**Module IHM**

# IHM

## Introduction

**Basic concepts and principles**

# Preface

# IHM, What does it mean?

**in French**

**IHM**

- **I**nteraction **H**omme – **M**achine
- **I**nterface **H**omme – **M**achine.

But also ( in French )

**CHM** : **C**ommunication **H**omme – **M**achine

**DHM** : **D**ialogue **H**omme – **M**achine

**IPM** : **I**nteraction **P**ersonne – **M**achine

# IHM, What does it mean?

in English

**HMI**

- **H**uman – **M**achine **I**nteraction
- **H**uman – **M**achine **I**nterface.

But also

**HCI** **H**uman – **C**omputer **I**nteraction

# IHM, What does it mean?

in Arabic

**HCI**

| تفاعل الإنسان والحاسوب |
|---|
| التفاعل بين الإنسان والحاسوب |
| تفاعل إنساني حاسوبي |

# HCI User, people, human, or customer?

**Several terms**

- user interface design (UI),
- software design,
- user-centered design,
- human-centered design,
- people-centered design,
- product design,
- web design,
- user experience (UX) design,
- Customer experience (CX) design,
- interactive system design.
- Interaction design (IxD)

**UI USER INTERFACE**

**UX USER EXPERIENCE**

**CX CUSTOMER EXPERIENCE**

**IxD INTERACTION DESIGN**

# Computers / Machines?

HCI

Computers everywhere
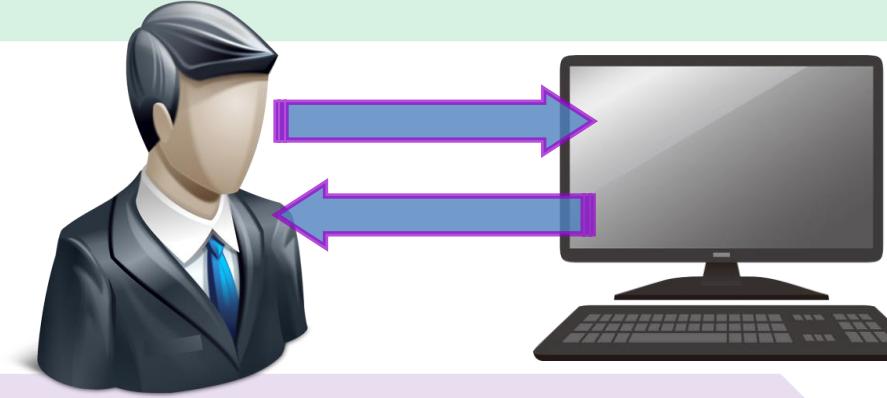
# Interface or Interaction?

## Human Machine Interface

set of hardware and software components **allowing** a user to interact with an interactive system, **The goal of UI design** is to create a visually appealing and engaging interface that is easy to use.
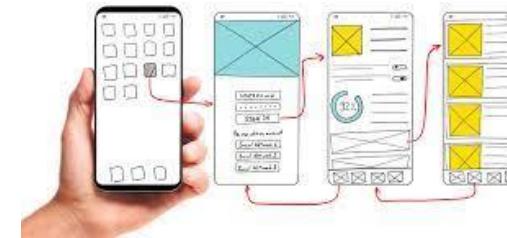


## Human Machine interaction

all **aspects** of the design, implementation and evaluation of interactive systems, **The goal of interaction design** is to create a seamless and intuitive user experience that meets user needs and goals.

# Interface or Interaction?

**HCI**
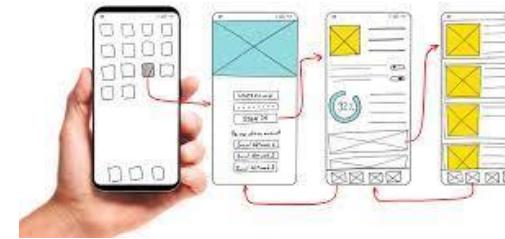
**Interface design**   is about visual design and aesthetics

**Interaction design**   is about Interactions and movement

# Interface or Interaction?
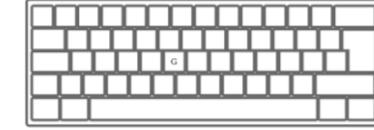


The interface to an interactive system, also called the user interface (UI), is all those parts of the system with which people come into **contact**,

- physically,

- perceptually and

- conceptually

# HCI

# Interface or Interaction?

## Modes/styles of interaction

An interactive system may contain one or more of these input and/or output interaction modes:
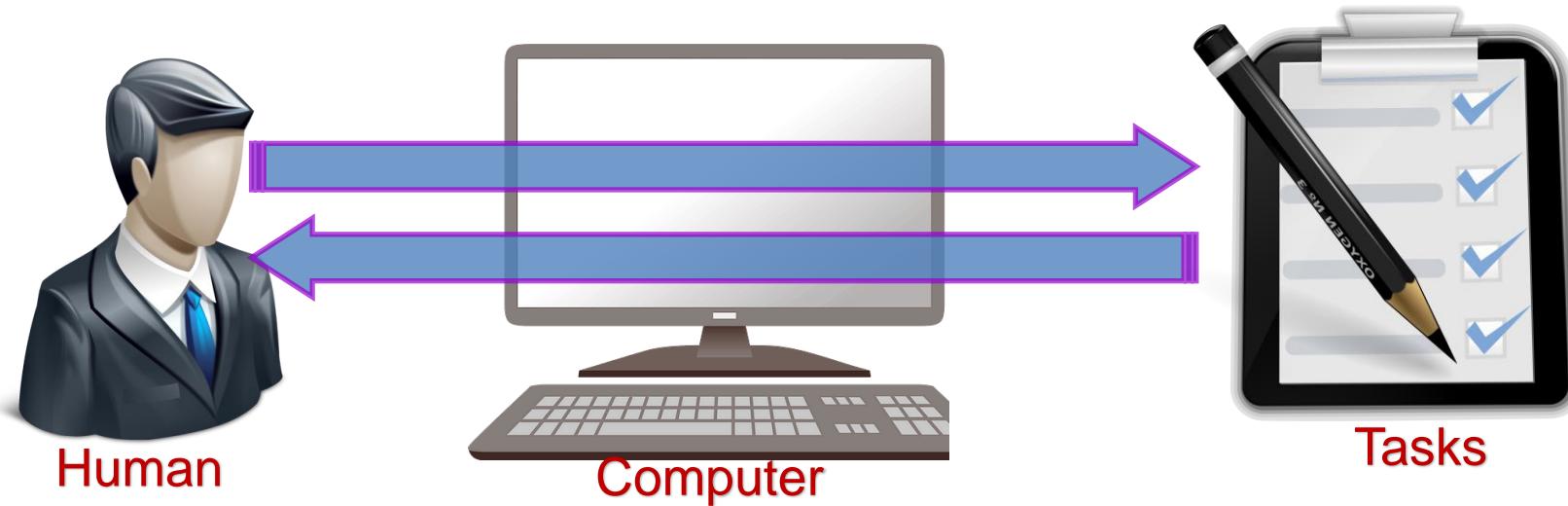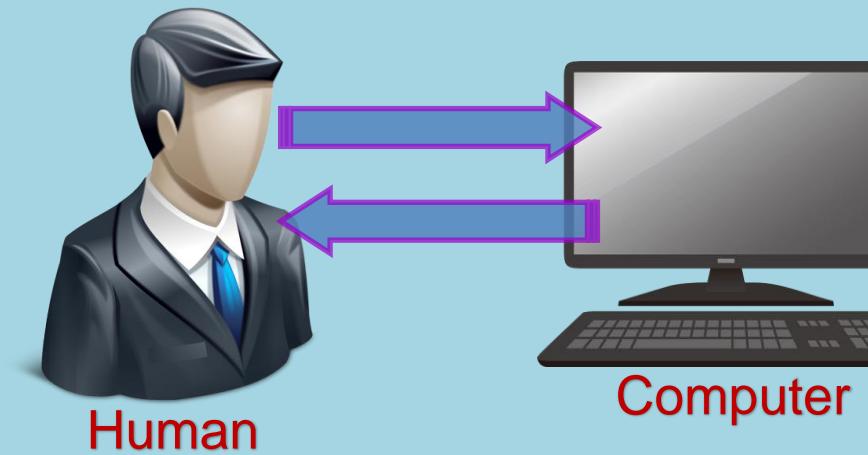
- **Spoken/Audio mode:** voice commands, voice guides, etc.

- **Writing/language mode:** input by keyboard and graphic tablet, display of text on the screen, etc.

- **Gesture mode:** 2D or 3D designation (mouse, data gloves, touch screen), etc.

- **Visual mode:** graphics, images, animations, etc.

- The interaction is said to be multimodal if it involves several sensory-motor modalities.

