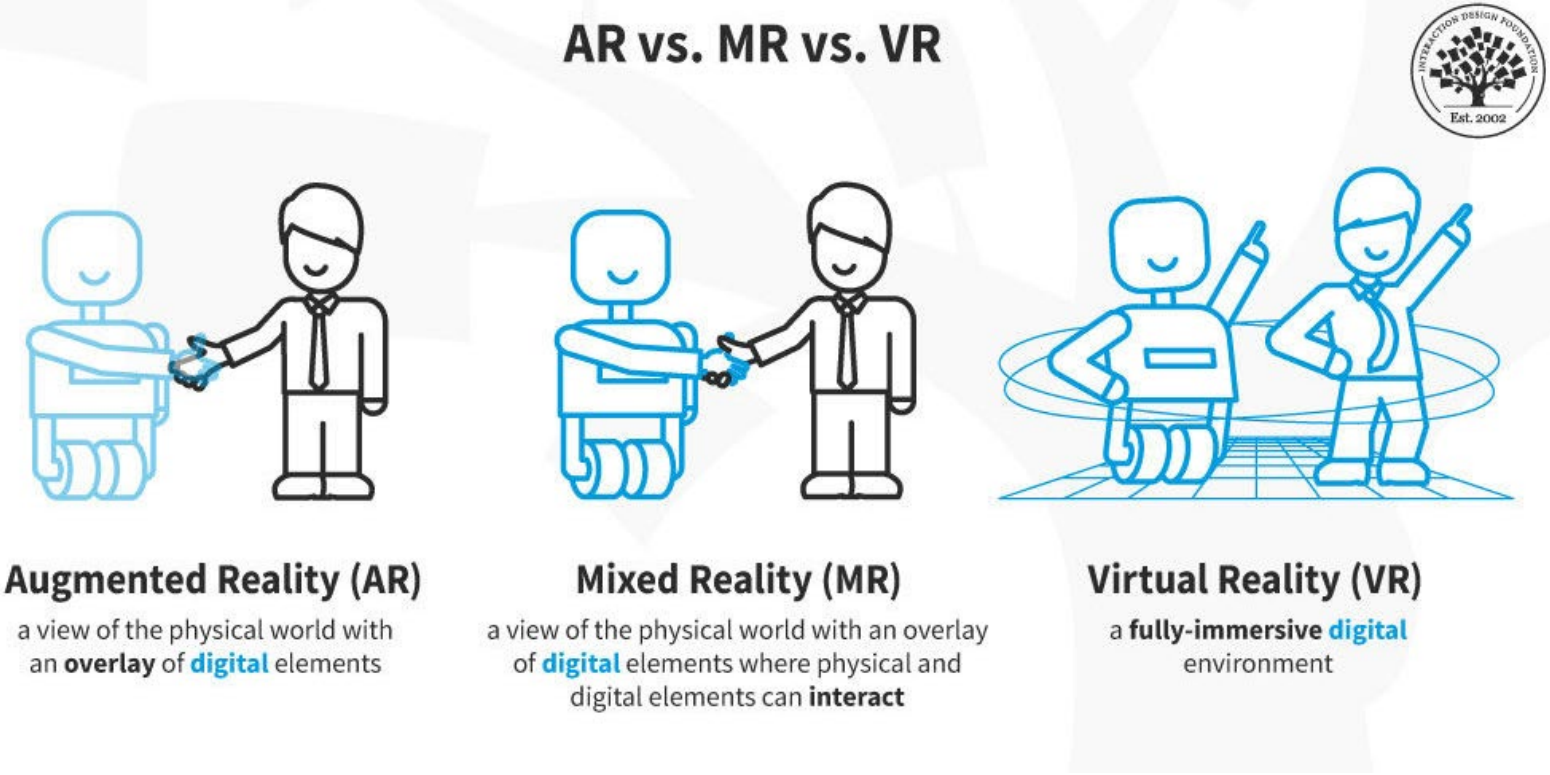
XR

Augmented Reality (AR)
Digital content on top of the real world

Mixed Reality (MR)
Digital interacts with the real world

Virtual Reality (VR)
Digital environments that shut out the real world

IBM Institute for Business Value



XR INTERACTIONS

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VIRTUAL REALITY

- Real world blocked out
- 3D Space
  - Virtual presence: comfortable in virtual world
  - Place: matching your movements and perception, built into VR headsets
  - Plausibility: world is real and responsive
- Embodiment: feeling that you are interacting with your body in virtual world
- VR: Magical Interaction
- Active & Passive Interactions

