CSM 357

# Human-Computer Interaction

lecture 1

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# INTRODUCTION TO HCI

**Human–computer interaction (HCI) is a cross-disciplinary area:**

- (e.g., engineering, psychology, ergonomics, design)
- that deals with the **theory**, **design**, **implementation**, and **evaluation** of the ways that humans use and interact with computing devices.

# Definition of HCI

Human Computer Interactions (HCI) is concerned **with designing, evaluating and deploying usable, effective technologies in a range of contexts** - be it home, office, school, cyberspace or other domain.

Human Computer Interaction is a discipline concerned with the design, evaluation and implementation of interactive computer systems for human use and with the **study of major phenomena surrounding them**

HCI has become much more important in recent years as computers (and embedded devices) have become commonplace in almost all facets of our lives.

# Human-Computer Interaction : The Human

As its name implies, HCI consists of three parts:

1. **the user,**
2. **the computer,**
3. **and the ways they work together (Interaction)**

# Human-Computer Interaction : The Human

A user is an individual user or a group of users working together.

It is important to **appreciate the way people's sensory systems (sight, hearing, touch) relay information.**

Also, different users **form different conceptions or mental models about their interactions** and have different ways of learning and keeping knowledge.

In addition, **cultural and national differences** play an important part in individual differences.

# Human-Computer Interaction : The Computer

Computers refer to any technology ranging from smart phones, embedded systems, desktop computers, to large scale computer systems.

# Human Computer Interaction : The Interaction

There are obvious differences between humans and machines.

In spite of these, **HCI attempts to ensure that they both get on with each other and interact successfully.**

**In order to achieve a usable system, you need to apply what you know about humans and computers, and consult with likely users throughout the design process.**

# Goals of HCI

The goals of HCI are to produce **usable** and **safe** systems, as well as **functional** systems.

In order to fulfill that, developers must attempt to:

- Understand how people use technology
- Building suitable systems
- Achieve efficient, effective, and safe interaction

# Goals of HCI

**At physical level**, HCI concerns selecting the most **appropriate input devices and output devices** for a particular interface or task

Determine the best type of interaction, such as direct manipulation, natural language, icons, menus

# Goals of HCI

For **systems that include computers**, develop or improve

- Safety
- Utility
- Effectiveness
- Efficiency
- Usability
- Appeal

# How important is HCI?

1. If the video does not record a TV program because we pressed the wrong button, we are likely to feel angry.
2. Users may struggle to understand or use the technology, resulting in dissatisfaction and potential abandonment.
3. A pilot shuts down the wrong engine and the plane crashes. This may lead to the loss of many lives
4. Users may spend more time navigating the system or completing tasks, leading to decreased overall efficiency.
5. Organizations incur higher costs for training programs, impacting budgets and timelines.

# Real World HCI Examples

1. Gaming Interfaces of popular video games.
2. Learning management platforms like Moodle or Canvas.
3. The intuitive touch interface on smartphones.
4. Social media user-friendly design and features.
5. Intuitive user interfaces on ATMs.

# What is HCI? : Lamp Case study

**Function/objective**: to illuminate the environment

- **Interface**: power switch button
- **Functional part**: light bulb
- **Interaction**: press “On”, light on;
  press “Off”, light off
- **User tasks**: turn on the lamp, turn off the lamp

# What is HCI? : Word processor: case study

Objective: to edit a document

- **Interface**: windows, icons, menus, etc.
- **Functional part**: sub-routines for command execution, file handling, saving, deleting, etc.
- **Interaction**: use mouse to click the “save” icon,
  use mouse to click “FILE” icon, …
- **User tasks**: edit file, save file, etc.

# Good and poor design choices

Wine glass: Is this a good or poor design choice?