# Interface or Interaction?



Human

Computer



Human
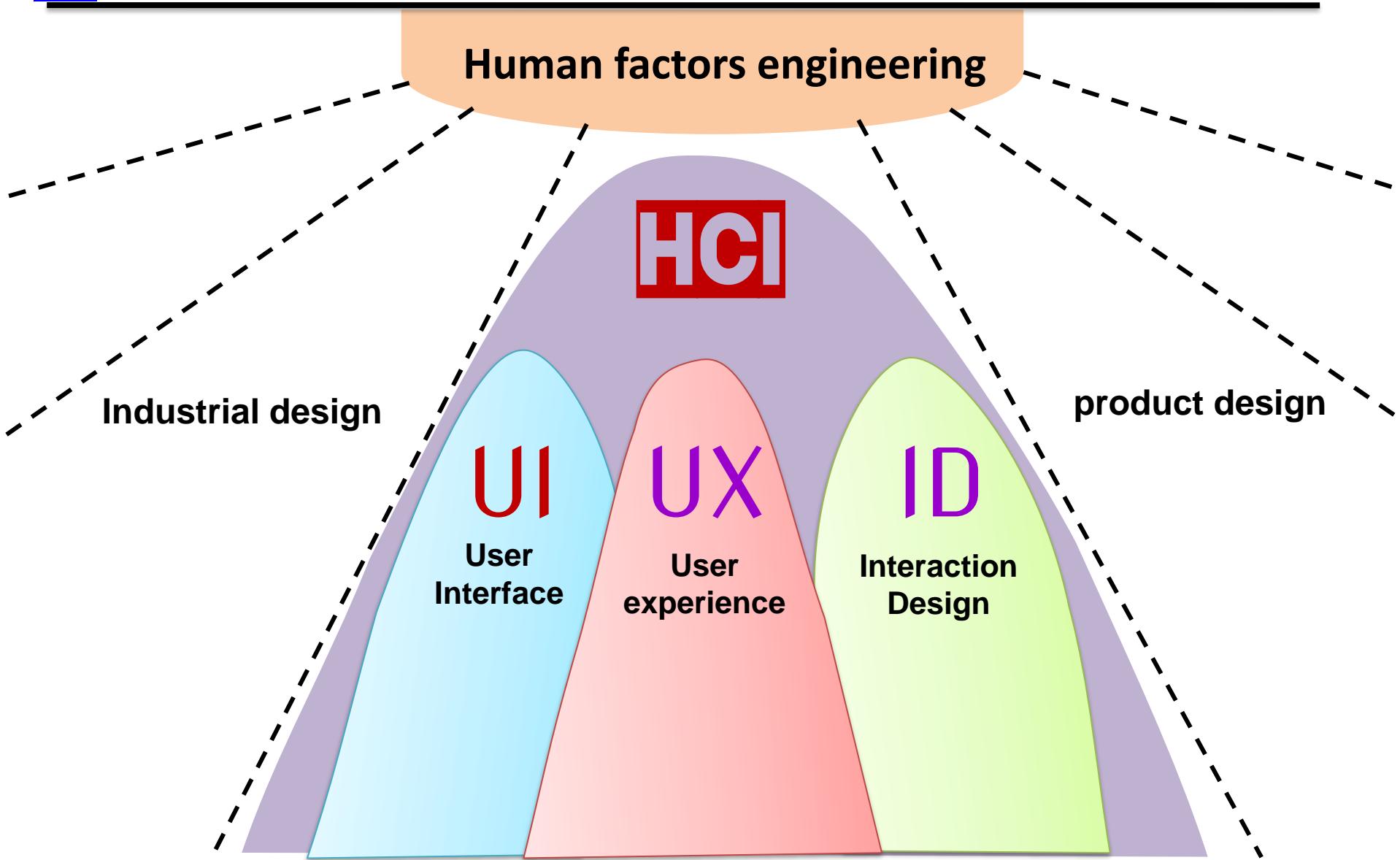
Computer

Tasks

# HCI in the Big Picture

**Human factors engineering**

**HCI**

**Industrial design**

**product design**

**UI**
**User Interface**

**UX**
**User experience**

**ID**
**Interaction Design**
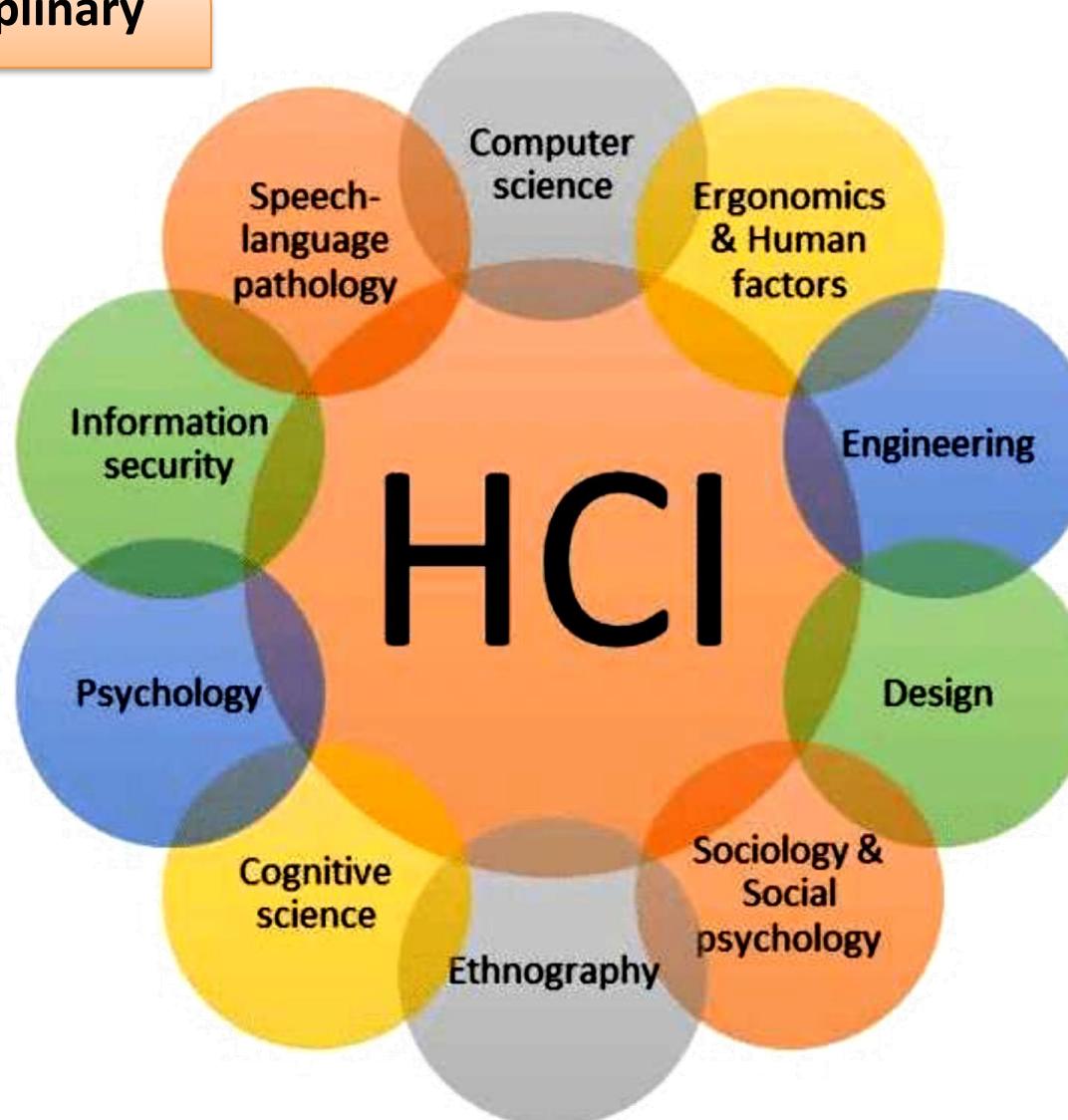
# HCI in the Big Picture

**HCI is multidisciplinary**

# What to design?

Need to take into account:

من الضروري أن تأخذ في الاعتبار:
- ✓ من هم المستخدمون؟
- ✓ ما هي الأنشطة التي يتم تنفيذها؟
- ✓ أين يتم التفاعل؟

- ✓ Who the **users** are

- ✓ What **activities** are being carried out

- ✓ Where **interaction** is taking place

الحاجة إلى تحسين التفاعلات بين الأشخاص والمنتج:
- • حتى تتناسب مع أنشطتهم واحتياجاتهم

Need to optimize the interactions people have with a product:

- • So that they match their **activities** and **needs**

# approaches

There are two main approaches to designing an ergonomic HMI:

**Anthropocentric approach:** This approach focuses on the user and their needs. It takes into account the user's physical capabilities, limitations, and cognitive abilities. The goal is to design an HMI that is easy to use and comfortable for the user, even for extended periods of time.

**Technocentric approach:** This approach focuses on the capabilities of the machine and its possibilities. The user is considered to be a passive element of the interaction, and they must adapt to the machine. The technocentric approach is often used in systems where safety or efficiency is paramount.

HCI : Why ?