VR DESIGN CHALLENGES

- Comfortable VR experience?

https://www.interaction-design.org/literature/article/beyond-ar-vs-vr-what-is-the-difference-between-ar-vs-mr-vs-vr-vs-xr

- Human perception: reality as perceived by our senses
- Lack of defined standards: Hardware & Software (Metaverse Standards Forum, June 2022): 3D graphics, geospatial systems, physical simulation and photorealistic content authoring
- Security
- Emotion tracking – virtual avatar imitating real-life facial expressions
- Most challenging is the design of UI & navigation: freedom of movement, ease of control, system responsiveness, device input: voice, gesture, click, haptics

VR DESIGN CHALLENGES

- *Head Mounted Displays (HMD):*
- *Designing these devices continues to be a study in contradictions. They must be extremely low power, with small enough batteries to make them comfortable to wear. But they also must be able to process large amounts of streaming image data in real time, and with a screen refresh rate high enough to prevent motion sickness. In addition, they must last long enough between charges to make it attractive to consumers. Also, they must stay relatively cool, because the device is worn over the face, and they need to be secure, include high-speed I/O and advanced communications technology — and still be affordable*

VR DESIGN CHALLENGES

- Diverse VR use cases: no one size fits all
- High-speed gaming: processing speed and latency
- Surgical training application: clarity and accuracy are priorities, e.g. 8K display with force feedback provides feeling of doing a real operation on a live person
- VR Training: flight, aerospace, military, communications
- Phobia Treatment

METAVERSE

The metaverse is a digital artificial intelligence (AI) platform with a 3D user interface that provides immersive user experiences

- **VR: AR-MR-VR: 3D & AI:** heavy processing requirements
- **Customisable avatars** & digital goods: Creator economy
- **Builtin cryptocommerce & NFTs**
- **Realtime environments:** IoT, IoE
- **Spatial audio**

Gerd Leonhard (2022)

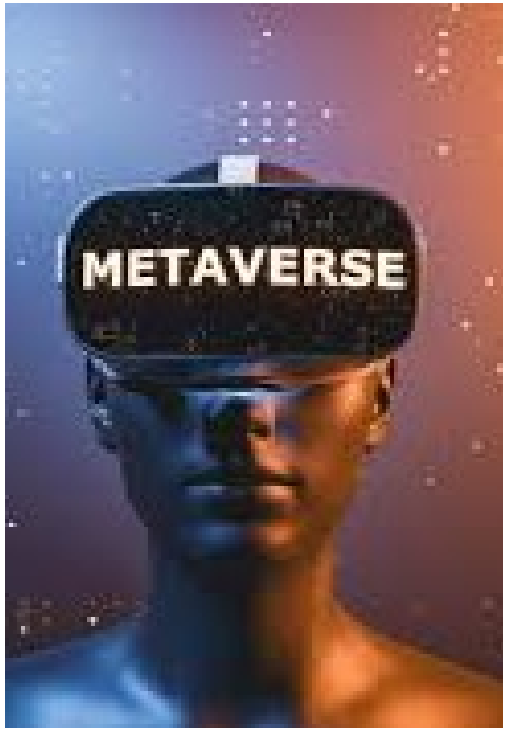
METAVERSE COMPANIES

- Meta CEO Mark Zuckerberg has repeatedly called Apple's 15 to 30% App Store commission monopolistic, saying the company's App Store "blocks innovation, blocks competition"
- Meta recently announced it would take a 47.5% cut of digital asset purchases in the Metaverse, when it begins allowing in-world purchases
- Its rival, Apple, took the news as an opportunity to lob a shot at its competitor

METAVERSE

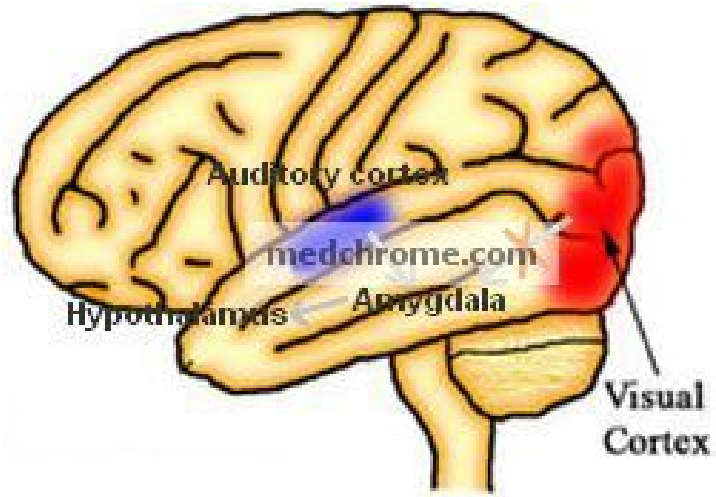
- An evolution of existing tech: CUI, 3D spaces, VR, blockchain
- Challenges:
  - Computing power required: 10 years away (Intel CEO)
  - Sustainability: computers currently 20% of global CO2 emissions
  - Data: Privacy?
  - Interoperability? Decentralisation?
- Gerd Leonhard:

