ITEC 399
MOBILE APPLICATION DEVELOPMENT

CHAPTER 3 –HUMAN COMPUTER INTERACTION

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OBJECTIVES

- **The role of HCI;**
- **General HCI principles;**
- **Goals of HCI;**
- **Scope of HCI;**
- **HCI techniques;**
- **HCI challenges for mobile apps;**
- **Guidelines for mobile apps design;**

WHAT IS HCI?

- **Human**: Individual user, a group of users working together, a sequence of users in an organization
- **Computer**: Desktop computer, large-scale computer system, Pocket PC, embedded system (e.g., photocopier, microwave oven), software (e.g., search engine, word processor) User
- **interface**: Parts of the computer that the user contacts with
- **Interaction**: Usually involve a dialog with feedback & control throughout performing a task (e.g., user invokes "print" command and then interface replies with a dialog box)

HUMAN-COMPUTER INTERACTION (HCI)

Human-computer interaction (HCI)

- **HCI** is the study of how people interact with computers and to what extent computers are or are not developed for successful interaction with human beings.
- HCI consists of three parts: the **user**, the **computer** itself, and the **ways** they work together.
- HCI was defined by SIGCHI (Special Interest Group on Computer-Human Interaction, 2009) as a discipline concerned with the ***design***, ***evaluation*** and ***implementation*** of interactive computing systems for human use and with the study of major phenomena surrounding them.

HCI SCOPE

- **Use & Context**: Find application areas for computers
- **Human**: Study psychological and physiological aspects e.g., study how a user learns to use a new product, study human typing speed
- **Computer**: Hardware & software offered e.g., input & output devices, speed, interaction styles, computer graphics
- **Development**: Design, implementation & evaluation

HCI AIMS

HCI discipline aims to create **safe**, **functional** and **usable** software applications and systems with a main focus on **user interfaces**.

In order to produce applications and systems with good **usability**, designers must consider the factors that determine how people use technology and develop tools and techniques to enable the building of suitable systems that allow efficient, effective and safe interaction.

Therefore, developers have to put the users of the products first and think about it from their perspective.

HCI AIMS

All users, systems and contexts have characteristics, capabilities and limitations which represent the scope of HCI (Figure 1).

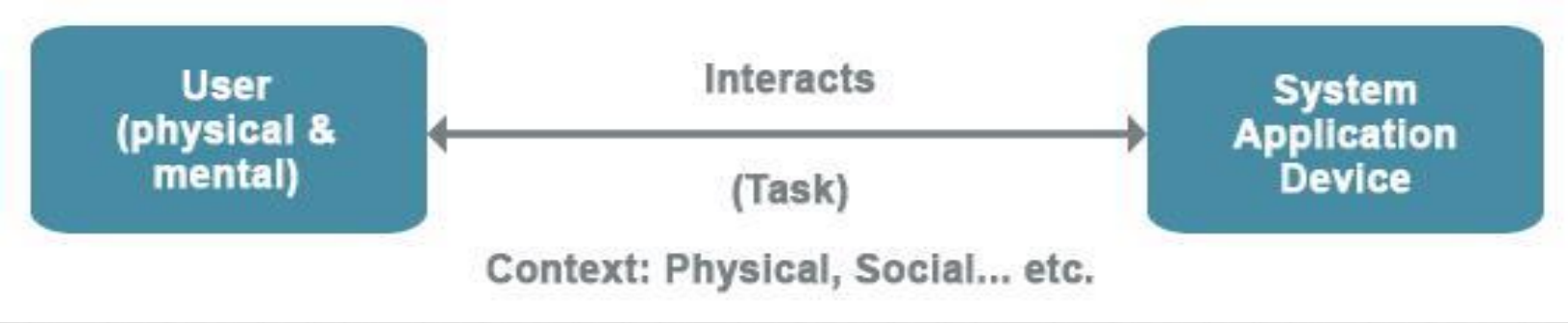

Figure 1: Scope of HCI

HCI AIMS

- At **physical** level, HCI concerns the selection of the most appropriate **input devices** and **output devices** for a particular interface or task
- Determine the best **style** of interaction, such as direct manipulation, natural language (speech, written input), WIMP (windows, icons, menus, pointers), etc.
- Develop or improve
  - Safety
  - Utility
  - Effectiveness
  - Efficiency
  - Usability
  - Appeal

of systems that include computers

HCI AIMS

Safety: protecting the user from dangerous conditions and undesirable situations

Users:

- Nuclear energy plant or bomb-disposal – operators should interact with computer-based systems remotely
- Medical equipment in intensive care unit (ICU)

Data:

- Prevent user from making serious errors by reducing risk of wrong keys/buttons being mistakenly activated
- Provide user with means of recovering errors
- Ensure privacy (protect personal information such as habits and address) & security (protect sensitive information such as passwords, VISA card numbers)

HCI AIMS

Efficiency: a measure of how quickly users can accomplish their goals or finish their work using the system

- Ex: Consider the scenario: a shopping Web provides all the information, instruction and server-side support required to perform an on-line purchase. However, the users cannot figure out how to find the items they want to buy.

Usability: ease of learning and ease of use

- Can I use the basic functions of a new digital camera without reading the manual?
- Does the software facilitate us to learn new functions easily?

Appeal: how well the user likes the system

- First impression
- Long-term satisfaction

Example: Microsoft Word

Goals	Achieved?	Example
Safety	Yes	Warning for "Exit before Save"
Utility	Yes	A lot of word processing functions is provided
Effectiveness	Yes	A science student can edit equations
Efficiency	Yes	Default template avoids initial document setting
Usability	Yes	Icons help ease of learning
Appeal	Yes	Interface is attractive

HCI AIMS

Utility:

- extent of providing the right kind of functionality so that users can do what they need or want to do

High utility:

- Scientific calculator provides many mathematical operations, built-in formulae, and is programmable

Low utility:

- Software drawing tool does not allow free-hand drawing but supports polygon shape drawing
- Effectiveness: concern a user's ability to accomplish a desired goal or to carry out work

HCI AIMS

The Goals of HCI

- understand the factors that determine how people use technology
- develop tools and techniques to enable building suitable systems
- achieve efficient, effective, and safe interaction
- put people first

How to achieve the aim of HCI:

In order to achieve the aim of HCI, it is important to focus on the HCI **principles**, **methodologies**, **processes** and **techniques** for designing, implementing and evaluating user interaction with computer interfaces.

HCI PRINCIPLES

Consistency

terminology, layout, colors and actions should always mean the same thing, no matter where they occur in the application and between applications.

Think how confusing it would be if the 'pinch gesture' meant *zoom out* in one app, and *delete* in another.

Simplicity

Use a simple way (dialogue) to talk to your users and avoid irrelevant information as 'every extra unit of information competes with units of relevant information and diminishes its visibility'.

Learnability

Speak the user's language to present information and instructions to them, i.e. express and present the information in concepts and terms which are familiar to the user.

HCI PRINCIPLES

Feedback

For every action that the user carries out, the system should provide feedback. Feedback should be proportionate - little actions require a small amount of feedback.

Prevention is Better Than Cure

It is much better to prevent the user from making an error rather than giving them an error message after they have already made the error.

For example, 30th February 2013 is not a valid date, so don't allow the user of your application to type or select it. This is much better than sending them a message saying, 'This is an invalid date. Please try again'.

Easy Reversal of Actions

Users will make mistakes and change their minds. Therefore, whenever possible, make actions reversible. Also, recognize rather than recall, Briefly make the required action easily 'discoverable' or predictable for the user.

HCI PRINCIPLES

Help and Documentation

The best applications are those that can be used without any need for documentation. However, when such help is required, it should be easily delivered, focused on the user's specific problem and include a list of specific solutions to complete the user's tasks.

Accessibility

Access to information and communications technologies is a basic human right, and accessibility is about ensuring an equivalent user experience for people with disabilities, including people with age-related impairments.

'Mobile accessibility' specifically refers to making software apps more accessible to people with disabilities when they are using mobile phones.