# Bad Design

Don't go to the right?
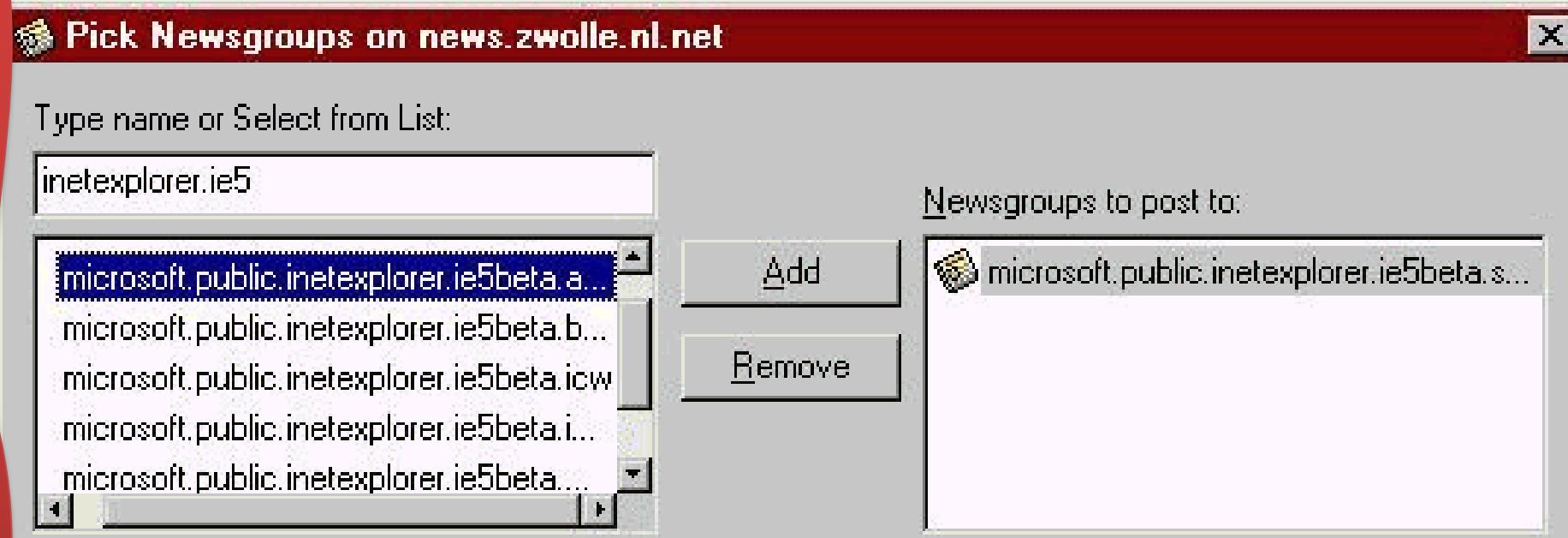


Don't go to the right?
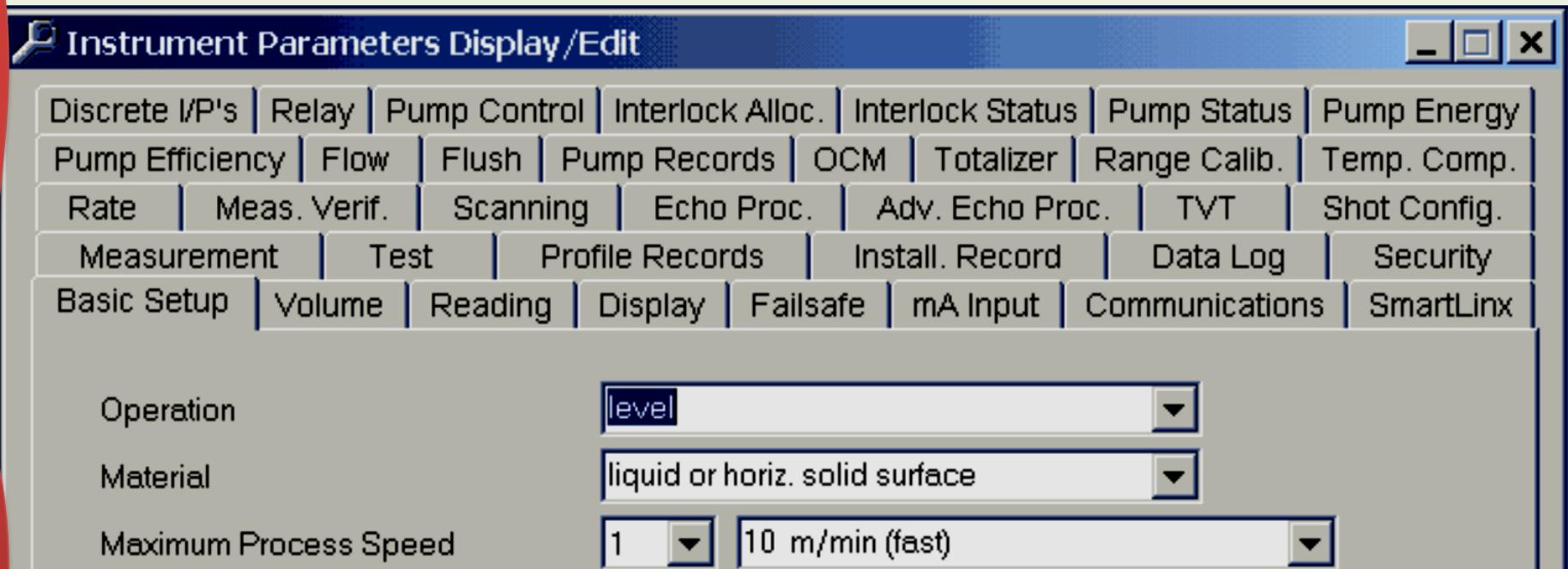
# Bad Design



Here, there is **not enough space** in the window to see the full names and obviously the **scrollbar** does not solve the problem. Since this dialog is **not expandable**, there is no way for the user to resolve the issue
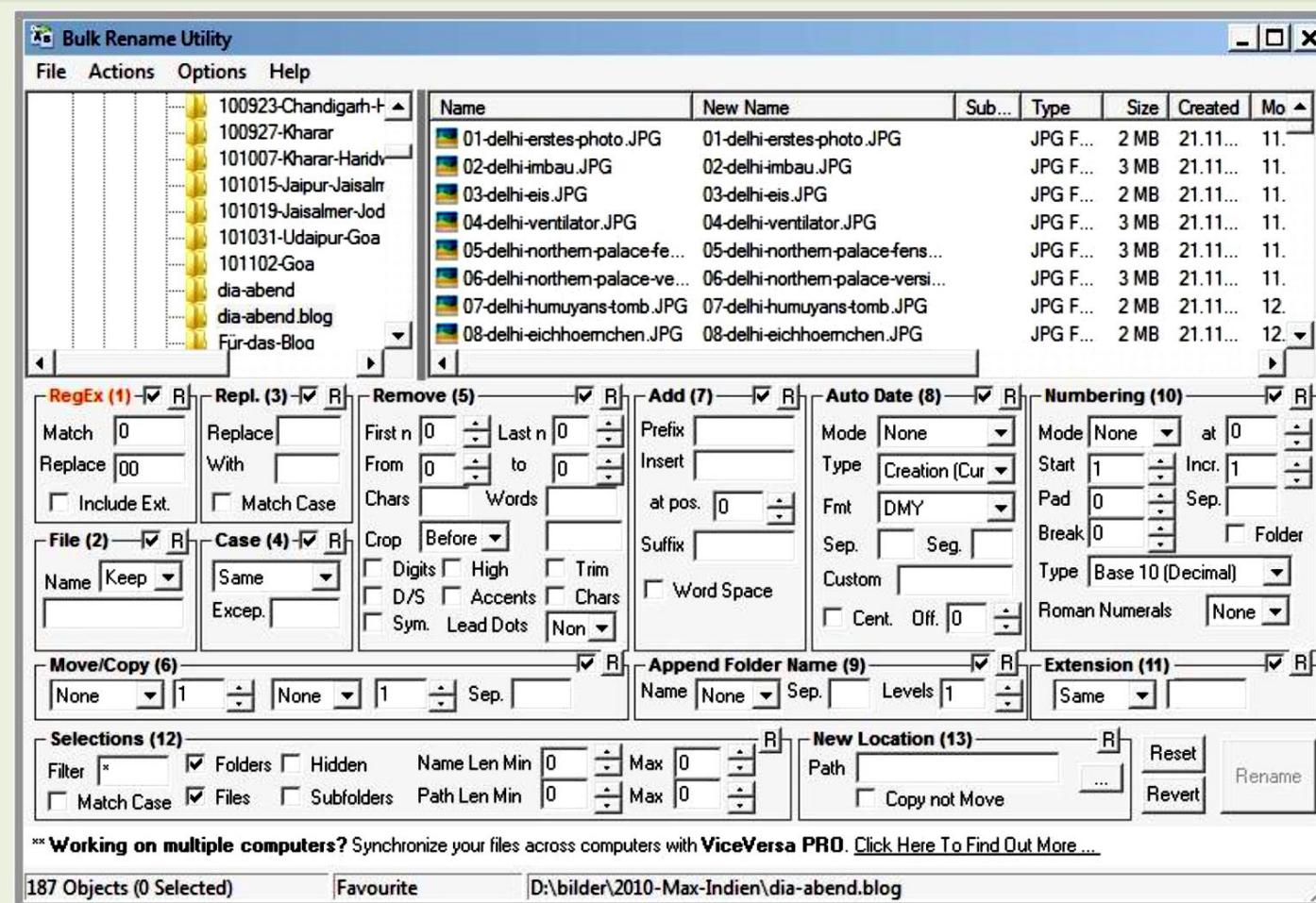
# Bad Design



No comment on **the abuse of tabs** in a dialog box.

# Bad Design



**Too many** tools and components in this window, which causes ambiguity

and disorientation of the user

# Bad Design

**Error Deleting File**

Cannot delete 016: There is not enough free disk space.

Delete one or more files to free disk space, and then try again.

OK
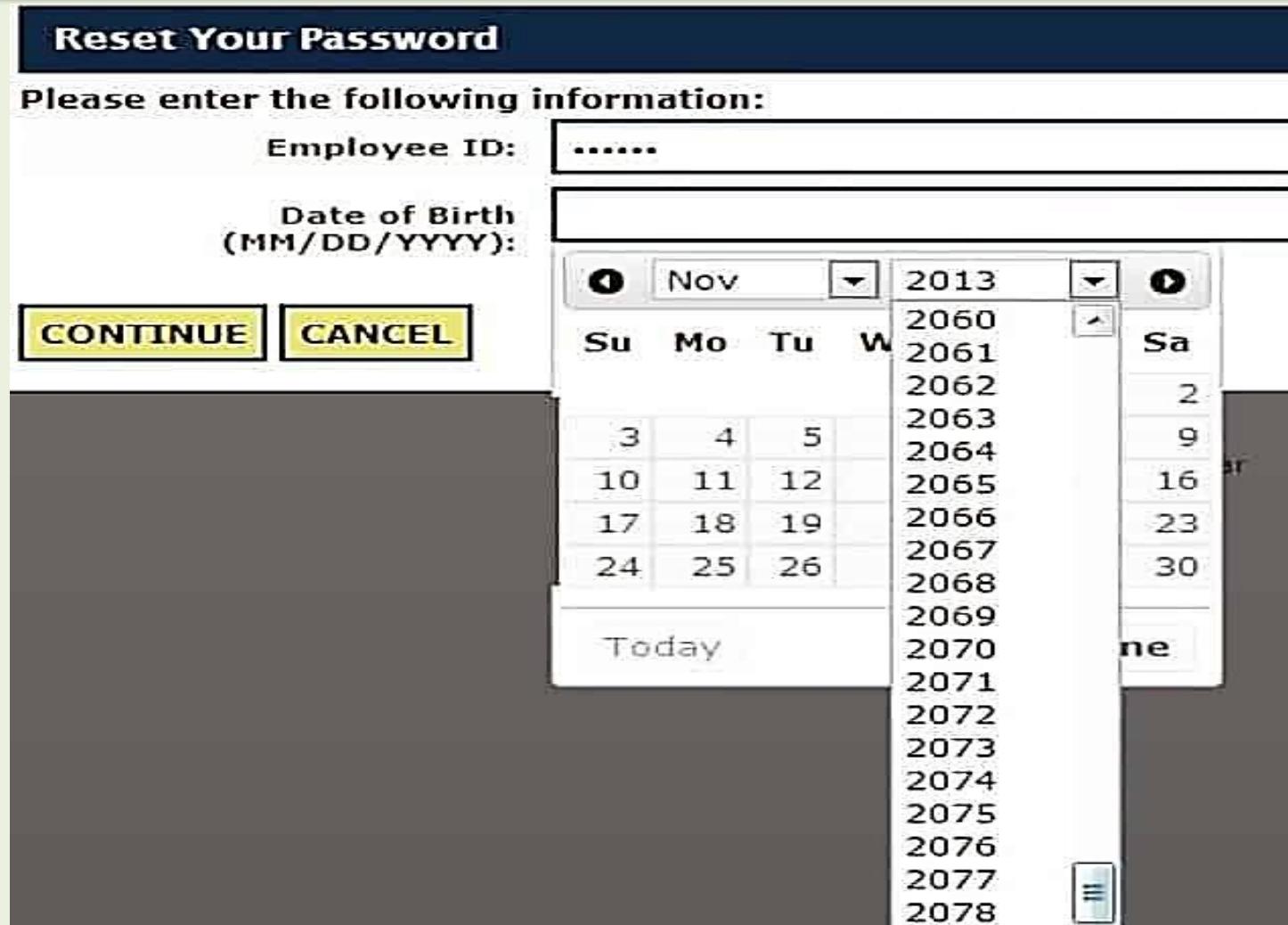
Message appeared **after trying to delete** a file on a nearly full disk. This is one of the dumbest messages.

# Bad Design



A (somewhat) crazy drop-down menu

# Bad Design



I have no clue what those icons , do you want to do your laundry? Well, you google how to do it or refer to the manual that came with the washing machine

# Bad Design





No comment

# New systems



Touch screen devices

# New systems



Kinect is a line of motion sensing input devices produced by Microsoft and first released in 2010.

Gesture control devices

# New systems



E-commerce (electronic commerce)

# New systems



E-learning (online training)
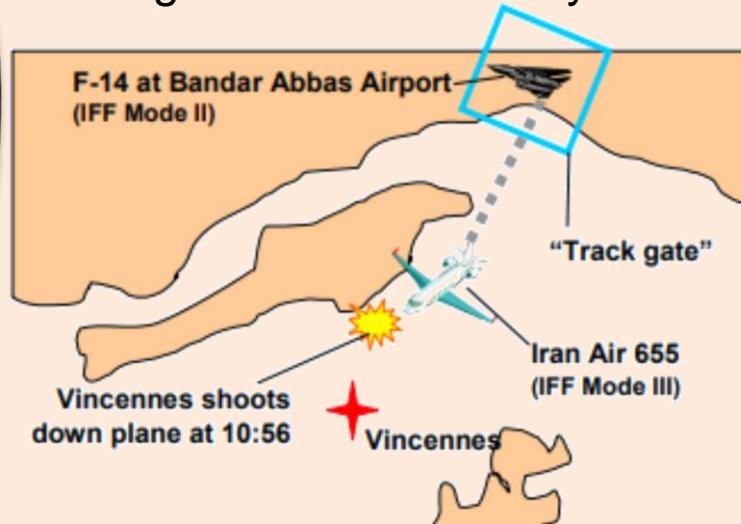
# New systems





Electronic media & Social media

# When bad design kills

**Iran Air Flight 655**. July, 1988, an Iran Air flight is shot down over the Arabian Gulf by two missiles from the USS Vincennes. All 290 on board die. The radar operators were dealing with multiple bad design decisions, There was nothing preventing radar operators, in high-stress situations making life-and-death calls, from tracking one radar target but seeing information displayed about another. And that's exactly what happened. They tracked a civilian aircraft but were reading details of a military aircraft (a U.S. F-14).



