Computing Studies

Information Systems Design and Development

An Introduction to Information Systems

N4 & **N5**

Buckhaven High School

Version 1

An Introduction to Information Systems

Contents

How to use this booklet

This booklet has been written to cover the following content in National 4 and National 5 Computing.

	National 4 **N4**	National 5 **N5**
Structures and Links (Databases)	Information system structures including: • flat databases organised by fields and records • websites, page and URLs. • hyperlinks.	Information system structures including: • relational databases with linked tables including primary and foreign keys • good design to avoid duplication of data
Structures and Links (Websites)	Websites, web page and URLs. Hyperlinks.	HTML and Javascript Hyperlinks (internal, external, relative and absolute)
Media Types	Sound, Graphics, Video, Text.	Standard File Formats • Text: txt, rtf • Audio: wav, mp3 • Graphics: jpeg, bmp, gif, png • Video: mp4, avi • Pdf
Purpose, Features, Functionality and Users	Simple description of main features and functions of an information system.	Description of the purpose of an information system. Users (expert, novice, age-range)
User Interface	Target audience of an information system.	User requirements of a user interface (visual layout, navigation, selection, consistency, interactivity, readability)

The booklet is colour coded as shown above.

For assessment purposes, pupils working at National 4 level should revise only the N4 content.
Pupils attempting National 5 assessments, coursework or final exam should study only N5 content.
(N5 pupils may wish to revise N4 content anyway to improve their overall knowledge of the subject.)

What is an Information System?

> *Definition - An information system is hardware and software used to collect, store and process data.*

Before the rise of computers, the world stored data and information on paper. Lots and lots of paper!
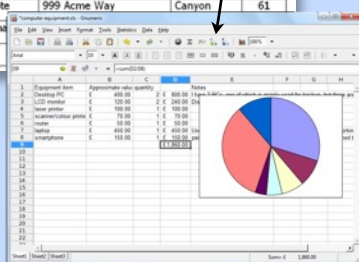
Over the last few decades computers and software have taken over the task of storing information. Why? Because computers are extremely fast at processing information.
Within seconds a computer can:

- sort very large amounts of information into order,
- perform analysis on vast quantities of data,
- process thousands of purchases and payments
- or filter and produce different views of selected information.

Filing cabinets of paper on customers, products and sales are now stored in databases and spreadsheets.
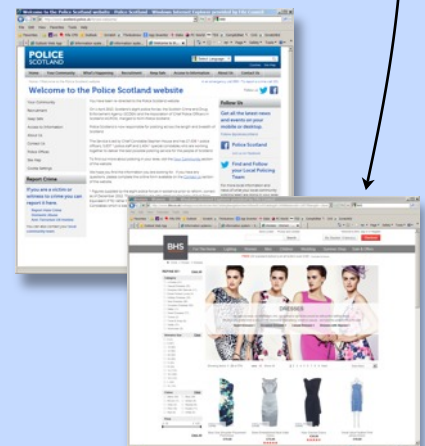
Books, maps, newspapers and magazines can now be viewed on portable devices.

Advertising leaflets, sales brochures and order forms can now be produced as web pages.

N5

Multimedia applications have also been developed to store and organise information including graphics, sound and video.

Online encyclopaedias are an excellent example of how a variety of information types can be recreated as a computerised information system. While the original paper version can only store text and graphics the use of multimedia not only offers facilities like search engines but often enhances the original information.
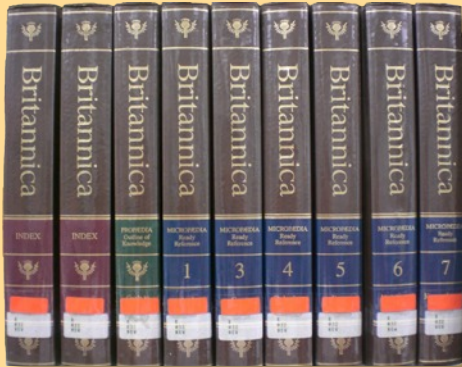
Types of Data in an Information System

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Whether it is organised as a website or a database the information stored in an information system will include text, graphics, sound or video.

Text - Nearly all information systems will store characters, words, sentences or paragraphs.

Graphics - In an information system, graphics could be part of the data that is being stored (for example a photo of a product or person) or part of the user interface (buttons, menus, logos).

Sound - In an information system sound is often added simply to improve the users experience. A button may make a click when it is pressed, an electronic page could make a sound as it's turned or the sound may just be used as background music.
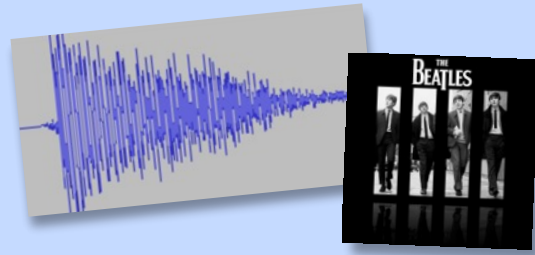
There are also examples of sound being the information itself in the information system. A example of this could be a website which sells music. The sound files (the product) will be stored in a database catalogued by artist, album, song title and genre.
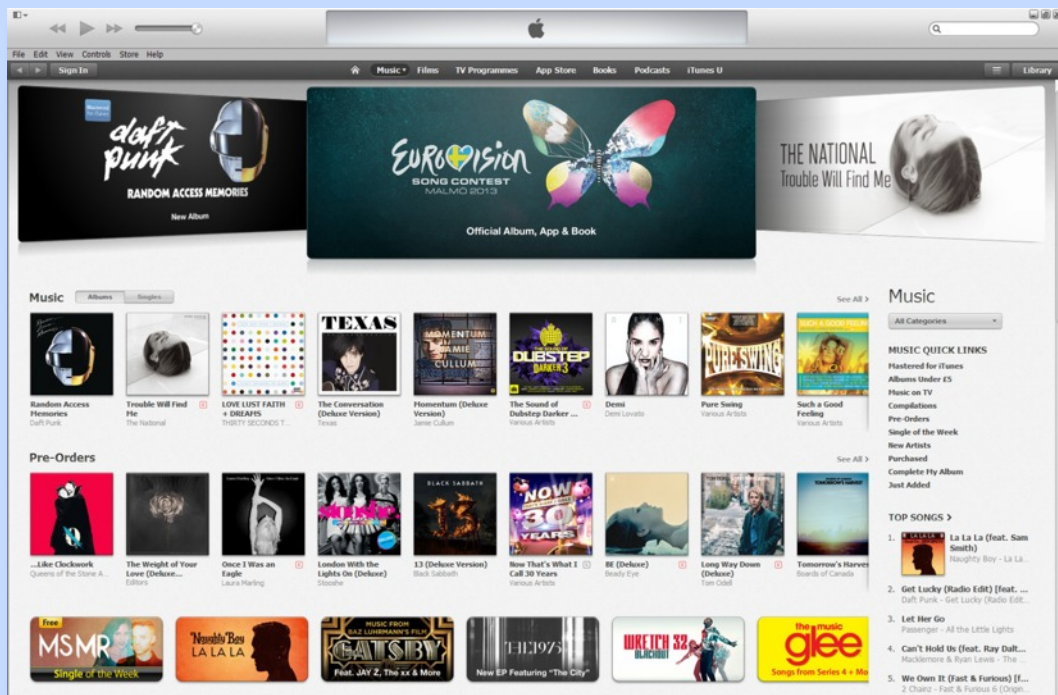
Video - Video files may also have several uses in an information system. A video could be a tutorial (maybe teaching the user of the database or website how to search for files), an advert or again could be the stored information, catalogued by subject, year, genre etc.
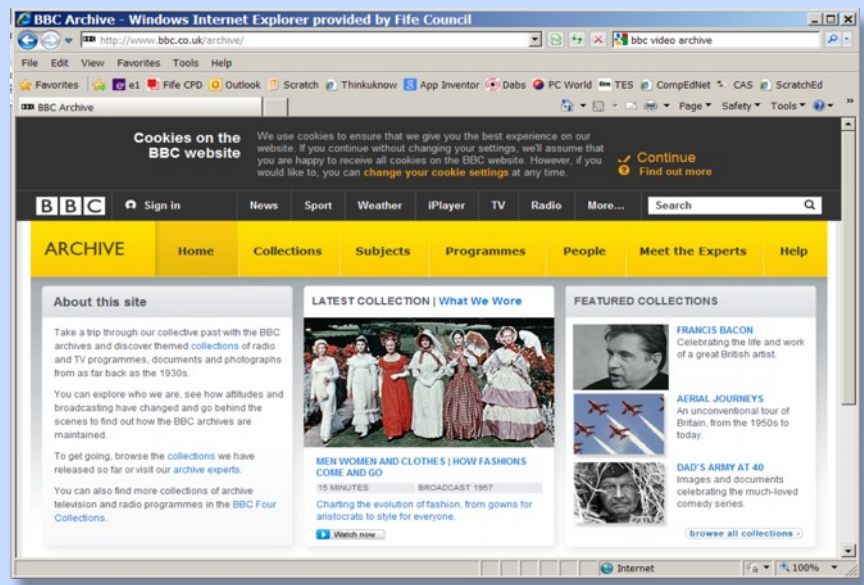
The example on the right shows the BBC's film, TV and radio archive website. This information system stores all four types of data.

N5

Standard File Types

A standard file type is a file that is not associated with a single application. Standard file types are used in information systems to ensure that the software and hardware devices being used to access the files are able to read and display them. Being able to use files in different applications is called portability.

Most applications have the ability to create standard file types using an 'Export' option in the software.

This example shows how the graphics application DrawPlus can be used to Save or Export files.

Exporting

Saving

The Image Export window in DrawPlus allows the user to select from a list of 13 standard file types.

The three standard file types created (bmp, png and gif) can now be used in hundreds of different applications.

When the graphic is simply saved, the DrawPlus file that is created (dpp) can only be opened again in DrawPlus.

Text Files

So why have application file types in addition to many different standard file types?

Let's use word processing software and standard text file types to explore this question.

If this document were saved as a Microsoft Word file (.doc) all of the data required to recreate the file must be saved.

This may include the following.

1. Text
   (font, size, formatting, justification, line spacing, paragraph spacing)

2. Graphics
   (position, size, resolution, wrap setting)

3. Autoshapes (blue stars)
   (position, size, layer, fill colour, line colour, line thickness, fill pattern)

4. Header & Footer
   (text, font, size, position, header height, footer height, even/odd page settings)

5. Page Setting
   (page size, landscape/portrait, margins)

When exporting a file from a word processor the selected standard file format may store all or some of the above data in the saved file.
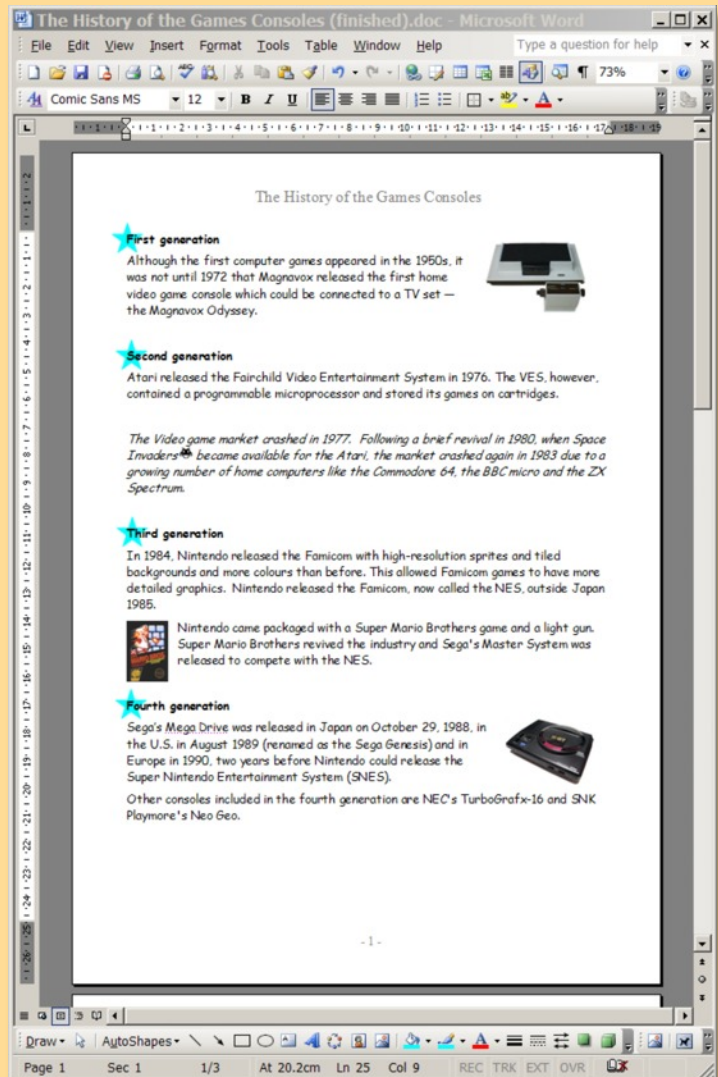
Task 1 - Standard File Types for Text

Two common standard file types used to store text are plain text files (txt) and rich text format (rtf).

Text.rtf
Rich Text Format
4 KB

Text.txt
Text Document
1 KB

Step 1 - Open a new word processing document. Add the following to the document: a paragraph of text, a picture from the Internet and a shape. Now change the page orientation to landscape, add a header and footer and move the page margins.

Step 2 - Save the file three times into a new folder. Once using the applications own file type, once as a .rtf file and once as a .txt file. You may have to look for the option to do this in the Save window.

Step 3 - Close the application and open the folder where you saved the files. Open each file and type a report describing how much of the original content and page setup changes were saved or lost by each file type. Print your report and submit it to your teacher.

Graphic Files

When a graphic is exported as a standard file type there can be significant differences in the exported file.

The original hedgehog button was drawn in Serif DrawPlus (a vector graphics application).

A shadow was added to the button and it was then exported as the four different standard file formats shown below.

Joint Picture Experts Group (jpeg)

File Size - 318 Kb

Colour Depth - 24bit

Compressed - Yes

Transparent - No

Portable Network Graphic (png)

File Size - 768 Kb

Colour Depth - 32bit

Compressed - Yes

Transparent - Yes

Bit-Mapped Graphic (bmp)

File Size - 4.78 Mb

Colour Depth - 24bit

Compressed - No

Transparent - No

Graphic Interchange Format (gif)

File Size - 379 Kb

Colour Depth - 8bit

Compressed - Yes

Transparent - Yes

The information next to each graphic shows that the characteristics of the files are very different.

Compression - Three of the files are compressed. This means that some of the data in the original file is lost to reduce the size of the file. The 318 Kb jpeg file is only 6% of the size of the uncompressed, 4.78 Mb bmp file. If you look very closely at the two graphics you will see that this results in a loss of quality.

Transparency - Some file types store whether or not areas of a graphic are transparent. If declared transparent, whatever is behind those areas can be seen through the graphic. Both gif and png files can implement transparency. The two files look different because while the gif file can only store whether an area is transparent or not, the png file stores exactly how transparent each pixel is. This allows the shadow in the png file to become more transparent the further it is from the hedgehog button.

