

**BIT 2<sup>nd</sup> Year**

**Semester 3**

**IT 3405**

**User Interface Design**  
**Chapter 7 - Usability &**  
**Accessibility**

# INTENDED LEARNING OUTCOMES

- Define the usability, accessibility and acceptability
- Recognize the importance of usability and accessibility
- Describe acceptability model of a software product
- Identify the legal and ethical requirement in usability and accessibility
- Understand the general guidelines and principles applied in usability

# SUB TOPICS

- 7.1. Defining usability and its importance
- 7.2. 5Es in Usability and Benefits
- 7.3. Human Interaction and Usability
- 7.4. Accessibility and standards
- 7.5. Acceptability
- 7.6. General guidelines and principles

# 7.1. DEFINING USABILITY AND ITS IMPORTANCE

Prof. K. P. Hewagamage



User Interface Design (UID)



# Introduction to Usability

- Usability has always been the central pursuit of human-computer interaction (HCI)
- The original definition of usability is that systems should be easy to use, easy to learn, flexible enough to engender a good attitude in people (Shackel, 1990)
- As the variety of people, activities, contexts and technologies of interactive system design has increased, this definition, whilst still being valid, hides many important issues

# Usability - Definitions

**1** - Usability means that the HCI design of the system supports the user's cognitive and ergonomic limitations and it is easy to use as well as to learn.

**2** - Usability means making products and systems easier to use, and matching them more closely to user needs and requirements.

**3** - The international standard, ISO 9241-11, provides guidance on usability and defines it as:

*“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”*

# 7.2.

## 5ES IN USABILITY AND BENEFITS

# 5Es of Usability



- 1. Effective** - Software is useful and helps users achieve their goals accurately.
- 2. Efficient** - The speed (with accuracy) with which work can be done.
- 3. Engaging** - How pleasant, satisfying, or interesting an interface is to use.
- 4. Error tolerant** - How well the product prevents errors and helps users recover from any errors that do occur.
- 5. Easy to learn** - How well the product supports both initial orientation and deeper learning.

Reference: <http://wqusability.com/articles/getting-started.html>

# Effectiveness in Usability

It addresses whether the software is useful and helps users achieve their goals accurately.

If users cannot actually do the thing they set out to do, it probably doesn't matter whether the experience is short or long, easy or hard. In the end, they have failed to complete their tasks or meet their goals.

If we want to measure effectiveness of usability, we first have to understand how people define the success or usefulness based on their expectation. Then we need to examine whether the outcome has solved the problem completely or partially

# Efficiency in the Usability

Efficiency is the speed together with accuracy to which the work can be done.

Efficiency may be something that is carefully defined; for example, in a call center where operators are measured on the number of calls they can handle in a day. Or it may be a subjective judgment of when a task is taking “too long” or requires “too many clicks.”

In other words, it is the time taken to follow the number of correct steps or actions to reach the goal.

# Engaging in the Usability

A simple definition of engaging is how pleasant, satisfying, or interesting an interface is to use.

All software has an emotional impact on users, though the importance of this dimension varies with the type of program.

In a work application, an engaging interface might draw someone into the work, help the person work with confidence, or present information in a way that is particularly easy to read.

The visual presentation and the style or quality of the interaction contribute to making software engaging or off-putting.

# Error Tolerant in Usability

Error tolerance involves how well the product prevents errors and helps users recover from any errors that do occur.

It would be lovely to say “error free” or “prevents errors,” but mistakes and accidents and misunderstandings will happen.

The cat nudges the mouse as you click. You misread a link and need to find your way back, or you enter a number with a typo. The real test is how helpful the software is when an error does occur.

# Easy to learn

## Easy to Learn

Ease of learning concerns how well the product supports both initial orientation and deeper learning.

A product may be used just once, once in a while, or on a daily basis. It may support a task that is easy or complex, and the user may be an expert or a novice in this task. But every time it is used the interface must be remembered or relearned, and new areas of the product may be explored over time.

# 7.3. HUMAN INTERACTION AND USABILITY

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# Why Usability Important in Practice

Millions of Web sites/Products offer users information, goods, services, and entertainment

But many of these sites/products are difficult to use

Don't work properly

Ultimately don't attract or keep users !

# Interactive Designers' Views of Usability

- One view might say 'The interactive systems designer aims to produce systems and products that are accessible, usable, socially and economically acceptable'.
- Another view might say 'The interactive systems designer aims to produce systems that are learnable, effective and accommodating'.
- A third view could be 'The aim of the interactive systems designer is to balance the PACT elements with respect to a domain'.

# Usability - Benefits

A highly usable system offers benefits to both users and business.

Increased productivity (for the user)

Decreased training and support costs

Increased enrollment (sales and revenues)

Reduced development time and costs

Reduced maintenance costs

Increased customer satisfaction

**The feeling of achievement that people get when they use a computer system without frustration should not be underestimated**

# Cost of Usability

Increased/ more functionality does not mean improved usability!

