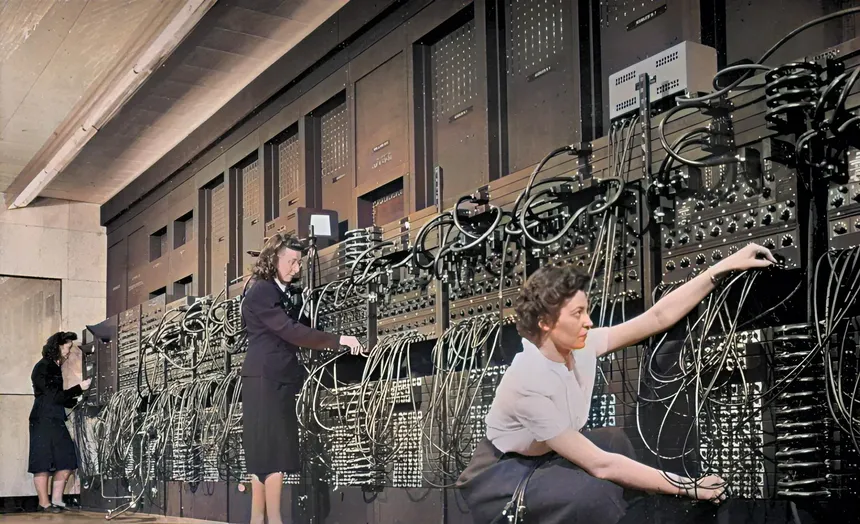
HUMAN-COMPUTER  
INTERACTION (HCI)

**INDEX**

- Manuel Marcelo Sánchez Salgado, 2DAW IES TEIS 2025-26

# 1. HISTORY OF HUMAN-COMPUTER INTERACTION

During the advent of computation in **1945**, *Human-Computer Interaction* was known as Man-Machine Interaction, and was a necessity in the computation field as the earliest mainframes required a specialist team to be operated, closing conections with cables, cranking levers and flicking switches as the machine needed. This was not deliberate design, but a physical neccesity — the interaction was usually one-directional, except in the cases that the machines physically reacted to their input.

The ENIAC computer in 1946, being operated by closing connections between different points.

Systems like the ENIAC (Electronic Numerical Integrator and Computer, 1945) used rudimentary punchcards as physical inputs, yet its contemporary BINAC (BINary Automatic Computer, 1948) had a typewriter-keyboard unit that allowed the crew to input numbers from 0 to 7 directly into it’s systems – a second typewriter, electromecanically controlled by the BINAC, handled the output of the machine. This could be understood as the predecesor of keyboards and CLI output.

As soon as **1963**, we can already find studies on more precise interaction with a machine. The concept of Graphical User Interface beings to float in the minds of early hardware developers, specially on Ivan Sutherland's mind, who developed a light pen for direct interaction with computer displays as his Ph. D thesis. This light pen, the Sketchpad, is the earliest precursor to the computer mouse.

 Sutherland and his Sketchpad, MIT 1963.

The first mouse prototype was born the next year by the hands of Bill English, who also fathered hypertext, videoconferencing and graphical user interfaces by **1968** in his conference *"mother of all demos"*.

During the **1970's** decade, there was a shift of vision: computers became smaller devices, built with the goal of being operated by a single individual instead of a team of specialists. The advent of the microprocessors facilitated this transition. Naturally, the computer industry changed its focus to service this new market – it was still rather restrictive due to high prices and busines focus, but inventions like the Xerox Alto, a computer that integrated a mechanical keyboard, mouse and a screen to display a GUI, served as an inspiration for the ones coming in the next decade.

Even before the Xerox foundation was even created, Alan Kay started to theorise about a computer that could be moved. He had children in mind while creating it – an interactive book was the blueprint. This materialized as the Dynabook, which today is regarded as the precursor to tablets and laptops despite the fact that it was never fully produced.

 Key and one of the old prototypes of the Dynabook 40 years after its conception, 2008.

Production of personal computers sped up in the **80s**, with IMB standardizing computers under IBM PC. They expanded the UI concept by creating interfaces that interconected separately developed components, mainly written under an open software license that now has been copied by Microsoft and Apple's OpenDoc architecture. Most of the computers created in the 80s already integrated an audio system within them, expanding the sensorial feeling of the users.

Since the advent of computers, some researchers focused their work in *ergonomics.* This research was the precursor to the User Experience, which only was born as a term in the **1988** book *The Design of Everyday Things* by Don Norman. By this time, HCI was a concept that was widely studied, as an example under the *British Computer Society Specialist Group on Human-Computer Interaction*. Nontheless, the way forward had already been established, and most of the HCI research colluded with UX/UI paths towards the future, mainly exploring ways to interact with the World Wide Web after the **1990** – we could understand the creation of the first web navigators as an HCI developement, but their focus and objective were more interface-related.

*"In the eighties most people were working in offices and they had a computer that was centrally controled. They were doing office work and they didn't have much discretion about what they did or how they did it. Once the internet caught on in the late nineties, things changed massively. We moved to a situation where people have disretion, they have choices, they can use it or not use it. [...]* ***The early 2000s*** *was just a time of massive change both in the way people interacted with computers and the opportunities that computers could give them."*

***Linda Macaulay,*** *Professor Emerita of Information System Design,*

*University of Manchester.*

In **2007**, a revolutionary technology was presented to the public by Apple: capacitive touchscreens and multi-touch gestures. The idea followed the precepts of Sutherland's Sketchpad and the first resistive touchscreens that were born in the 1980s. Nontheless, multi-touch gestures weren't realisable until the 2000s.