Colour Depth - Colour depth defines the number of unique colours that the file format can store. The table below shows how the colour depth determines the maximum number of colours that can be stored.
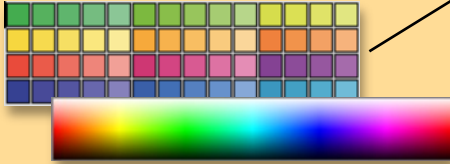
Colour Depth	Maximum Number of Colours
1 bit	2 colours (black and white)
4 bit	16 colours
8 bit	256 colours
16 bit	65,536 colours
24 bit	16,777,216 colours
32 bit	4,294,967,296 colours

Why a 16 bit colour depth sets a maximum of 65,536 available colours will be explained in another part of this course. For now, it's enough to know that more bits equals more colours.

Some graphic standard file types can only store one colour depth while others can be changed when the file is exported.

bmp - variable colour depth from 1 bit to 32 bit

jpeg - always 24 bit colour

gif - can be varied but usually 8 bit colour

png - variable colour depth from 1 bit to 32 bit

Export Area

1262 x 1325 pixels 150 dpi

○ Page ○ Selected Area ● Selected Items

Properties

Format: PNG (Portable Network Graphics)

Bit Depth: ● 32 ○ 24 ○ 8 ○ 4 ○ 1

○ CMYK
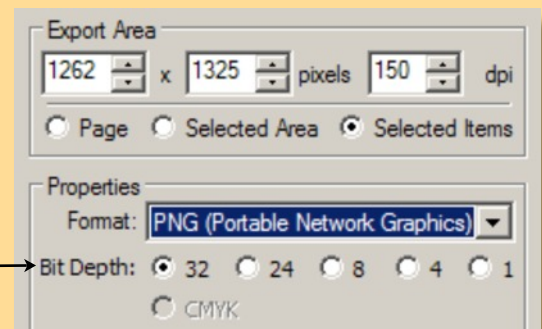
Task 2 - Standard File Types for Graphics

You have been asked to design a home button for a tourist information kiosk.

To meet design needs and storage limitations your button must be:

- either an ellipse or a rounded rectangle
- 100 pixels wide by 100 pixels high
- 32 bit colour
- no more than 5 Kb in size.

Step 1 - On paper, first design your home button. Using a vector graphics application, draw the home button and save your completed graphic.

Step 2 - Ensuring you meet the above requirements, export the home button graphic as a standard file type.

Step 3 - E-mail the exported home button file to your teacher.

N5

Sound Files

Standard file formats used to store sound also exist in a large number of types and attributes.

Sound files can:

• be compressed or uncompressed

• vary greatly in sound quality

• vary in file size

The music on Compact Disks is stored using the wav format. These are high quality, uncompressed sound files with large files sizes.

A CD can store approximately approximately 75 minutes of music on a 750 Mb disk. Files sizes are therefore roughly 10 Mb per minute of sound.

The most common standard file type used to store sound is the mp3 format (or to give it its full name MPEG-1 Audio Layer III). Mp3 were officially recognised as a standard file format in 1993.

Mp3 files are compressed files so have significantly smaller file sizes than wav files. Their relative size has been a contributing factor to their success as a file format. Smaller file sizes made them faster to download and allowed more of them can be stored on devices like the new mp3 players that appeared in the late 90s.

1st Gen iPod

To compress a sound file you have to lose some of the information from the original. The mp3 format uses the characteristics of the human ear to compress files to about a tenth of their original size.

It achieves this dramatic change in file size by:

• removing low and high frequency sounds that the human ear can't hear

• deleting quiet sounds that are drowned out by louder ones

• removing one of the bass channels making the sound mono. (Note that the human ear can't detect which direction low sounds come from so the same bass sound can be sent to both speakers.)

Task 3 - Standard File Types for Sound

The sound quality of music stored using the mp3 format is affected by its bit rate.

Using the world wide web, answer the questions below and e-mail your answers to your teacher.

Q1 - Explain the term bit rate in relation to sound files.

Q2 - Describe the effect that increasing or decreasing the bit rate has on the quality and size of a sound file.

The next two standard file formats are both video files. Avi and mpeg files are so popular that they make up a high percentage of all digital video files.

Avi (audio video interleave) files are container files as they store both video and sound data streams.

The video data stream is encoded using a codec and may be compressed or uncompressed depending on the codec used. The sound stream is also encoded.

When an avi file is played the video and sound streams are decoded and played together.

Along with containing compressed video and audio data, mp4 files can also store subtitles and still images. Several methods of compression are used to remove some of the original video data but the most interesting one is called interframe encoding. This compression method only stores the differences between frames in the video.

In this example the background never changes so would only be encoded once. The woman's face and the hand that appears at the bottom would have to be encoded for each movement.

Pdf (portable document format) files were developed to share complex documents in a way that was independent of the software, hardware or operating system they were created on. This is particularly useful when sharing files on the world wide web where documents will be accessed from a huge variety of different devices.

```
PDFDocument MyPDF = new
PDFDocument("Tables.pdf");
Table table = new Table(2,2);
table.DisplayHeader = true;
table.column(0).header.SetValue("Name");
table.column(1).header.SetValue("Surname");
table.cell(0, 0).SetValue("John");
table.cell(0, 1).SetValue("Smith");
table.cell(1, 0).SetValue("Joe");
table.cell(1, 1).SetValue("Doe");
MyPDF.CurrentPage.Body.DrawTable(table);
MyPDF.Save();
```

Pdf files use an adaptation of PostScript (a language used by printers). This is a page description programming language which runs as an interpreter create an image of a page. The language stores the positions of text (font, size, style) and graphics (resolution, rotation, transparency and layer). The example code draws a table with three rows and two columns.
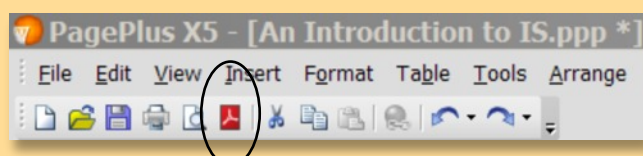
The current versions of the Microsoft Office Suite (Word, Publisher, Excel, Access, PowerPoint), the Serif Suite (DrawPlus, PhotoPlus, PagePlus, WebPlus) and OpenOffice can all export documents as pdfs.

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Task 4 - Exporting a PDF Document

To complete this task we require a document so create a poster on a topic of your choice. Ensure that the application you use to create the poster is capable of exporting to a pdf file.

This is the first time in this booklet that you have been asked to design a complete document. At National 5 level you should be doing significantly more than copying a few pictures from the web and adding a few lines of text.

Consider the following design aspects:

- posters rarely have blank spaces so fill your page

- ensure that your document has a colour scheme (complimentary colours, several shades of the same colour can achieve this)

- when considering the text size remember the purpose of a poster

- overlapping or interaction between objects

- techniques like transparency or shadows can add depth to objects
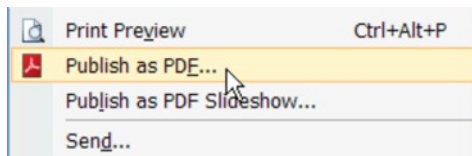
When you have completed your poster look for the option in your chosen application that allows you to export to pdf.

Several options are usually available when you create a pdf file.
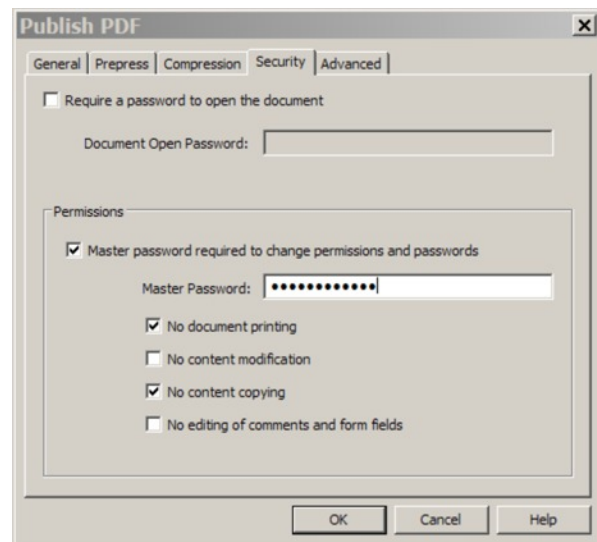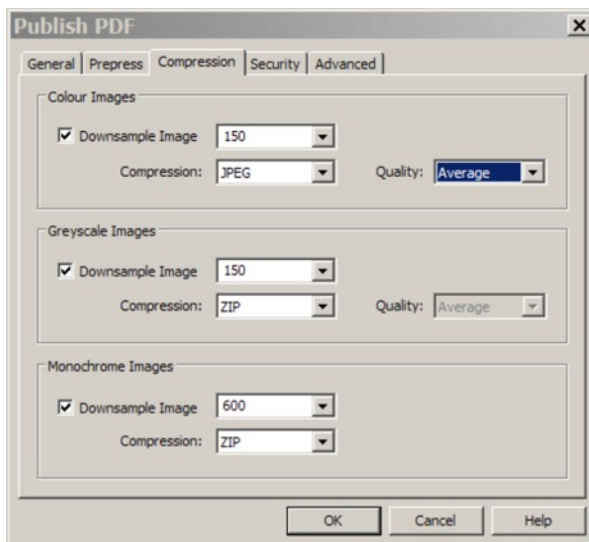
Create a **password protected** pdf file that is **locked for printing & copying**. E-mail it to one of your classmates and ask them to open it.

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Task 5 - Media Types Revision

Open a browser and navigate to the URL below.

http://www.nts.org.uk/Home/

the National Trust for Scotland
a place for everyone

The National Trust for Scotland website is a modern information system which uses a variety of media types to inform visitors.

Open the file called "Task 4 - Media Types Revision". Your teacher can tell you where to find it.

Search the National Trust website for example of different media types.

Complete the table in the file to show the media types you have found and describe what they are being used for.

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Task 6 - Standard File Types Revision

In the National 5 exam you may be asked to :

- Show an understanding of what standard file formats are
- discuss why they are needed
- give examples of standard file formats
- show basic knowledge of the differences between different formats.

To prepare you for this, complete the table below (your teacher will supply you with a file). A couple of examples have been filled in to give you an idea of the detail required.

Note - Not all the information you require is on the previous pages so do research as well.

Data Type	Standard File Format	Characteristics	Example of Use
Text	txt	Plain text file that only stores characters, spaces and paragraphs.	
	rtf		
Graphics	jpeg		Can be used to store high resolution digital photographs while keeping file sizes down.
	bmp		
	gif	File sizes very small due to compression and limited colour depth. Supports transparency.	
	png		
Audio (sound)	wav		High quality sound files used on Compact Disks.
	mp3		
Video	mpeg	Compressed video file that uses a variety of methods to keep file sizes low.	
	avi		Used to reduce file sizes to fit videos onto CD/DVD and make it easier to download or view files on the www.
Text/Graphics	pdf		

Information System Structures

An information system is a store of facts and knowledge. One of the most important facilities offered by an information system is the ability to search through the information it stores.

Whether it is stored in a database or a website, an information system must be very well organised for a search to find the information.

Flat Database Structures

A database is organised store of information. A flat database organises its data using a single table.

For example, a Veterinary Surgery could use a database to store information on customers and their pets.

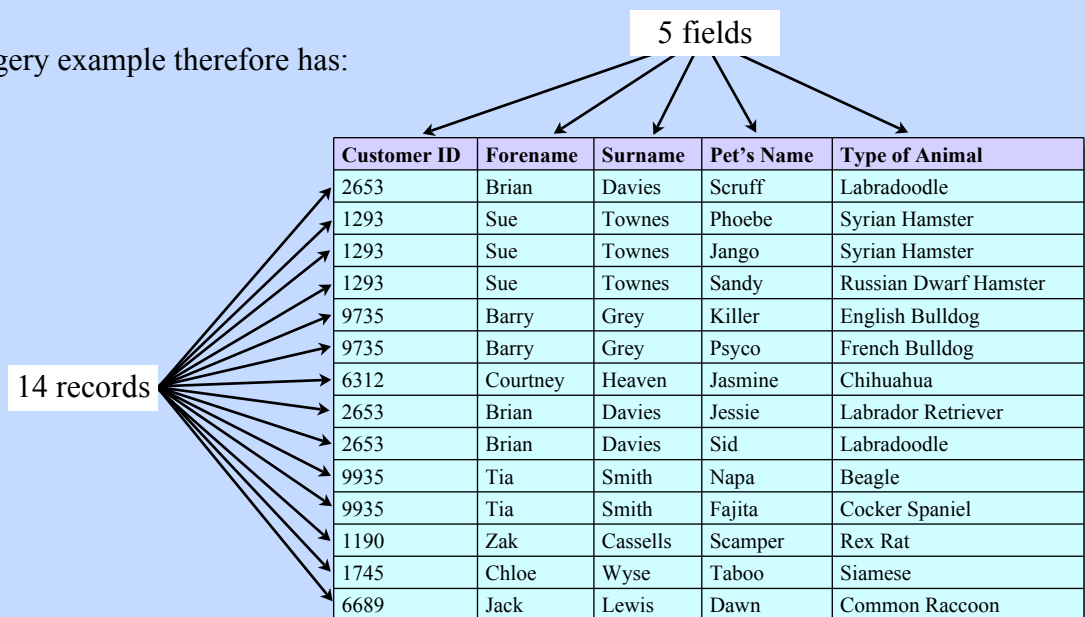| Customer ID	Forename	Surname	Pet's Name	Type of Animal
2653	Brian	Davies	Scruff	Labradoodle
1293	Sue	Townes	Phoebe	Syrian Hamster
1293	Sue	Townes	Jango	Syrian Hamster
1293	Sue	Townes	Sandy	Russian Dwarf Hamster
9735	Barry	Grey	Killer	English Bulldog
9735	Barry	Grey	Psyco	French Bulldog
6312	Courtney	Heaven	Jasmine	Chihuahua
2653	Brian	Davies	Jessie	Labrador Retriever
2653	Brian	Davies	Sid	Labradoodle
9935	Tia	Smith	Napa	Beagle
9935	Tia	Smith	Fajita	Cocker Spaniel
1190	Zak	Cassells	Scamper	Rex Rat
1745	Chloe	Wyse	Taboo	Siamese
6689	Jack	Lewis	Dawn	Common Raccoon

The information in a database is organised under headings called **fields**.

Customer ID	Forename	Surname	Pet's Name	Type of Animal

Each block of information in a database in called a **record**. The row below stores information on one pet and its owner. This block would be one record.

2653	Brian	Davies	Sid	Labradoodle

Our Veterinary Surgery example therefore has:

5 fields

14 records

Customer ID	Forename	Surname	Pet's Name	Type of Animal
2653	Brian	Davies	Scruff	Labradoodle
1293	Sue	Townes	Phoebe	Syrian Hamster
1293	Sue	Townes	Jango	Syrian Hamster
1293	Sue	Townes	Sandy	Russian Dwarf Hamster
9735	Barry	Grey	Killer	English Bulldog
9735	Barry	Grey	Psyco	French Bulldog
6312	Courtney	Heaven	Jasmine	Chihuahua
2653	Brian	Davies	Jessie	Labrador Retriever
2653	Brian	Davies	Sid	Labradoodle
9935	Tia	Smith	Napa	Beagle
9935	Tia	Smith	Fajita	Cocker Spaniel
1190	Zak	Cassells	Scamper	Rex Rat
1745	Chloe	Wyse	Taboo	Siamese
6689	Jack	Lewis	Dawn	Common Raccoon

Relational Database Structures

A relational database stores data in more than one table. This is often done to get rid of duplicated data in the information system.