# Good and poor design choices

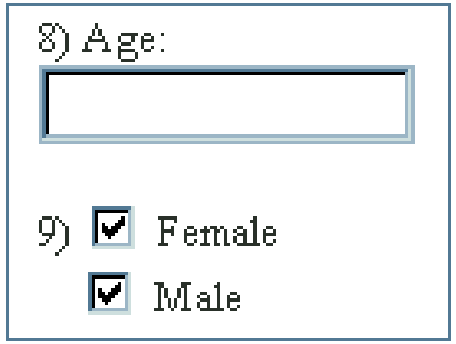

**Can you guess what is it? How to operate it?**

# Good and poor design choices

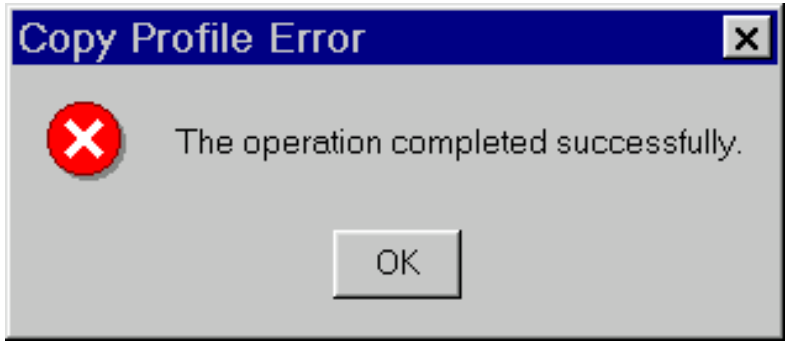
WHICH OF THE TWO EGG SEPARATORS WILL YOU CHOOSE AND WHY?

