CSE 428
Human Computer Interaction

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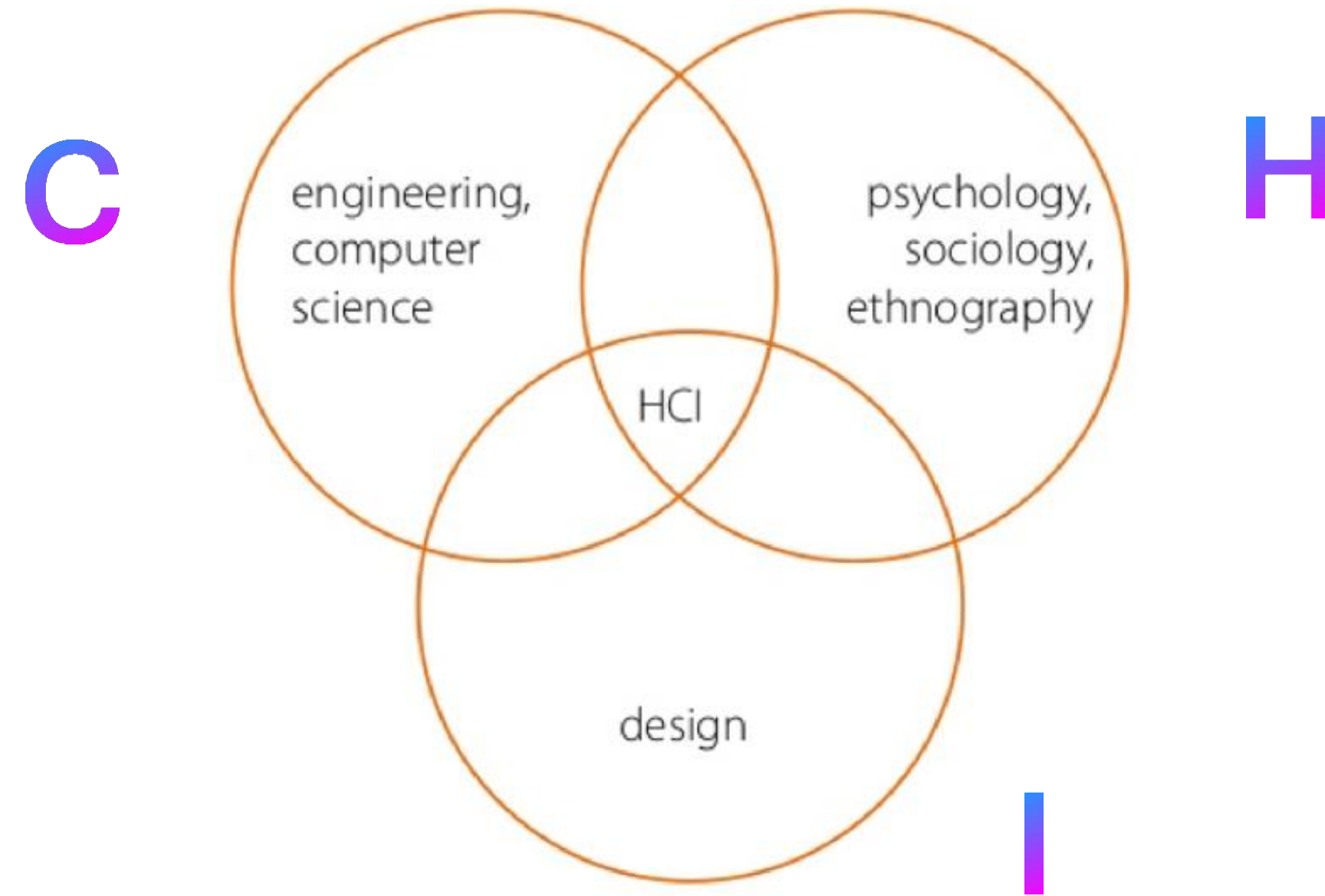
What is HCI?