If you look closely at our Vet example you will see that all the highlighted data appears more than once in the table.

Customer ID	Forename	Surname	Pet's Name	Type of Animal
2653	Brian	Davies	Scruff	Labradoodle
1293	Sue	Townes	Phoebe	Syrian Hamster
1293	Sue	Townes	Jango	Syrian Hamster
1293	Sue	Townes	Sandy	Russian Dwarf Hamster
9735	Barry	Grey	Killer	English Bulldog
9735	Barry	Grey	Psyco	French Bulldog
6312	Courtney	Heaven	Jasmine	Chihuahua
2653	Brian	Davies	Jessie	Labrador Retriever
2653	Brian	Davies	Sid	Labradoodle
9935	Tia	Smith	Napa	Beagle
9935	Tia	Smith	Fajita	Cocker Spaniel
1190	Zak	Cassells	Scamper	Rex Rat
1745	Chloe	Wyse	Taboo	Siamese
6689	Jack	Lewis	Dawn	Common Raccoon

Customers

Pets

Customer ID	Forename	Surname
2653	Brian	Davies
1293	Sue	Townes
9735	Barry	Grey
6312	Courtney	Heaven
9935	Tia	Smith
1190	Zak	Cassells
1745	Chloe	Wyse
6689	Jack	Lewis

Customer ID	Pet's Name	Type of Animal
2653	Scruff	Labradoodle
1293	Phoebe	Syrian Hamster
1293	Jango	Syrian Hamster
1293	Sandy	Russian Dwarf Hamster
9735	Killer	English Bulldog
9735	Psyco	French Bulldog
6312	Jasmine	Chihuahua
2653	Jessie	Labrador Retriever
2653	Sid	Labradoodle
9935	Napa	Beagle
9935	Fajita	Cocker Spaniel
1190	Scamper	Rex Rat
1745	Taboo	Siamese
6689	Dawn	Common Raccoon

By splitting the table into two, we can solve the problem of duplicate information. When designing a database, this process is called **normalisation**.

The Customer ID field is used to link the two tables. This type of field is called a key field. If the values are unique, the key field is a **Primary Key**. A Primary key that is used in another table is called a **Foreign Key**. The values in a foreign key do not need to be unique.

Primary Key Field

Foreign Key Field

Customer ID	Forename	Surname
2653	Brian	Davies
1293	Sue	Townes
9735	Barry	Grey
6312	Courtney	Heaven
9935	Tia	Smith
1190	Zak	Cassells
1745	Chloe	Wyse
6689	Jack	Lewis

Customer ID	Pet's Name	Type of Animal
2653	Scruff	Labradoodle
1293	Phoebe	Syrian Hamster
1293	Jango	Syrian Hamster
1293	Sandy	Russian Dwarf Hamster
9735	Killer	English Bulldog
9735	Psyco	French Bulldog
6312	Jasmine	Chihuahua
2653	Jessie	Labrador Retriever
2653	Sid	Labradoodle
9935	Napa	Beagle
9935	Fajita	Cocker Spaniel
1190	Scamper	Rex Rat
1745	Taboo	Siamese
6689	Dawn	Common Raccoon

The term **relational** database comes from the relationship between the tables.

In the vet example, one customer can own many pets. This is called a **one to many** relationship.

When designing a database the relationships between tables are often represented using a diagram.

Customer Table

Customer ID
Forename
Surname

1 ∞

Pet Table

Pet's Name
Customer ID
Type of Animal
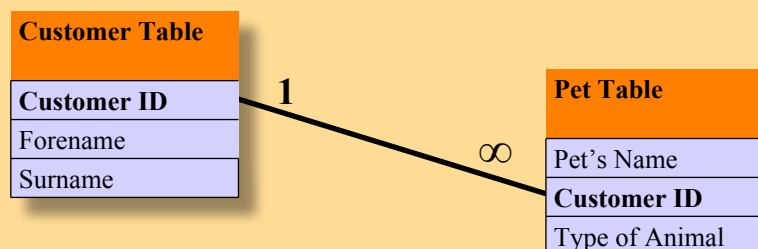
It is very important that databases are well designed. This will not only ensure that the database stores and manipulates the information more efficiently, it will also ensure that errors in the information are less likely to occur.

Let's imagine that Tia gets married and changes her surname. In a flat database this could lead to errors if only one change were made. The same customer now has two names.

In a well designed relational database, Tia's name would appear only once making this error impossible.

Customer ID	Forename	Surname	Pet's Name	Type of Animal
2653	Brian	Davies	Scruff	Labradoodle
1293	Sue	Townes	Phoebe	Syrian Hamster
1293	Sue	Townes	Jango	Syrian Hamster
1293	Sue	Townes	Sandy	Russian Dwarf Hamster
9735	Barry	Grey	Killer	English Bulldog
9735	Barry	Grey	Psyco	French Bulldog
6312	Courtney	Heaven	Jasmine	Chihuahua
2653	Brian	Davies	Jessie	Labrador Retriever
2653	Brian	Davies	Sid	Labradoodle
9935	Tia	Jones	Napa	Beagle
9935	Tia	Smith	Fajita	Cocker Spaniel
1190	Zak	Cassells	Scamper	Rex Rat
1745	Chloe	Wyse	Taboo	Siamese
6689	Jack	Lewis	Dawn	Common Raccoon

Website Structures

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A **website** organises information into pages or **web pages**. A website is a group of web pages usually produced by the same people about the same topic.

Websites always have a **home** or **index** page that links to pages (sub-topics) on the website.
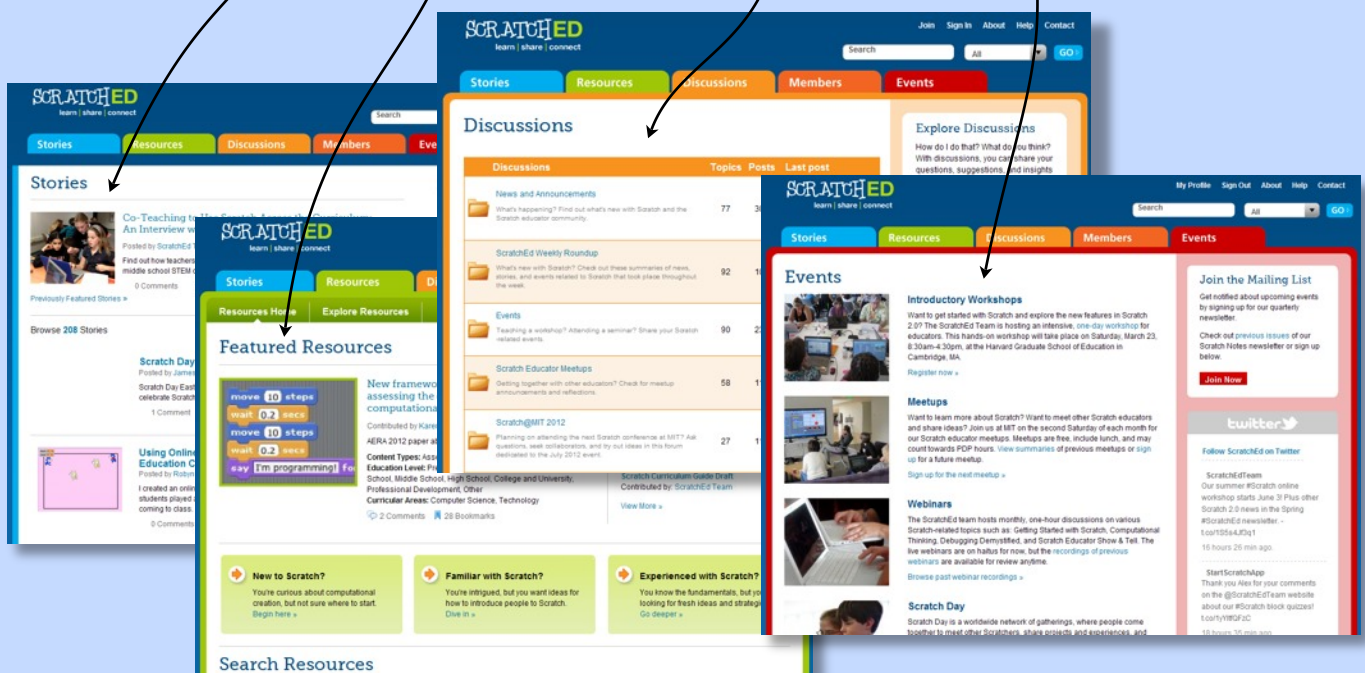
Home Page
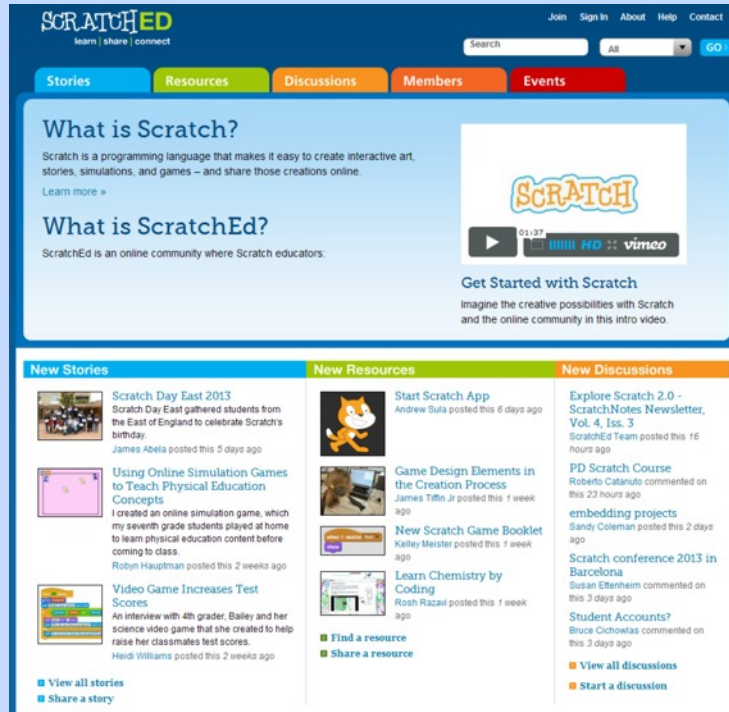
Stories   Resources   Discussions   Events

Every web page on the world wide web has a unique address, shown in the address bar of the browser.

http://scratched.media.**mit.edu**/

These addresses or **URLs** (Uniform Resource Locators) can also tell you a bit about the structure of the website.

Main Page

Home Page

http://scratched.media.mit.edu/

The home page of a website contains the **Domain Name** of the site.

scratched.media.mit.edu

This may have to be purchased and registered when the website is first created.

Sub Pages

Stories

http://scratched.media.mit.edu/stories
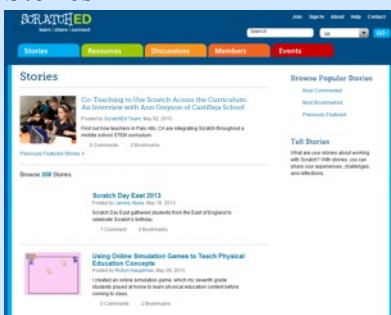
The URLs of the other pages shown are an extension of the domain name.

This tells us that these pages are sub-pages, one level below the home page.

Resources

http://scratched.media.mit.edu/resources

Discussions
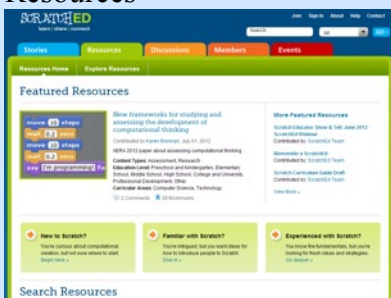
http://scratched.media.mit.edu/discussions
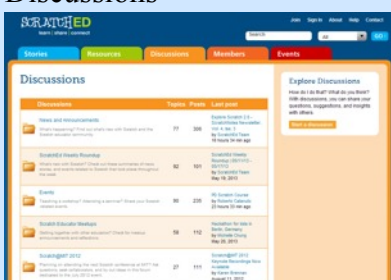
When designing a website it's useful to draw a map of the website showing how all the pages are related and linked to each other.

A partial map of the ScratchEd website may look like this. A complete map would consist of hundreds of boxes.
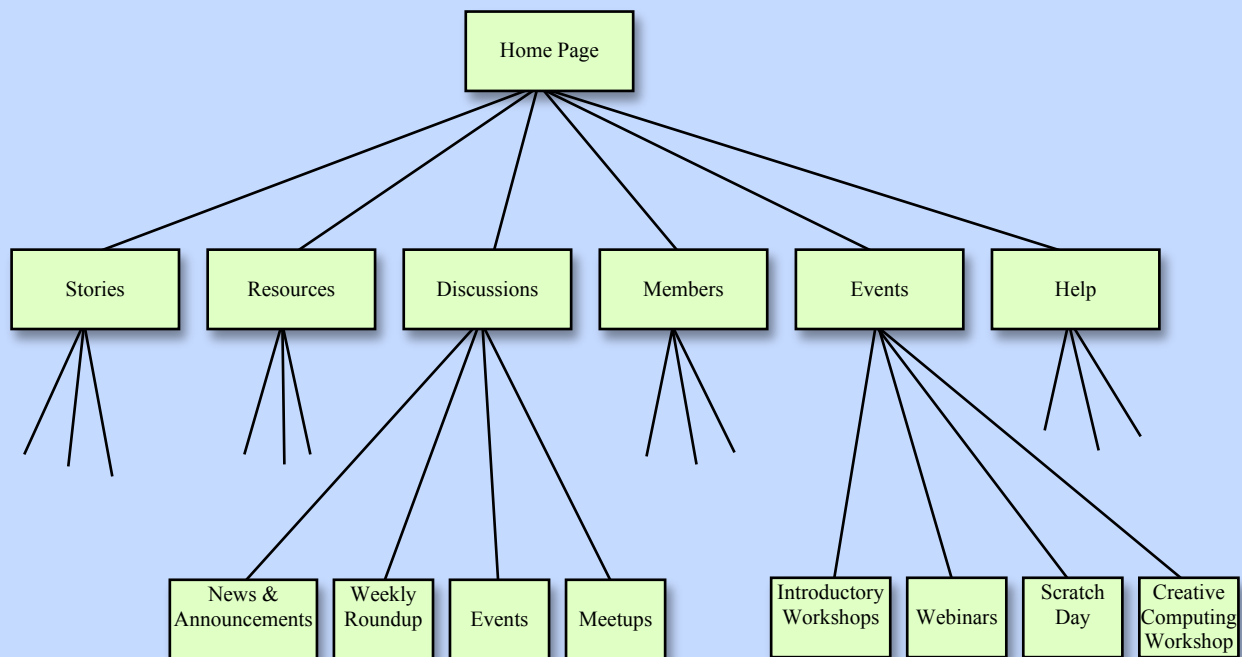
Note that large websites are likely to have sub-pages of sub-pages. Very large websites may continue down several more levels.

Maintaining a well organised structure is important when developing a website. To find the information they are looking for, categories and links must make sense to the users of the website.

Task 7 - Mapping a Website

Choose **one** of the following websites, collect a blank sheet of A3 paper and produce a map of the website (minimum 30 pages). Use the URLs in the address bar to help you.

