Lecture 1 – Introduction to HCI and User Interface Design
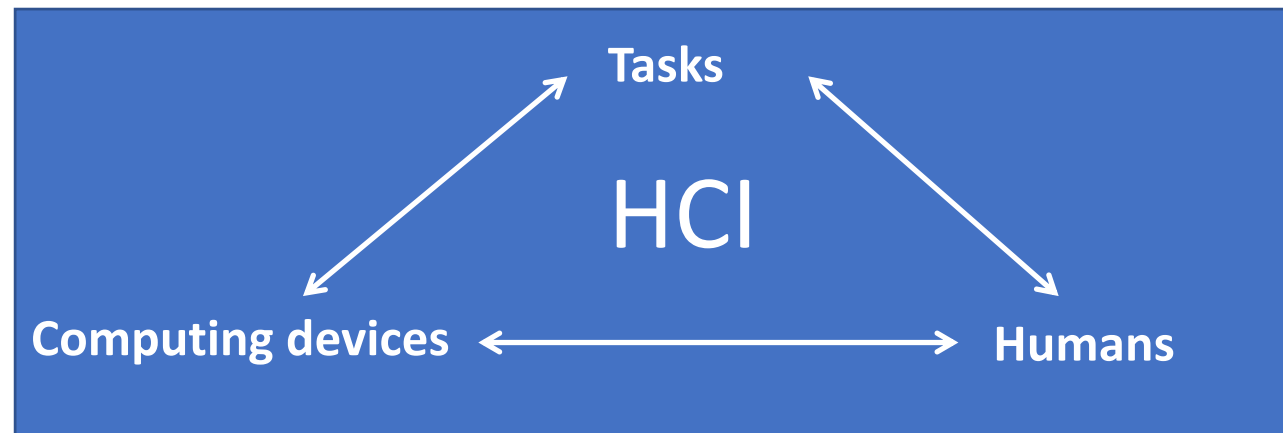
FIT5152 - User Interface Design and Usability

Learning objectives

1. Understanding HCI and its role in different fields
2. Differentiate between the interface and user interaction
3. Understanding what user interface design involves
4. Understanding the importance of user-centered design

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Human Computer Interaction (HCI)

- HCI deals with the interactions between **humans** and **computing devices**, where certain **tasks** are performed
- Tasks: set of activities undertaken in order to achieve a specific goal
- Computing devices include:
  - laptops, desktop computers, tablets, mobile phones, smartwatches, smart TV, ATM, vending machine, ticket machines, self checkouts, the flight deck of an aircraft carrier, Google Home, Amazon Echo, …
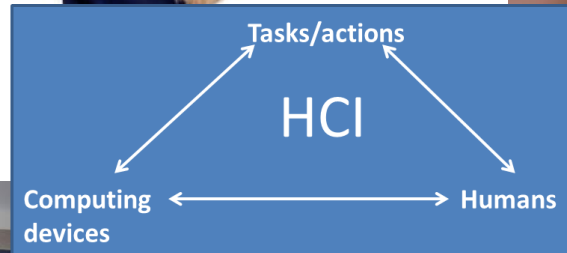
Examples

Source http://whatissmarttv.com.au/

Source http://iwatch101.blogspot.com.au

Source http://www.lg.com/

Source https://www.draeger.com/

Tasks/actions

HCI

Computing devices ⟷ Humans

Human Computer Interaction (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.** "

(Kim 2015, pg 1)

HCI (cont'd)