F-14 at Bandar Abbas Airport
(IFF Mode II)

"Track gate"

Iran Air 655
(IFF Mode III)

Vincennes shoots
down plane at 10:56    Vincennes

# When bad design kills

**Air Inter Flight 148** was a scheduled passenger flight from Lyon Satolas

Airport to Strasbourg Airport in France. On **20 January 1992**

A too rapid descent, initiated a few seconds before the crash: a rate of descent of 3300 feet/minute (16.7m/s) instead of around 800 feet/minute. According to the BEA, the most probable hypothesis is an autopilot programming error by the crew which would have displayed a rate of descent of 3300 feet/minute (16.7m/s) instead of a descent angle of 3.3°. This would be due to a confusion related to the display of the rate of descent in feet/minute ("33" for 3300 feet/minute) which is done on the same dial as the angle of descent ("33" for 3.3°). The difference in reading is made according to the selected mode: descent angle (FPA-Flight Path Angle mode) or vertical speed (VS-Vertical Speed mode). The pilot recorded on the on-board computer the value "33", believing that he was in FPA mode a when he was in VS mode.

**killing 85 of the 96 on board.**

The enabling factor was a poorly designed readout making it easy to set vertical speed thinking you were adjusting angle and vice versa

Same button for 2 separate functions (speed and angle of descent)

# When bad design kills

**M/S Herald of Free Enterprise**. March, 1987, a ferry takes on water and capsizes very quickly after leaving Zeebrugge, Belgium. 193 die. The immediate cause was no mystery — the bow doors, where cars would drive onto the ferry, were open, and water was literally pushed onto the car deck as the ferry set to sea. The enabling factors were design: There was **no indicator** of any kind whether the doors were open or closed, and you could not see the doors from the bridge.

The ferry's operators were later found guilty of negligence. Crews had repeatedly asked for a door status indicator, but the operator didn't want to spend the money
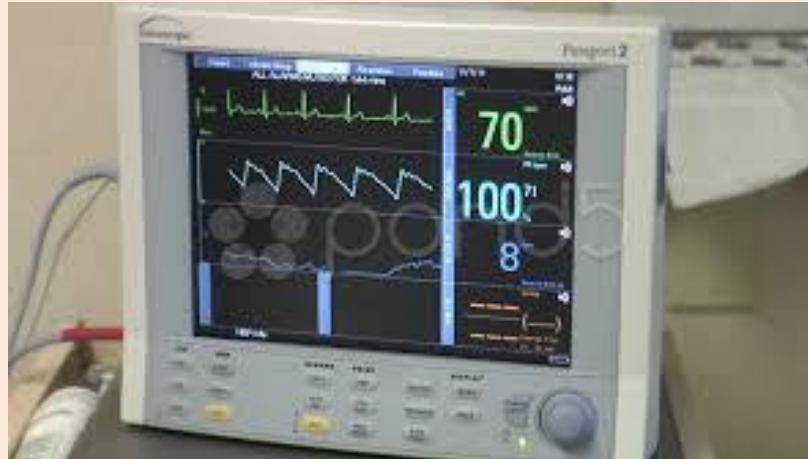
# When bad design kills

## Medical field

- **1986**,    Seattle Hospital,    4 year old girl

- **1993**,    Chicago Hospital,    12-day-old baby

Error connecting the heart monitor cables

# Why study HCI ?

Why study Human Computer Interactions?

- The impact of a bad interface is not always serious… But it can cause thousands of people to lose thousands of hours

- Innovation in interaction can have a big impact.

- New systems pose challenges for usability.

  - ✓ Gesture control devices (Kinect), Touchscreen (smartphone..) ambient computer…

  - ✓ e-commerce, video games, the current integration of traditional and electronic media, online training, arts using technology…

- in HMIs there is a vast field of application and research.

  - ✓ Field of creation..

  - ✓ of reflection..

  - ✓ of theorization

# Why study HCI ?

## من حقوق المستخدم

١. يحق للمستخدم الحصول على تعليمات سهلة الاستخدام لتنفيذ مهامه
٢. يحق للمستخدم التحكم في استخدام النظام؛
٣. يحق للمستخدم الحصول على نظام يوفر معلومات واضحة ومفهومة ودقيقة عن المهمة التي يقوم بها.
٤. يجب أن يكون المستخدم هو المتحكم في التكنولوجيا وليس العكس؛ يجب أن تكون المنتجات طبيعية وسهلة الاستخدام

## User rights

1. The user has the right to easy-to-use instructions for carrying out his tasks;
2. The user has the right to control the use of the system;
3. The user has the right to a system that provides clear, understandable and precise information regarding the task he is performing;
4. The user should be in control of the technology and not the other way around; products should be natural and intuitive to use.

## des droits d'utilisateur

1. L'utilisateur a droit à des instructions faciles à utiliser pour réaliser ses tâches;
2. L'utilisateur a le droit d'être maître dans l'utilisation du système;
3. L'utilisateur a droit à un système qui fournit de l'information claire, compréhensible et précise en regard de la tâche qu'il est en train de réaliser;
4. L'utilisateur devrait être maître de la technologie et non l'inverse; les produits devraient être naturels et intuitifs à utiliser.

# Why study HCI ?

Human-Computer Interaction (HCI) will give you the **skills** to properly understand, and design, the relationship between the "humans", on one side, and the "computers" (websites, apps, products, services, etc.), on the other side. With these skills, you will be able to build products that work more efficiently

سيمنحك التفاعل بين الإنسان والحاسوب (HCI) المهارات اللازمة لفهم وتصميم العلاقة بين "البشر" من جهة، و"أجهزة الكمبيوتر" (مواقع الويب والتطبيقات والمنتجات والخدمات وما إلى ذلك) من جهة أخرى، بشكل صحيح. باستخدام هذه المهارات، ستتمكن من بناء منتجات تعمل بكفاءة أكبر

# Why study HCI ?

## HCI & programming

➢ Most computer applications are interactive

➢ The HCI is often a **key element** of the software (in + or -)

➢ The design of the interaction represents more than **50%** of the development cost

➢ The HMI can represent **80%** of the code of an application

- ▪ it can be modified/reconstructed multiple times

- ▪ importance of interface / core independence of the system

# Why study HCI ?

## HCI & programming

Development of interactive software :

- It is

  ✓ difficult, long, expensive

  ✓ requires an early, methodical, iterative,

    experimental approach

- It's not

  o an aesthetic operation of the screen

  o a matter of taste, common sense, intuition

## The HCI must be taken into account from the start

# Adapt the HMI

## Context

✓ general public     (offer immediate handling)

✓ leisure            (make the product attractive)

✓ industry           (increase productivity)

✓ critical systems   (ensure zero risk)

# Adapt the HMI

## Task characteristics

- ✓ repetitive,

- ✓ regular,

- ✓ occasional,

- ✓ sensitive to changes in the environment,

- ✓ constrained by time,

- ✓ risky...

# Adapt the HMI

**Technical constraints**

- ✓ platform

- ✓ memory size

- ✓ screen, sensors, effectors

- ✓ reuse of old code

# Adapt the HMI

## User Characteristics

### 1. physical differences

- ✓ age
- ✓ Disability

### 2. knowledge and experience

- ✓ in the domain of the task (novice, expert, professional)
- ✓ in computer science, on the system (occasional, daily use)

# Adapt the HMI

## User Characteristics

### 3. psychological characteristics

- ✓ visual/auditory,
- ✓ logical/intuitive,
- ✓ analytical/synthetic…

### 4. socio-cultural characteristics

- ✓ direction of writing
- ✓ date format
- ✓ meaning of icons,
- ✓ colors
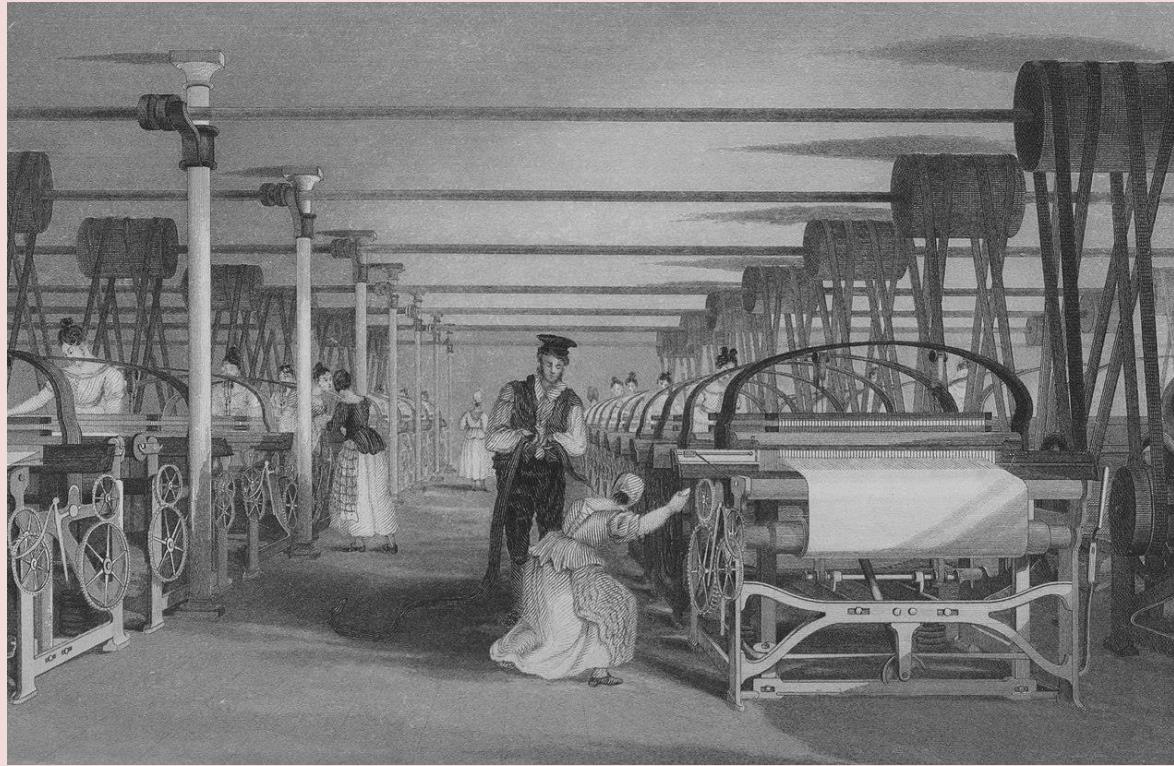
# HCI : History