1. www.itv.com
2. www.dyson.co.uk
3. www.apple.com

The map should:

- have a home page at the top
- Show the entire second level (the URLs will tell you the level)
- Show **some** third level pages
- Show when a hyperlink takes the user to a different website (new domain name in address bar)
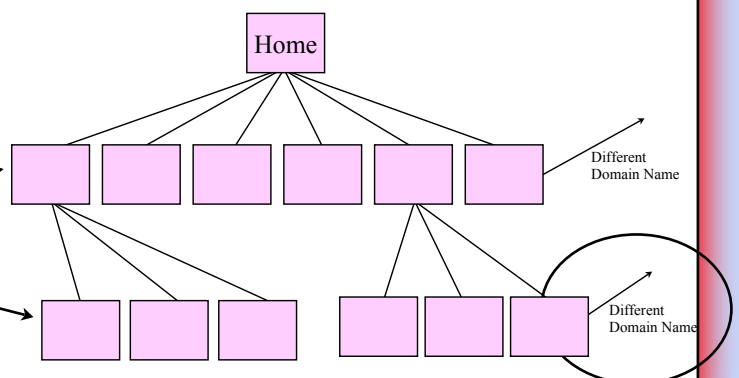
Web pages are linked together using hyperlinks. These are points on a page that when clicked on will take the user to another URL (web page). There are many types of hyperlink.

Often websites have a hyperlink on their logo. Clicking here usually takes you back to the home page.
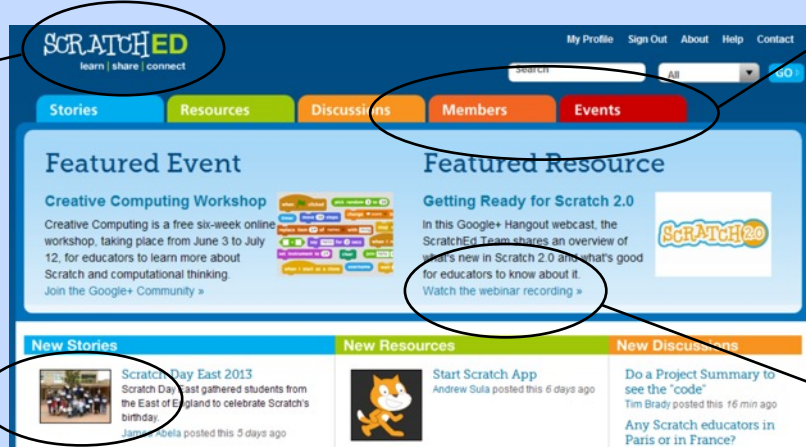
Most websites have Navigation Bars offering hyperlinks to other sub-topics.

Text may be hyperlinked to another web page. Hyperlinked text is often coloured to show that it's a hyperlink.

Hyperlinks can be added to graphics. This is often used with photos where the link takes you to a page about that photo.

Hypertext Markup Language (HTML) and Javascript

N5

The information on a webpage is structured (organised on the page) using a programming language called Hypertext Markup Language. This is a descriptive language that describes:

- the position of objects on the webpage (left, right, centre, full justified, paragraph, table row/column)
- how they look (bold, underline, italics, border, background colour, border colour)
- details regarding a placed object (resolution of graphic, location of sound file)
- hyperlinks (URL to go to when an object is clicked)

HTML uses tags (<> </>) which enclose an object. Each tag describes how the object inside the two tags is to be positioned, displayed or behave.

The most basic tags are single letters.

 	This emboldens the text inside the tags	info sys =	**info sys**
<i> </i>	This displays text in italics	<i>info sys</i> =	*info sys*

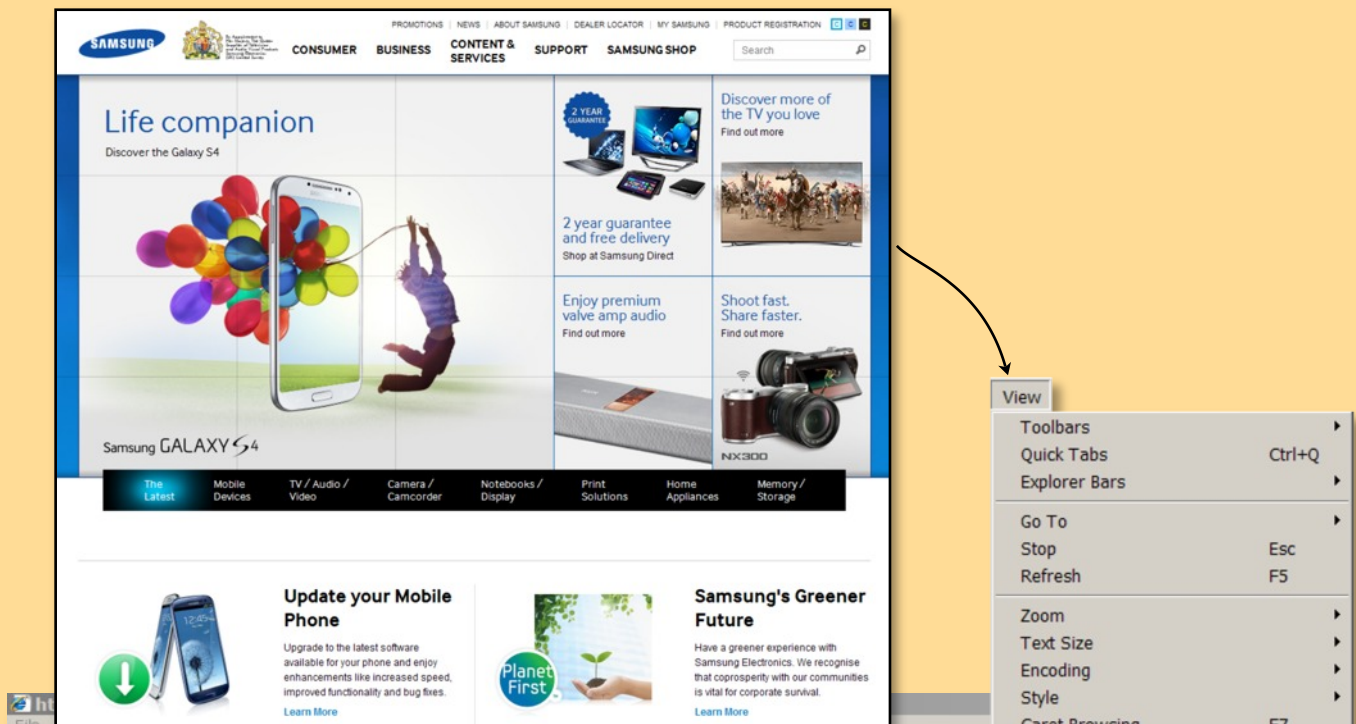Tags, like <table>, <tr> and <td> can work as a group.

```
<table>
    <tr>
        <td></td>
        <td></td>
    </tr>
    <tr>
        <td></td>
        <td></td>
    </tr>
</table>
```

This code produces a table with two rows <tr> and two columns <td> within each row.

Note that tags can be expanded to contain additional information.
For example   <table width=100% height = "300", border="2">

N5

The complexity of a modern website can be examined by looking at the source code for the page. All browsers have an option to look at the HTML behind what you see on the screen.


```
111   <body>
112   <div id="TMAN_TOP_BODY"></div>
113   <script type="text/javascript">
114   //<![CDATA[
115   TMAN.doTags(TMAN.position.TOP_BODY);
116   //]]>
117   </script>
118
119   <!-- Nav for accessibility-->
120   <div id="accNav">
121     <p><a href="#jwFirstLink">Skip to product promotion</a></p>
122     <p><a href="#indexTab">Skip to social media</a></p>
123     <p><a href="#accHelp">Skip to accessibility help</a></p>
124   </div>
125   <!-- //Nav for accessibility-->
126
127   <!-- 90day expire cookie-->
128   <div class="cookie_notice">
129           <span>This site uses cookies. By continuing to browse the site you are agreeing to our use of cookies.
      privacy policy">Find out more here</a></span>
130           <span class="closer"><button onclick="setExp();"><img alt="close" src="/common/img/close_x.gif"></butto
131       </div>
132
133
134   <script type="text/javascript" >
135       if ( getCookie("UkCookieNotice") == "" ) {
136               $('.cookie_notice').show();
137           }else{
138               $('.cookie_notice').hide();
139           }
140
141           function setExp(){
142               $('.cookie_notice').hide();
143               setCookieEx("UkCookieNotice","90Day",90);
144           }
145   </script>
146   <!-- 90day expire cookie-->
147
148   <!-- Body Wrap -->
149   <div id="wrap" class="con">
150
151       <!-- Header -->
152       <div id="header">
153           <p class="logo" role="banner"><a href="/uk/"><img src="/common/img/logo.png" width="106" height="35" al
154           <p class="royalWarrant" ><a href="/uk/news/localnews/2012/by-royal-appointment"><img src="/uk/common/im
155
156           <!-- GNB -->
157           <div id="globalNav" role="navigation" class="ir">
158                   <ul>
```

x12 pages

As the world wide web becomes increasingly more widespread, the complexity of websites has also developed. Today, large companies have teams of programmers who specialise in writing and editing web page code.

The use of HTML tags to produce web pages is now regarded by web developers as a fairly old fashioned way of producing web pages. Websites, like e-bay and Amazon, now use program code (for example PHP) and databases to generate web pages as they are viewed. Without this approach a new HTML page would have to be written for every item they sell. An impossible task!

Task 8 - Researching HTML tags

The HTML code below displays the basic web page shown.

```
<!DOCTYPE HTML PUBLIC "-//W3C//DTD HTML 4.01 Transitional//EN"
"http://www.w3.org/TR/html4/loose.dtd">
<html>
<head>
    <title>Untitled</title>
</head>

<body bgcolor="#98aff4">
<b><div align="center"><font size="4">An Internet Minute</font></div></b>
<br>
A minute is a lifetime in Computing.  In a single minute the following will happen on the
World Wide Web.
<br>
<ul>
<li>6 new Wikipedia documents are published.</li>
<li>Amazon sell £60,000 of stock</li>
<li>100,000 tweets are published on Twitter.</li>
<li>1,300,000 videos are viewed on YouTube.</li>
<li>2,000,000 searches are entered into Google.</li>
</ul>
<table cellspacing="5" width="100%" border="1" bordercolor

<tr>
        <td><img src="Images/Wikipedia.png" width="100" hei
        <td><img src="Images/Amazon.png" width="100" height
        <td><img src="Images/Twitter.png" width="100" heigh
        <td><img src="Images/YouTube.png" width="100" heigh
        <td><img src="Images/Google.png" width="100" height
</tr>
</table>

</body>
</html>
```

An Internet Minute

A minute is a lifetime in Computing. In a single minute the following will happen on the World Wide Web.

- 6 new Wikipedia documents are published.
- Amazon sell £60,000 of stock
- 100,000 tweets are published on Twitter.
- 1,300,000 videos are viewed on YouTube.
- 2,000,000 searches are entered into Google.

Navigate to where this web page is saved (your teacher may have to show you) and open the "Home.html" page in a browser of your choice.

In the browser's menu, find the option that allows you to view the source code.

Use the website - www.w3schools.com/tags   to help you answer the questions below.
E-mail your answers to your teacher.

1. What is the purpose of the <body> tag in an HTML document?

2. Which HTML tag centre justifies the heading "An Internet Minute"?

3. The web page contains a bullet point list.
    a) Which **two** HTML tags are required to produce a bulleted list?
    b) Research - How would you change the list to a numbered list?

4. How have HTML tags been used to arrange the 5 graphics in a row on the page?

5. Describe where a colour has been inserted into the HTML code.

6. State the resolution the YouTube icon is being displayed at on the web page.

7. Change the size of the browser window and observe what happens to the position of the 5 company logo icons as you make the window bigger and smaller.
    How has the HTML been coded to ensure the icons always fit from one side of the window to the other?

8. Use the Internet to research **two** items of information usually found in the <head> section of an HTML document.

N5

Reading HTML code is a bit like reading the green binary shown in the Matrix trilogy. The more you use it the better you get at visualising what the code will look like as a web page.

Many Web Authoring applications allow users to see both the HTML code and also use a WYSIWYG (what you see is what you get) editor. Much of the web page can be set up in the WYSIWIG as if you were using a word processor. Access to the HTML code allows expert users to tweak the web page making small adjustments as required.
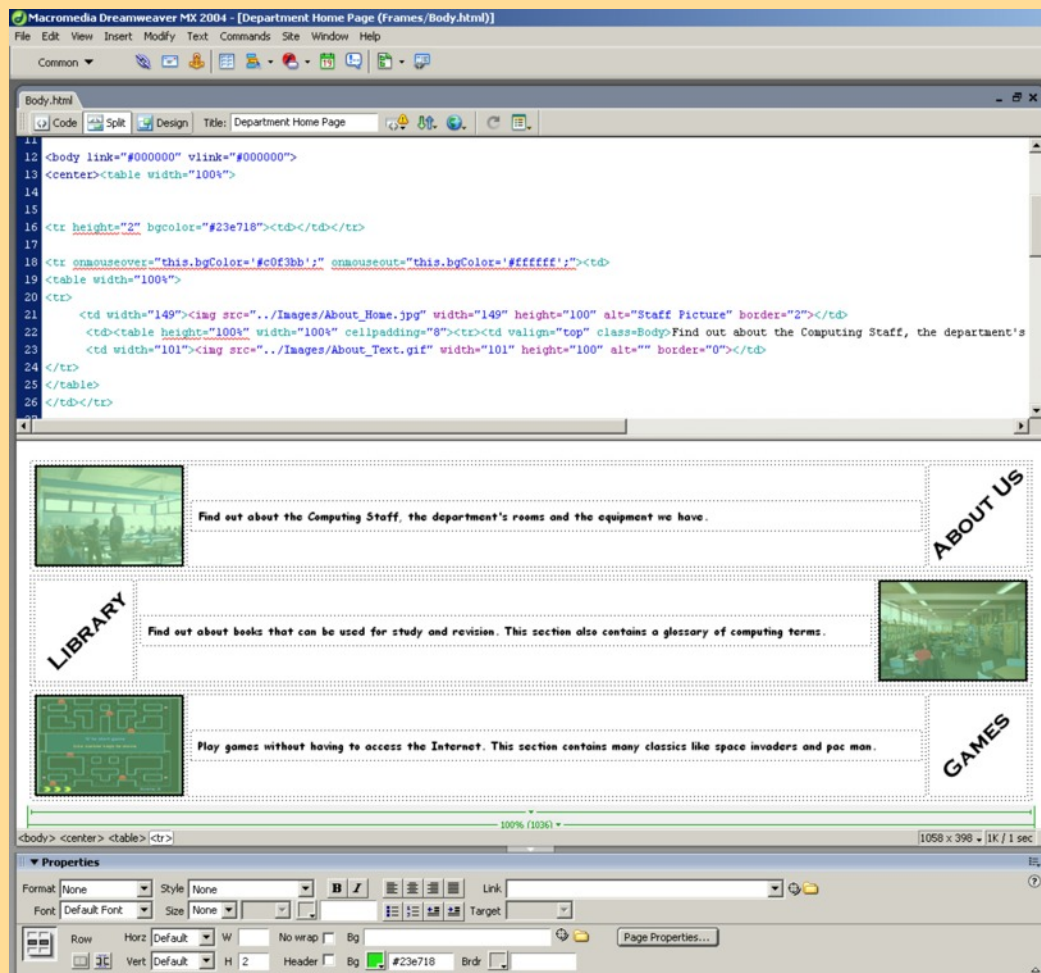
HTML

WYSIWIG

Screenshot of Macromedia DreamWeaver in Split Screen Mode

As the world wide web developed, web pages became more interactive, responding to user input as well as simply displaying information.