More functionality inquire more cost

**Unusable systems can result in substantial costs to the business, not just in terms of lost sales, but in customer satisfaction, staff productivity and support requirements.**

# Indication of Usability

A system with a high degree of usability will have the following characteristics. It will be

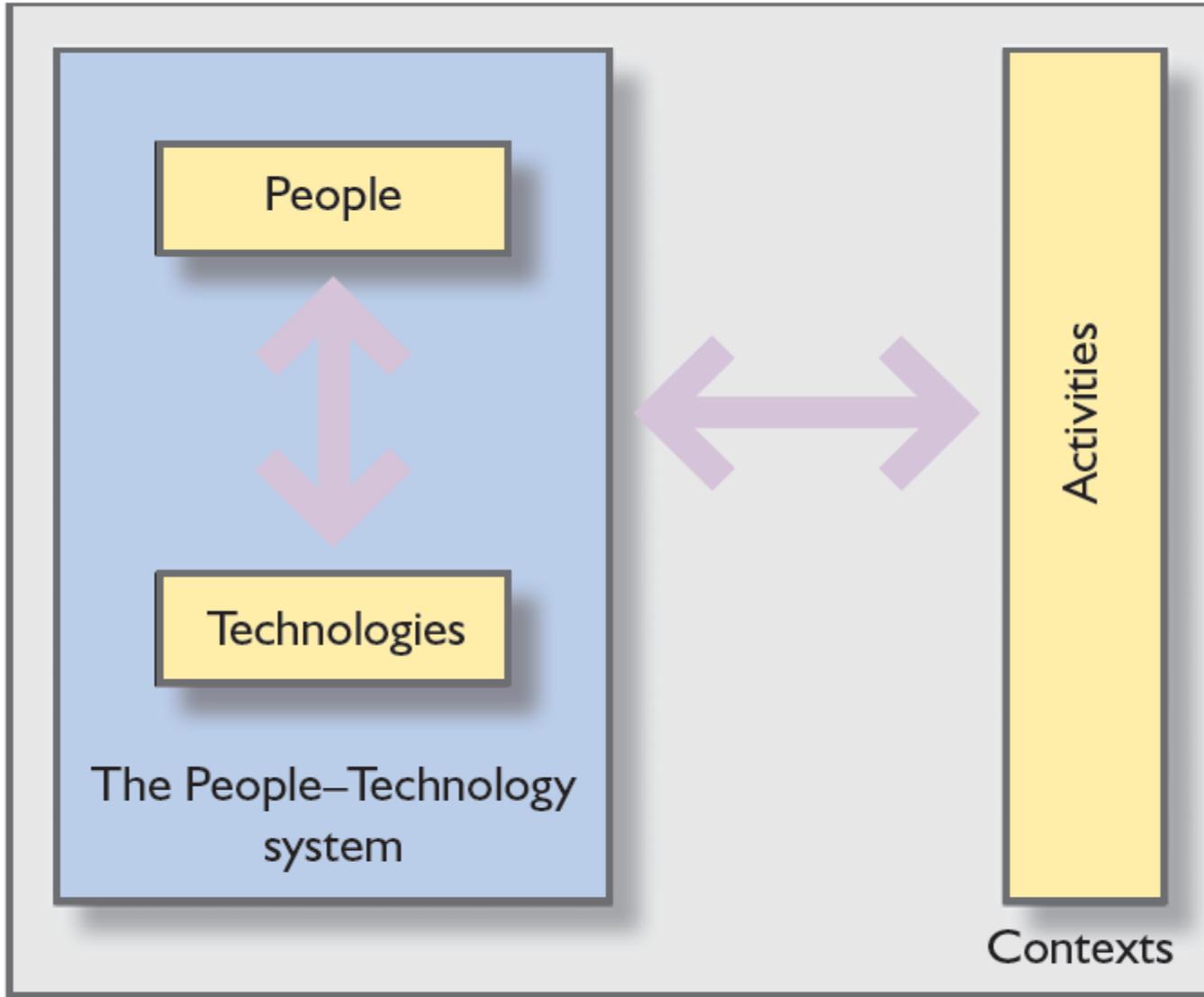
- **efficient** in that people will be able to do things using an appropriate amount of effort.
- **effective** in that it contains the appropriate functions and information content, organized in an appropriate manner.
- **easy** to learn how to do things and remember how to do them after a while.
- **safe** to operate in the variety of contexts in which it will be used.
- **having high utility** in that it does the things that people want to get done.

# Usability and mental models

- Another important aspect of usability is to try to engender an accurate mental model of the system.
- A good design will have adopted a clear and well structured conceptual design that can be easily communicated to people.
- A complex design will make this process much more difficult.
- Striving for a clear, simple and consistent conceptual model will increase the usability of a system.