# Examples of bad design

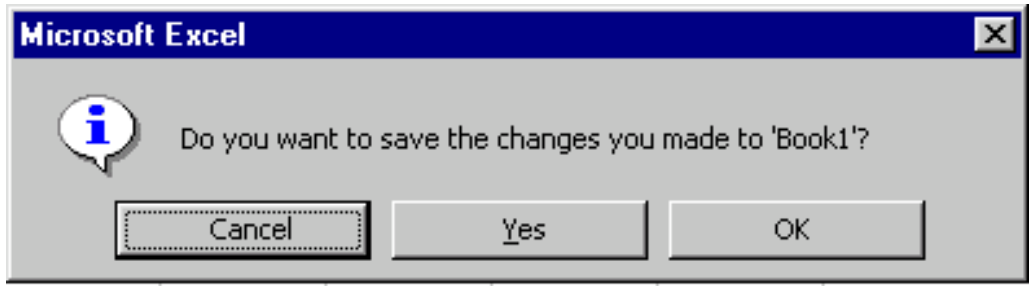
# Examples of bad design



# Examples of bad design



# Examples of bad design



# To avoid bad design choices

Take into account

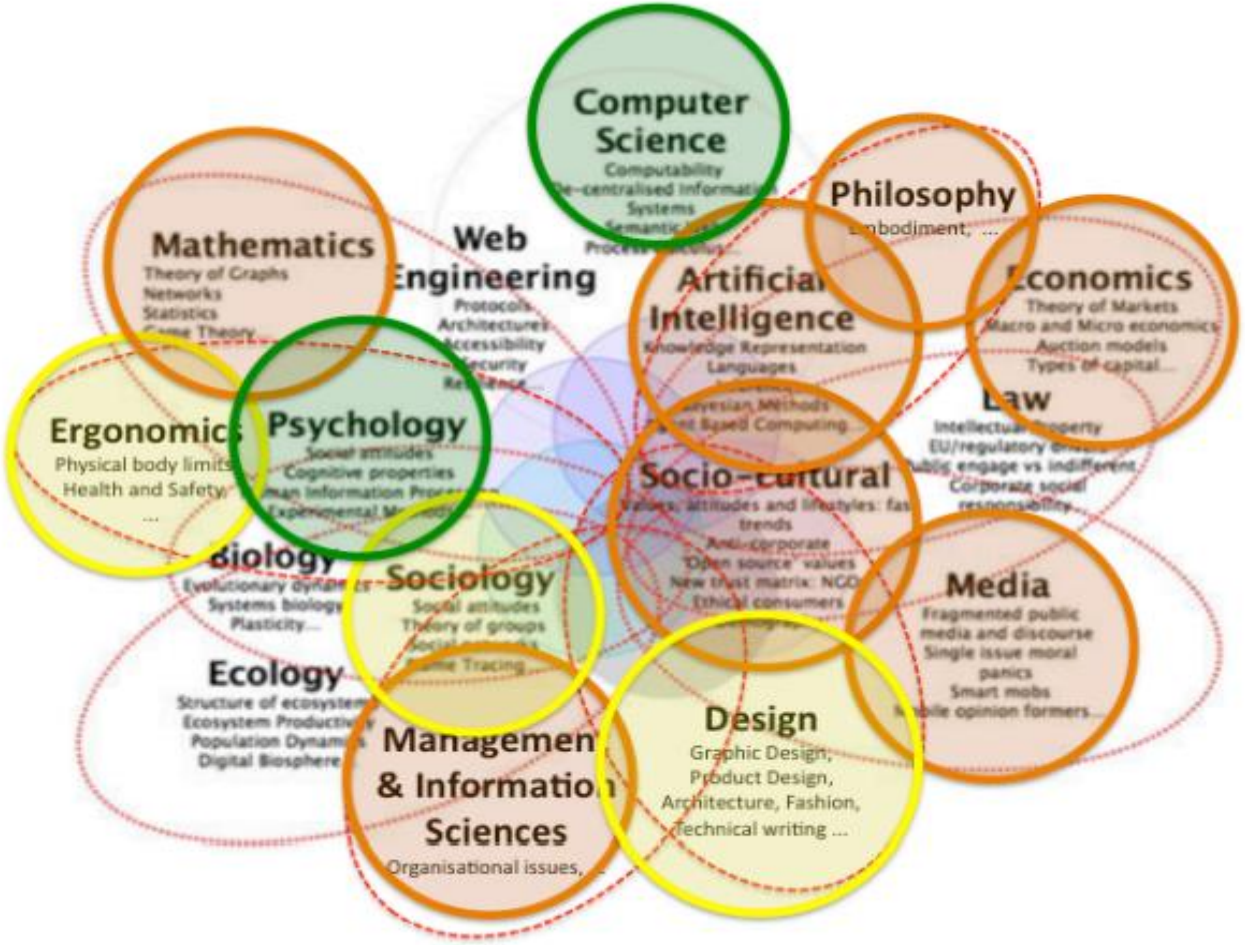
–who the users are

–what activities are being carried out

–where the interaction is taking place

**And then Optimise the interactions users have with products such that they match users' activities and needs**

# Multidisciplinary Nature of HCI




Human-Computer Interaction (HCI) is a multidisciplinary field which combines the theories and practices from a number of fields including:

- computer science,
- cognitive and behavioral psychology,
- anthropology,
- sociology,

# Multidisciplinary Nature of HCI

- ergonomics,
- industrial design, and more

# Watch this video

**History of HCI: https://www.youtube.com/watch?v=C21Hx0yiHF0**

# What do professionals do in the HCI business?

**interaction designers** - people involved in the design of all the interactive aspects of a product

**usability engineers** - people who focus on evaluating products, using usability methods and principles

**web designers** - people who develop and create the visual design of websites, such as layouts

**information architects** - people who come up with ideas of how to plan and structure interactive products

**user experience designers** - people who do all the above but who may also carry out field studies to inform the design of products

# Design Focus

## Quick fixes

You should expect to spend both time and money on interface design, just as you would with other parts of a system. So in one sense there are no quick fixes. However, a few simple steps can make a dramatic improvement.