Human-Computer Interaction

Human-Computer Interaction (HCI)

- Human
  - the end-user of a program
  - the others in the organization
- Computer
  - the machine the program runs on
- Interaction
  - the user tells the computer what they want
  - the computer communicates results

C

H

I

engineering, computer science

psychology, sociology, ethnography

HCI
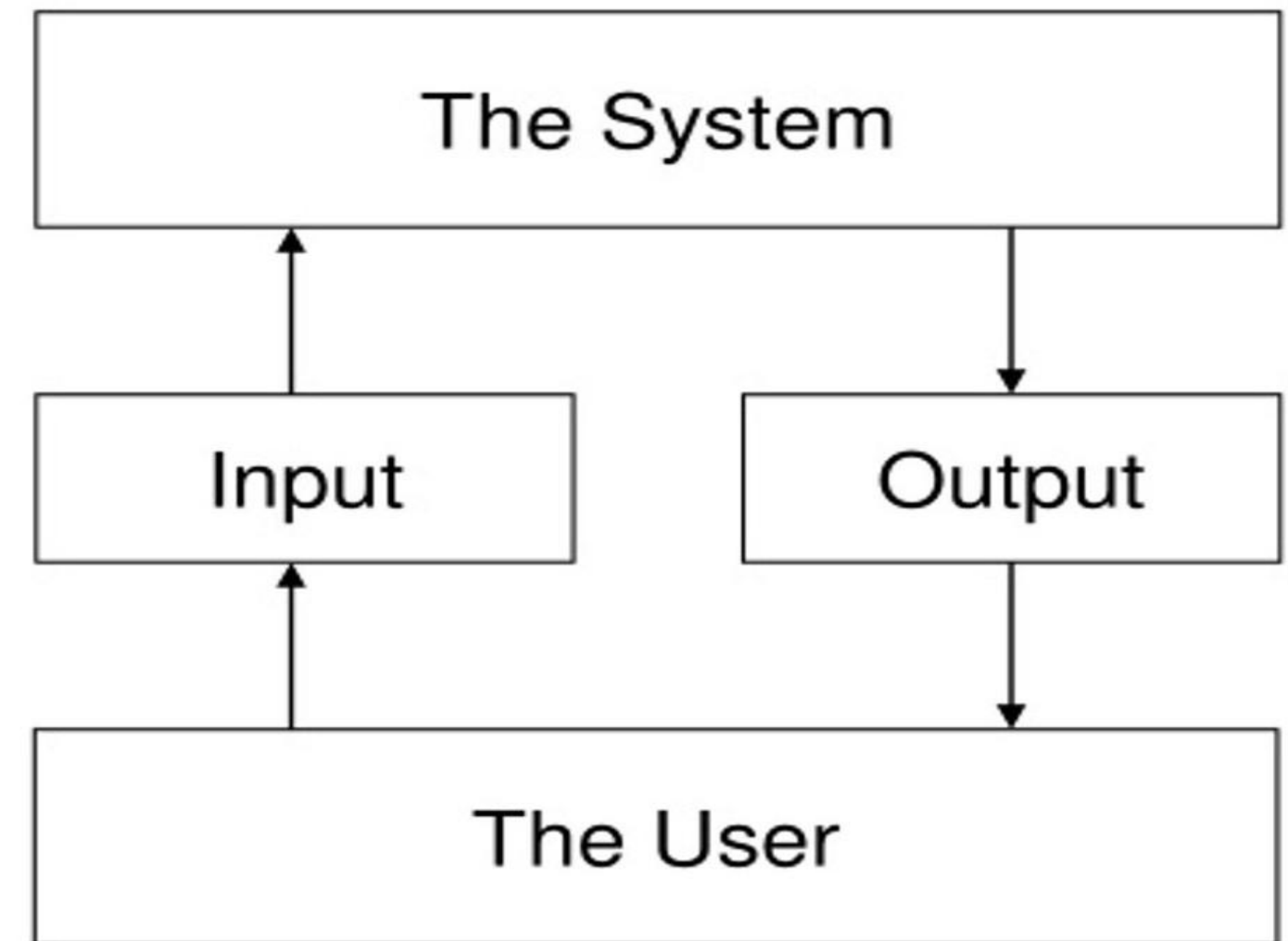
design

HCI is about the **design and use** of computer technology

What is **design**?

- Design is about **making** things
- "[Design is] a plan for arranging elements in such a way as to best accomplish a particular **purpose**." - Charles Eames *(designer of some famous chairs)*

What is an **interface**?

- "the place at which independent and often unrelated systems meet and act on or communicate with each other" - Merriam Webster dictionary

- This is the **interaction** part of human-computer interaction

- Humans and computers interact using an interface - and that interface is what we design!

Why is interaction design hard?

You are not the user!

- User interfaces are about communicating with users. **Users are NOT like you!**

- As the engineer, you already know a lot more about your application than any user will, and it's difficult to un-learn it.

- What do we mean when we say "the user is always right"?