# Usability and PACT

- One way to look at usability is to see it as concerned with achieving a balance between the four principal factors of human-centred interactive systems design, PACT:
  - People
  - Activities people want to undertake
  - Contexts in which the interaction takes place
  - Technologies (hardware and software).
- The combinations of these elements are very different in, for example, a public kiosk, a shared diary system, an airline cockpit or a mobile phone; and it is this wide variety that makes achieving a balance so difficult.
- Designers must constantly evaluate different combinations in order to reach this balance.



# The Gulfs and Usability

- Don Norman (Norman, 1988) focuses on the interface between a person and the technology and on the difficulty of people having to translate their goals into the specific actions required by a user interface.
- People have goals - things they are trying to achieve in the world. But devices typically only deal with simple actions. This means that two 'gulfs' have to be bridged.
- **The gulf of execution** is concerned with translating goals into actions, and **the gulf of evaluation** is concerned with deciding whether the actions were successful in moving the person towards his or her goal.
- These gulfs have to be bridged both semantically (does the person understand what to do and what has happened?) and physically (can the person physically or perceptually find out what to do or what has happened?).

# Technological breakdown

- When using a hammer, driving or writing with a pen we will usually focus on the activity itself: we are hammering, driving or writing.
- It is only when something happens to interfere with the smooth operation of these technologies that we become aware of them.
- If you hit your finger whilst hammering, if you have to swerve to avoid a hole in the road, or if the pen stops working, then the unconscious use of the technology turns into a conscious interaction with the technology.
- Winograd and Flores (1986) refer to this as a ‘breakdown’.
- One aim of interactive systems design is to avoid such breakdowns, to provide people with a way of undertaking activities without really being aware of the technologies that enable them to do what they are doing.

# 7.4. ACCESSIBILITY AND STANDARDS

# Difference Accessibility & Usability

- **Accessibility** concerns with removing the barriers that would otherwise exclude some people from using the system at all.
- **Usability** refers to the quality of the interaction in terms of parameters such as
  - time taken to perform tasks
  - number of errors made
  - the time to become a competent user

## Note:

- Clearly a system must be accessible before it is usable.
- A system may be assessed as highly usable according to some usability evaluation criteria, but may still fail to be adopted or to satisfy people.
- **Acceptability** refers to fitness for purpose in the context of use. It also covers personal preferences that contribute to users 'taking to' an artifact, or not.

# Accessibility

- An important legal and ethical requirement
  - Both Real world and Information Space (ICT Enabled Space)
  - Legislation such as the UK's Disability Discrimination Act and Section 508 in the US now requires software to be accessible
- The United Nations and the World Wide Web Consortium (W3C) have declarations and guidelines on ensuring that everyone can get access to information that is delivered through software technologies.
- Designers need to
  - focus on the demands their designs make on people's abilities.
  - design for the elderly and for children.

# Accessibility - Why?

- To provide **equal access** and **equal opportunity** to people with disabilities.
- Help people with disabilities more actively participate in society.
- Accessibility barriers to print, audio, and visual media can be much more easily overcome through Web technologies.
- Web accessibility is required by laws and policies in some cases.
  - Disability Discrimination Act 1992 - Australia
  - Canadian Human Rights Act of 1977 - Canada
  - The Disability Discrimination Act 1995 - UK
  - Americans with Disabilities Act (ADA) - USA

# Web Accessibility

- Web accessibility means that people with disabilities can
  - perceive, understand, navigate, and interact with the Web
  - contribute to the Web
- Web accessibility also benefits others, including older people with changing abilities due to aging.
- The Web Accessibility Initiative (WAI) develops strategies, guidelines, and resources to help make the Web accessible to people with disabilities.
  - <http://www.w3.org/WAI/>

# Exclusions

- **Physically** people can be excluded because of inappropriate placement of equipment or through input and output devices making excessive demands on their abilities. For example,
  - an ATM may be positioned too high for a person in a wheelchair to reach
  - a mouse may be too big for a child's hand
  - a mobile phone may be too small to use
- **Conceptually** people may be excluded because they cannot understand complicated instructions or obscure commands or they cannot form a clear mental model of the system.

# Exclusions

- **Economically** people are excluded if they cannot afford some essential technology.
- **Cultural exclusion** results from designers making inappropriate assumptions about how people work and organize their lives.
- **Social exclusion** can occur if equipment is unavailable at an appropriate time and place or if people are not members of a particular social group and cannot understand particular social mores or messages.

# Overcoming barriers

- Overcoming these barriers to access is a key design consideration.
- Two main approaches to designing for accessibility are **‘design for all’** and **inclusive design**.
- Design for all (also known as universal design) goes beyond the design of interactive systems and applies to all design endeavors.
- By meeting the needs of those who are excluded from product use, inclusive design improves product experience across a broad range of users.