HTML tags offer very limited options for user interaction so a programming languages, such as Javascript, were developed to allow programs to be embedded into the HTML web pages.

JS

Javascript can:

- load new page content without reloading the web page.

A Javascript powered picture gallery.

Clicking the small thumbnail images at the bottom changes the main image.

- animate page elements, fading them in/out, resizing them, moving them etc.

```
01   function highlight(elem) {
02   var from = [255,0,0], to = [255,255,255]
03   animate({
04       delay: 10,
05       duration: 1000,
06       delta: linear,
07       step: function(delta) {
08       elem.style.backgroundColor = 'rgb(' +
09           Math.max(Math.min(parseInt((delta * (to[0]-from[0])) + from[0], 10), 255), 0) + ',' +
10           Math.max(Math.min(parseInt((delta * (to[1]-from[1])) + from[1], 10), 255), 0) + ',' +
11           Math.max(Math.min(parseInt((delta * (to[2]-from[2])) + from[2], 10), 255), 0) + ')'
12   }}) }
```

This short program highlights the background colour of some text fading it slowly from red (255,0,0) to white (255,255,255).

- provide interactive content: games, audio and video

- allow users to enter data into input boxes in forms and validates the input to ensure its acceptable

- transmit information regarding a user's reading habits or browsing activities to other websites (this may be used to collect and analyse data to optimise web usage)

More About Hyperlinks

Two types of hyperlink can be written in HTML code; internal and external.

An **internal hyperlink** is takes the user to a new location within the current page. This is often used with menu systems at the top of a page.

The example shows a FAQ (frequently asked questions) help page on a website. Clicking on a question will take the user to the answer found further down the page.

An internal link has a hyperlink and an anchor point on the same page:

1. A named **anchor** is placed round the object. This is where the hyperlink will jump to.

What is Google Summer of Code?

2. A **hyperlink** tag then creates the link to the named anchor point.

What is Google Summer of Code?

Note that the # symbol in the tag tells us that this is an internal hyperlink.

An **external hyperlink** will take the user to a completely new web page.

Go to the BBC website now.

The external hyperlink shows the URL (Uniform Resource Locator or address) of the web page the user will be taken to when they click on the text "Go to the BBC website now".

The pages in a website are usually organised in hierarchical folder structure. The diagram below shows the root folder (called mysite.com) and three layers of sub-folders.

Example of a Simple Directory Structure

```
mysite.com
  main-directory
    directory1
      directory2
        page2.html
      page1.html
      sourcepage.html
    directory3
      page3.html
    directory4
      page4.html
  index.html
```
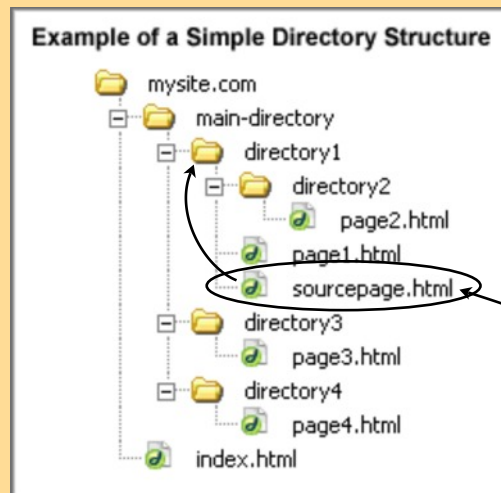
The destination page in a hyperlink tag (<href> </>) may show where the new page is stored in relation to the page the user is currently viewing.

There are three ways of doing this.

Let's assume that the user is currently viewing "sourcepage.html" in the folder called "directory1".

1. Go To Page 1

    If only the name of the destination is used, the link will take the user to a page that is stored in the same folder as the current page.

2. Go To Page 2

    This example names the folder the destination page is stored in. The folder is down one level from the current page.

3. Go To Page 3

    The ../ code translates as go up one level in the hierarchy (to "main-directory"). The destination page is then in a sub-folder (one down again) called directory3.

The above examples are known **relative** hyperlinks as the link shows the position of the destination file relative to the current file.

If the hyperlink tag contains a full URL,

   MIT App Inventor Home Page

Then the link is known as an **absolute** hyperlink.

Absolute hyperlinks often start with http://. The Http (or Hypertext Transfer Protocol) part of the URL sends a message to a web server to telling it to fetch the requested page.

Web Server

Server returns the web page

Browser requests web page

Browser
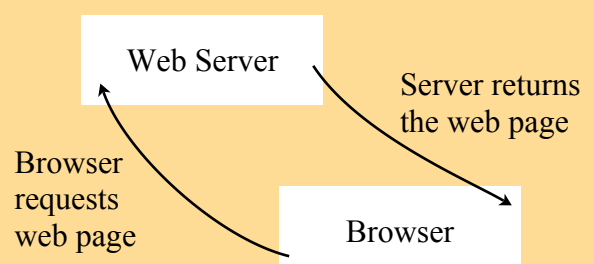
Information System Features and Functions

N4

At the beginning of this booklet we stated that the purpose of an information system is to collect, store and process information.

To achieve this, an information system must have the following features:

Data

People

An Information System

Hardware

Software

1. Data - The raw information on people, facts, objects or events stored in the system.

2. People - The users, creators and maintainers of the system.

3. Hardware - The computers, servers, storage devices to save/process the data and communications devices to access and transfer the data.

4. Software - The programs required to organise, edit and view the data in the information system.

**Task 9 - Costing an Information System**

Use the Internet to research the following:

- the annual salary of an Information Systems Analyst
- the cost of buying a single copy of FileMaker Pro (a database application)
- the cost of a RAID (redundant array of independent disks) storage device capable of storing at least 12 Tb of data
- three data collection methods (means of getting raw data into a computer system).

E-mail the results of your research to your teacher.

The Purpose of an Information System

Raw Data

Input

Definition - The purpose of an information system is to collect data, process it into information then convert information into knowledge for a specific purpose.

Information

Process

Knowledge

Output
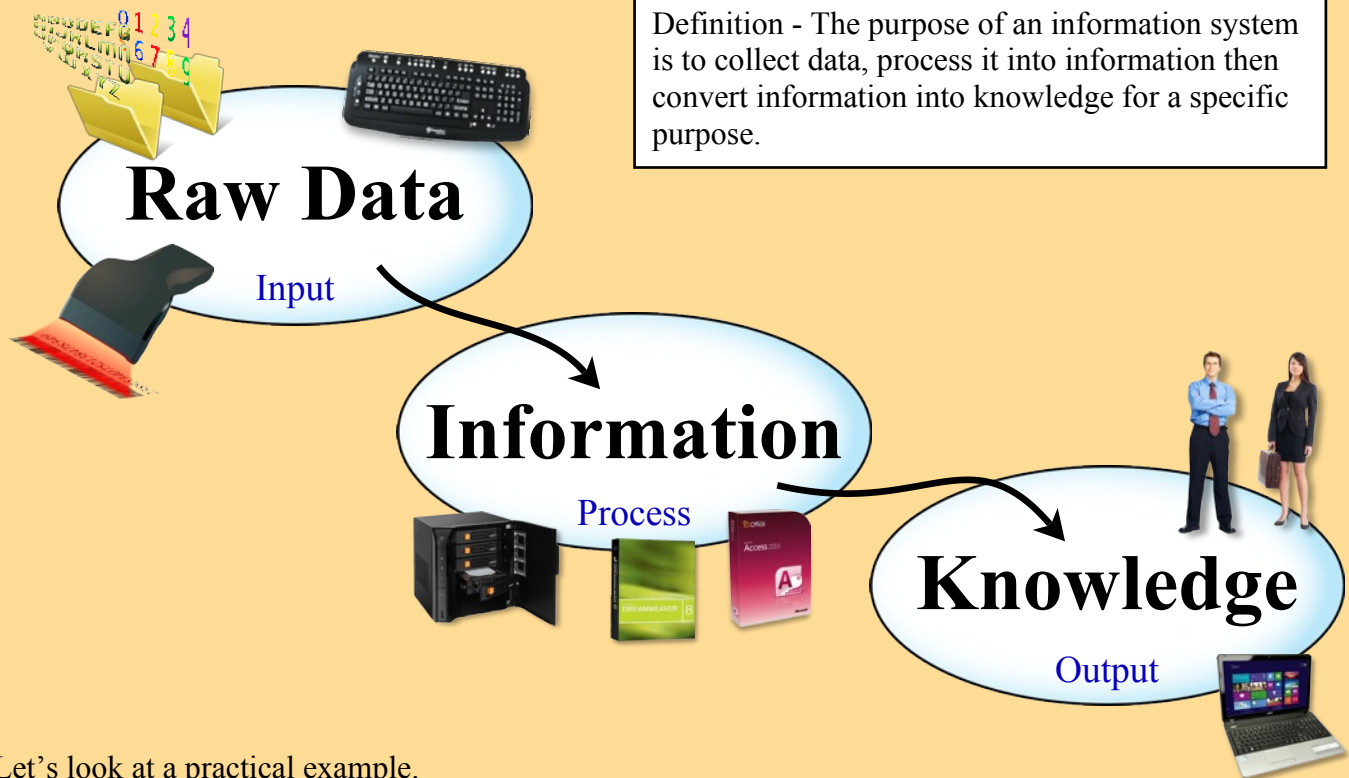
Let's look at a practical example.

A shoe shop has a computerised information system to store information about its products, transactions, staff and the building. Below are four example of the type of data, information and knowledge we could expect to see in a shoe shop's information system.

	Shoes	Payments	Staff Hours	Shop
Raw Data	Nike Air Running Size 10 £45.99	£19.99 10.33am, 26/8/13 Bank of Scotland 7536928, 82-34-97	8 7 9.5 9	£12.35 12 High Street 2/9/13
Information	Size 10, Nike Air running shoes cost £45.99	On the 26th August 2013 the shop sold £1298.45 worth of stock.	4 Staff worked for 33.5 hours on the 3rd May 2012.	The electricity bill for the shop on the 2nd Sept 2013 was £12.35
Knowledge	1 pair of size 10, Nike Air running shoes in stock so order more soon.	This is a 5% improvement on the same day last year.	Hire part-time staff for 10 hours a week to avoid paying overtime.	By changing electricity supplier the shop can save 5% per month.

Knowledge is Power!

Computerised information systems are expensive to create and maintain. If they are well implemented, an information system offers access to knowledge that would previously have been difficult or impossible to come by. In business, this allows managers to make more informed decisions about how the company is run, saving both time and money. Information systems allow data to be accessed remotely and can be used to present data in ways that it can be understood by a variety of audiences.

N5

Task 10 - Exploring a Scenario

Read the scenario below and then attempt the task at the bottom of the page.

Edinburgh Castle Tennis Club are considering creating an information system to aid with the running of the club. They hire an Analyst, to assist in designing the system, who starts by asking the club secretary and club captain to list all the activities of the club. Below is the list they created.

1. Members -
   Each year, new and current members must complete an application form on paper and post it to the secretary. The applications form contains the name, age, address and type of membership for each member.

2. Tennis Courts -
   There are five courts at the club which can be booked by writing your name in a folder in the lounge. Booking slots are 30 minutes each. Two slots can be booked by members each day. League matches and training sessions have priority and are always pre-booked on the booking sheets. Junior members can only book courts before 6pm.

3. Finance -
   Membership fees for a year are as follows:
   Adult - £260
   Junior/OAP - £60
   Joint Adult - £450
   Family (2 adults, 2 junior) - £500
   Coaching fees per 1 hour session are:
   Adult - £4
   Junior - £3

4. Matches -
   There are six East of Scotland League Teams (2 mens, 2 womens, 1 under 18, 1 under 14) who play home and away alternate weeks. Matches are published by the Scottish Tennis Association.
   The club organises four Box Leagues for club players ranging fromexpert to beginner. League results are written on the club notice board in the lounge. There are three junior leagues as well.

5. Publications -
   The club publishes a monthly newsletter and yearly report following the Annual General Meeting.

Task - You are now going to be the Analyst. Write a letter to the club explaining how you can computerise some (or all) of the above. This may include the purchase of hardware, software as well as the creation of one or more information systems (database or website or both). Consider how data will be input into the system, how it will be organised and what additional knowledge the club may have access to following the implementation of your plan.

Note - you do not have to worry about whether what you suggest is possible. You're simply coming up with the ideas. Print out your finished, formatted and proof-read letter for your teacher to mark.

Expert and Novice Users of Different Ages

Information systems may have a variety of purposes and users, from the highly qualified expert working in a company to a young child playing on a website.

The method used to communicate with the information system (its interface) must be designed to take the expertise of the user into account.

An expert level interface will tend to be simple. It does not rely on bright colours and graphics to hold the users attention as this is of little importance to someone whose focus is to access data quickly and efficiently.

Experts may also wish to create their own ways of searching and editing the data in the information system. Set menus would limit how the data could be manipulated.
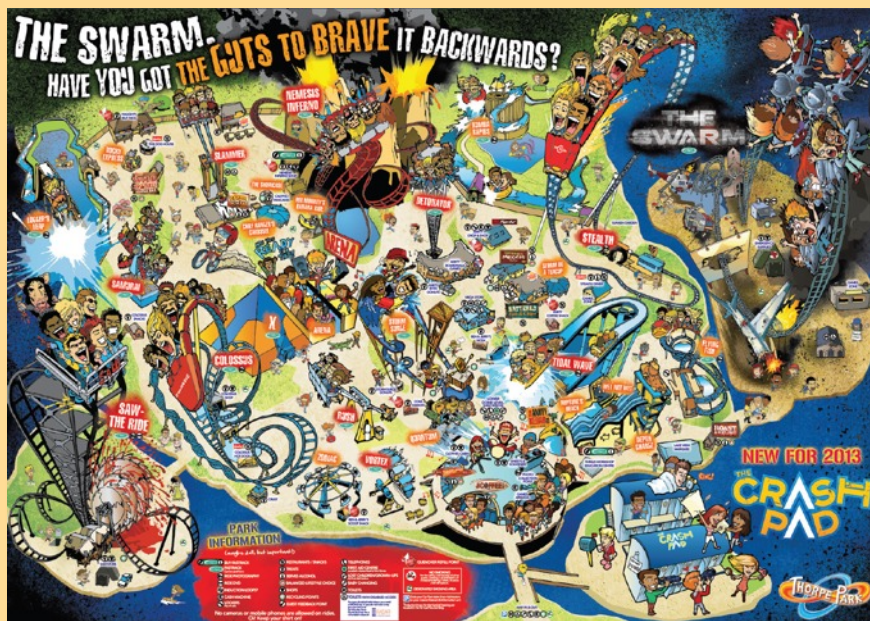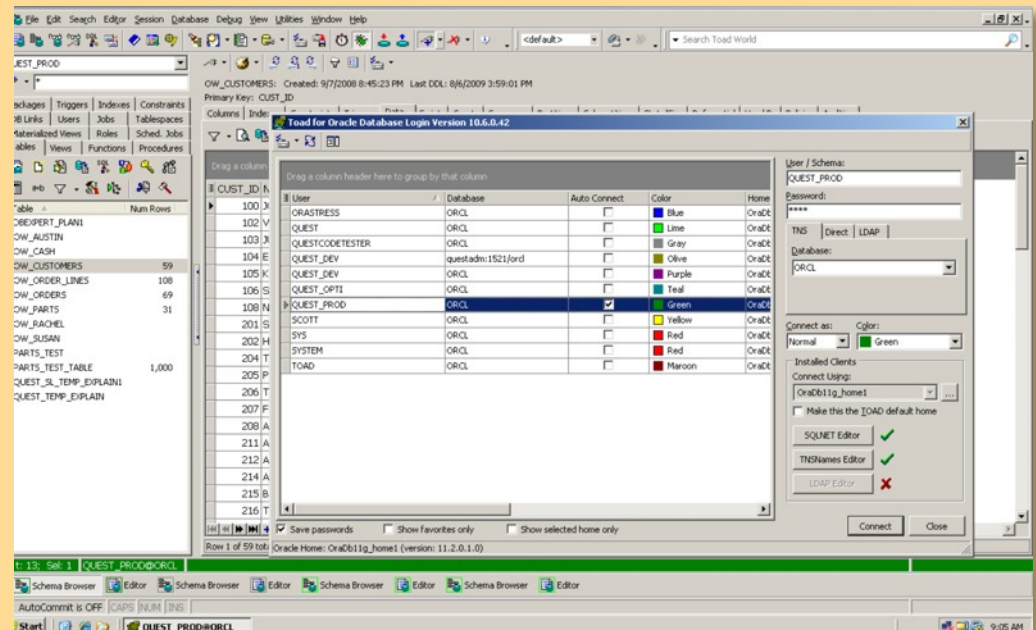
A novice (beginner) wants simplicity of use. The information system's interface will have limited, well explained options, colourful graphics and help functions built in.