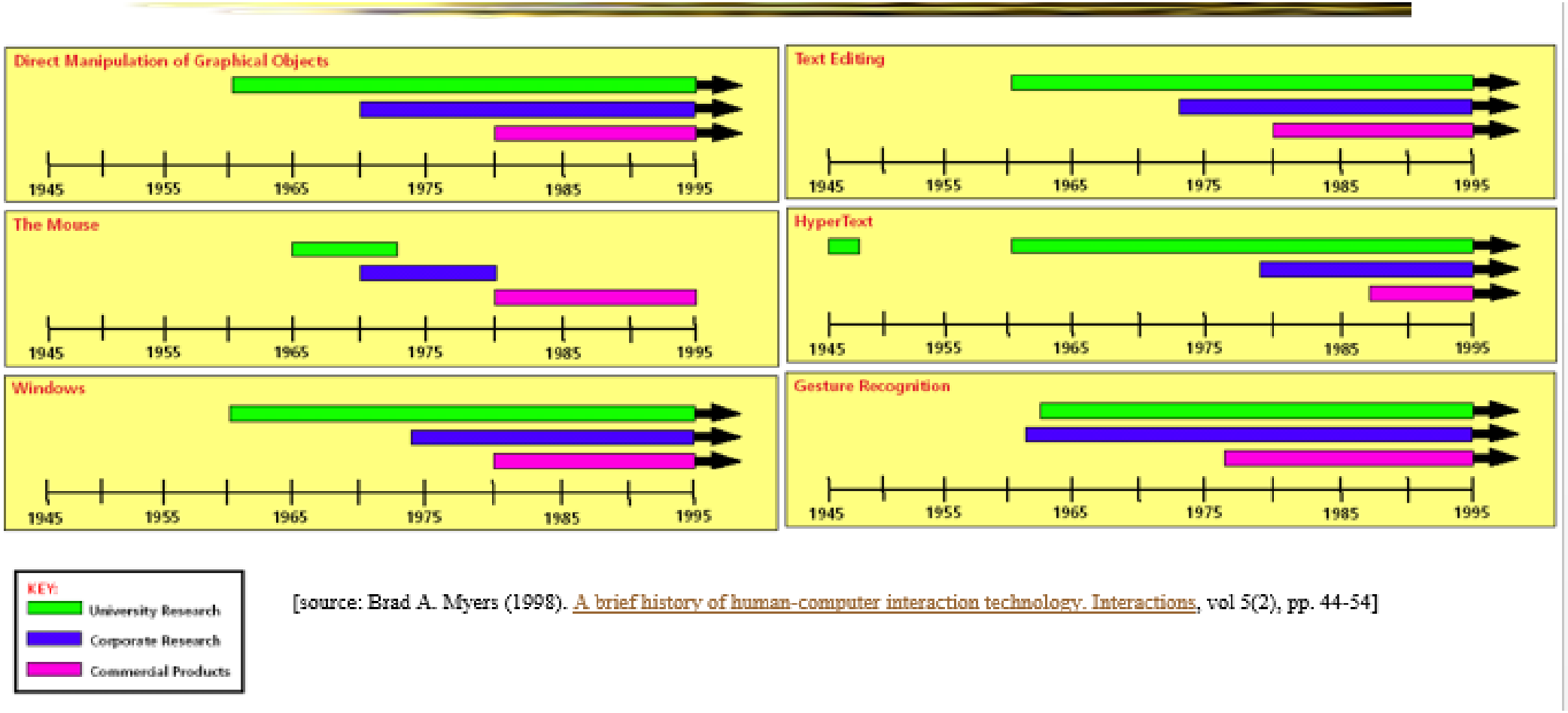
**Think 'user'**
Probably 90% of the value of any interface design technique is that it forces the designer to remember that someone (and in particular someone else) will use the system under construction.

**Try it out**
Of course, many designers will build a system that they find easy and pleasant to use, and they find it incomprehensible that anyone else could have trouble with it. Simply sitting someone down with an early version of an interface (without the designer prompting them at each step!) is enormously valuable. Professional usability laboratories will have video equipment, one-way mirrors and other sophisticated monitors, but a notebook and pencil and a home-video camera will suffice (more about evaluation in Chapter 9).

**Involve the users**
Where possible, the eventual users should be involved in the design process. They have vital knowledge and will soon find flaws. A mechanical syringe was once being developed and a prototype was demonstrated to hospital staff. Happily they quickly noticed the potentially fatal flaw in its interface.

# History of HCI: Paper Discussion

## Brad A. Myers. "A Brief History of Human Computer Interaction Technology." *ACM interactions*. Vol. 5, no. 2, March, 1998. pp. 44-54.