# Assistive Technologies

- There are a number of assistive technologies, such as
  - Web browsers that read Web pages
  - screen enlargers which allow people to set and move the area of focus.
- Voice input is increasingly available not just for text entry but also as a substitute for mouse/keyboard control.
- There are many highly specialized methods for input and output for people with various disabilities.

# 7.5. ACCEPTABILITY

# Acceptability

- Acceptability is about fitting technologies into people's lives.
- For example,
  - some railway trains have 'quiet' carriages where it is unacceptable to use mobile phones.
  - cinemas remind people to turn their phones off before the film starts.
  - Apple's iMac computer was the first computer designed to look good in a living room.
  - A computer playing loud music would generally be considered to be unacceptable in an office environment.

# Difference between usability and acceptability

- An essential difference between usability and acceptability is that acceptability can only be understood in the context of use.
- Usability can be evaluated in a laboratory (though such evaluations will always be limited). Acceptability cannot.
- Evaluations are to be carried out with real users in the field.

# The Technology Acceptance Model

- The Technology Acceptance Model (TAM) is a way of looking at technologies and whether they will be accepted by communities.
  - origins in business studies rather than in computing or psychology.
- TAM looks at technology acceptance from two perspectives; ease of use and effectiveness.
  - Each of these is further broken down into more specific characteristics of the technology.
- There are many variants of TAM as it gets adapted to the particular characteristics of a technology.

# Political acceptability

- Is the design politically acceptable?
- Do people trust it?
- In many organizations new technologies have been introduced for simple economic reasons, irrespective of what people may feel about them and the ways that people's jobs and lives might change.
- In the broader environment human rights might be threatened by changes in technologies.

# Convenience

- Designs that are awkward or that force people to do things may prove unacceptable.
- Designs should fit effortlessly in to the situation.
- Many people send documents electronically nowadays, but many people find reading on-line unacceptable.
- They print out the document because it is more convenient to carry and read.

# Cultural and social habits

- If political acceptability is concerned with power structures and principles, cultural and social habits are concerned with the way people like to live.
  - It is rude to disturb other people, for example. ‘Spam’ e-mail has become such an unacceptable aspect of life that some companies have given up on e-mail altogether.
- Usefulness.
  - This goes beyond the notions of efficiency and effectiveness and concerns usefulness in context.
  - For example, many people have found the diary function on their PDAs perfectly usable, but not sufficiently useful in the context of everyday living.

# Economic acceptability

- There are many economic issues that render some technology acceptable or not.
- Price is the obvious one and whether the technology offers value for money.
- But the economic issues go further than that as the introduction of new technologies may completely change the way businesses work and how they make money.
- A new ‘business model’ is often a part of economic acceptability.
- Don Norman characterizes the situation for a successful technology as a stool with three legs: user experience, marketing and technology

# 7.6. GENERAL GUIDELINES AND PRINCIPLES

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User Interface Design (UID)



# Usability - How to achieve?

Through User Centered Design (UCD)

**User Centered Design involves three key aspects:**

1. learning *about* human abilities and limitations
2. designing *for* a particular group of people
3. working *with* these people throughout the design process

# Usability - User Centered Design (UCD)

User-centered design (UCD) is an approach for employing usability

## How to create a UCD web site

1. Define organization and users' needs, goals, and objectives
2. plan your site
3. collect data from users (Requirement gathering)
4. develop prototypes
5. write content
6. conduct usability testing with users

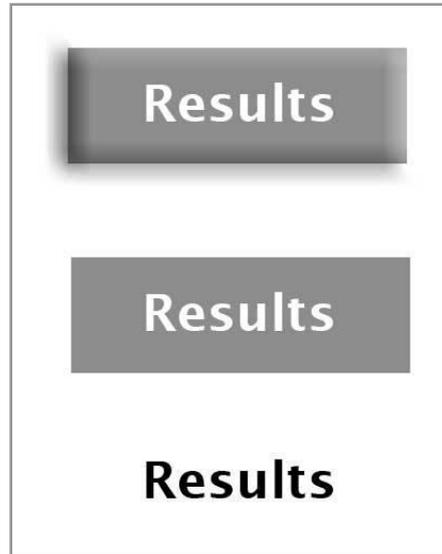
# Usability Guidelines - Don't Make me Think



As much as possible, when you look at a webpage, It should be self evident. Obvious. Self Explanatory.

If the user has to extend or exert extra effort to complete a task, then you can still refine your efforts to make the task easier.

# Usability Guidelines -Make it obvious



Which one gives the sense of a button?