# History



The Industrial Revolution
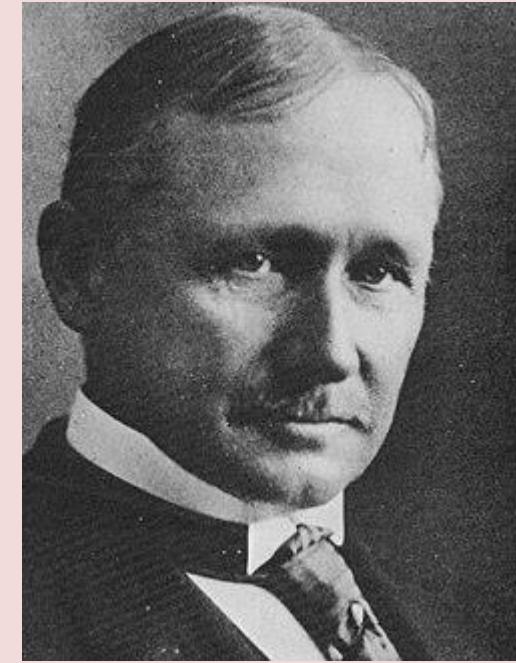
# History

*1900s*



Henry Ford
July 30, 1863 – April 7, 1947



Frederick Winslow Taylor
March 20, 1856 – March 21, 1915

# History

1900s

Frederick Winslow Taylor
**March 20, 1856 – March 21, 1915**

At the dawn of the 20th century, an American mechanical engineer Frederick W. Taylor published his book "The Principles of Scientific Management." The book is based on a series of research about the interactions between workers and their tools.

• Taylor proposed that optimizing and simplifying working conditions can increase people's productivity.

• According to Taylorism, breaking down each job into subtasks and standardizing tools and techniques increases efficiency, guarantees consistency, and reduces workplace injuries.

• Taylor was the first who proposed the idea of researching how to improve the work process.
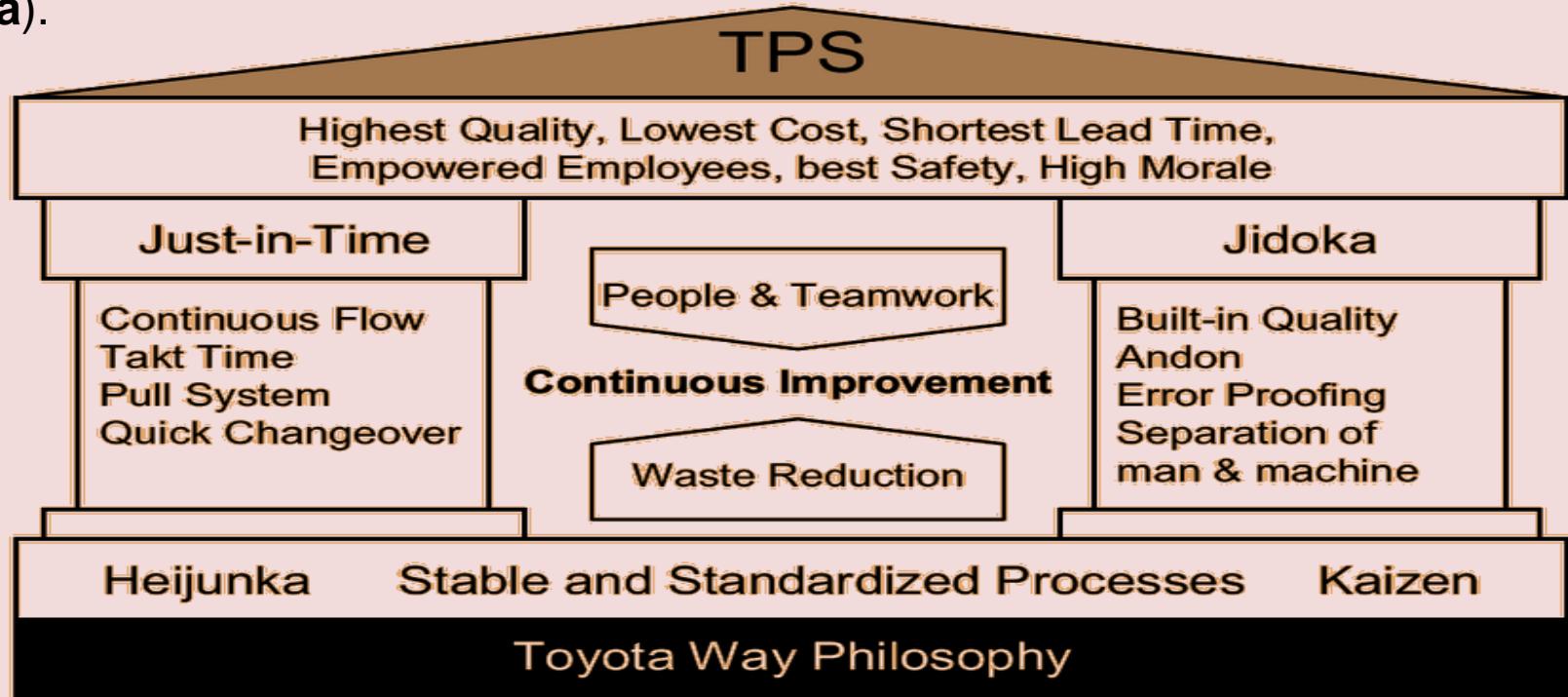
# History

1940s

## between 1948 and 1975 : The Toyota Production System (TPS)

It is an integrated socio-technical system,The main objectives of the TPS are to design out overburden (**muri**) and inconsistency (**mura**), and to eliminate waste (**muda**).
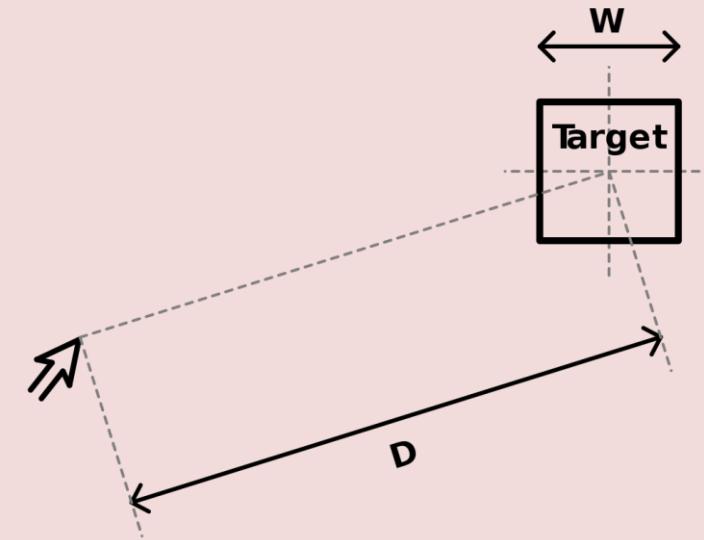


In contrast to Taylorism, the Toyota Production System relied on respect for people and encouraged assembly workers to share their thoughts and ideas on optimizing things.

## 1954 : Fitts's law
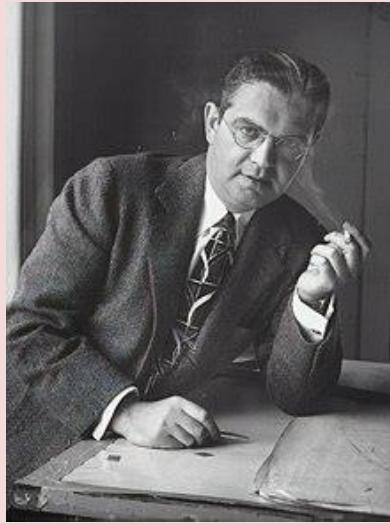


Fitts's law is a law in psychology that states that the time it takes a person to reach a target is directly proportional to the ratio of the distance between the target and the starting point to the size of the target

Fitts' law is used in the design of systems that require people to reach targets frequently, such as the graphical user interfaces of electronic devices. For example, Fitts' law may be used to determine the size of icons on a smartphone screen, so that they are easy for the user to reach.

# History

1950s

Henry Dreyfuss, an American industrial designer, is another bright point on the UX history timeline. In 1955, he published his book Designing for People, where he defined the concept of the point of friction between a user and a product. Dreyfuss also established the core principles of making user experience efficient and delightful.

**Henry Dreyfuss**

**March 2, 1904 – October 5, 1972**

These principles are:

✓ • Make people feel safe.

✓ • Make people feel comfortable.

✓ • Help people use their time efficiently.

✓ • Make people happy.

# History

1960s

## Walt Disney and his creative strategy for improving Disney products



**Walter Elias Disney**
**December 5, 1901 – December 15, 1966**

. Here are some of them:

Have you realized that the magical world of Disney theme parks follows UX principles? The principles Disney created for his design team — "Imagineers"— are still relevant to all UX designers

✓ • Know your audience and develop a great sense of empathy towards them

✓ • Tell people good stories instead of lecturing them

✓ • Use "visual magnets" to capture people's attention and reward them for making a journey

✓ • Avoid overloading people with too much information

# History

1960s

## New Input/Output Devices

- The first screen display
- The first light pen, at this time still called "light gun",

# History

1960s

## New Input/Output Devices

- The first mouse




Around 1980 – First Optical Mouse


1981 – First Commercial Mouse


1983 – First Consumer Mouse
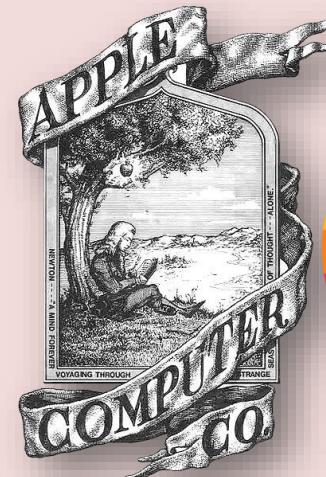
# History

1970s

**1975–1980**

**1980–1982**

**1982–1987**

**1987–2012**

**1976–1977**

**1977–1998**

In the 1970s, the era of personal computers began. Before that, IBM machines had text-only UI and were too difficult to use to become popular.

# History

1970s

**In 1974,** Xerox's Alto became the first device with a complete graphical user interface, including windows, icons, and the cursor. The computer allowed users to:

- Share files
- Print out documents
- Type and edit texts
- Do simple sketches
- Edit graphics
- Send emails

A decade later, **in 1981**, it was released to the mass market, but sales weren't high.



Xerox Alto

# History

1980s

**In 1979**, Steve Jobs arranged a visit to Xerox Palo Alto Research Center (PARC) and traded $1 million in stock options to Xerox in exchange for a detailed demonstration of their technologies.

**In 1983,** Apple introduced Lisa — the first commercial personal computer, which, however, didn't make a breakthrough due to a high price.