It may into account things like the reading age of the user, size of text and accessibility for disabled users.

The interactive map of Thorpe Park shown here, allows users to access information about the theme park and only requires a mouse to use it.

Task 11 - Analysing a User Interface

Apple's iTunes Store is an example of information system. It's user interface allows customers to search through a database of music, films, TV shows and much more. The interface has several different sections.
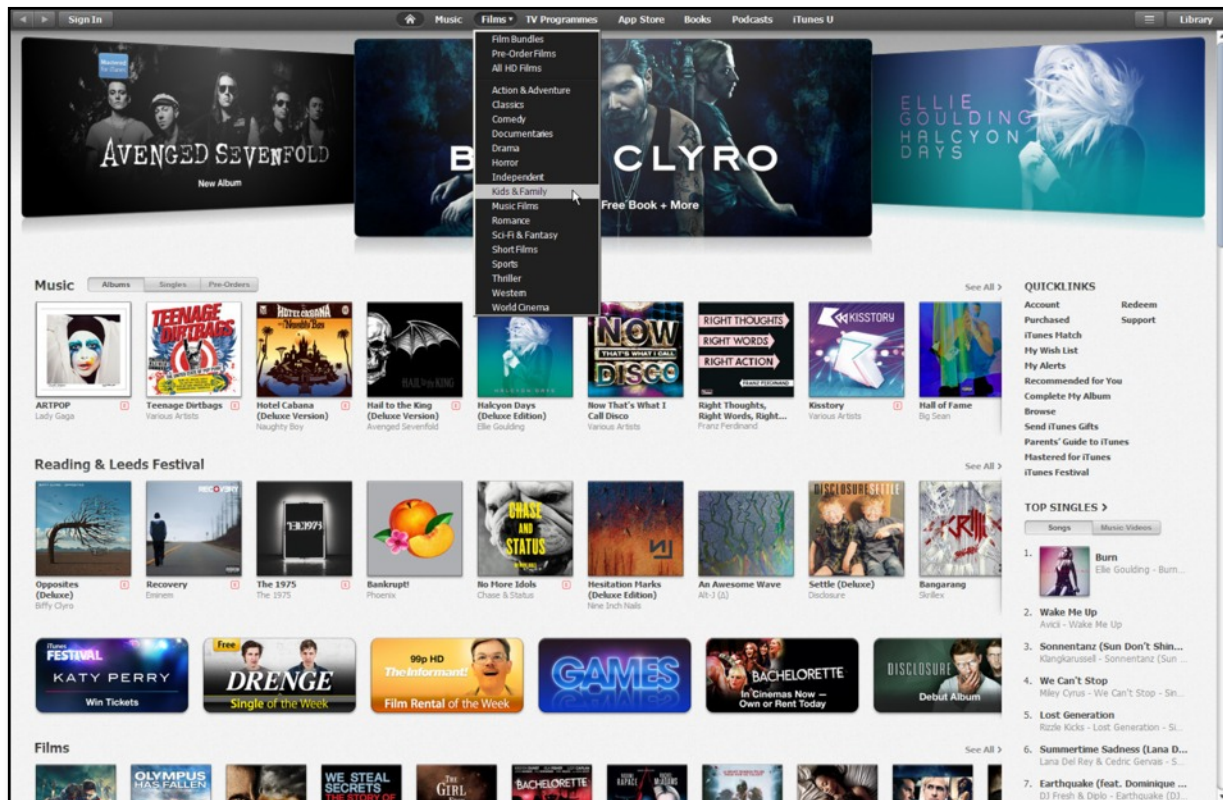
1. What input device has this user interface been primarily designed for?

2. Describe three aspects of the above Interface that make it suitable for novice users.

3. State why the above interface design would be unsuitable for use on a smart phone.

4. Identify a part of the user interface that allows the user to search the iTunes database for a specific category of music, for example "Classical".

5. How would a search facility with input boxes help expert users to find music faster?

Print out your answers. Your teacher will discuss this task with the class.

Target Audiences

The design of an info system's user interface must take into consideration the audience it's aimed at.

Example 1 - Very Young Children

As the majority of children don't learn to read until the age of 5, an information system designed for really young children will have little or no text. Bright colours may also be used to hold the attention of a really young audience.


Example 2 - Young Adults

With an older audience information systems may introduce increasingly large amounts of text. The website for the Xbox One only has a single colour. The graphics have a slick cool look to attract their audience of computer literate, console users.
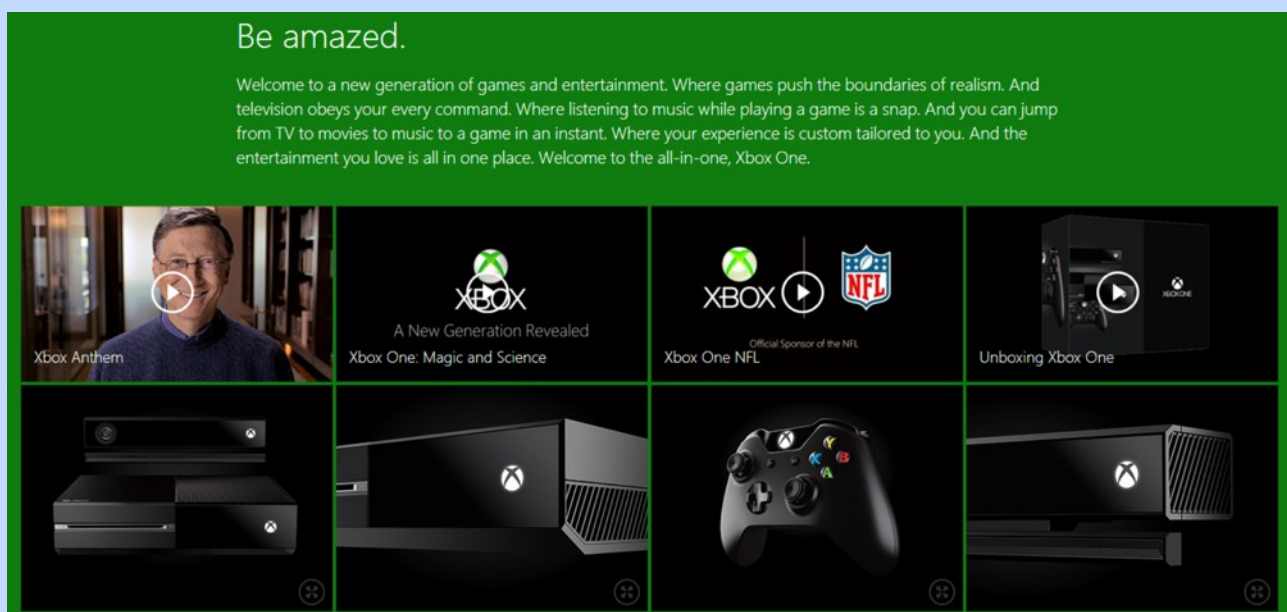
Example 3 - Subject Experts

Some information systems are designed for users who already have a great deal of subject knowledge. The level of language and terminology used may only be understood by a small percentage of the population.
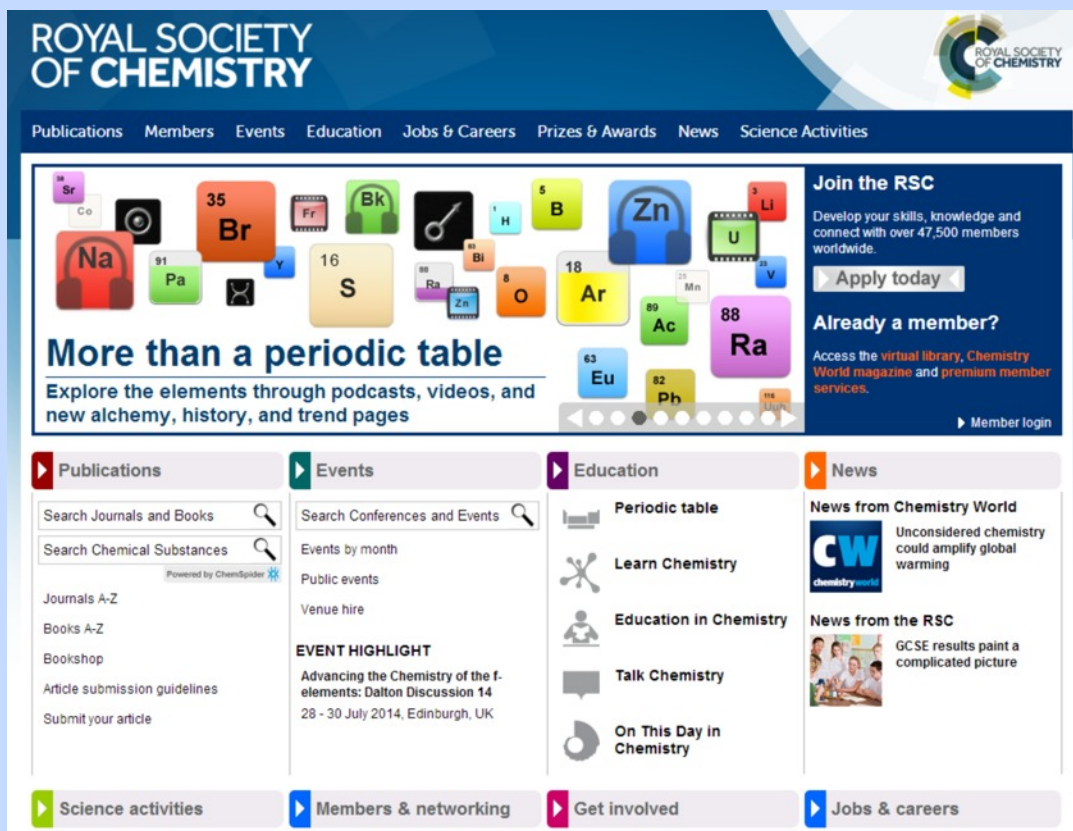
Example 4 - Older Adults

Older audiences are less likely to be concerned with the look and feel of an information system preferring quick, clear access to the information they are searching for. This may result in a more traditional, plainer look.

N4
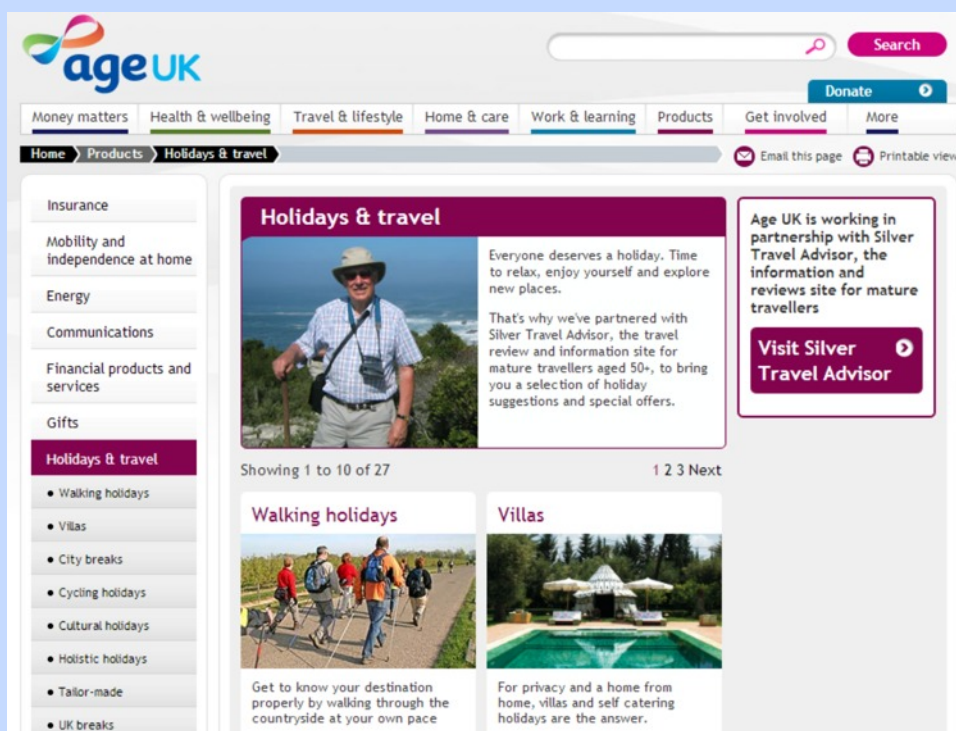
Task 12 - Designing your own User Interface

Using an appropriate software package, your task is to design a website home page for the 1970s cartoon series, Hong Kong Phooey. The design should be drawn on the computer in colour.

The content of the website will include the following:

- An introduction
- An episode guide
- A list of characters from the cartoon
- Background information on the writers and producers
- Famous quotations
- The theme tune
- The Hong Kong Book of Kung Fu

You will be supplied with a few graphics to get you started.

If you wish to include buttons and menus, you will have to design/draw your own.

Ensure your home page design takes the following into account:

- the age range of your audience (young, old, both)
- an appropriate colour scheme
- how will users use the interface to select options or hyperlinks (buttons, menus etc)
- will the above content be on other pages (in which case you will need to add clear links) or will it be on the home page

Print your finished design and submit it to your teacher.