Soon after, in the **2010**s, Microsoft presented gesture-based interfaces technologies, that soon extended into Augmented Reality and Virtual Reality enviroments, enabling users to interact with virtual objects using hand gestures and touch-based controls. The blueprint for this new creation was Sutherland's "Ultimate Display" concept:

“*The ultimate display would, of course, be a room within which the computer can control the existence of matter. A chair displayed in such a room would be good enough to sit in. Handcuffs displayed in such a room would be confining, and a bullet displayed in such a room would be fatal. With appropriate programming such a display could literally be the Wonderland into which Alice walked.”*

***Ivan Sutherland***

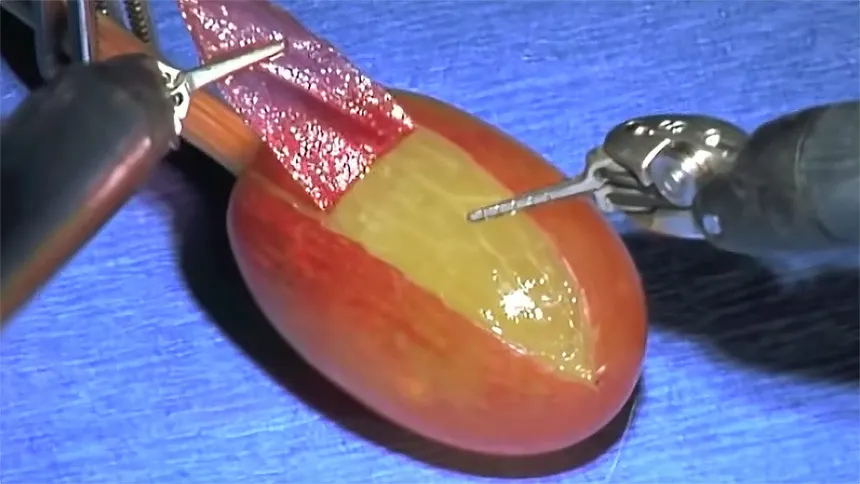
******

Sutherland and his student Bob Sproull, were also the people responsible of the creation of the first head mouted display, the *Sword of Damocles*, which, while primitive during it's conception, was used as the concept for such headsets: Nasa in 1989 created training systems through them, and SEGA in 1993 tried to implement them into entretainment systems, unsuccessfuly. **2012** was the turning point, as Facebook purchased the Oculus project. By 2017, multiple companies were competing for the AR / VR supremacy.

The *Internet of Things* quickly caused a proliferation of distinct technologies that interacted directly with humans. Connected devices and sensors present in devices that were always understood as simple. Watches that could measure your pulse. Glasses that could zoom into objects. This also implemented new technologies, like Voice User Interfaces, popularized as virtual assitants like Google's Siri or Amazon's Alexa, descendants of *Kurzweil Voice* software (1982), the first creation capable of understanding human voice and processing its words.

In 2016, the concept Brain-Machine Interface first appeared under the Neuralink developement – technologies capable of detecting and interpreting brain activity, enabling individuals to control and interact with those deviced using neural signals, which echoed the Man-Machine Symbiosis concept, proposed by Joseph Carl Robnett Licklider in 1960. Kevin Warwick has been a trailblazed in this topic, implanting sensors and receptors on his own nervous system (and his wifes) since the late 1990s. He is under the belief that such enhancements are neccesary for human survival and evolution.

In the last years we've also observed how HCI takes over the medical field. What would you trust best, the steading hand of a surgeon, or a machine arm?

*Surgery on a grape, Edward Hospital, Naperville, Illinois.*

# 2. CURRENT TRENDS

## AI INTEGRATION

As AI casts a shadow over every tecnological advancement in the current era, HCI has not been spared of its presence. AI-powered HCI interfaces integrate seamlessly with IoT devices generating innovative designs only made possible through interaction abstract interpretation and criticism.

* **Auto-actualization:** Thanks to AI algorithms being integrated into interfaces, they are capable of learning from previous user interactions to personalize the experience according to the users preferences or special needs. It also expands voice recognition and predictive text inputs.
* **Personalization:** Thanks to the ability to process vast ammounts of information, an interface might become used to its user enhancing user satisfaction and engagement.
* **Recognition improvement:** AI expands the capabilities of the software behind the interfaces to recognize inputs that might vary from the entry expectations. A gesture that its close to what is expected might still work.

There is plenty of concerns surrounding privacy when speaking about AI integration, as usually this models are prepared to use whatever data they have collected to improve the whole distribution, not only the model local to the interface that has registered the improvements first.

## SPATIAL COMPUTING

Three out of four papers accepted by the ACM CHI conference in 2020 were directly related to augmented and virtual reality problems and the potential to leverage aumented reality technology to enhance the ability to interact with 3D objects even further.

* **Spatial input:** Sensors like LiDAR (Light Detection and Ranging), combined with depth cameras, are capable of mapping and understanding a 3D space, being able to place virtual objects with great precision.
* **Large Vision Models:** Similar to the language models, LVMs try to leverage the power of the data they contain to give technology "eyes and ears" – the capability to not only see but understand the enviroment in which they exist.
* **Technological convergence:** Augmented Reality, Virtual Reality, Extended Reality and Mixed Reality are starting to be understood as one simple concept, as their technologies are now able to integrate each other.

Humans understand and interact with the world in a volumentric way. Spatial computing projects the ability to interact with technology into that volumetric world taking into account the context that surrounds the user. So far, we have only managed to do this by emerging interfaces, which are becoming smaller and more widely accepted and accessible.

## AFFECTIVE COMPUTING

We understand as affective computing the multidisciplinary field that focuses on enabling systems to recognize, interpret, process and simulate human emotions. We capture data through sensors: facial expressions, body posture, gestures, speech and phyisiological data, which then relies on meaningful patterns analized by machine learning