Some good practices in this context are: use proper fonts (i.e. don't use small or fancy fonts), choose appropriate letter and line spacing and avoid poor color contrasts.

BAD


MGBD Parts & Services
Rover P6 Parts Specialist
ROVER P6 PARTS
Online Store
Click here to go to our shop

VS

GOOD


OUEST CANADIEN

Good Vs. Bad Design

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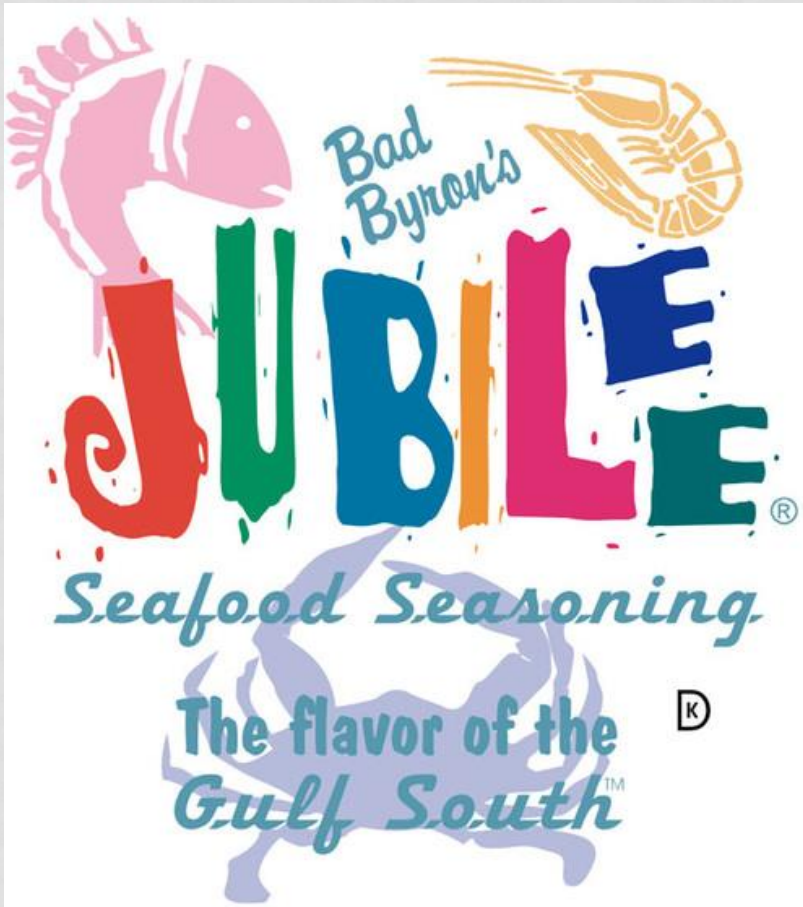
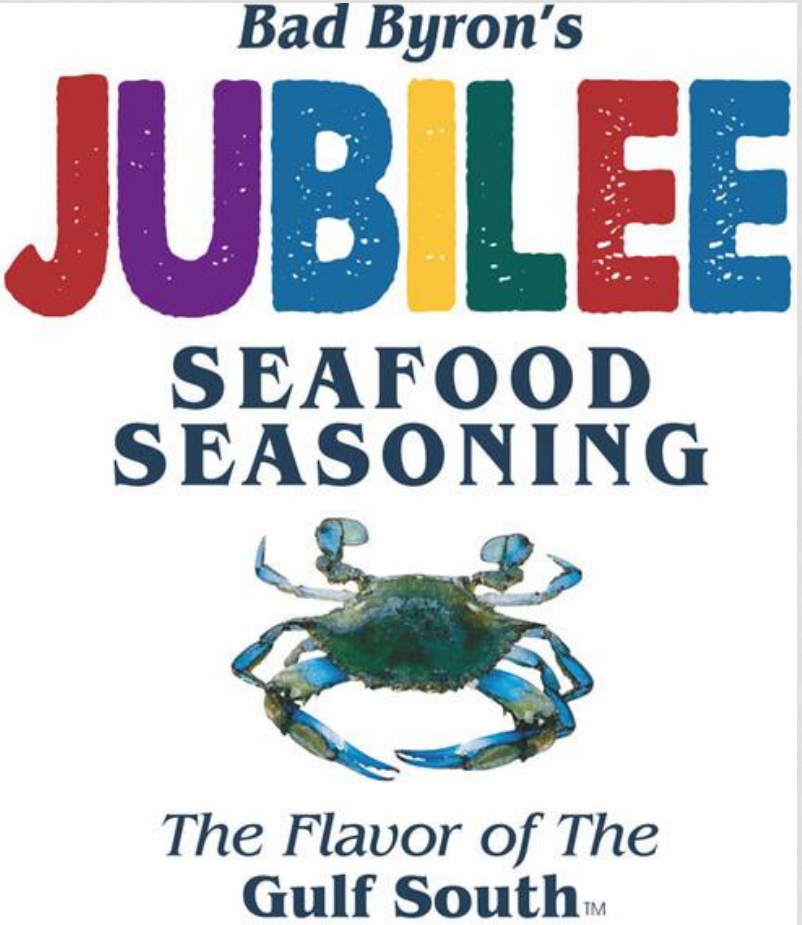
More efforts