"It is concerned both with understanding **how people make use of devices and systems** that incorporate computation, and with designing new devices and systems that **enhance human performance and experience**"
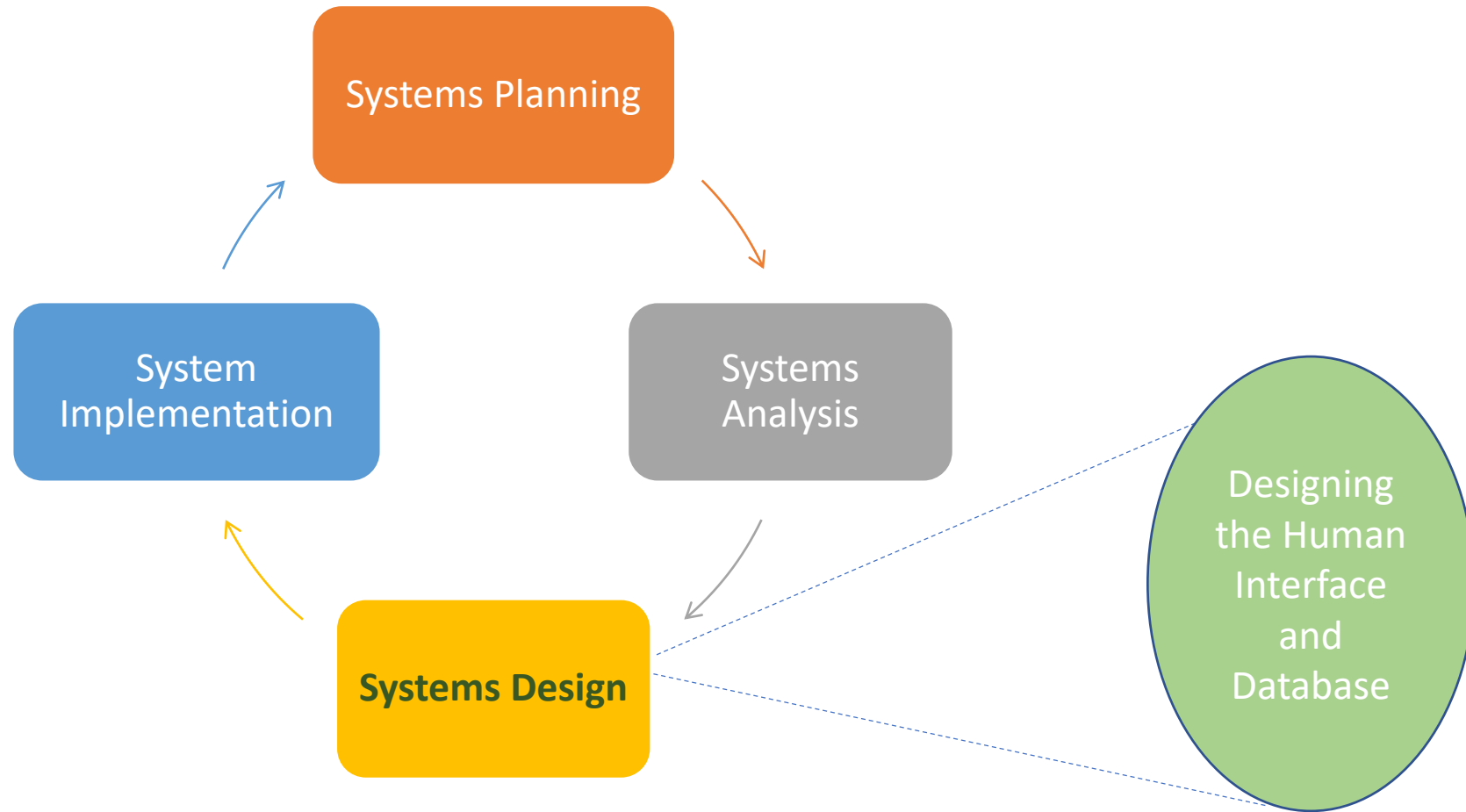
(Carroll 2006, Abstract)

HCI (cont'd)