BUT don't expect users to be designers either

1) Telephone handset weight
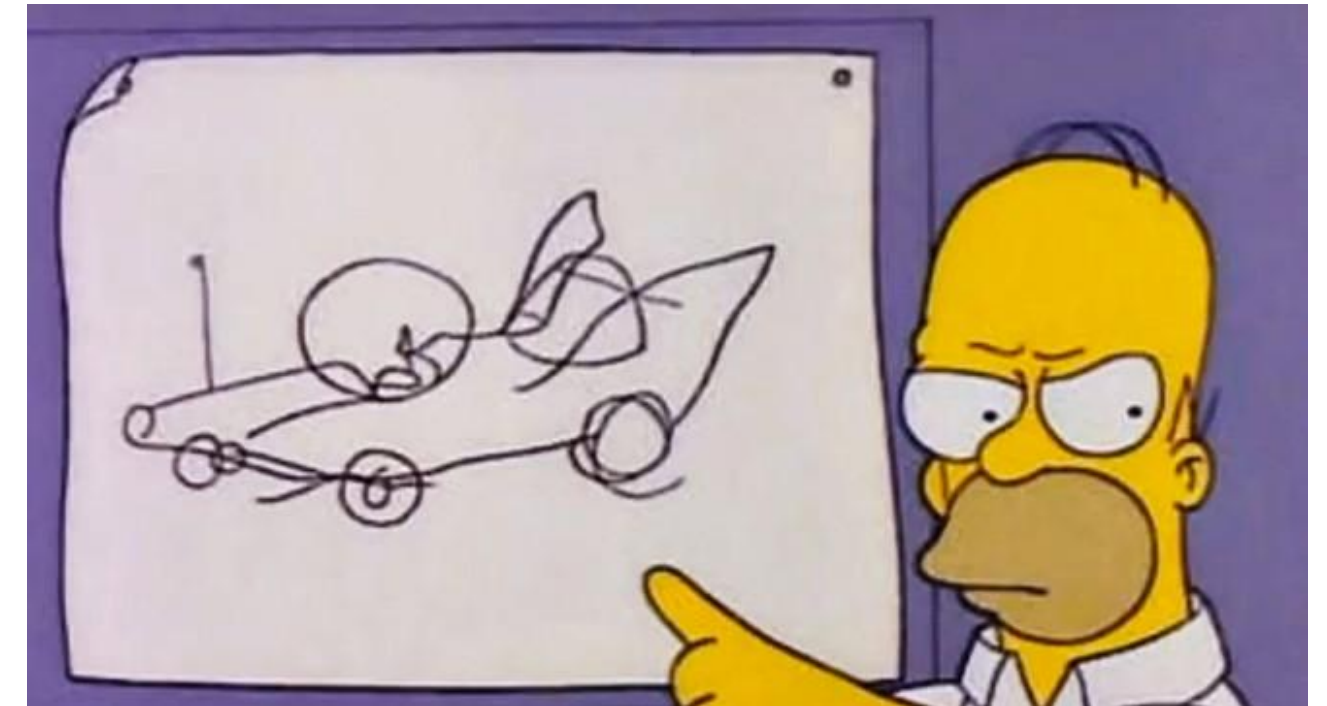
- users said: it's fine! —but they wanted lighter

2) # of Google search results

- users said: 30 results —but they really wanted 10

3) Command abbreviations

- Users made 2x more errors with their own custom abbreviations

"I want a horn here, here, here, and here. You can never find a horn when you're angry."

1) Klemmer, Ergonomics, Ablex, 1989, pp 197-201
2) http://perspectives.mvdirona.com/2009/10/31/TheCostOfLatency.aspx
3) Grudin & Barnard, "When does an abbreviation become a word?", CHI '85

So how do you know what to design?

- **Answer 1**: Design as a **process**:

  - To synthesize a solution from all the relevant constraints

  - To frame, or reframe, the problem and objective

  - To create and envision alternatives

  - To select from those alternatives

  - To visualize and prototype the intended solution

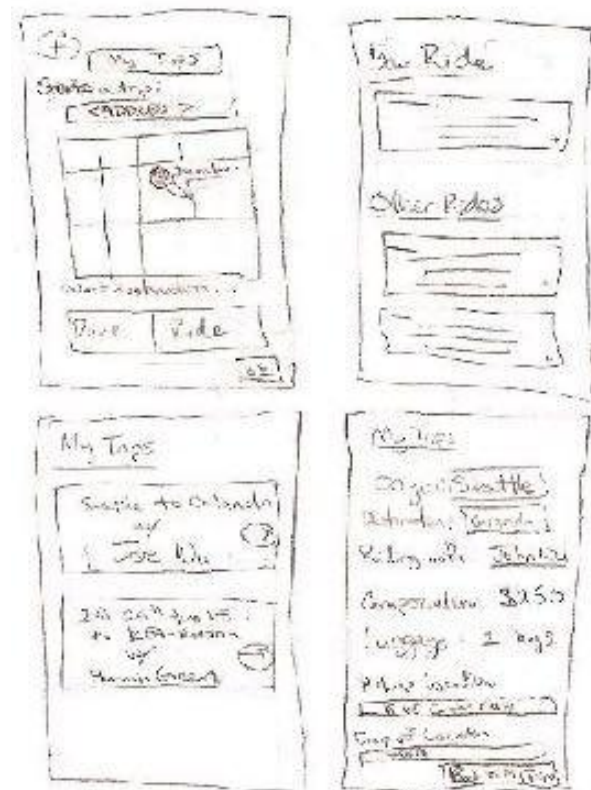 - Bill Moggridge (co-founder of IDEO)