Less efforts



ORIGINAL DESIGN



UPDATED DESIGN

Good Vs. Bad Design

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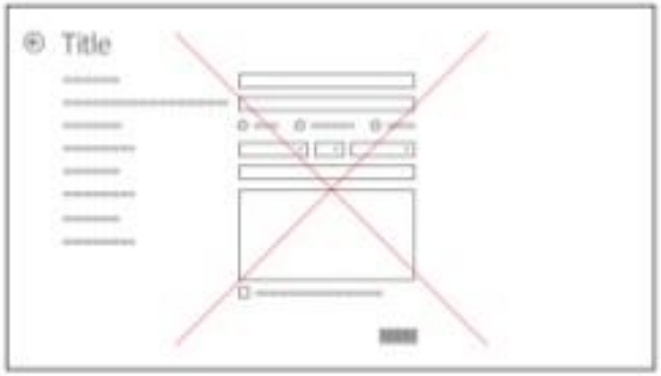
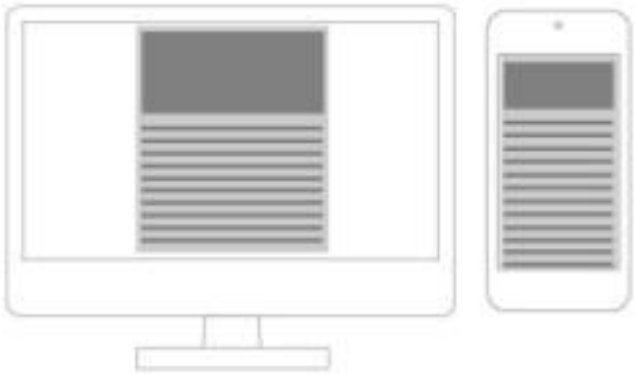
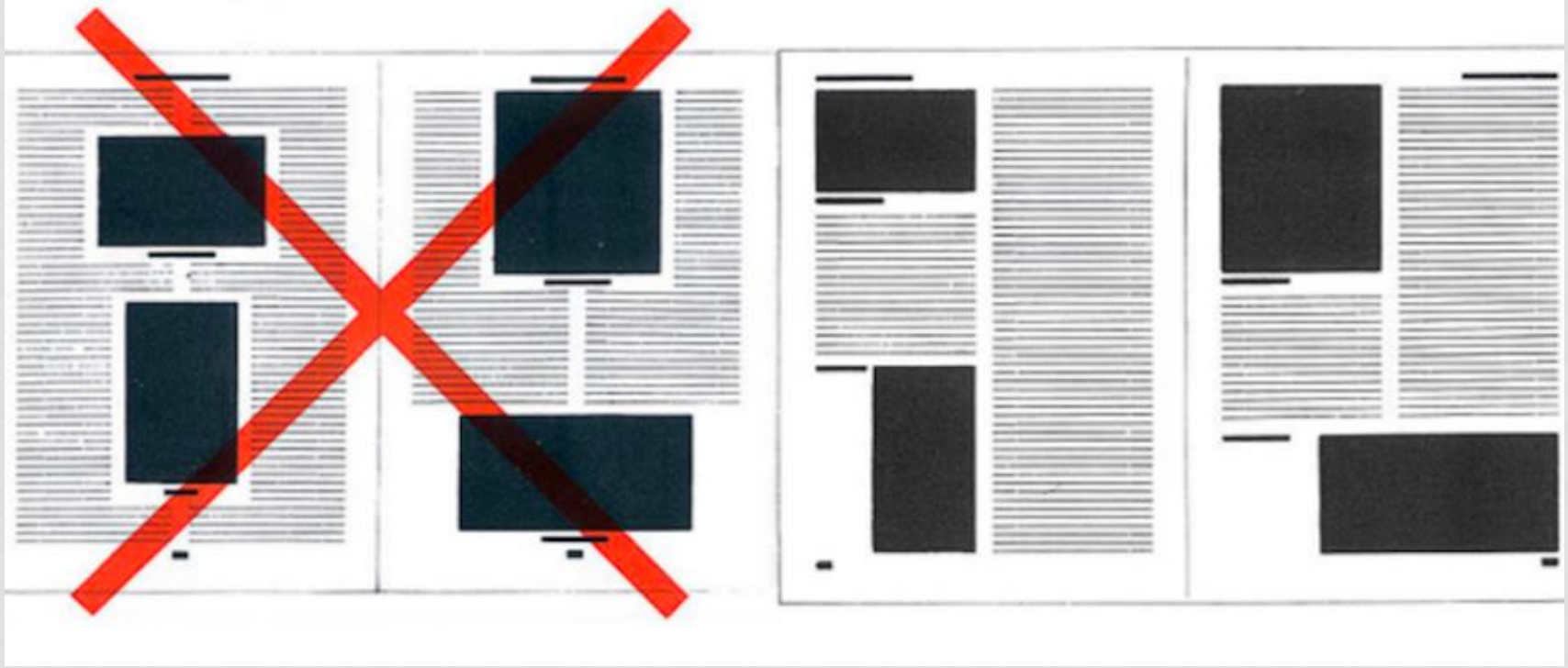
Multiple Columns