"… attempts to understand and shape **the way people interact with computers**: the processes they engage in, the resources they use, and the impact they accomplish."
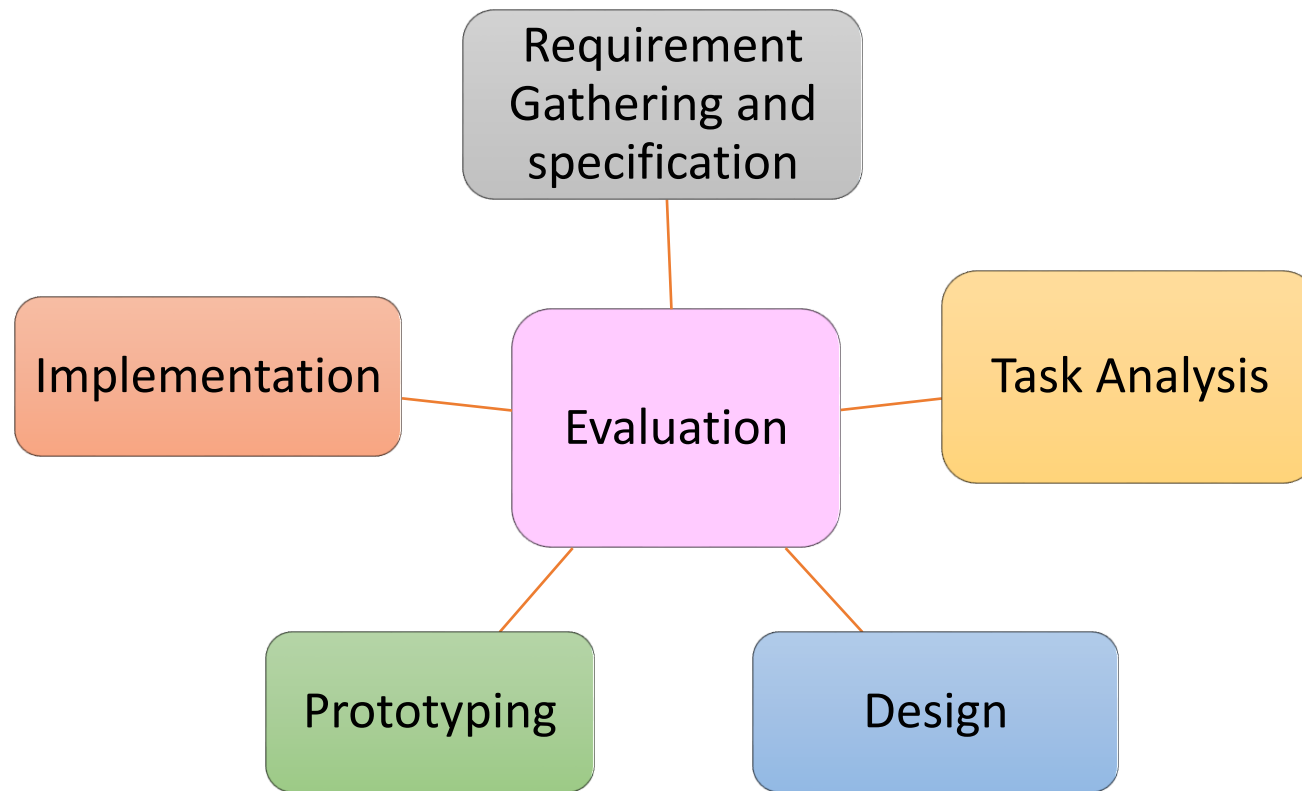
(Te'eni et al. 2006, pg 2)

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System Development Life Cycle

The system design phase as part of SDLC (Adapted from Valacich et al, 2015, pg 265)

Design of Interactive Systems

Requirement Gathering and specification

Implementation

Evaluation

Task Analysis

Prototyping

Design

The Star Life Cycle Model (Adapted from Hix and Hartson 1993)

