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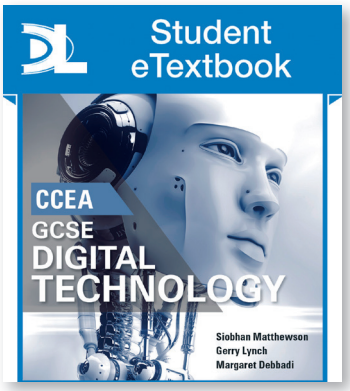

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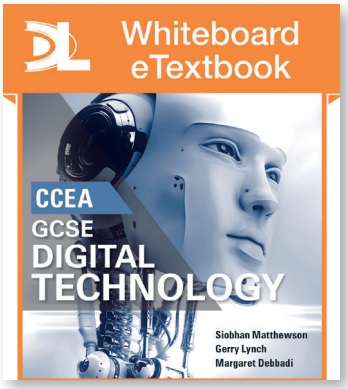

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UNIT 2 DIGITAL AUTHORING CONCEPTS

UNIT 3 DIGITAL AUTHORING PRACTICE

Features in the book:

CONTENTS

Simple layout helps students find the information they need for the Core compulsory unit and the optional units

Chapter 1 Digital data

What this chapter covers

- Representing data
- Representing images
- Representing sound
- Data portability

Topics covered in each chapter are clearly displayed at the start to help students track their progress through the course

Representing data

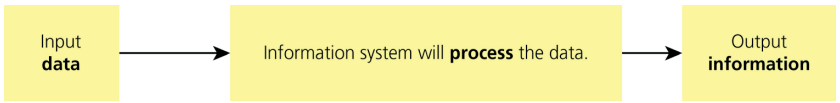
Difference between information and data

Data consists of raw facts and figures with no meaning attached. When data is processed (or given meaning) it provides us with **information**. Therefore, we can define information as 'data with meaning'.

For example, in the table in the margin, the number 62351 is data, but when we add meaning to this sequence of figures, such as 'Product number 62351 is a 2 TB portable hard drive', we provide information.

Product number	Product description
24315	32 GB USB flash drive
62351	2 TB portable hard drive

An information system, consisting of hardware and software working together, takes data as input and converts it into information. Therefore, an information system *processes* data and produces information.



An information system

Clear and colourful diagrams build understanding and act as useful revision aids

Storing data

Computers store data in digital format. This is done using a number system known as binary. A **Binary digIT** (also known as a bit) has a value of 0 or 1 and is the smallest unit of computer storage. When bits are grouped together (typically in groups of eight) they are referred to as a byte. A single **character** (such as a letter or a digit) is represented by one byte (or 8 bits). Therefore two letters (or two characters) are represented by two bytes (or 16 bits). A nibble is four bits, therefore two nibbles is equal to one byte (or 8 bits).

Key terms are highlighted throughout and defined in the glossary, building students' understanding of technological terms

The storage capacity of a computer's memory is measured in bytes. Multiples of bytes are referred to as:

1024 bytes	1 kilobyte (kB)
1024 kilobytes	1 megabyte (MB)
1024 megabytes	1 gigabyte (GB)
1024 gigabytes	1 terabyte (TB)

These terms are usually used to describe data storage capacity and computer memory. Therefore we use these terms to describe the capacity of USB flash drives and hard drives used in typical computers.

Characters are classified as letters, digits and punctuation marks. Each character is a byte (or 8 bits). A commonly used character set is ASCII (American Standard Code for Information Interchange). Every character in the set has a unique binary pattern (or byte) as shown below.

01000001 A	01100001 a
01000010 B	01100010 b
01000011 C	01100011 c
01000100 D	01100100 d
...	...

Data types

In order to optimise a computer's processing power, data needs to be stored in the most appropriate way. In order for this to happen, data must be defined as a certain type before it is processed.

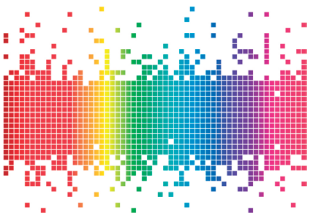
Data type	Description
Numeric	**Integer numbers**: an integer can be a positive or negative whole number, which has no decimal or fractional parts. **Real numbers**: real numbers include whole numbers (integers) and numbers with decimal/fractional parts. Real numbers can be positive or negative.
Date/Time	This determines the way that the date or time appears when it is displayed or printed by a computer. You can use a predefined format that already exists in the software or create your own customised date and time formats. Examples of predefined formats: Long date — Displayed as Saturday, April 1, 2018 Medium date — Displayed as dd-mmm-yyyy Example: 1-Apr-2018 Short date — Displayed as dd/mm/yyyy Example: 01/04/2018 Long time — Displayed as hh:mm:ss Example 13:26:34 Medium time — Displayed as hh:mm PM/AM Example 01:26 PM Short time — Displayed as hh:mm Example 13:26
Character/ String	A character is a single letter or digit represented by codes from the character set used by the computer (such as ASCII). A string is textual data in the form of a sequence of characters from a character set. This could be in the form of a word. A string will have a variable number of characters.