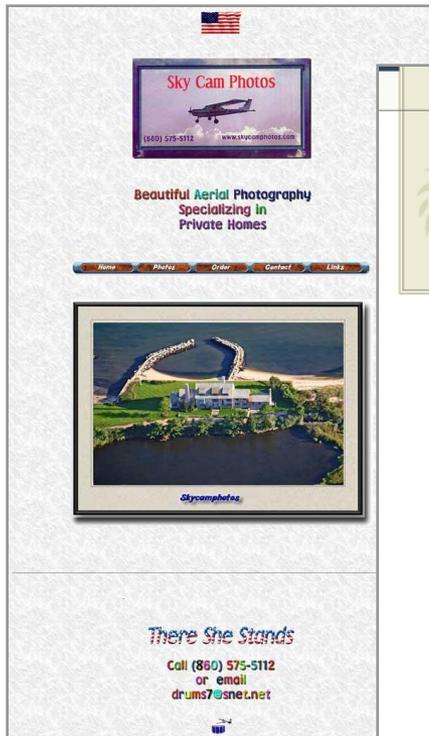
This is the power of conventions, similarly, a word with an underline will always look like a hyperlink to many users.



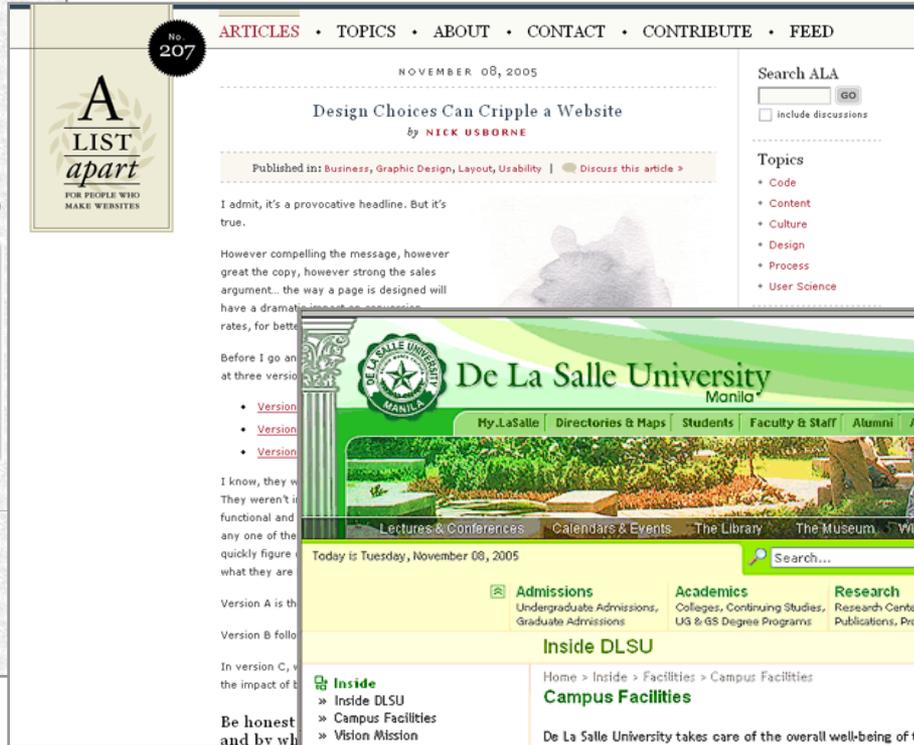
# Usability Guidelines - Good navigation

- Site ID (site logo and tagline)
- Page name
- Sections and sub-sections (global navigation)
- Local navigation
- “You are here” indicators (breadcrumbs)
- Search

# Sample Navigation



No navigation



Navigation not prominent



Perfect Navigation

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# Design principles for Usability

- Over the years many principles of good interactive system design have been developed. Design principles can be very broad or they can be more specific.
- There are also good design principles that derive from psychology such as ‘minimize memory load’ (i.e. do not expect people to remember too much).
- The application of design principles has led to established design guidelines and patterns of interaction in certain circumstances such as the ‘undo’ command in a Windows application, the ‘back’ button on a website or the greying-out of inappropriate options on menus.
- Design principles can guide the designer during the design process and can be used to evaluate and critique prototype design ideas.

# 12 Design Principles for Usability

- All the principles interact in complex ways, affecting each other, sometimes conflicting with each other and sometimes enhancing each other.
- Help to orientate the designer to key features of good design and guide the designer to important issues.

For ease of memorizing and use, grouped them into three main categories - learnability, effectiveness and accommodation (not rigid)

- Principles 1-4 are concerned with access, ease of learning and remembering (**learnability**).
- Principles 5-7 are concerned with ease of use, and principles 8 and 9 are concerned with safety (**effectiveness**).
- Principles 10-12 are concerned with accommodating differences between people and respecting those differences (**accommodation**).

# 1 - Visibility

- Try to ensure that things are visible so that people can see what functions are available and what the system is currently doing. (Screen Design)
- This is an important part of the psychological principle that it is easier to recognize things than to have to recall them.
- If it is not possible to make it visible, make it observable.
- Consider making things ‘visible’ through the use of sound and touch.
- Attention needs to be paid to the use of appropriate, non-clashing colours and the careful layout of information using tables, graphs or text as appropriate.
- However on mobile applications visibility is very difficult to achieve.