Single Column



Bad Design Good Design



HCI TECHNIQUES

Two prominent techniques are:

1. **Wireframing**

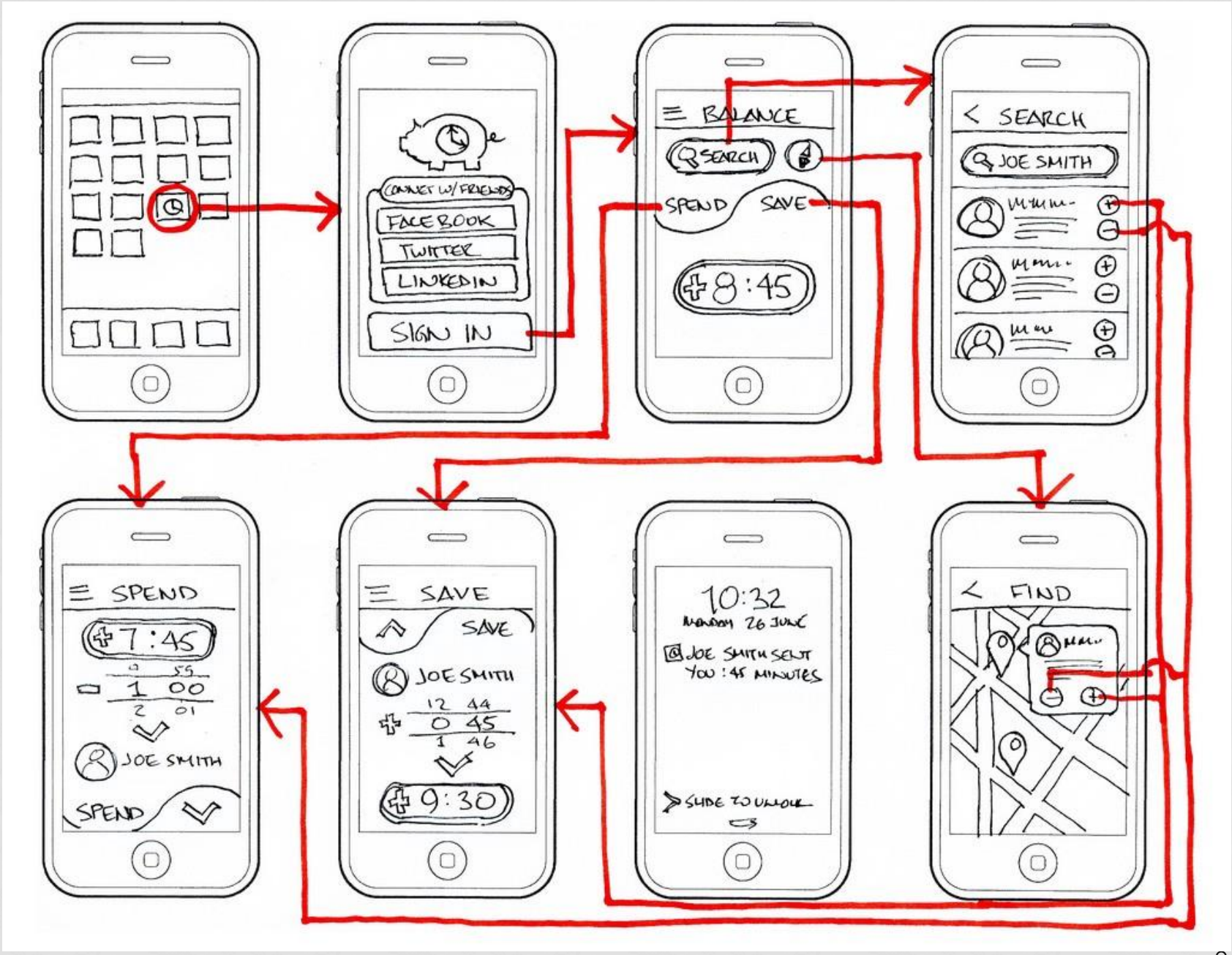
- Wireframing is also known as **screen blueprint**.
- It presents the skeletal framework of a software application.
- Wireframes intend to arrange various elements of an application to best accomplish a particular task, by depicting the application **layout** and arrangement of the **content**, including interface elements and navigational systems, and how they work together.
- Wireframes focus mainly on the **kinds** of information displayed, the **range** of **functions** available, the **rules** for displaying certain kinds of information and the **effect** of different scenarios on the display.

HCI TECHNIQUES

Two prominent techniques are:

2. **Prototyping**

- Prototyping aims to create a sample, model, or release of a product built to test a concept or process, or to act as an item to be replicated or learned from.
- A prototype is designed to test and trial a new design in order to enhance precision by exposing it to system analysts and users.
- Prototyping serves to provide specifications for a real, working system rather than a theoretical one.


CONNECT W/ FRIENDS
FACEBOOK
TWITTER
LINKEDIN
SIGN IN
BALANCE
SEARCH
SPEND
SAVE
+8:45
SEARCH
JOE SMITH
SPEND
+7:45
JOE SMITH
SPEND
SAVE
SAVE
JOE SMITH
+9:30
10:32
MONDAY 26 JUNE
JOE SMITH SENT YOU : 45 MINUTES
SLIDE TO UNLOCK
FIND

IMPORTANCE OF HCI

The importance of HCI relates to the fact that people are surrounded by computers and internet connection almost everywhere and all the time (ubiquitous computing), at home, in the car, at schools, restaurants, libraries, etc.

and people use different kinds of computer devices, ranging from desktop computers to the very small handheld devices with different screen sizes, connection speeds, weight, etc.