Considering Different Users Requirements

N5

The design of a good user interface takes into account the huge variety of users that may access an information system. The following should be considered…
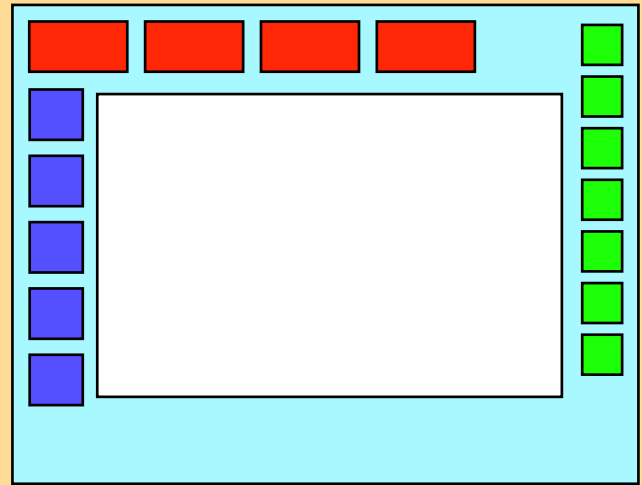
Visual Layout

A good layout can help a user locate objects on the screen, identify different areas easily and aid navigation.

It's important to group similar objects together. Imagine that the boxes below represent objects in your user interface (tools in a toolbar, buttons linking screens). Objects with the same colour are from the same group.
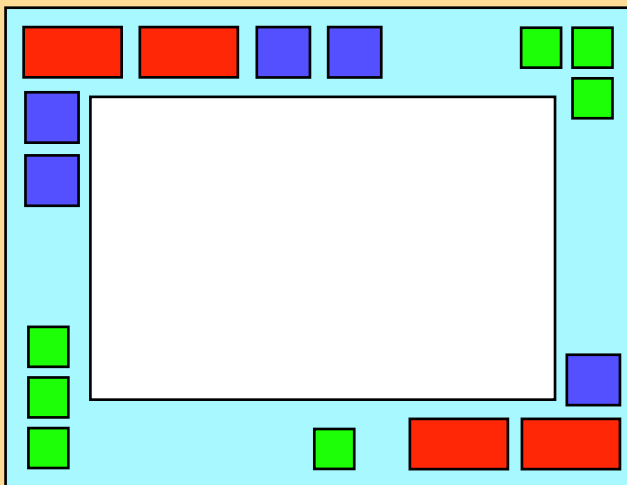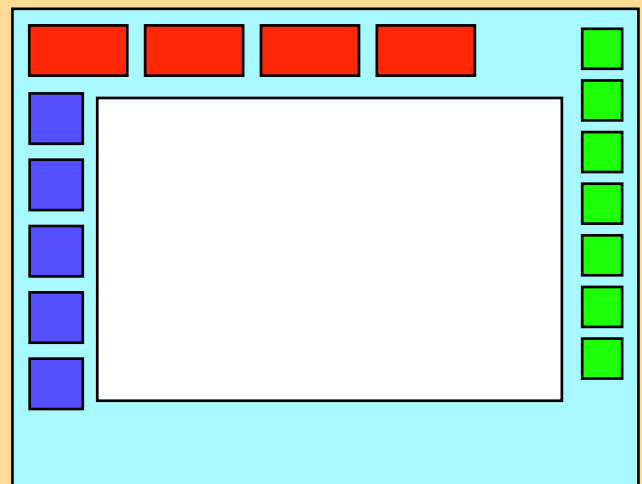
Poor layout - difficult to locate objects.

Good layout - by grouping objects they are easily located by the user.

Visual consistency is achieved by matching the appearance and size of similar objects.
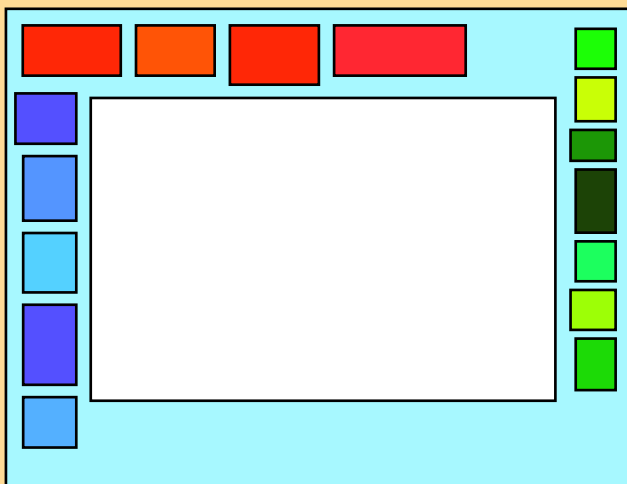
Poor example - no consistency

Good example - excellent consistency

A lack of consistency creates confusion as the user has to concentrate to identify groups of objects.

Laying objects out in a grid pattern also improves the visual layout of an interface. This again helps the user locate similar items such as menus, dialogue boxes or control panels.

However, care must be taken to ensure that the grid does not become too cluttered as this then reduces the effectiveness of the layout. Between 5 and 9 divisions in the grid are recommended.
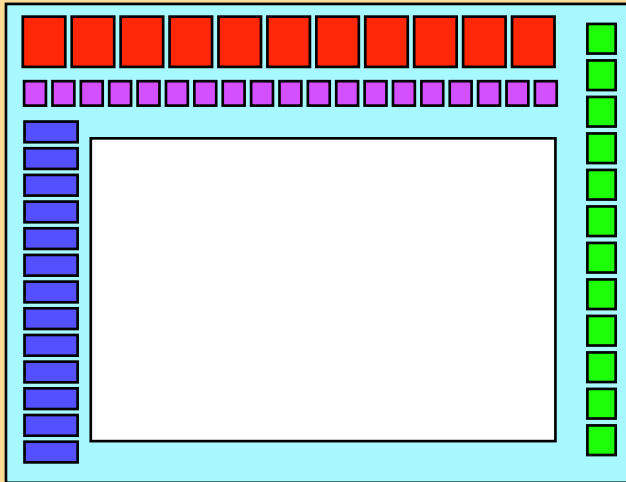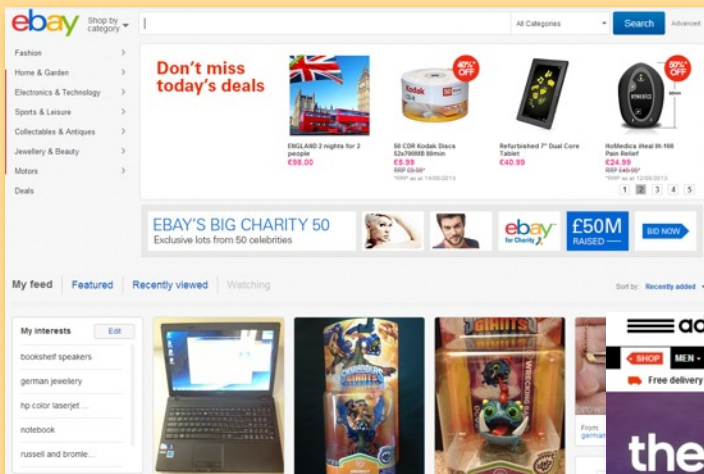

Too many objects, so difficult to find options.
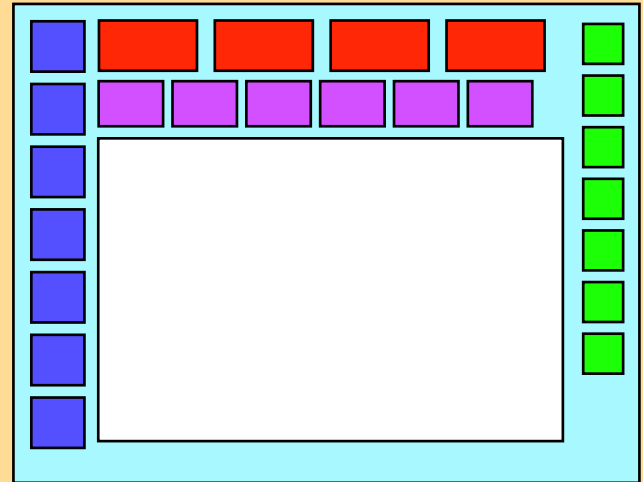
Just the right number of options.

Once you understand the theory you can begin to see it in practice when you look at user interfaces.

ebay - Layout arranged in a grid of rows and columns. Menus have a consistent look throughout the page. The graphics in each area of the screen are the same size.

Adidas - Again the rows and columns of a grid layout can clearly seen. Menus have a consistent look but note that this time each group of menus have their own identity. Graphics and menu columns are consistently sized.

Navigation

N5
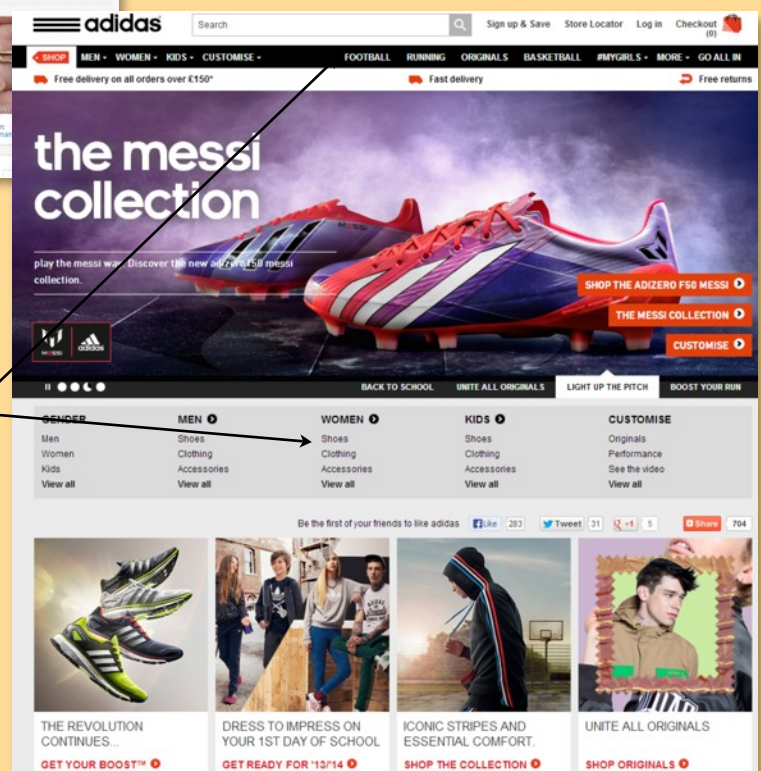
Below are five navigation rules that should be considered when designing a user interface.

1. **Navigation should be easy to find (really easy).**
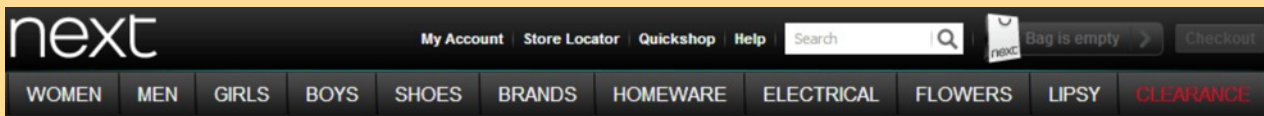
Often when people visit a website they are looking for something specific. The main navigation bar should clearly stand out and be the initial focus for visitors to the site. This is why many sites make this the first area you see at the top of the page.

2. **Keep it consistent.**

Navigation in a website should appear on the same place on every page. This makes it easier for the user to navigate through the site as they get used to it very quickly.

It should also retain the same style, type and colours throughout so that the user. Once the user has seen it once they can then identify it quickly the next time they look for it.

3. **Use obvious section names.**

The names you use in navigation bars and buttons should be immediately obvious to the user. You don't want your user to get frustrated trying to find something in your information system.

Websites use a common language in navigation that world wide web users are used to.
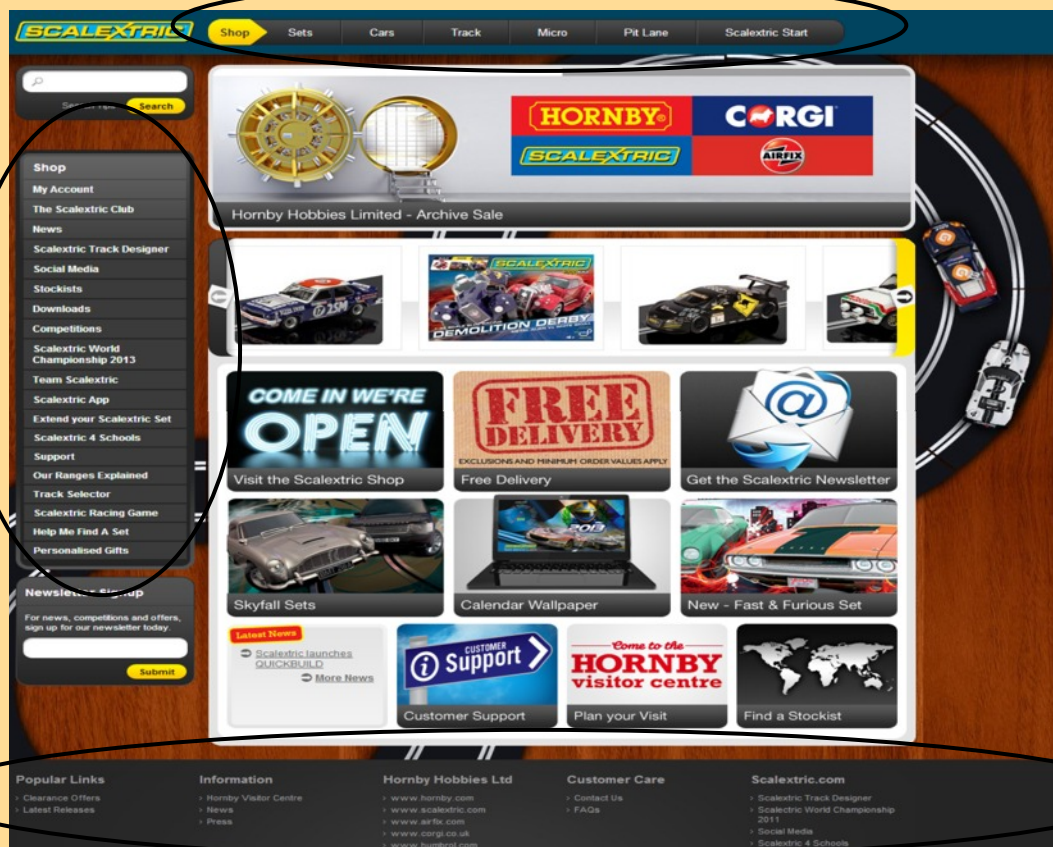For example:
- news
- about
- support
- download
- contact us.

4. **Less is more.**

Too many options in your navigation bar may just confuse your user.

Websites where members sign in often have three navigation bars. Links to the main sub-sections, access to users account details and at the bottom, one for legal disclaimers, contact details etc.

5. **Remind the user where they are.**

Design a consistent way of telling the user where they are in the site. For example, this can be done by changing the look or colour of a navigation bar option.
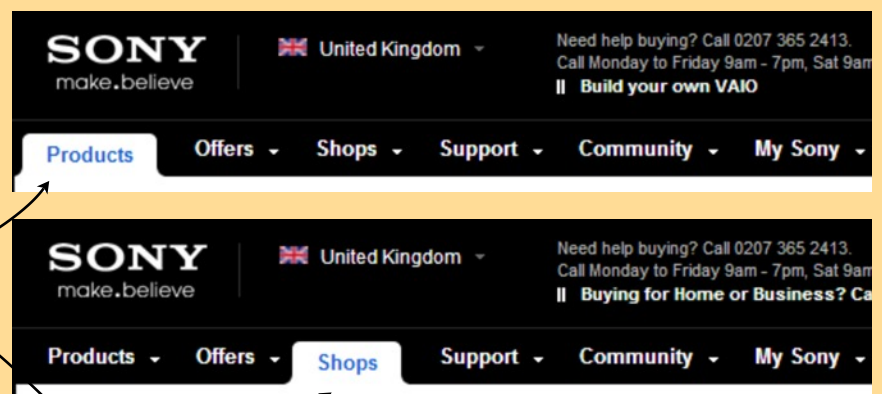
Selection

The method used to select objects and links in a website will vary according to the target audience.