## 2 Consistency

- Be consistent in the use of design features and be consistent with similar systems and standard ways of working.
- A design will be consistent with respect to some things but may be inconsistent with respect to others.
- There are also times when to be inconsistent is a good thing because it draws people's attention to something that is important.
- The difference between conceptual consistency and physical consistency is important.
  - Conceptual consistency is about ensuring the mappings are consistent, that the conceptual model remains clear.
  - This involves being consistent both internally to the system and externally as the system relates to things outside it.
  - Physical consistency is ensuring consistent behaviors and consistent use of colours, names, layout and so on.

# Working with people

- Often in the design of applications, the designer can talk to the actual future stakeholders of the system and find out what they want and how they refer to things.
- This will help the designer to ensure familiar language is used and that the design follows any organizational conventions (preferred ways of working).
- Participatory design techniques - involving people closely in the design process - can be used, and stakeholders can participate in the design process through workshops, meetings and evaluation of design ideas.
- Documentation and training can be given.

## 3 Familiarity

- Use language and symbols that the intended audience will be familiar with.
- If this is not possible because the concepts are quite different from those people know about, provide a suitable metaphor to help them transfer similar and related knowledge from a more familiar domain.

# 4 Affordance

- Affordance refers to the properties that things have (or are perceived to have) and how these relate to how the things could be used.
  - People will expect to see a menu at the top of the screen and will expect the menu items to be displayed when the header is clicked on. Items that are not greyed out will afford selecting.
- Buttons afford pressing, chairs afford sitting on, and Post-it notes afford writing a message on and sticking next to something else.
  - The various ‘widgets’ such as check boxes, radio buttons and text entry boxes should afford selecting because people familiar with the standards will know what to expect.

## 4 Affordance -contd..

- Design things so it is clear what they are for; for example, *“make buttons look like buttons so people will press them”*
- Affordances are culturally determined.
- On mobile devices the physical buttons afford pressing, but because of the limited screen space the same button has to do different things at different times.
  - This may lead to problems of consistency.

# 5 Navigation

- Provide support to enable people to move around the parts of the system:
  - Maps
  - directional signs
  - information signs
- Menus are also the main form of navigation in applications.
- People move around the application by selecting items from menus and then by following dialogue structures.

# Navigation and control

- Many applications make use of ‘wizards’.
  - These provide step-by-step instructions for undertaking a sequence of operations, allowing users to go forward and backwards to ensure that all steps are completed.
- Control is usually left in the hands of the users.
- They have to initiate actions, although some features that provide security features are undertaken automatically.
- Many applications, for example, automatically save people’s work to help with recovery if mistakes are made.