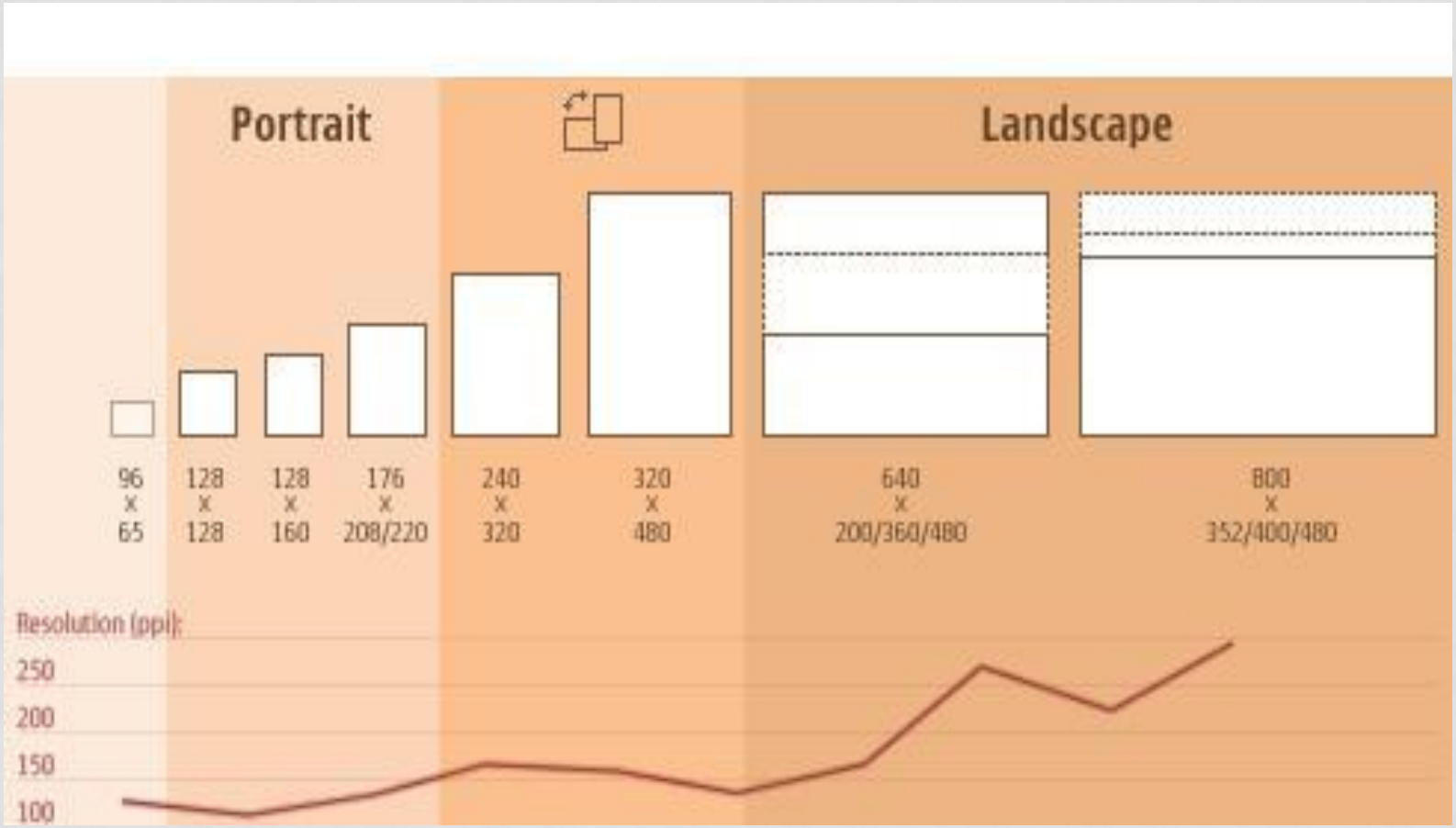
The HCI role here is to enable smooth and effective human interaction with any computer device.