https://www.youtube.com/watch?v=QfuaV8g0OAY&t=53s



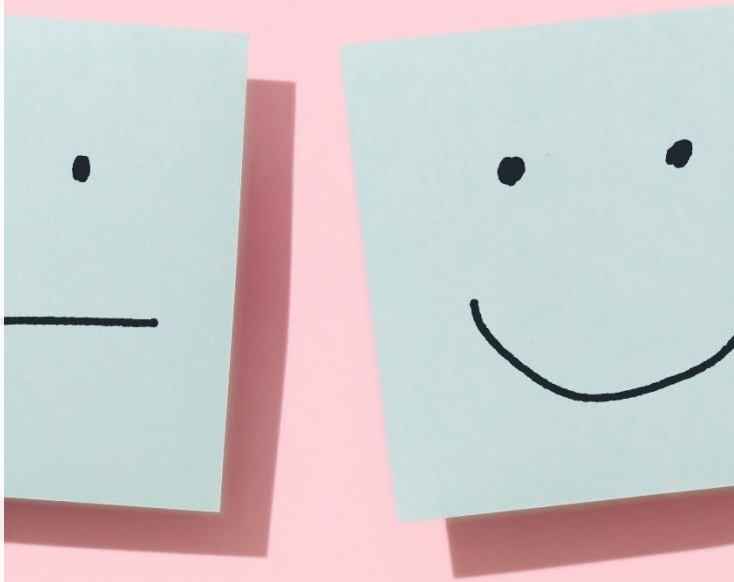
AFFECTIVE COMPUTING

- Recognition of important role of emotions in intelligent human functioning
- Emotions improve our decision making: make us smart!
- Importance of Emotion: neuroscience research
- Complexity and overhead of defining, communicating and interpreting affect: Why?
- What applications? For whom?



AFFECTIVE SYSTEMS

- Applying knowledge from emotional to digital world
- "*Affective HCI is when emotional information is communicated by the user in a natural way, recognised by the computer and used to* ***improve*** *the interaction*", Picard 2003
- Affective computing levels:
  - Designing interactive systems which evoke human emotions: designing for pleasure or virtual environments to treat phobias
  - Getting computers to recognise human emotions and react accordingly
  - Computers expressing emotion?