**A year later,** Apple's Macintosh computer was released, and it had insanely successful sales. It was the first relatively cheap computer with a user-friendly and intuitive interface
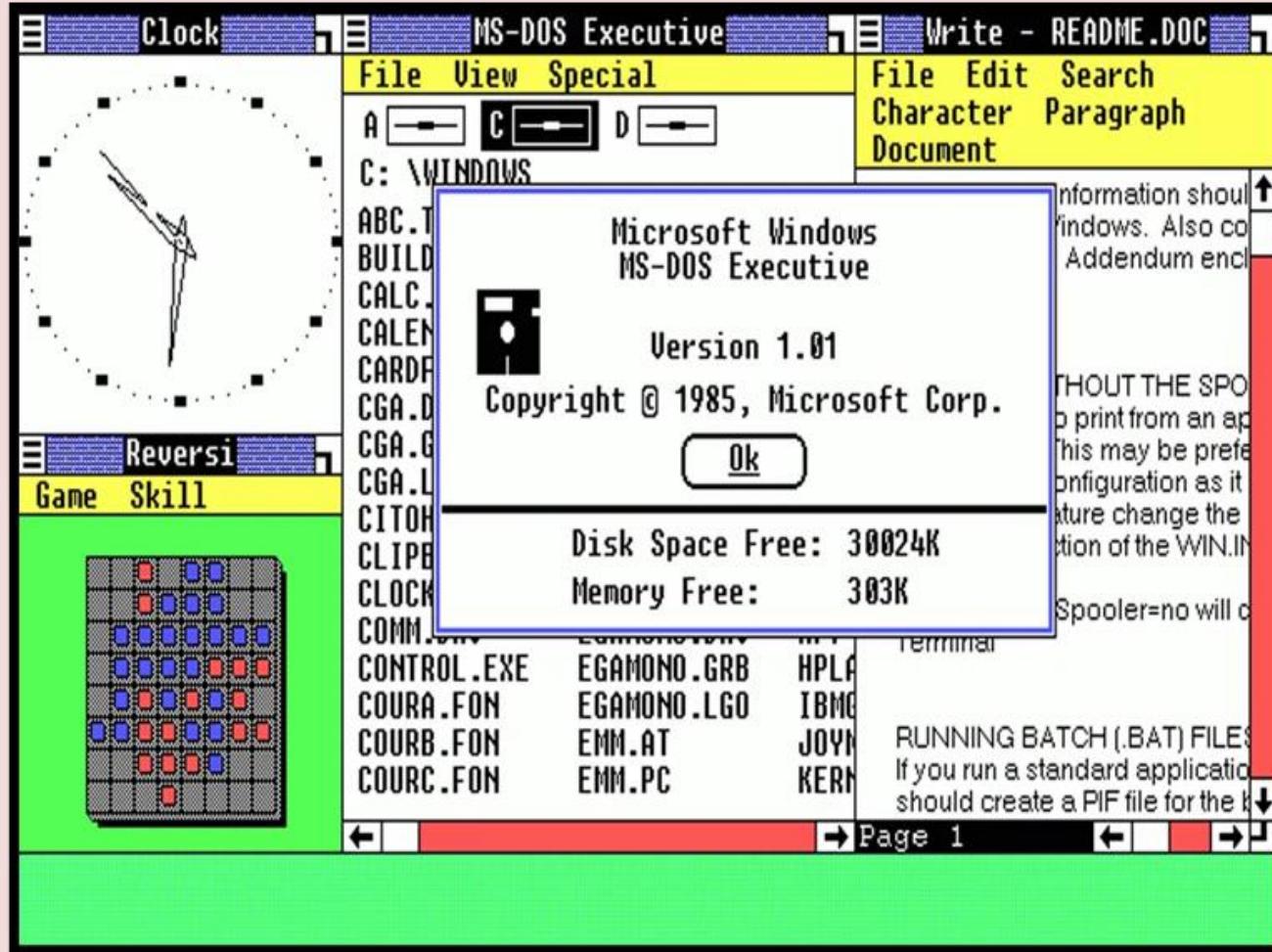


Xerox 8010 Star - 1981    Apple Lisa - 1982    Macintosh - 1984

# History

*1980s*

## November 20, 1985     Microsoft Windows 1.0x
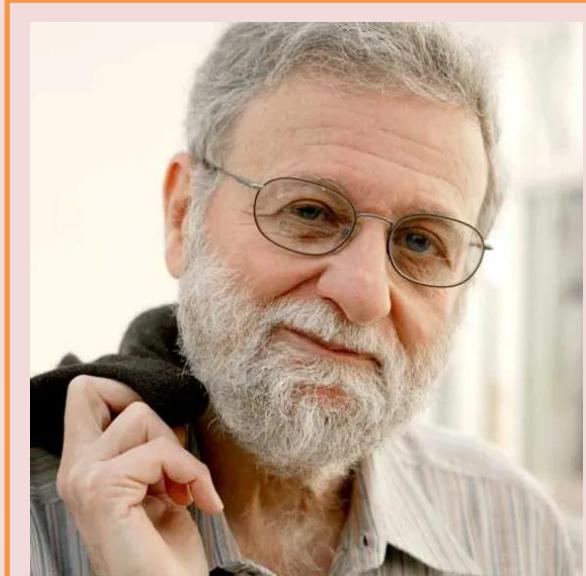
# History

1980s

**In 1986**, **Norman** introduced the term "**user-centered design**" in the book User Centered System Design: New Perspectives on Human-computer Interaction, a book edited by him and by Stephen W. Draper. In the introduction of the book, the idea that designers should aim their efforts at the people who will use the system is introduced:

He is **the first** to put on his identification card the profession of "**an expert or consultant in user experience design**"

Donald Arthur Norman

born December 25, 1935

# History

2000s

**In 2007**, **Steve Jobs** introduced the first **iPhone**, which forever changed the digital world.



**Steven Paul Jobs**
February 24, 1955 – October 5, 2011
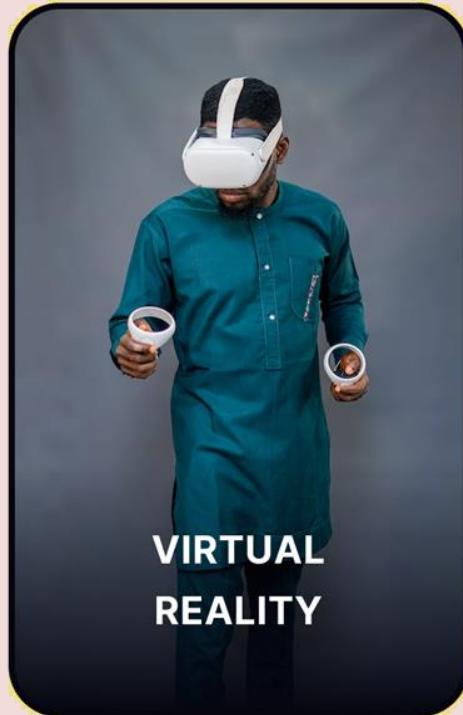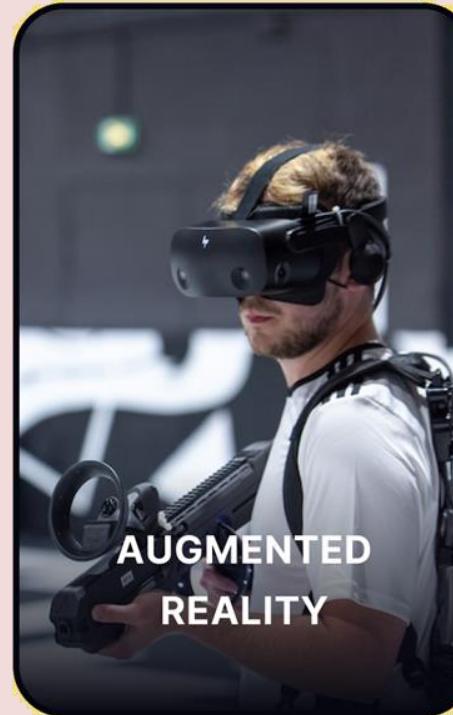
# History