For example, a younger audience may prefer large, colourful buttons while older, more experienced users will happily use drop down menus as they offer quick access to multiple options.
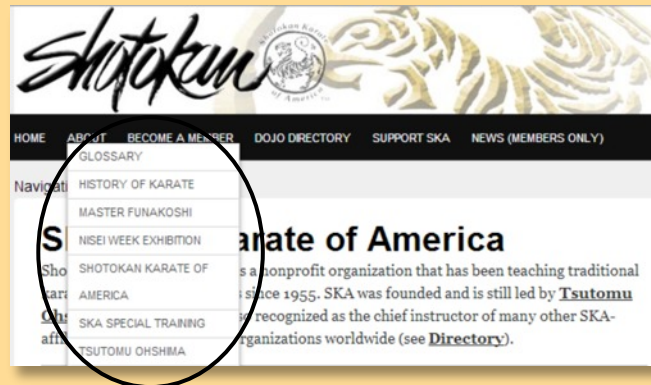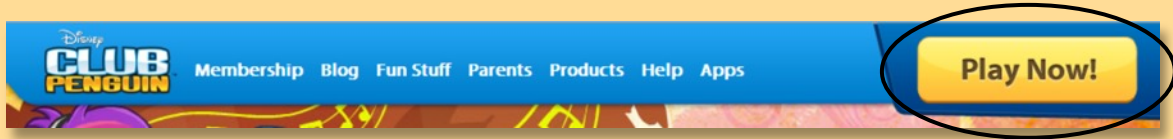
A variety of selection methods may also be used to input data into an information system.

New Member Entry Form

Name:

Greg Reid

Text entry.

Address:

911 Police Avenue

Nicked Street

Bangedup

Please select an age range:

Radio buttons are used to select a single option from a list.

- Under 18
- 18 to 25
- 26 to 32
- 33 to 44
- 45 to 49
- 50 to 65
- Over 65

Please indicate your preferences:

- ☒ Contact by e-mail
- ☐ Contact by post
- ☒ Contact by home phone number
- ☐ Contact by work phone number
- ☐ Contact by mobile phone number

Check boxes allow multiple items to be selected from a list of options.

Sex

- ◉ M
- ○ F

Subscription Payment Method

Cash
Cheque
Internet Banking
Direct Debit

A drop down menu is used to select a single item from a list.

It has the advantage of using less space than a collection of radio buttons but the disadvantage of not being able to glance at the all options before you have selected the menu.

N5

Consistency

There are three types of consistency a user interface designer will aim to achieve.

1. Internal consistency. As previously mentioned, the appearance and layout of objects such as navigation and content should be the same throughout the information system.

2. External consistency. Information systems should be designed to match recognised conventions. You would not expect to find the main navigation bar down at the bottom of the page or screen.

3. Real world consistency. A user interface should take account of users' experiences in the real world.

    An information system that plays music or video will make use of the standard symbols for play, pause, fast forward etc.

Interactivity

The amount of interactivity in a website depends on the purpose of the information system and the user the information system is targeted at.

An information system with limited interaction simply supplies information to the user. The only interaction will be the ability to select the information you wish to view.

Further interaction may be added by requiring the user to respond to events. A game would be the ultimate example of this as constant input is required.
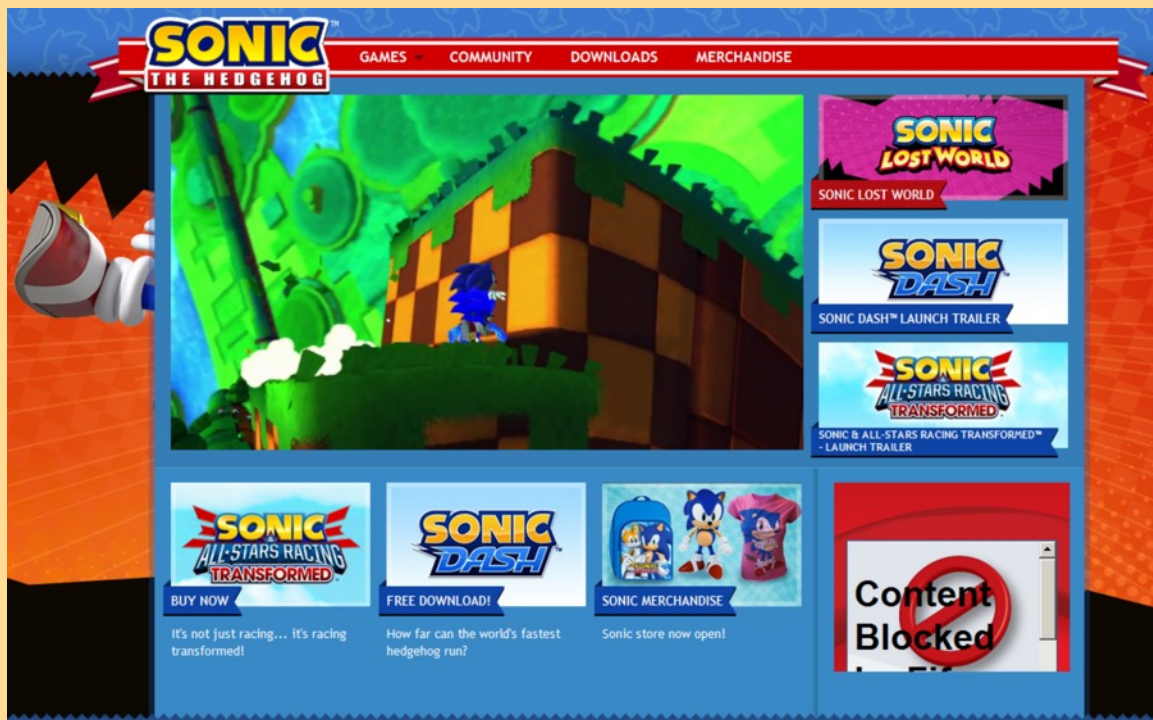
Readability

The readability of pages of text is a measure of how difficult the text is to read. This is determined by a number of factors including:

- the average number of words in each sentence

- the average number of syllables in each word of the text

- how often the words are used in things that we read every day

- the frequency of technical language in the text

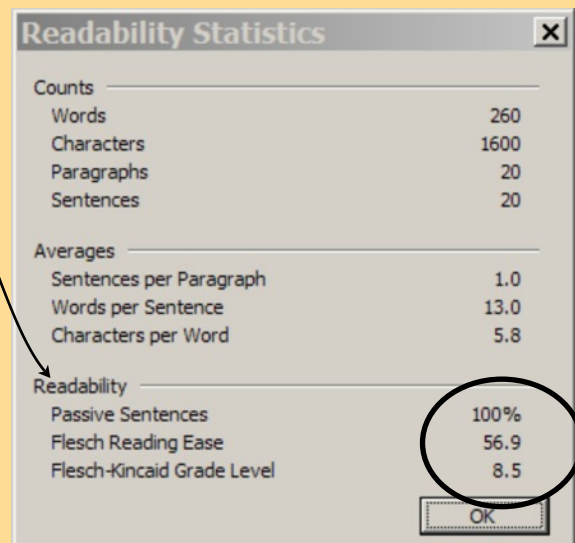- The size of the text and font used
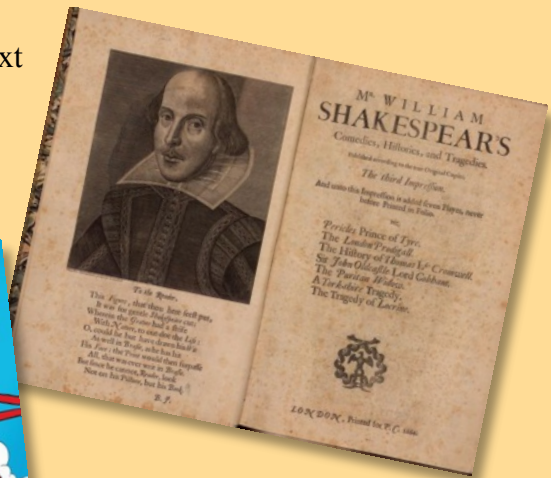
A great deal of research has been done to find ways of measuring the "readability" of a passage of text. Modern word processing applications often have the facility to measure the reading age of text that has been typed into a document.

In Microsoft Word, the Flesch-Kincaid scale is used to produce the window shown.

The "Flesch Reading Ease" value can be matched to the table below.

Score	Notes
90 to 100	Can be read by the average 11 year old.
60 to 70	Can be understood by most 13 to 15 year old
0 to 30	Best understood by university graduates.

Readability Statistics

Counts
Words	260
Characters	1600
Paragraphs	20
Sentences	20

Averages
Sentences per Paragraph	1.0
Words per Sentence	13.0
Characters per Word	5.8

Readability
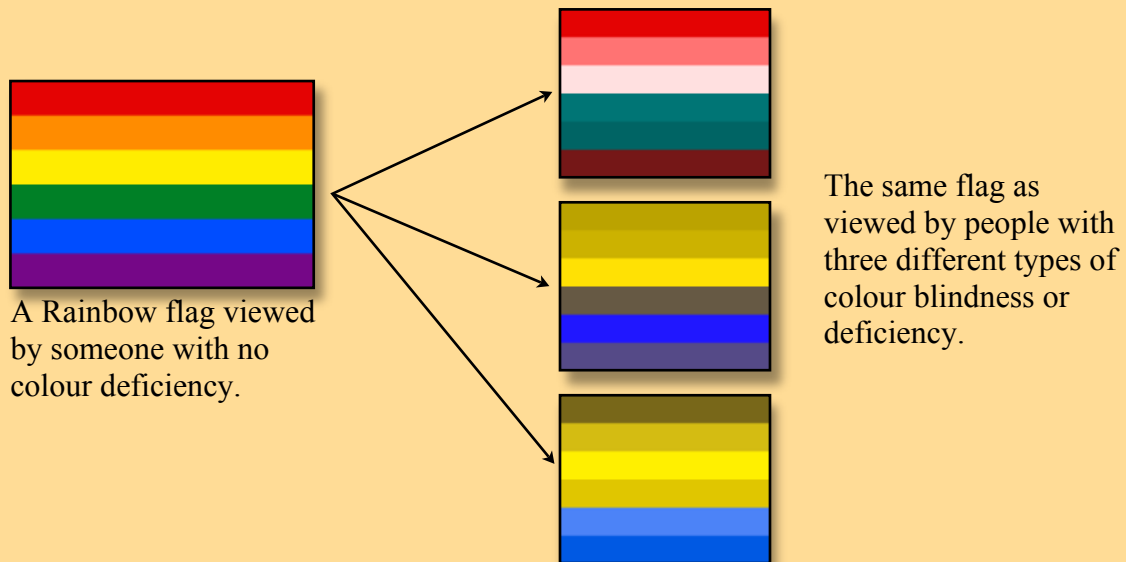|	
Passive Sentences	100%
Flesch Reading Ease	56.9
Flesch-Kincaid Grade Level	8.5

OK

The text created for an information system should be matched to the intended audience by checking it's readability using a facility like the one above. If it is too easy or too difficult to read, the text should be edited. This can be a difficult skill to learn.

Taking Disability into Account

There may be a variety reasons that a user may find it difficult to access a user interface. A user interface designer may have to take account of the following:

1. **Sensory Disability**

   Colour Blindness is a deficiency in the eyes that prevents people from perceiving certain colour differences. Colour blindness affects around 8% of men and 0.5% of women.

A Rainbow flag viewed by someone with no colour deficiency.

The same flag as viewed by people with three different types of colour blindness or deficiency.

The two main categories of colour blindness are Red-Green and Blue-Yellow where individuals find it difficult to tell the difference between these pairs of colours.

Colour blindness is easily taken into account by avoiding certain colour combinations in a user interface. For example, never have green icons on a red background.

Vision Impairment can vary from partial loss of sight to complete loss of vision. Here are five techniques to ensure a user interface is accessible.

1. Ensure text is not too small.
2. Make sure that foreground and background colours contrast. ⟶ | Bad | Good |
3. Take care when using certain colours (see colour blindness).
4. Allow mobile versions of interfaces to be viewed on larger screens.
5. Build keyboard shortcuts into your interface to reduce mouse use.

Hearing Impairment may also be an issue if the information system contains video or sound clips. Subtitles may have to be added to include users with this disability.

A manatee and her baby.

N5
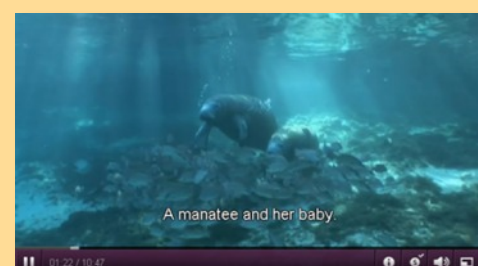
2. **Physical disability** includes anything that involves limited or lack of motor control in the hands and arms. This may prevent or hinder a potential user from selecting items or inputting data.

There are many devices that allow physically disabled users to communicate with a computer but they are often replacements for keyboards.

Large button keyboard

Eye Tracking (senses where on the screen a user is looking)


Head pointer

Toe Mouse

An effective way of ensuring an interface is compatible with physically disabled users is to ensure that the keyboard can be used to select and input data throughout the information system.

3. **Intellectual disability** covers a broad range of cognitive problems from learning difficulties to brain injuries.

There are several simple techniques you can use to make your information system easier to understand.

- Use shorter sentences with simple punctuation and natural language (write as you would speak. Ensure your text is displayed in a nice clear, easy to read font.

- Use pictures and diagrams to back up or explain passages of text.

- Use the ALT text option on graphics. This shows some text explaining the graphic when you hover the mouse over it.

- Add a spoken version of your text for users with poor literacy skills.
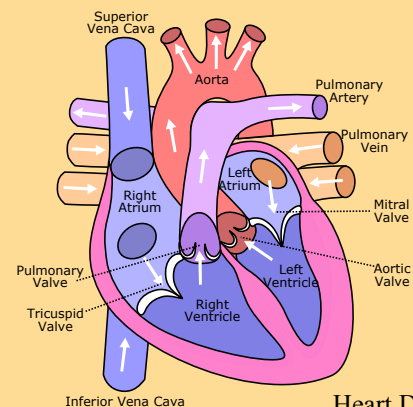
Heart Diagram

Headset to record text

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Task 13 - Analysis of a User Interface

In the final task you are going to write an report on a user interface.

Your report should include analysis and discussion of the following:

- Age Range (target audience)
- Visual Layout
- Navigation
- Selection
- Consistency
- Interactivity
- Disabled Users
- and Readability

Ensure you view the entire information system as a home screen or single page on its own will limit your ability to discuss some of the above bullet points.

_____

Note:

If your teacher does not select an information system for you to analyse then you may use the website below. Use a search engine to find the site.