Requirements gathering and definition

Task and User Analysis

Design and Prototyping

Implementation

Evaluation

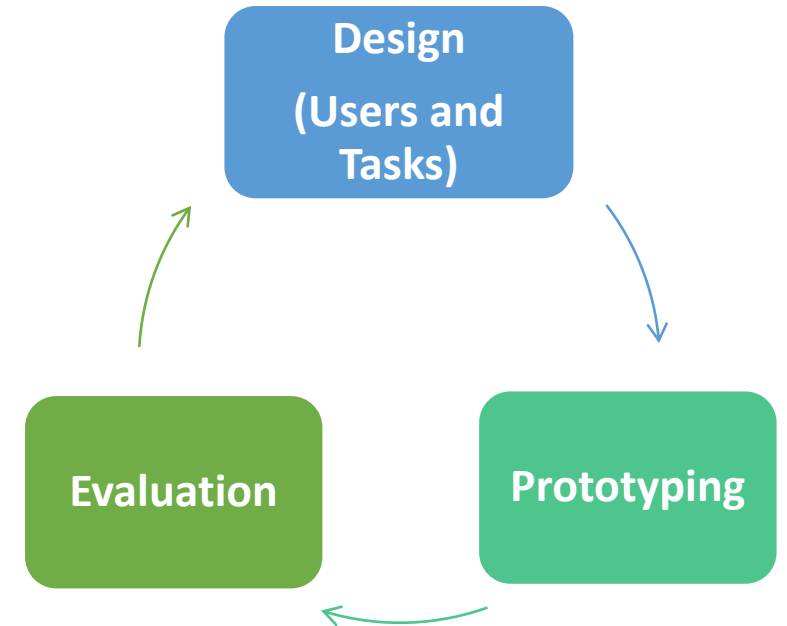Waterfall Model

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Three Main Aspects of HCI

1. How do we design it?
   - who are the users?
   - what are the tasks?

2. How do we build it?

3. How do we evaluate what we have designed and built?

```
        Design
     (Users and
        Tasks)

Evaluation      Prototyping
```

HCI process (Adapted from Greenberg, 1996)

Three Aspects of HCI - Design

How do we design it?

- Early design approaches:
  - Gathering data and defining requirements:
    - User analysis (know your user)
    - Task analysis
    - Environment/domain Analysis
    - Data collection methods: interviews, questionnaires, focus groups, or observation
  - Conceptual design
    - Description of what the system should do and look like
  - Physical design
    - Considers the physical details of the system

Three Aspects of HCI - Prototyping

- Prototyping techniques
    - Low-fidelity (paper) prototyping
        - Such as sketches, storyboards or scenarios
    - High-fidelity (digital) prototyping
        - Using development tools
        - Not the final product, but looks like the final product
    - Native prototyping
        - Prototyping using the native programming language

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Three Aspects of HCI - Evaluation

- Evaluation techniques:
  - Expert reviews
    - Heuristics evaluation
    - Cognitive walkthrough
  - Usability testing
  - Field studies
  - Observation

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User Interface

Human interaction with a computer happens through an interface

User Interface: all components of an interactive system including software and hardware that provide information and controls so that the user can accomplish tasks   (ISO 9241-110:2006)

The user interface is: – "that part of a computer system with which the user interacts in order to undertake his or her tasks and achieve his or her goals"   (Stone et al, 2005, p.62)
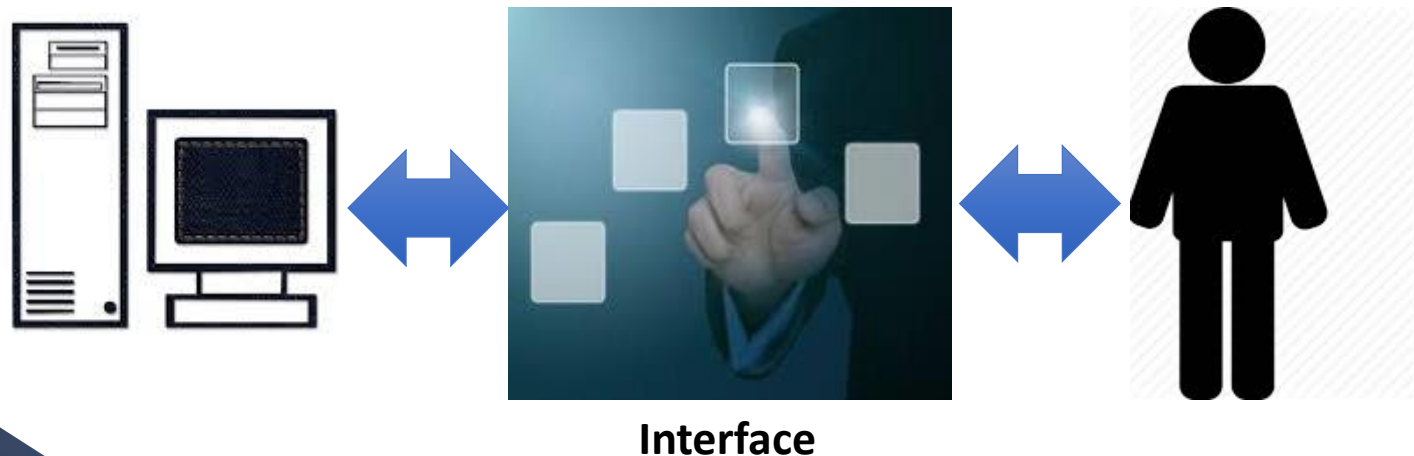
Interface