Design as a **process**

- Design process as **iterative** and **explorative**, constantly involving **users** and investigating **use**, since we can't just trust our instincts

Talk to people, investigate problems

Sketching and Storyboarding

Low-fidelity Prototyping

Digital Mockup

Presentation & Communication

So how do you know what to design?

- **Answer 2**: Design as an open-ended **series of principles**:
  - Usability: how well users can use the system's functionality
    - Learnability: how easy is it to learn?
    - Efficiency: once learned, how quickly can it be used?
    - Safety: are errors few and recoverable?
  - Accessibility
  - Aesthetics, minimalism
  - Ergonomics
  - Expressivity, flexibility
  - Malleability, control

Which principles to emphasize depends on context

- There are **trade-offs** between different design principles, so you can't just apply them mindlessly

- Emphasis depends on the **user**

  - Novice users need greater learnability

  - Expert users need efficiency

  - But everyone can be a novice or an expert at different points in time

- Emphasis depends on the **task**

  - Highly critical tasks should emphasize safety (amber alert system)

  - Less critical, repetitive tasks need efficiency (unlocking your smartphone)

There are also other trade-offs

- Software builders have a lot to worry about!

  - functionality
  - security

  - performance
  - maintainability

  - cost
  - reliability

- Some of your other CSE courses focus on these other attributes

- But we'll mostly ignore these trade-offs in this class in favor of how well the interface addresses a **problem that people have** and how successful is the interface for people to **achieve their goals and tasks**

- Just like with these other attributes, we have to think about constraints —but now, we add humans' physical, mental, and social constraints in *addition* to physical constraints of machines

Why Study User Interface Design?

- 75% or more of development effort can go into the user interface
  - 40% to 70% is typical
  - User interface specialists are needed
  - Everybody needs to know the basics

- User interface software is becoming more complex
  - Complexity increase is faster than other aspects of systems
  - Graphical user interfaces have provided the biggest jump in complexity
  - Applications tend to grow to fill available computing resources

- There are direct financial benefits from improved user interfaces

Financial benefits & Costs of improved user interfaces

- Increased user productivity
  - Direct financial savings
- Increased revenues from sales
  - The system is more attractive and customer satisfaction is higher
- Decreased training and support costs
  - The system is more intuitive
- Decreased maintenance cost
  - The system does what user wants
  - Much maintenance involves fixing UI problems
  - Pay a little during development, or pay a lot after application/product release!
- But
  - Staff must be trained in user interface analysis and design
  - Users must participate
  - UI design tools are needed.
- The benefits almost always outweigh the costs

Goals of HCI

- Improve productivity and reduce costs through:
  - Safety:
    - Does the system prevent danger?
  - Functionality:
    - How many things can the system do?
  - Efficiency:
    - How few resources does it take to get a task done?
  - Usability :
    - How easy to learn and use is the system?

- BUT
  - High functionality (many ways of doing the same thing) can actually reduce usability
    - By causing confusion

Five Key Ideas in HCI

- Visibility
  - The UI should help the user always understand...
    - The current state of the system
    - What operations can be done
  - E.g.
    - When you position the cursor over a point on the screen, it should be clear what would happen if you clicked the mouse
- Feedback
  - When anything changes it should be made visible
    - When you delete a file, the system should not just say 'ready'
- Goal
  - A state the user wants to reach
    - to be talking with somebody on the phone
    - to have saved a file

Five Key Ideas in HCI (Cont'd)

- Affordance
  - The set of operations and procedures that can be done to an object
  - 'Perceived affordance' is what typical users think can be done to an object
    - Should a door be pulled or pushed?
    - What does this icon mean?
  - To improve visibility/feedback we need to:
    - Choose objects with good perceived affordance
    - Design the UI to generate better perceived affordance
- Task
  - An action the user wants to do
    - to call somebody
    - to save the file
  - Goals beget tasks, tasks beget goals.

THANK YOU