*present*

**Today is history in the making**

**XR : Extended Reality**



VR



AR



MR

# History

*present*

## Today is history in the making

## DR : Diminished Reality
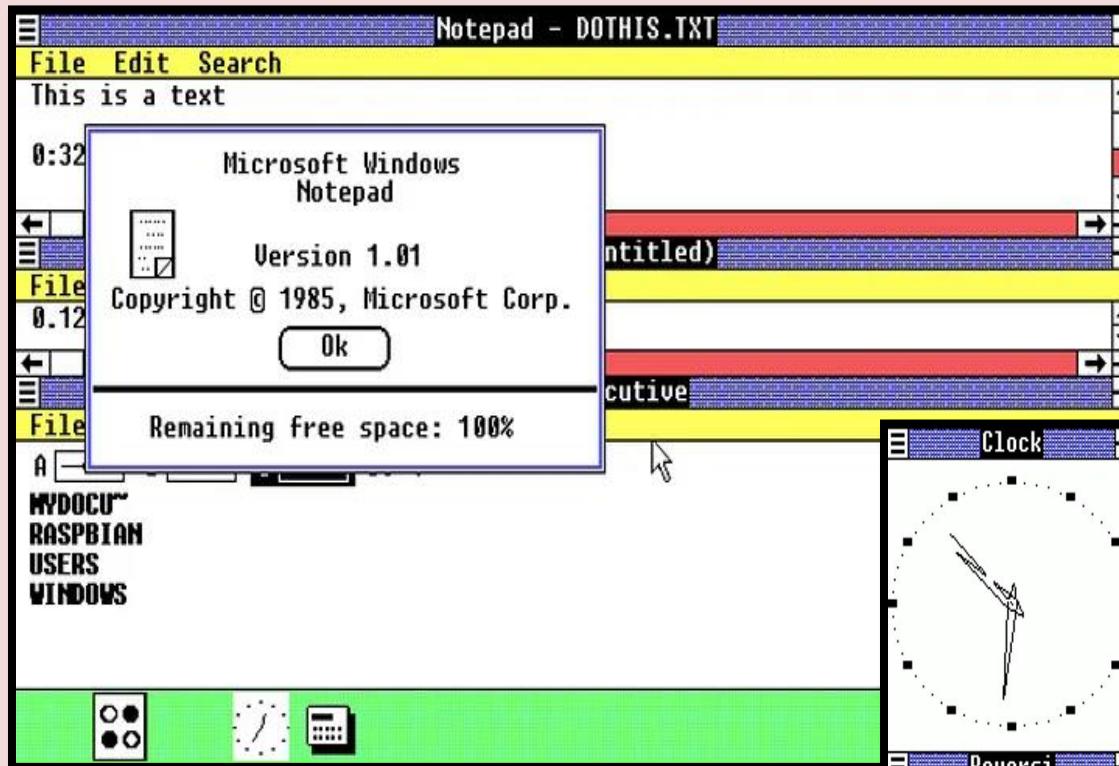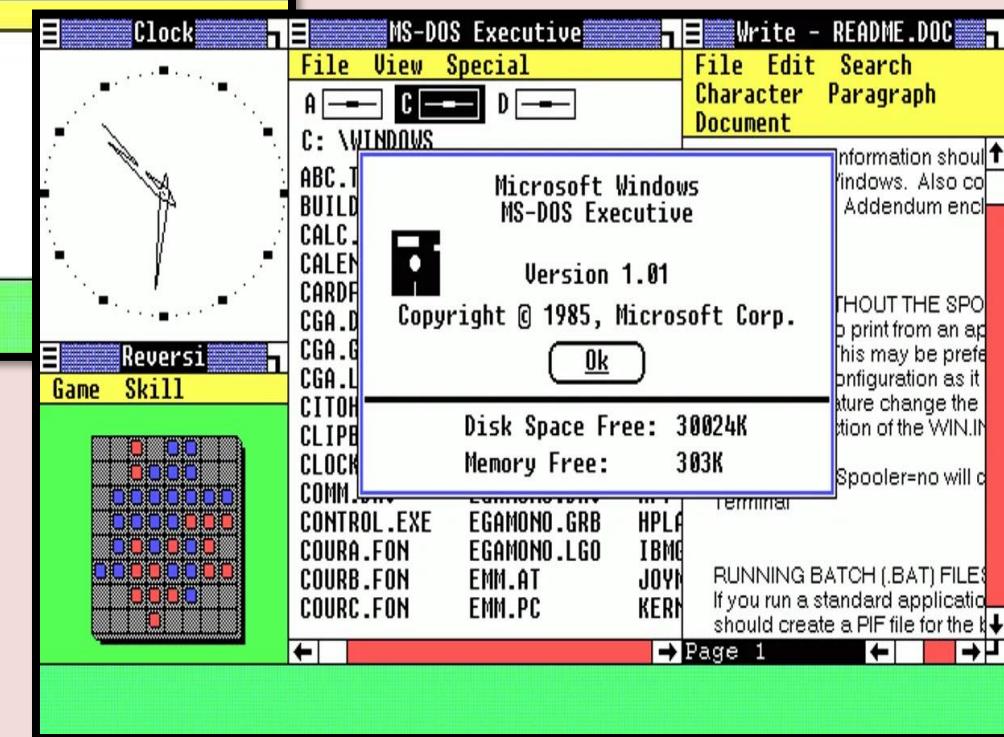
# History

MICROSOFT WINDOWS

# History
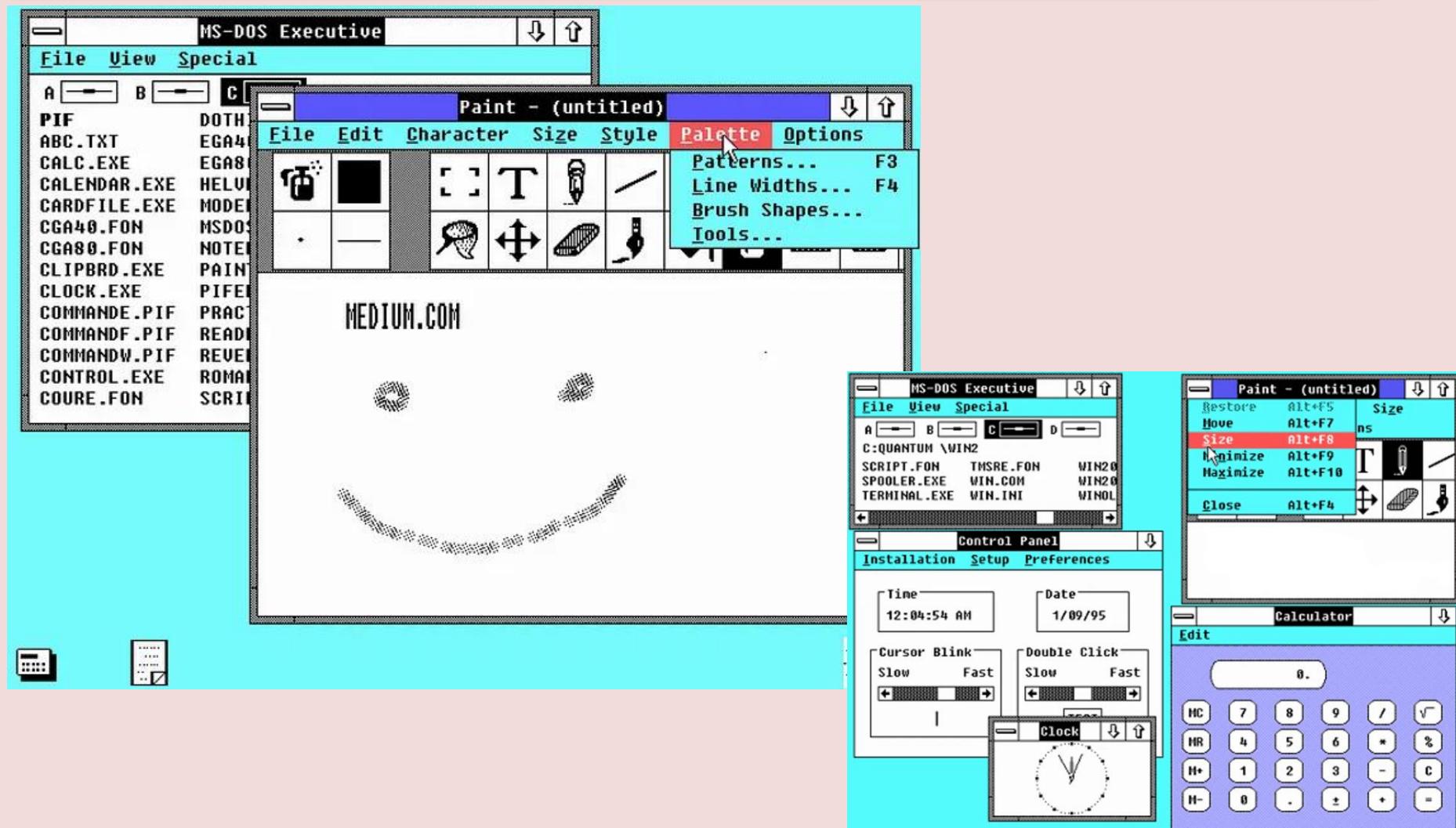
MICROSOFT WINDOWS



Windows 1.01 Interface; **(1985)**

# History
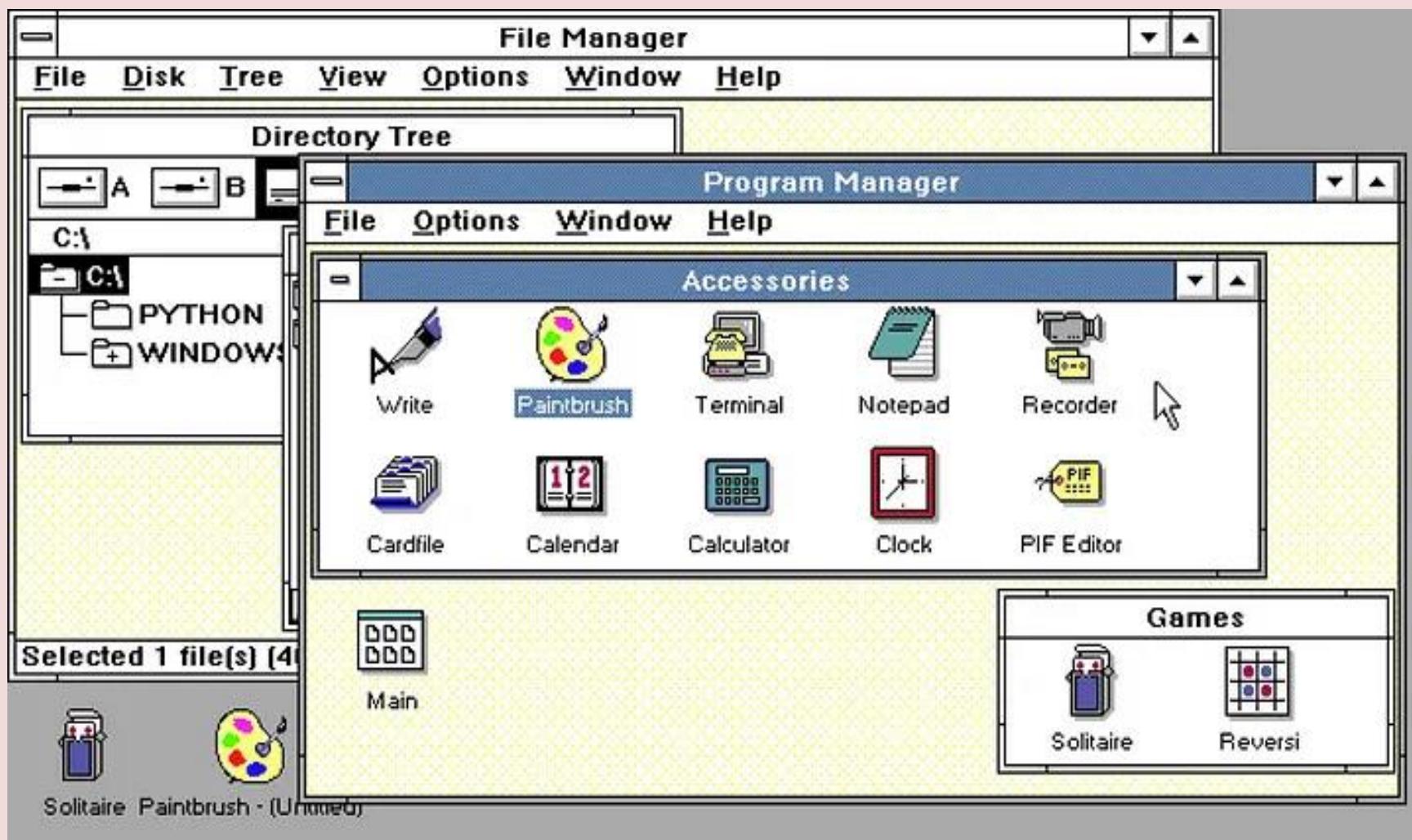
MICROSOFT WINDOWS



Windows 2.1 Interface;  **(1988)**

# History

MICROSOFT WINDOWS



Windows 3.0 Interface; **(1990)**

# History
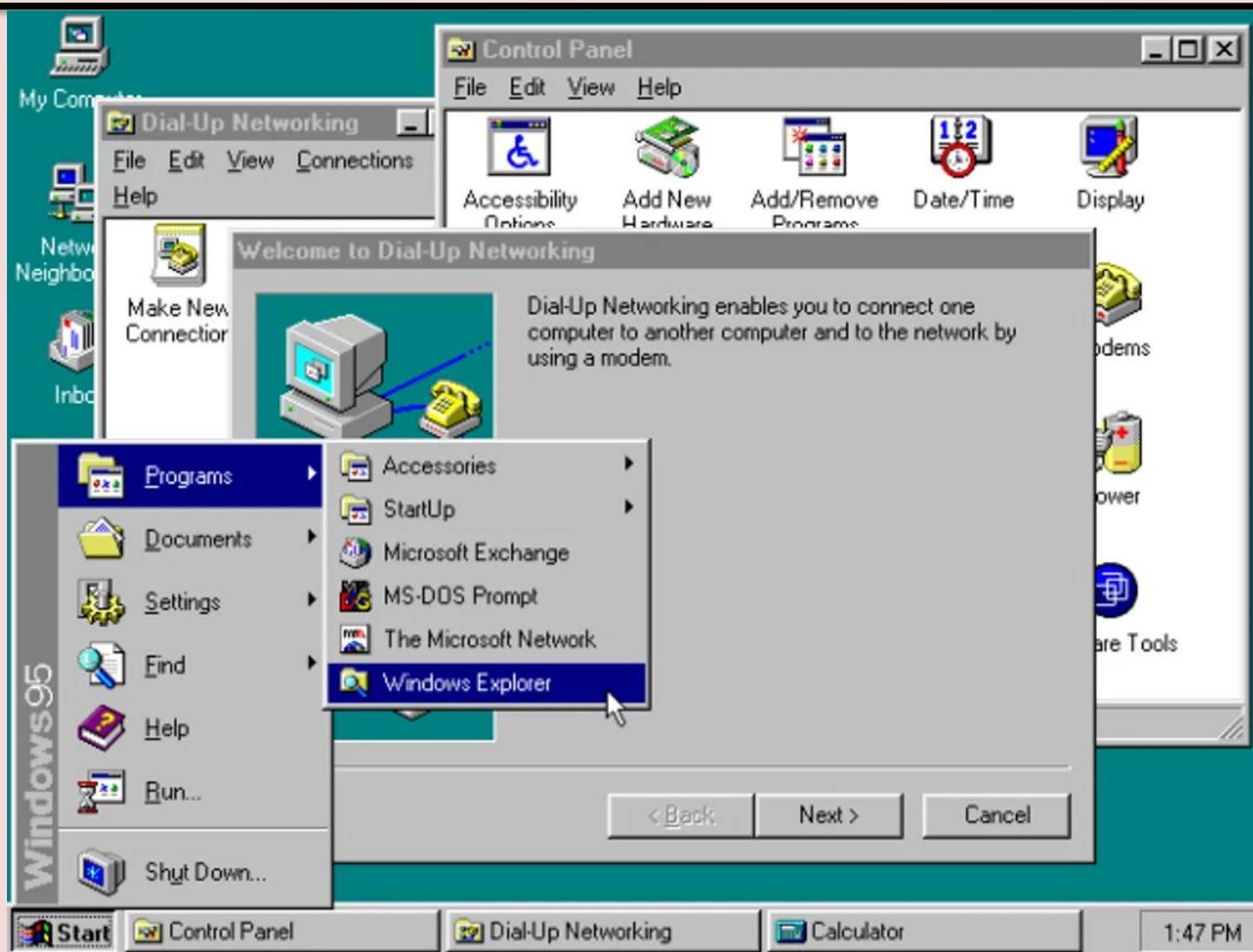