Interface and Interaction Model
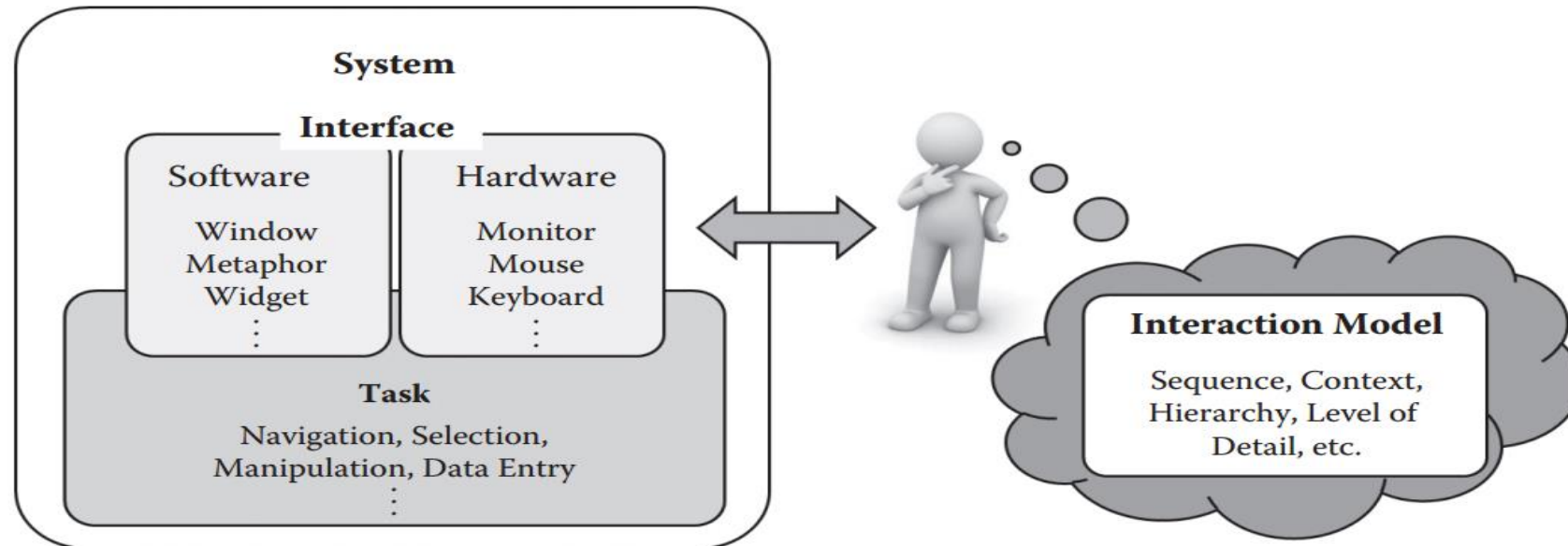
The interaction model (i.e. the sequence, hierarchy and details of the same tasks) can vary according to the type of the user (e.g. based on their mental models, experience or skills)

(Kim 2012, pg 1 and pg 6)
Source http://www.ittoday.info/Excerpts/HCI.pdf

Beyond Graphical Interfaces in HCI

- Speech interface
- Brain Computer Interface (BCI)
- [Olfactory interface](#)

[BCI research led by Dr Lina Yao, The University of New South Wales, Australia](#)

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User Interface Design

"User interface design is one of the **most important** and one of the **most difficult** aspects of **designing a computer system**.