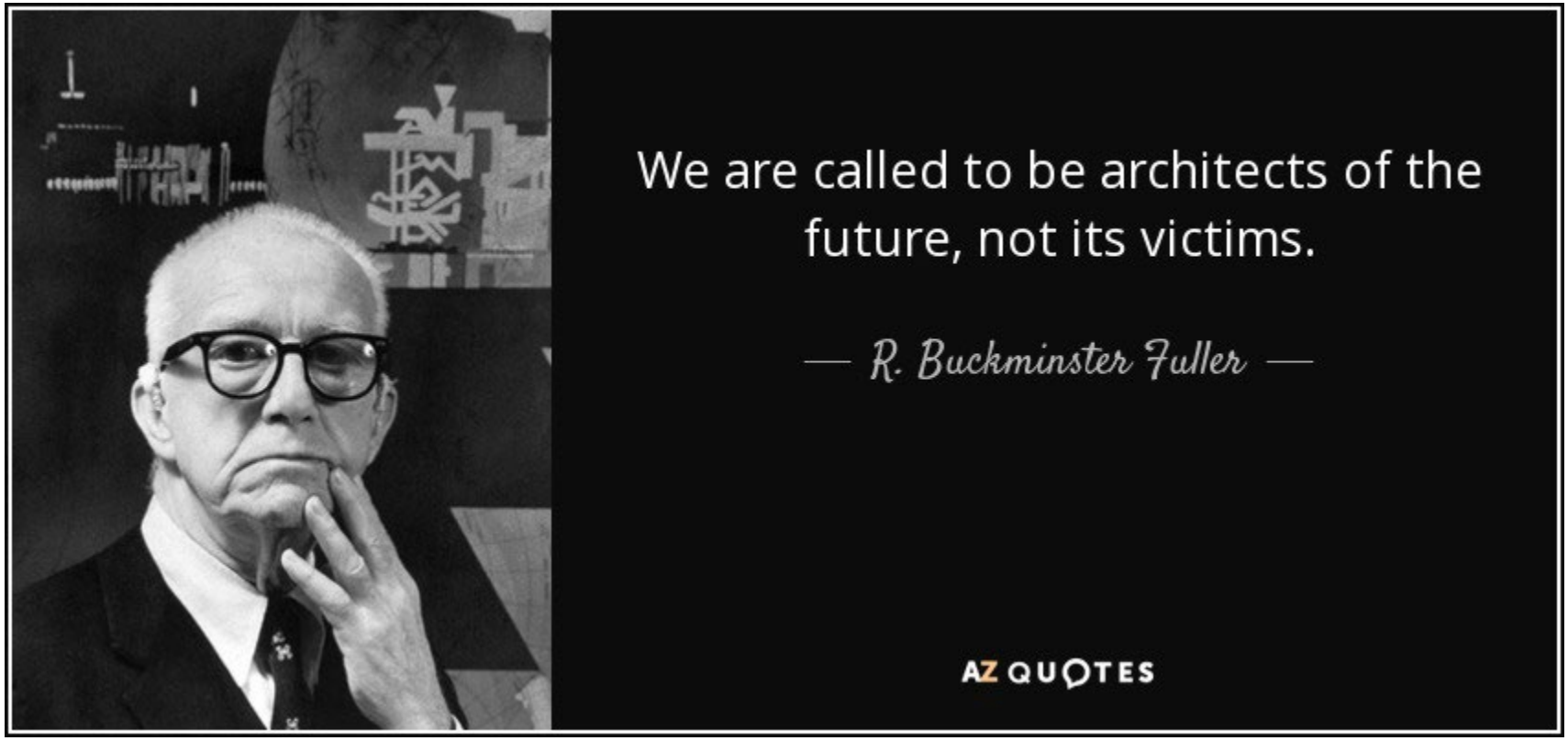
AFFECTIVE SYSTEMS

"*In the growing field of "affective computing," robots and computers are being developed to analyze facial expressions, interpret our emotions, and respond accordingly. Applications include, for instance, monitoring an individual's health and well-being, gauging student interest in classrooms, helping diagnose signs of certain diseases, and developing helpful robot companions.*" (Picard)

- Challenge: human diversity
- Human brains instinctively catch these variations; machines struggle – DL Techniques
- MIT Machine Learning Model (Picard et al): MoE Neural Networks

AFFECTIVE SYSTEMS

"It could, for example, run in the background of a computer or mobile device to track a user's video-based conversations and learn subtle facial expression changes under different contexts. "You can have things like smartphone apps or websites be able to tell how people are feeling and recommend ways to cope with stress or pain, and other things that are impacting their lives negatively," Feffer says. This could also be helpful in monitoring, say, depression or dementia, as people's facial expressions tend to subtly change due to those conditions. "Being able to passively monitor our facial expressions," Rudovic says, "we could over time be able to personalize these models to users and monitor how much deviations they have on daily basis — deviating from the average level of facial expressiveness — and use it for indicators of well-being and health."
(Picard, MIT)



What kind of future do we want?

FUTURE HCI?

- Being the computer / Being within the computer – rather than accessing the computer
- Technology: tool or purpose?
- Always being online – rather than having access to an online world: "go there, buy there but live there?" (Leonhard)
- Proxy experiences
- Reality? Perfect, convenient simulation over a complicated, messy reality
- Dehumanisation: Nature Deficit Disorder: suffocating our humanity
- More addicting: who's protecting us, our humanity?

FUTURE INTERACTIONS?

"We must consider conversations, engagements, and embodiments, not simply slick gestures, mechanics, or tools that sensationalize or romanticize a fantasy notion of interaction."
Gajendar, 2017

Future Interactions? (Circolo del design)
https://www.youtube.com/watch?v=xPpfMxB7C_0

FUTURE HCI?

- What kind of future do we want?
- Technology: a tool or a purpose?
- Who benefits? Technology as modern oil industry
- Market size of all extended reality technologies combined is expected to reach USD 125.2 billion by 2026
- Future of Internet?
- *Algorithms know the logic of everything but the feeling (truth?) of nothing*
  - More user monetization, digital inequality, feudalism, surveillance, dehumanization, simulations, loneliness, confusion, abuse

HUMAN COMPUTER INTERACTION

Lecture 11:
Future Interactions?

Lecture 12:
CT318 Course Review & Examination