[source: Brad A. Myers (1998). A brief history of human-computer interaction technology. Interactions, vol 5(2), pp. 44-54]

Approximate time lines showing where work was performed on some major technologies

History of HCI: Paper Discussion (Excepts)

**Brad A. Myers. "A Brief History of Human Computer Interaction Technology." *ACM interactions*. Vol. 5, no. 2, March, 1998. pp. 44-54.**

## **Direct Manipulation of graphical objects**:

The now ubiquitous direct manipulation interface, where visible objects on the screen are directly manipulated with a **pointing device**, was first demonstrated by Ivan Sutherland in Sketchpad, which was his 1963 MIT PhD thesis.

**SketchPad supported the manipulation of objects using a light-pen, including grabbing objects, moving them, changing size, and using constraints.** The system was built at Lincoln Labs with support from the Air Force and NSF

## Direct Manipulation of graphical objects:

David Canfield Smith coined the term "**icons**" in his 1975 Stanford PhD thesis on Pygmalion (funded by ARPA and NIMH) and Smith later popularized icons as one of the chief designers of the Xerox Star

Many of the interaction techniques popular in direct manipulation interfaces, such as how objects and text are selected, opened, and manipulated, were researched at Xerox PARC in the 1970's.

In particular, the idea of "**WYSIWYG**" (what you see is what you get) originated there with systems such as the Bravo text editor and the Draw drawing program

# History of HCI: Paper Discussion (Excepts) **Brad A. Myers. "A Brief History of Human Computer Interaction**

**Direct Manipulation of graphical objects**:

The first commercial systems to make extensive use of Direct Manipulation were the **Xerox Star (1981) , the Apple Lisa (1982) and Macintosh (1984)**

Image source:https://www.thocp.net/hardware/xerox_star.htm

# History of HCI: Paper Discussion (Excepts) **Brad A. Myers. "A Brief History of Human Computer Interaction**

The Xerox Star workstation

Image source:https://www.thocp.net/hardware/xerox_star.htm

# History of HCI: Paper Discussion (Excepts) **Brad A. Myers. "A Brief History of Human Computer Interaction**

Xerox Star

The Xerox Star workstation, officially named Xerox 8010 Information System, was the first commercial personal computer to incorporate technologies that have since become standard in personal computers including:

- **a bitmapped display,**
- **a window-based graphical user interface,**
- **icons,**
- **folders,**
- **mouse (two-button),**
- **Ethernet networking,**
- **file servers,**
- **print servers, and**
- **e-mail**

# History of HCI: Paper Discussion (Excepts) **Brad A. Myers. "A Brief History of Human Computer Interaction**

Apple Lisa (1982)

Image source:https://www.macstories.net/mac/the-lisa/

Lisa is a desktop computer developed by Apple, released on January 19, 1983.

It is one of the first personal computers to present a graphical user interface (GUI) in a machine aimed at individual business users

# History of HCI: Paper Discussion (Excepts) **Brad A. Myers. "A Brief History of Human Computer Interaction**

## Macintosh (1984)


The Macintosh (mainly Mac since 1998) is a family of personal computers designed, manufactured, and sold by Apple Inc. since January 1984.

The original Macintosh is the **first successful mass-market personal computer** to have featured a graphical user interface, built-in screen, and mouse

Image source: https://appleinsider.com/articles/19/01/24/apple-launched-macintosh-on-january-24-1984-and-changed-the-world----eventually

## The Mouse

**The mouse was developed at Stanford Research Laboratory to be a cheap replacement for light-pens, which had been used at least since 1954**

It first appeared commercially as part of the Xerox Star (1981), the Three Rivers Computer Company's PERQ (1981), the Apple Lisa (1982), and Apple Macintosh (1984).

## Windows

Multiple tiled windows were demonstrated in Engelbart's NLS in 1968.

Early research at Stanford on systems like COPILOT (1974) and at MIT with the EMACS text editor (1974) also demonstrated tiled windows.