It is **the contact point between the user and the system** and determines to a large extent the **usefulness** and **effectiveness** of the system."
(Lee and Lochovsky 1985, pg 1)

• The concept of interface also focuses on **the cognitive and emotional** characteristics in the user's experience

(Brenda and Mountford 1990)

User Interaction Questions?

What can we interact with it?

How can we interact with it?

How will the system respond to our interactions?

How will we know if we completed the task successfully?

How will we know what to do if things go wrong?

How will we learn if it is a new system?

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What is Usability?

Usability is '**a quality attribute of the UI**' (Norman & Nielsen)

"The extent to which a product can be used by specified users to achieve specified goals with **effectiveness, efficiency,** and **satisfaction** in a specified **context of use**"

(ISO 9241 -11)

Context of use: combination of users, goals and tasks, resources, and environment

Usability Aspects

- **effectiveness**: the accuracy and completeness with which users achieve goals within a context

- **efficiency**: based on the resources expended (e.g. time and effort) to complete a task

- **satisfaction**: the level of the comfort and acceptability of the system to its users, and the extent to which the user experience that results from actual use meets the user's needs and expectations.

(ISO 9241-11:2018)

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When the Design Goes Wrong

Leaning tower of Pisa (1173-1372)
(source: Wikipedia)

Design is like an architecture. Without good design it is so easy to go totally wrong

Programming is the easy part, getting the design right is what is hard

Importance of UI Design

User interfaces are important to perform tasks in

- transportation and aviation
- banking, finance, retail and online shopping
- healthcare
- education and training
- entertainment and gaming
- and many other aspects of our lives

- Good design will lead to user satisfaction, business success, and cost savings

- Good design will help:
  - doctors and surgeons with better diagnosis,
  - and pilots with flying airplanes safely

(Shneiderman et al, 2014)

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Importance of UI Design (cont'd)

The statement that **the interface `makes or breaks the system'** is generally no exaggeration because users see the system through the human computer interface."

(Te'eni et al., 2007)

2000 US Presidential Elections

(The Dartmouth Review, November 2000)