Tasks

1. How many bits are there in 5 kilobytes?
2. How many characters are there in the word 'digital'?
3. Which of these numbers are 'real numbers'? 2, 3.5, -4.6, 7, 21, 99.2
4. Which of these are 'integers'? 5.34, -4, -89, 2.1, 678

Representing images

A **pixel** (usually represented by a dot or square) is the smallest unit of a digital image that can be displayed and edited on a computer screen. Each pixel can have its own individual colour and when pixels are combined together they produce a complete image. The number of pixels on a typical computer screen depends on the size of the screen and the graphics card used by the processor.



A number of pixels are put together to provide an image. Each pixel can be a different colour.

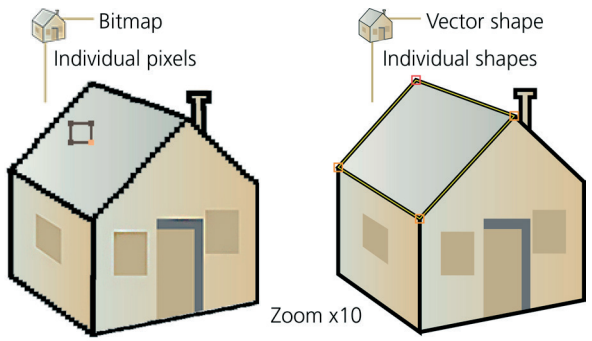
When an image is created using pixels, each pixel is stored as a series of binary digits. The number of bits used to store a pixel depends on the range of colours used. For example, to use 256 different colours for a pixel will require 8 bits for a pixel to be stored (28 = 256).

Image resolution tells us the quality of an image. The greater the number of pixels used in an image, the higher the **resolution** and the sharper the image. However, higher resolution images need more storage space. Image resolution is represented by two numbers, such as 1280 x 720. The first number is the number of pixels displayed horizontally and the second number is the number of pixels displayed vertically. The position of a pixel in an image is given using a system similar to (X, Y) coordinates.

Bitmap and vector-based graphics

Bitmap graphics

Bitmap graphics are made up of a grid of pixels. If you use your mobile phone to take a photograph, or you scan a picture into your computer, you are creating a bitmap image. The higher the resolution of the mobile-phone camera you are using to capture the image, the higher the quality of the image will be. In other words, the more pixels, the better the resolution of the image. This will also require more storage space to save the image.



Bitmap and vector-based graphics

Bitmap graphics store details about every individual element (pixel) of the image and since each pixel could have a different colour, this means an image can be very complex. Because the computer has to store every pixel, the file size of a bitmap image can be very large. Large bitmap images can take a long time to load from the computer's memory. Bitmap images can be compressed to reduce the file size but this may result in a loss of quality.

When you zoom in to or enlarge a bitmap image, pixelation can occur. This means that the pixels become larger on screen and look like a number of small blocks put together. This is the reason why bitmap images are poor quality when enlarged too much.

Vector-based graphics

Vector-based graphics are not made up of a grid of pixels. Instead vector-based graphics store information about the components that make up an image. These components are based on mathematical objects such as lines, curves and shapes. This means it is possible to edit these objects separately, for example by changing the colour, size or the position of the object.

Vector-based graphics do not depend on resolution for quality. Because they store details about the shape of individual image objects they require less storage capacity compared to using pixels. This means they can be saved as smaller files and can be easily edited without loss of quality. Since vector-based images are not made up of a grid of pixels, they can be enlarged and not lose image quality.

Buffering and streaming a video

A large video can take a long time to download from the internet. **Streaming** is a process that allows video to be viewed on a website or app straight away, without having to wait for the full video to be downloaded. Using streaming, the user can start watching the video as it downloads in 'real time' rather than downloading and permanently storing the complete video to be watched later.

A **buffer** is an allocated part of memory that is used to store a downloaded part of the video before it is watched. When a user is watching a video, a buffer is used to download the next part. This helps to prevent possible disruptions in streaming while the video is playing, for example if the speed of the internet connection is inconsistent or if the internet connection is temporarily lost. Buffering helps to improve the streaming experience.