MICROSOFT WINDOWS



Windows 3.1 (1992) and 3.11 (1993)

# History

MICROSOFT WINDOWS



Windows 95 (1995)
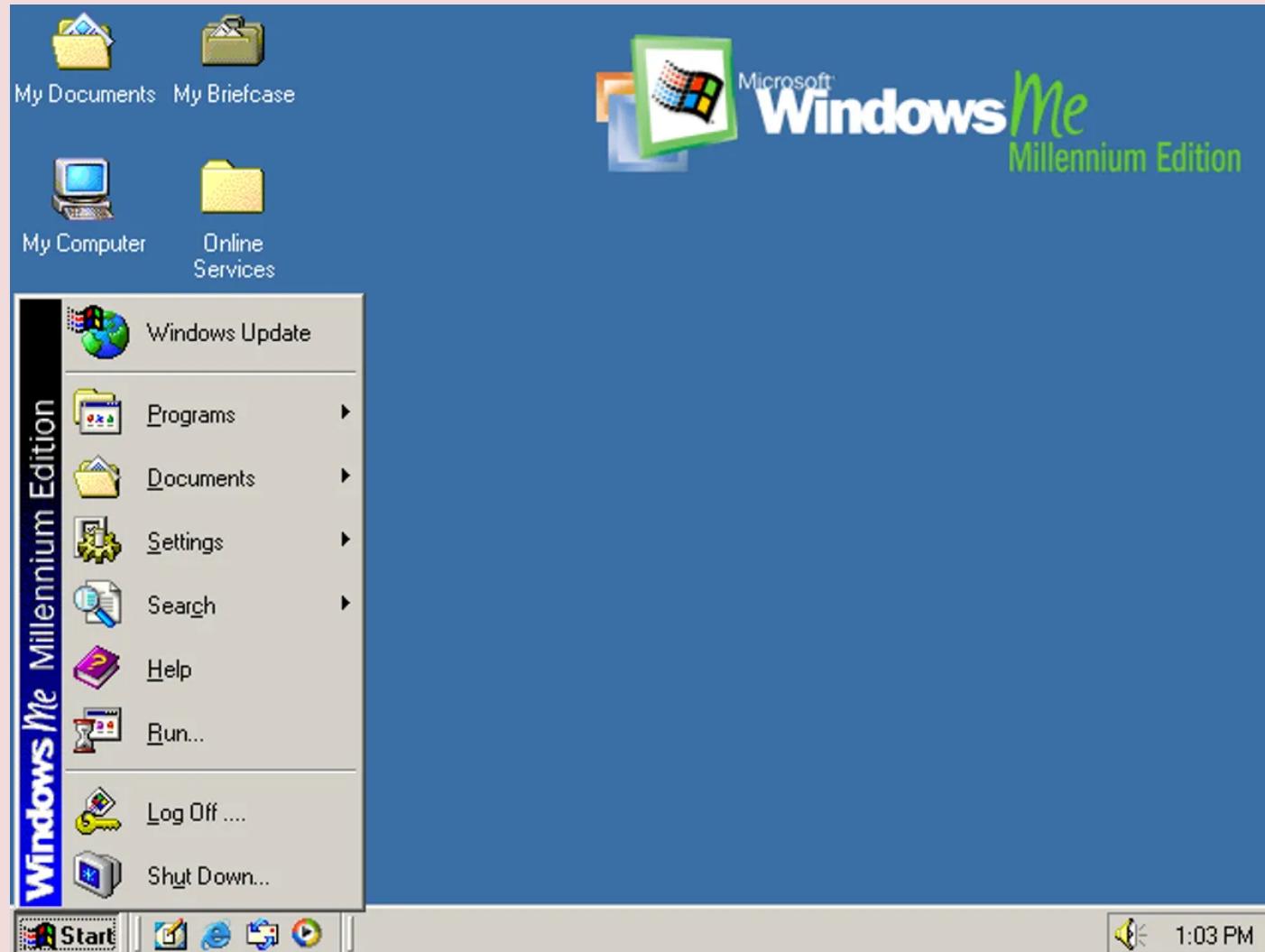
# History

MICROSOFT WINDOWS



Windows 98 (1998)

# History

MICROSOFT WINDOWS



Windows me (2000)
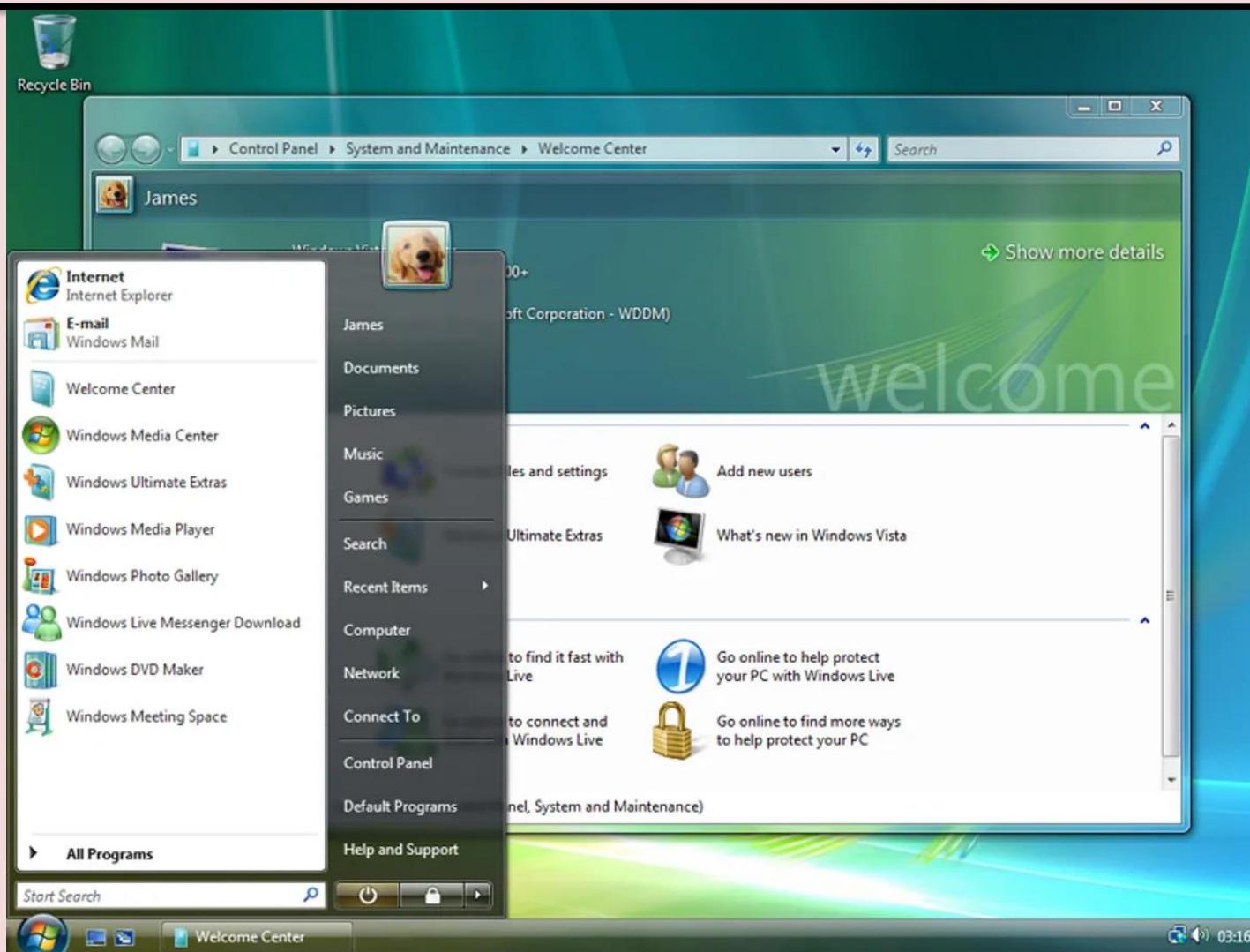
# History

MICROSOFT WINDOWS



Windows xp (2001)

# History

MICROSOFT WINDOWS



Windows vista (2007)

# History

MICROSOFT WINDOWS



Windows 7 (2009)

# History

MICROSOFT WINDOWS



Windows 8 (2012)

# History

MICROSOFT WINDOWS



Windows 10 (2015)

# History

MICROSOFT WINDOWS



Windows 11 (2021)