Alan Kay proposed the idea of overlapping windows in his 1969 University of Utah PhD thesis

The main commercial systems popularizing windows were the Xerox Star (1981), the Apple Lisa (1982), and most importantly the Apple Macintosh (1984

# History of HCI: Paper Discussion (Excepts) **Brad A. Myers. "A Brief History of Human Computer Interaction**

## Application types

**Drawing programs**: Much of the current technology was demonstrated in Sutherland's 1963 Sketchpad system. The use of a mouse for graphics was demonstrated in NLS (1965)

**Word processors**: In 1962 at the Stanford Research Lab, Engelbart proposed, and later implemented, a word processor with automatic word wrap, search and replace, user-definable macros, scrolling text, and commands to move, copy, and delete characters, words, or blocks of text

**Spreadsheets**: The initial spreadsheet was VisiCalc which was developed by Frankston and Bricklin (1977-8) for the Apple II while they were students at MIT and the Harvard Business School.

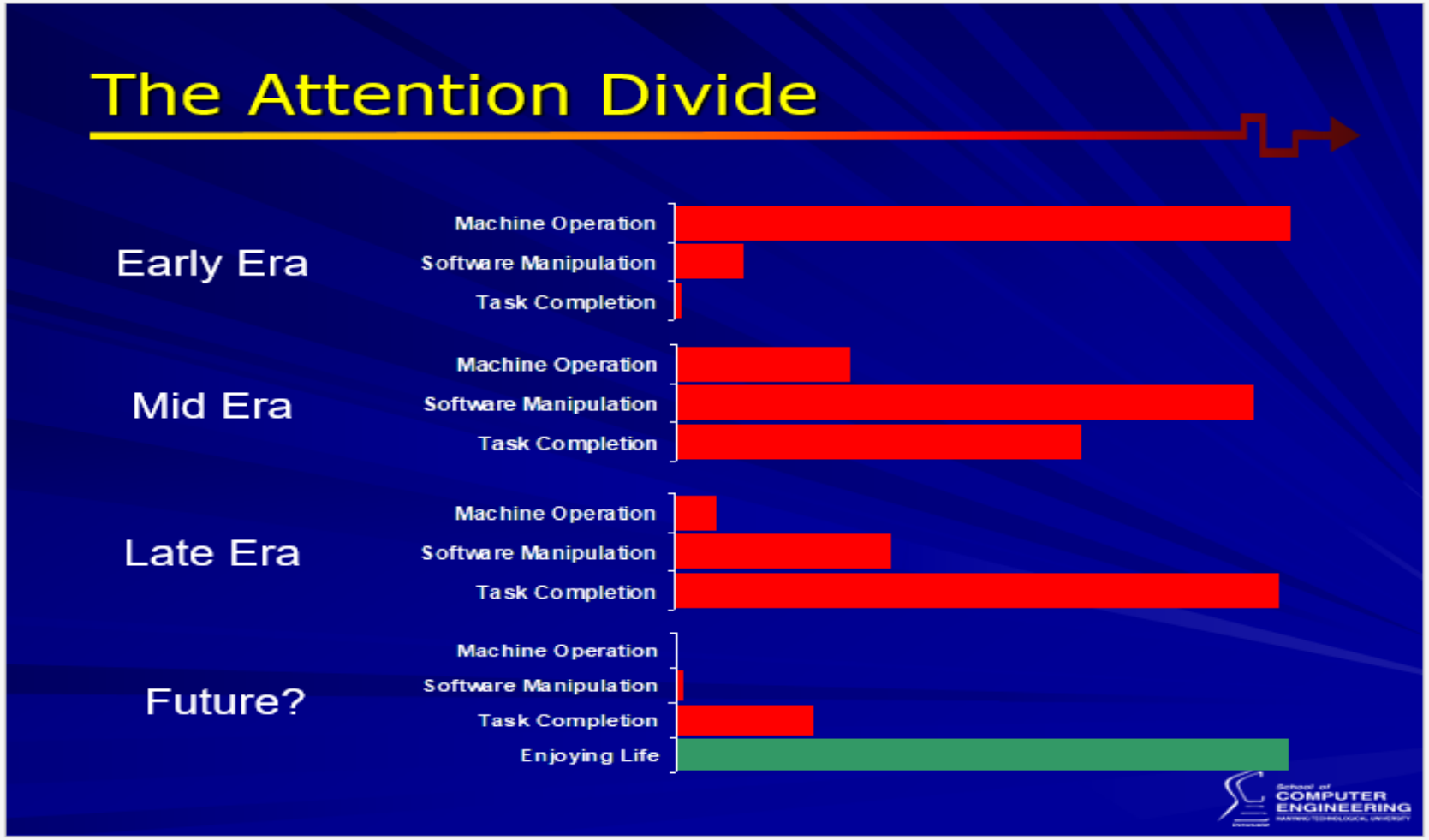
# History of HCI: Paper Discussion (Excepts) **Brad A. Myers. "A Brief History of Human Computer Interaction**