Representing sound

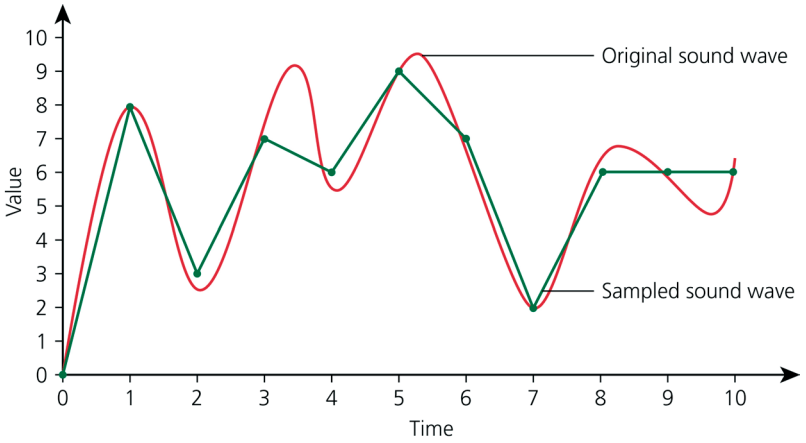
Factor	Description
Sample rate	This is the number of audio sound samples captured every second to represent the sounds digitally and is measured in Hertz (Hz). The more samples that are taken per second the more accurate the digital representation of the original sound (resulting in higher quality sound) and the shape of the sound wave is captured more accurately.
Bit depth	Bit depth is the number of bits used to store each sound sample. Higher quality sound requires a higher bit depth. Bit depth is usually 16 bits on a CD, which has a resolution of 65 536 possible values (216). Bit depth is higher on a DVD which is usually 24 bits.
Bit rate	Bit rate refers to the quantity of data measured in bits that is processed in a given amount of time. This is usually in kilobits per second. For example, a typical iTunes song stores 256 kilobits of data in every second of a song.

▲ Factors affecting the quality of sound when it is recorded using a computer.

Analogue to digital conversion

An **analogue signal** is described as a continuous varying signal that represents a physical quantity such as sound. Before a computer can process analogue signals (in this case, sound waves) they need to be converted into a digital format (binary). For this to happen, the sound first needs to be captured by an input device, such as a microphone, and then converted to a digital signal using an analogue to digital converter (ADC).

An analogue to digital converter will sample a sound wave at regular time intervals. If the number of sound samples per second (sample rate) is low, there will be a loss of audio quality because the samples do not show what the sound wave is doing in between each time sample. To ensure the original sound is maintained, sampling per second should be increased. The frequency at which samples are taken is known as the sample rate, measured in Hertz (Hz) (see above).



▲ How a sound wave alters when converted from analogue to digital

Data portability

Data portability is the ability to transfer data from one computer to another or from one software application to another without having to re-enter the data. Different types of data need to be stored using particular formats to ensure data is portable between different software applications or different computer systems.

File format	Detail
JPEG	JPEG (Joint Photographic Expert Group) files support the compression of images. The level of compression can vary and can be controlled by the user. Higher compression will reduce the quality of the image but decrease the file size (hence making the image load quicker). JPEG images are often used on web pages.
TIFF	TIFF (Tagged Image File Format) files store bitmapped images. This file format allows the image to be portable so it can be moved between a Windows (PC) and an Apple environment. TIFF image files retain their quality but larger file sizes compared to JPEGs.

Features in the book:

Accessible explanations of key content and concepts guides you and your students through the 2017 specification