# GOLDEN Rules

K

- Where you are

N

O

- What you can do

W

I

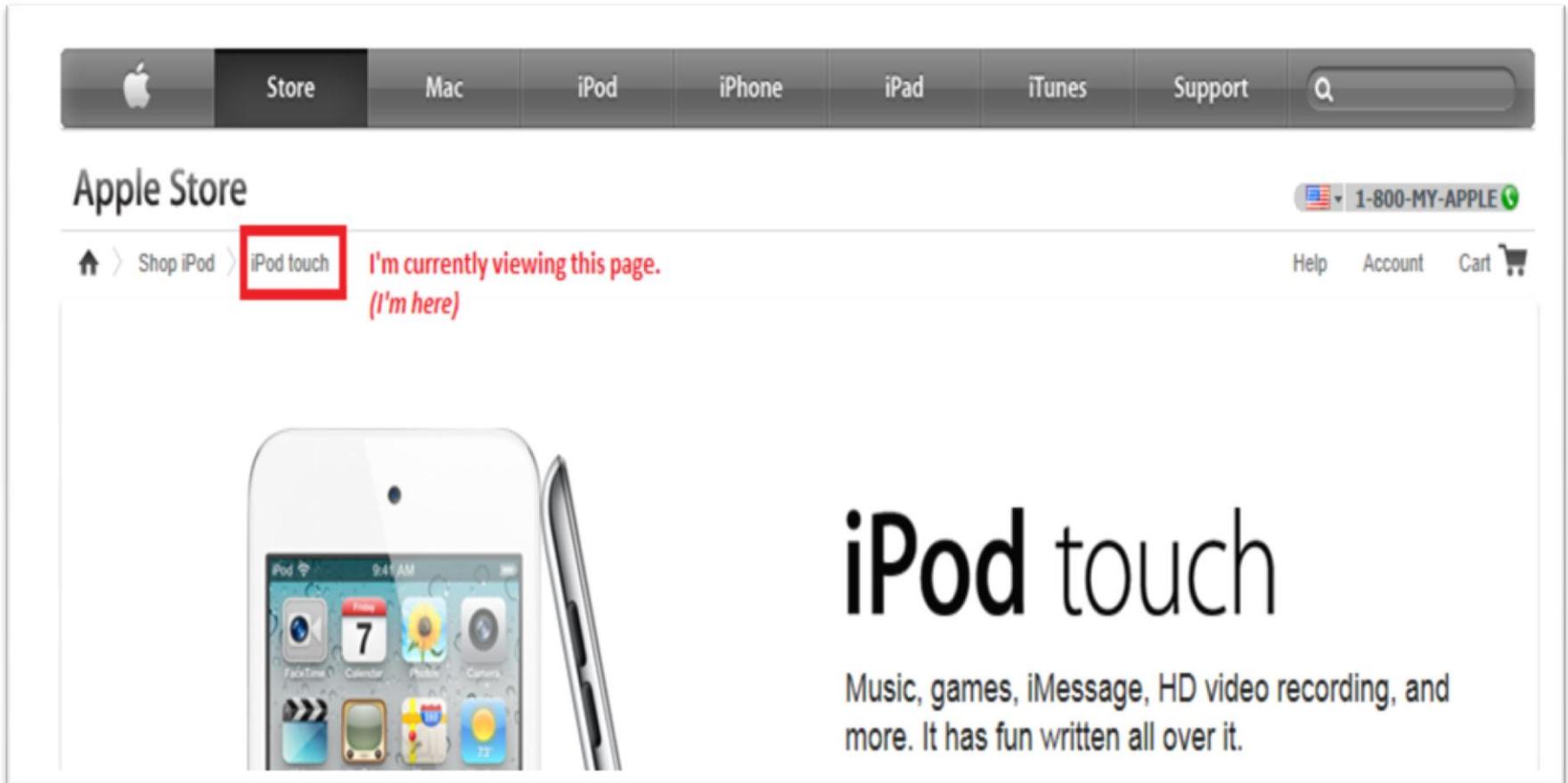
- Where you are going

N

G

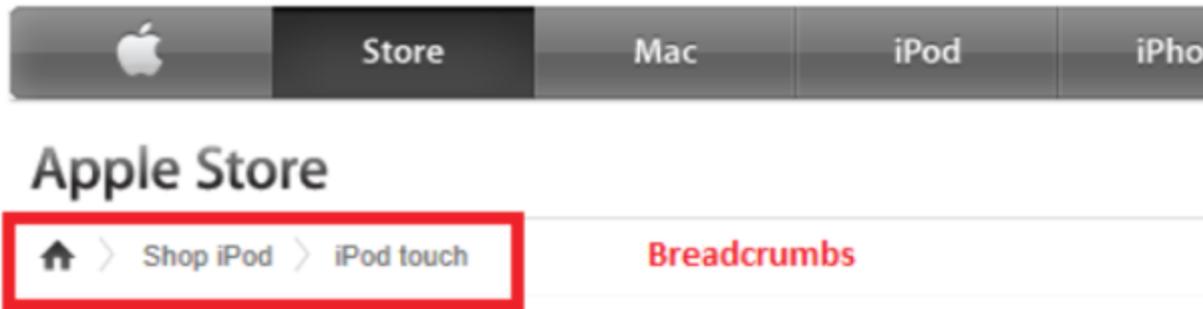
- Where you have been

# Knowing where you are



Which page are you viewing at this moment?

# Breadcrumbs



# Apple Store

Shop iPod > iPod touch

Things I can perform



## iPod touch

Music, games, iMessage, HD video recording, and more. It has fun written all over it.

From \$199.00

Buy online and get free shipping or in-store pickup:

Select an iPod touch ▶

Visit the iPod touch site:

Features | Built-in Apps | Tech Specs | From the App Store

## Knowing what you can do

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# Knowing what you can do

Things you can perform in the site. (using menus, buttons, hyperlinks, etc.)

In the given image

- Search
- Select an iPod Touch
- Click on links to view more details on the selected product.
- Get online assistance through Skype call.
- View your account.
- View HELP.

# Knowing where you are going

The image shows a user interface for an Apple account. On the left, a navigation menu is open under the 'Account' tab, listing 'Popular Account Links' such as 'Track an Order', 'Return Items', 'Cancel Items', 'View Order History', and 'Account Home Page'. A red text label 'Not logged in' is positioned above a large black arrow pointing from the menu to the main sign-in area. The main area is titled 'Please Sign In' and includes a 'Secure' indicator. It is divided into two sections: 'Returning Customer' with fields for 'iTunes or Apple ID' and 'Password', and 'Single Order Lookup | Find Order Number' with fields for 'Order Number' and 'Shipping Zip Code or Email Address'. Both sections have 'Sign In' and 'Continue' buttons respectively. At the bottom, there is a link for 'Forgot your Apple ID or Password?', a contact number '1-800-MY-APPLE', and a 'Cancel' button.