Impact on election results
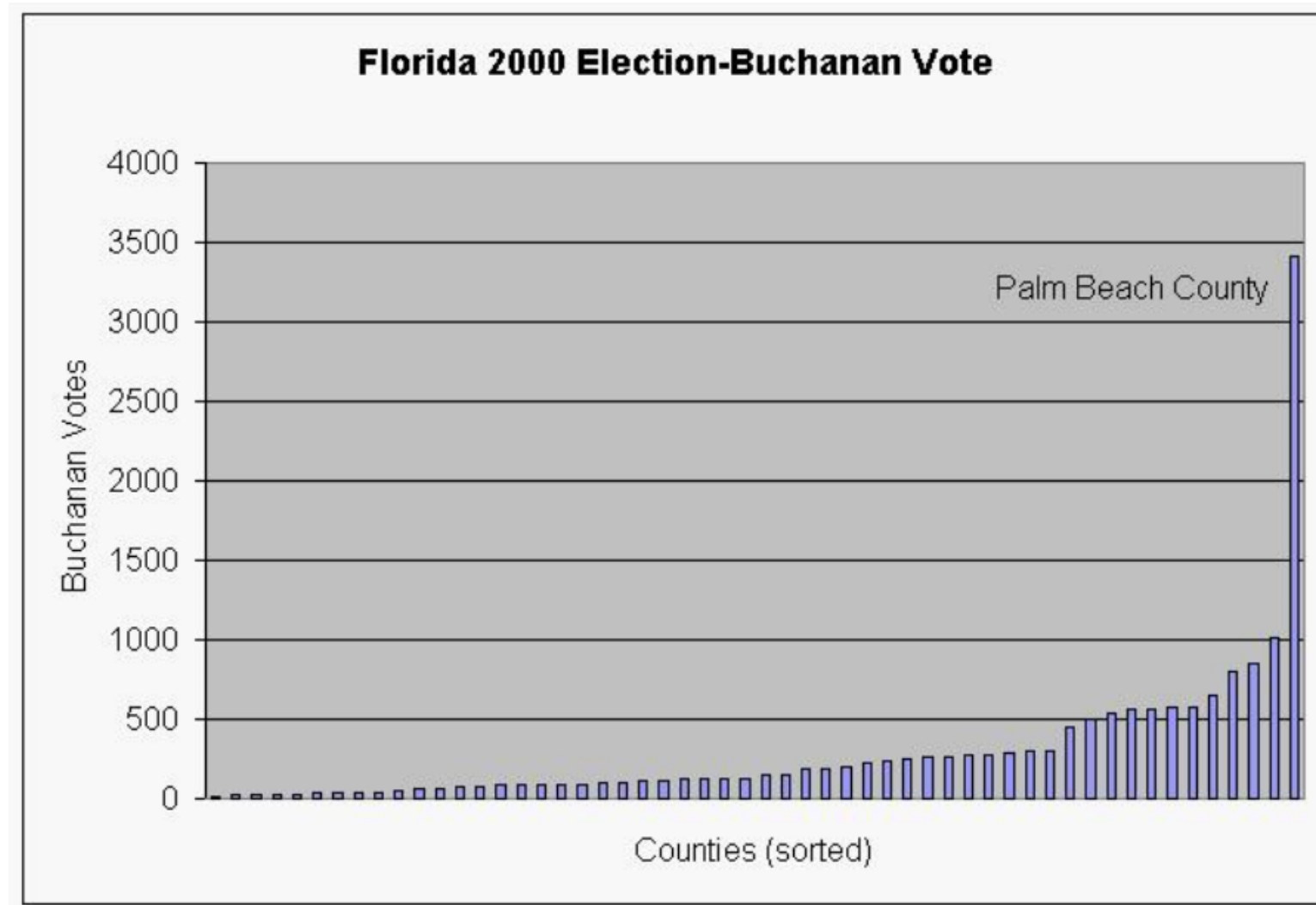
(The Dartmouth Review, November 2000)

Users Should Come First

"Underlying all HCI research and design is the belief that **the people** using a computer system **should come first.**

Their **needs, capabilities and preferences** for performing various activities should inform the ways in which systems are designed and implemented.

People should not have to change radically to 'fit in with the system,' **the system should be designed to match their requirements**."

(Preece et al 1994, pg 15)

User-Centred Design

"…an approach that puts **human needs, capabilities, and behavior** first …

"… ensures that the designs match **the needs and capabilities** of the people for whom they are intended."

(Norman, 2013)

A philosophy based on the **needs and interests of the user**, with an emphasis on making products usable and understandable.

(Norman, 1988)

Users' **tasks and goals** are the driving force, rather than the technology

Users are **consulted at every stage** of development

(Sharp et al, 2007)

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Why to involve users?

- **Users bring important knowledge** of work tasks
- Designers can gain **a better understanding** of users' needs and goals
- **Greater acceptance of the system** often results
- **Fewer problems** during development
- **Lower maintenance costs** over time
- Products that are **easier to learn**
- **Reduction in errors**
- Users develop **a feeling of ownership** through contributing to the development

User Involvement Considerations

- Organising and managing user involvement
  - Need to consider organisational politics and policies
- Ensuring that all users have an opportunity to contribute meaningfully
- Cannot involve all users so selected users must represent all users
- User involvement can:
  - be costly and increase development time
  - be challenging to arrange
  - mean that designers may make compromises to satisfy participants
- Recognising the fact that users are not designers
- Need to decide on the extent of the user involvement
  - Some studies suggest too much user involvement leads to problems

Human-Centred Design

- User-centred design and human-centred design are often used interchangeably

- Human-centred design puts more emphasis on all stakeholders, and not just 'users'

- Human-centred design: "… aims to make systems usable and useful by focusing on **the users, their needs and requirements**, and by applying human factors/ergonomics, and usability knowledge and techniques." (ISO 9241-210)

Principles of Human-Centred Design

The ISO standard describes 6 key principles.