**HyperText**: The idea for hypertext (where documents are linked to related documents) is credited to Vannevar Bush's famous MEMEX idea from 1945. Ted Nelson coined the term "hypertext" in 1965. Tim Berners-Lee used the hypertext idea to create the World Wide Web in 1990

# Other Major technologies in HCI history

- Computer Aided Design
- Video games
- Gesture recognition
- Multi-media
- 3-D
- Virtual and Augmented Reality
- Natural language processing
- Wearable Affective Computing
- Multimodal Interaction
- Tangible Interaction
- Human-Robot Interaction
- Ubiquitous Computing

# Human Factors in HCI




Source: Human factors in HCI design, Cham,Tat-Jen

# Human Factors in HCI

Humans are limited in their capacity to process information. This has important implications for design.

Information is received and responses given via a number of input and output channels:

- **visual channel**
- **auditory channel**
- **haptic channel**
- **movement.**

The human, the *user*, is, after all, the one whom computer systems are designed to assist.

The requirements of the user should therefore be of priority.

# Human Factors in HCI

In order to design something for someone,

- we need to understand their capabilities and limitations.
- We need to know if there are things that they will find difficult or, even, impossible.
- It will also help us to know what people find easy and how we can help them with things they find difficult

**This means that cognitive psychology has a bearing on the use of computer systems**: how humans perceive the world around them, how they store and process information and solve problems, and how they physically manipulate objects.

# Human factors in HCI

## Handling the goods

E-commerce has become very successful in some areas of sales, such as travel services, books and CDs, and food. However, in some retail areas, such as clothes shopping, e-commerce has been less successful. Why?

When buying train and airline tickets and, to some extent, books and food, the experience of shopping is less important than the convenience. So, as long as we know what we want, we are happy to shop online. With clothes, the experience of shopping is far more important. We need to be able to handle the goods, feel the texture of the material, check the weight to test quality. Even if we know that something will fit us we still want to be able to handle it before buying.

Research into haptic interaction (see Chapter 2 and Chapter 10) is looking at ways of solving this problem. By using special force feedback and tactile hardware, users are able to feel surfaces and shape. For example, a demonstration environment called TouchCity allows people to walk around a virtual shopping mall, pick up products and feel their texture and weight. A key problem with the commercial use of such an application, however, is that the haptic experience requires expensive hardware not yet available to the average e-shopper. However, in future, such immersive e-commerce experiences are likely to be the norm. (See www.novint.com/)

# Human Factors in HCI

## DESIGN FOCUS

### Cashing in

Closure gives you a nice 'done it' when we complete some part of a task. At this point our minds have a tendency to flush short-term memory in order to get on with the next job. Early automatic teller machines (ATMs) gave the customer money before returning their bank card. On receiving the money the customer would reach closure and hence often forget to take the card. Modern ATMs return the card first!

# Importance of HCI

1. Can Prevent accidents
2. Health and safety concerns
3. Can reduce the cost of customer training and support
4. Direct correlation between HCI and sales
5. HCI can provide you a job.

# Assignment

Discuss the impact of large language models on the future of human-computer interaction in not less than 300 words. Submission will be on vclass

# THANK YOU