# Knowing where you are going

# Knowing where you are going

A user cannot view an order unless logged in.

A user tries to view track an order

If he/she is not a logged user direct the user to the sign in page.

Else allow the user to navigate to the orders.

# Knowing where you have been

Command history

Items in a shopping cart

Breadcrumbs

Are some of the methods that can be used.

Breadcrumbs - Horizontal series of text links connecting to all parent levels of the hierarchy above the current location

## 6 Control

- Make it clear who or what is in control and allow people to take control.
- Control is enhanced if there is a clear, logical mapping between controls and the effect that they have.
- Also make clear the relationship between what the system does and what will happen in the world outside the system.

# 7 Feedback

- Rapidly feedback information from the system to people so that they know what effect their actions have had.
- Constant and consistent feedback will enhance the feeling of control.
- Feedback is provided in a variety of ways.
  - A 'bee' symbol or an 'egg timer' symbol is used to indicate that the system is busy doing something.
  - Counters and progress bars are used to indicate how much of an operation is complete.

# Feedback

- Feedback can be provided through sound such as a beep when a message is received on an e-mail system or a sound to indicate that a file has been safely saved.
- Flexibility is provided with things such as short-cut keys, allowing more expert users to use combinations of keyboard controls in place of using menus to initiate commands and navigate through the system.
- Many windows applications allow the user to set their own preferences, to configure features such as the navigation bars and menu items and to disable features that are not often used.

# 8 Recovery

- Enable recovery from actions, particularly mistakes and errors, quickly and effectively.

# 9 Constraints

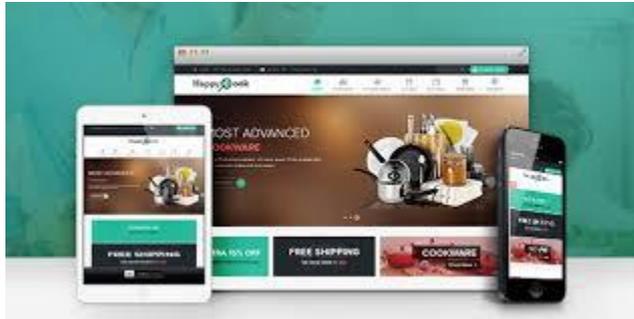
- Provide constraints so that people do not try to do things that are inappropriate.
- In particular, people should be prevented from making serious errors through properly constraining allowable actions and seeking confirmation of dangerous operations.

# 10 Flexibility

- Allow multiple ways of doing things so as to accommodate people with different levels of experience and interest in the systems.
- Provide people with the opportunity to change the way things look or behave so that they can personalize the system.

# 11 Style

Designs should be stylish and attractive.



# 12 Conviviality

- Interactive systems should be polite, friendly, and generally pleasant.
- Nothing ruins the experience of using an interactive system more than an aggressive message or an abrupt interruption.
- Design for politeness.
- Conviviality also suggests joining in and using interactive technologies to connect and support people.

# Style and conviviality

- In terms of style and conviviality, applications are rather limited as they should remain within the standard design guidelines.
- Error messages are one area where the designer can move towards a more convivial design by thinking hard about the words used on the messages.
- However, all too frequently messages appear very abruptly and interrupt people unnecessarily.

# Design principles in action

- Designing for applications is still dominated primarily by issues of usability.
- In particular the key issue is consistency.
- There are clear guidelines for issues such as menu layout, ordering, dialogue boxes and use of the other ‘widgets’ associated with graphical user interfaces.
- There are standards for providing constraints such as greying out items on a menu that are not relevant at a particular point.
- A toolkit, or a design environment such as Visual Basic, will probably be used that will help to ensure the design confirms to an overall style.

# Usability in web design

- Navigation is a central issue in web site design.
- Even if a site is well focused, it will soon get large and issues of how to move around a website become important.
- Designers need to provide support to enable people to discover the structure and content of the site and to find their way to a particular part of the site.
- Information architecture is an established area of study devoted to designing websites.
- A key feature of consistency is the use of standard Web features such as a blue underline for showing a link.
- Many sites confuse people by not making links sufficiently visible and distinguishable from other text in the site.

# Usability in web design

- Flexibility of navigation can be enabled by providing alternatives for people; different routes though the site and having a variety of links. Having a site map will afford people getting oriented.
- Issues of recovery, *feedback and control*
- There are often long pauses when processing things such as a payment transaction.
- Feedback is critical here and statements such as ‘this action may take 45 seconds to complete’ are used to persuade people not to do anything while the transaction is processed.
- There is no way of enforcing constraints in these circumstances.

# Usability in web design

- Conviviality can be provided by allowing people to join in, to support and create communities.
- Unlike windows applications, websites can easily connect people with other.
- Style is also key to websites and offers the most opportunities for designers to demonstrate their creative flair.
- The use of animation, video and other design features can really develop a whole sense of engagement with the site.