These principles apply to user-centred design as well.

- The design is based upon an explicit **understanding of users, tasks and environments**

- Users are **involved throughout entire development**

- The design driven and **refined by user-centered evaluation**

- The process is **iterative**

- The design addresses **the whole user experience**

- The design team includes **multidisciplinary** skills and perspectives

Human-Centred Design Activities

The ISO standard describes 4 key activities:

- Understanding and specifying the context of use

- Specifying the user requirements

- Producing design solutions

- Evaluating the design

User Experience

- User experience: user's perceptions and responses that result from the use and/or anticipated use of a system, product or service

- User's perceptions and responses include the users' **emotions, beliefs, preferences, perceptions, comfort, behaviours,** and **accomplishments** that occur **before, during and after use**.

- It also results from the user's internal and physical state **resulting from prior experiences, attitudes, skills, abilities and personality; and from the context of use**.

(ISO 9241-11:2018, 3.2.3)

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USER-CENTERED DESIGN

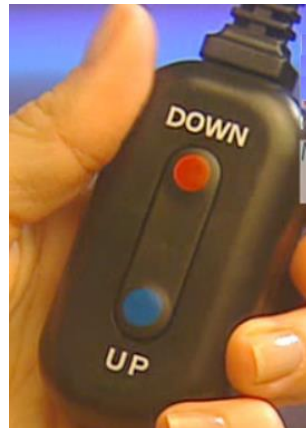**OFF THE LEASH** By W.B. Park
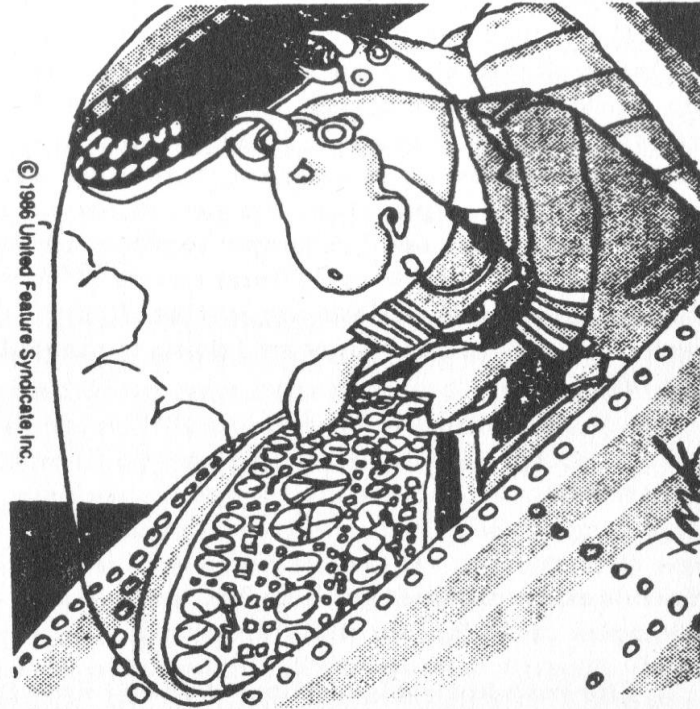
"Darn these hooves! I hit the wrong switch again! Who designs these instrument panels, raccoons?"

Design by Raccoons?

Source http://www.theage.com.au/national/new-scanners-out-of-reach-of-many-disabled-travellers-20091003-ghbr.html

http://pleated-jeans.com/2014/11/10/24-examples-of-extremely-crappy-design/

"The real problem with the interface is that it is an interface. Interfaces get in the way. I don't want to focus my energies on an interface, I want to focus on the job"

Donald Norman, *The Art of Human-Computer Design, pg 210*

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