IMPORTANCE OF HCI

There is a general consensus that HCI is even more important and challenging for mobile applications than for traditional computer machines.

1. **Display**

- Mobile devices have a smaller screen size than the traditional computers (desktop and laptops). Moreover, there are many other issues to consider other than the physical size, such as orientation (landscape or portrait) and screen resolution (Figure 2).


Portrait
Landscape
96 x 65
128 x 128
128 x 160
176 x 208/220
240 x 320
320 x 480
640 x 200/360/480
800 x 352/400/480
Resolution (ppi):
250
200
150
100

IMPORTANCE OF HCI

2. **Input**

The purpose of input into a mobile device is to give instruction (e.g. click a button) or to input information (e.g. registration form). This can be done using different methods, such as by using the touchscreen, physical keys and buttons, voice, camera, shaking the device, etc.

3. **Context of Use**

There are three mobile user contexts that developers should consider:

a. Busy, user attention is largely elsewhere, or they want something quickly;
b. Bored and want to be entertained, therefore they begin texting their friends or chat with them;
c. Users are lost, not able to continue using the applications because they are asleep, have network problems or battery life has ended.

MOBILE APPLICATIONS THAT CONFORM WITH HCI PRINCIPLES

Keep your application simple:

- Include only essential features;
- Make navigation throughout the application straightforward;
- In cases of mobile sites, minimize the content size as much as possible.

Avoid Scrolling:

- People dislike scrolling on desktop/laptop machines, and even more so on mobile phones;
- Don't have controls (buttons, etc.) at the bottom of the scrolled screen as people won't see them; Non-scrolled screens look more solid and predictable.

For touchscreens, design for thumbs:

- Most smartphone touchscreen interaction is done with thumbs;
- Think about the thumb sizes;
- Think about the placement of controls, e.g. should *Cancel* and *Send* be right next to each other.

MOBILE APPLICATIONS THAT CONFORM WITH HCI PRINCIPLES

Textual input - be kind to the user:

- Minimize the need for textual input and enable the appropriate keyboard for each input field - text, number, URL etc.
- Use auto-correct, auto-capitalize, etc., appropriately.

Expect interruptions:

- Interruptions come from many sources, for example users become distracted, experience network interruption, have an incoming phone call, or the battery runs out.
- Save state frequently and carry on from where the user left off.

Design for different screen sizes/layouts:

- Find the most common size and orientation for your target device and optimize for that; Support other sizes/orientations.

DISCIPLINES CONTRIBUTING TO HCI

The field of HCI covers a wide range of topics, and its development has relied on contributions from many disciplines. Some of the main disciplines which have contributed to HCI are:

Computer Science

o technology
o software design, development & maintenance
o User Interface Management Systems (UIMS) & User Interface Development Environments (UIDE)
o prototyping tools
o graphics

Cognitive Psychology
o information processing
o capabilities
o limitations
o cooperative working
o performance prediction
Social Psychology
o social & organizational structures
Ergonomics/Human Factors
o hardware design
o display readability
Linguistics
o natural language interfaces
Artificial Intelligence
o intelligent software
Philosophy, Sociology & Anthropology
o Computer supported cooperative work (CSCW)
Engineering & Design
o graphic design
o engineering principles

FACTORS IN HCI

There are a large number of factors which should be considered in the analysis and design of a system using HCI principles.

- **Organization Factors**
  Training, job design, politics, roles, work organization
  Environmental Factors
  Noise, heating, lighting, ventilation
  Health and Safety Factors
  The User
  Cognitive processes and capabilities
  Motivation, enjoyment, satisfaction, personality, experience
  Comfort Factors
  Seating, equipment, layout.

FACTORS IN HCI

User Interface

Input devices, output devices, dialogue structures, use of color, icons, commands, navigation, graphics, natural language, user support, multimedia,

Task Factors

Easy, complex, novel, task allocation, monitoring, skills

Constraints

Cost, timescales, budgets, staff, equipment, buildings

System Functionality

Hardware, software, application

Productivity Factors

Increase output, increase quality, decrease costs, decrease errors, increase innovation