File format	Detail
PNG	PNG (Portable Network Graphics) allows data compression of bitmapped graphics. PNG format was developed to support the sharing of graphics via the internet whilst maintaining the quality of the image.
PICT	PICT files are the standard file format for Apple graphics. They can support graphic interchange between both bitmapped and vector-based graphics.
GIF	GIF (Graphics Interchange Format) supports bitmapped image file formats. This format uses a form of compression that does not degrade the quality of the image. These file sizes are relatively small and therefore take up less storage space. They are also suitable for inclusion on web pages. Animated GIFs combine a series of GIF images and display them one after the other.
TXT	TXT file is a plain text document that contains no text formatting. It is stored as a 'text' file and can be opened by any word-processing program to allow for text editing.
CSV	A CSV (comma-separated value) file is a text format file used by database and spreadsheet applications. For example, in a spreadsheet, each line in the CSV file corresponds to a row in a worksheet. Within the line of CSV text, columns are separated by commas. The CSV files are often used for moving tabular data between a spreadsheet and a database.
RTF	RTF (Rich Text Format) format is used for text-based documents and supports basic formatting. It allows the movement of text files between different word processors and different operating systems. Documents scanned using the OCR facility of a scanner are usually saved as RTF documents.
MP3	MP3 is file format for compressing a sound file to decrease the file size for storage and at the same time keeping the original level of sound quality when the sound file is played.
MP4	MP4 is similar to MP3 but it a file format that compresses both sound and video to decrease the storage size. It can also be used to store other data such as still images and text subtitles. This file format also allows data streaming across internet.
MIDI	MIDI (Musical Instrument Digital Interface) is a communication protocol that allows sound samples to be interchanged between different digital musical instruments.
MPEG	MPEG (Moving/Motion Picture Experts Group) refers to a group of experts who developed standards for compressing digital video.
AVI	AVI (Audio Video Interleaved) is a multimedia file format created by Microsoft® for Windows® software. AVI files can contain both audio and video content allowing synchronous audio-with-video playback.
PDF	PDF (Portable Document Format) is a file format developed by Adobe Systems®. A PDF file can be created from a range of files including Microsoft Word® documents and PowerPoint® presentations. The PDF captures formatting used within a document so that when the document is opened the original fonts, images and the layout of the file is the same. Files are usually 'read only' and the contents cannot be edited. The PDF file generated is usually smaller in file size than the original file. A special piece of software is required to view or print the PDF file.
WAV	WAV (Windows Audio Waveform) is a file format standard for storing an audio bit stream on PCs. A WAV file is uncompressed audio file format.
WMA	WMA (Windows Media Audio®) is an audio data compression file format developed by Microsoft for Windows Media Player®.

Data compression

When we include images on webpages it is important that these images can be downloaded in an acceptable time. When creating and editing graphical

images it is important to consider how the final graphic will be distributed when deciding what file format to save the graphic image in.

To ensure that we maximise the potential of these aspects it is important to reduce the storage requirements of image files and audio files data, allowing uploading or downloading to and from the internet at faster transfer speeds.

Data compression is used to convert digital data to as small a size as possible while still maintaining the quality of the data contained in the file. Data that has been compressed takes less time to upload and download. There are two main types of data compression: lossy and lossless.

Lossy compression reduces the file size by removing some of the data, for example by reducing the number of colours used in an image. This can result in a small reduction in quality of an image. Once a file has been compressed using this method data is permanently lost. JPEG is an example of a lossy compression method.

Lossless compression maintains the quality of the file, so no data is lost. An example of this form of compression is the use of WinZip® software, which reduces file size by 'zipping' up a file, so it can be sent over the internet. The file can then be recreated (unzipped) exactly as it was before it was compressed.

Tasks

1 Distinguish between bit depth and bit rate when capturing sound for a digital device.

2 Define the purpose of an ADC.

Ready-made tasks test students' essential knowledge and skills required for success in the examined and controlled assessment units

Checkpoint

- Data is raw facts and figures. Information is data with meaning.
- Computers store data in digital format using the binary number system.
- ASCII is a character set used to represent letters, digits or punctuation marks in binary format.
- A bitmap graphic can be formed as a number of pixels. The more pixels the better the resolution of the image.
- A vector-based graphic is formed using mathematical objects such as lines and curves.
- Videos that are streamed can be viewed straight away as opposed to downloading before viewing.
- An analogue signal is a varying signal that represents a physical quality such as a sound wave.
- Text and graphics use standard formats to allow data to be portable.
- Data compression is the act of reducing the file size which will decrease transmission speeds.

Checkpoints provide a useful recap for students to consolidate their understanding

Practice questions

1 Using an example, distinguish between data and information. [4 marks]

2 Why does a computer use ASCII codes? [2 marks]

3 State three ways in which a date could be formatted as a data type. [3 marks]

4 Describe two differences between vector-based graphics and bitmap graphics. [3 marks]

5 Describe what is meant by the term 'pixelation'. [3 marks]

6 Explain how the number of pixels can affect the resolution of an image. [4 marks]

7 Explain how a buffer can assist in the process of video streaming. [4 marks]

8 Name and describe two graphic file formats. [6 marks]

9 Name and describe two text file formats. [6 marks]

10 Explain how data compression can assist in uploading a file to the internet. [4 marks]

Each chapter ends with a **practice questions exercise** to assess understanding, encourage progression and develop problem-solving skills

Marks awarded for each question provide students with the opportunity to practice their timings for the externally examined and controlled assessments

Answers will be provided online

Chapter 9 Ethical, legal and environmental impact of digital technology on wider society

What this chapter covers

- Legislation relevant to digital technology
- Ethical impact of technology on society
- Impact of digital technology on employment
- Digital-technology-related health and safety issues

Legislation relevant to digital technology

Consumer Contracts Regulations 2013

The Consumer Contracts Regulations 2013 specify the rights of customers when shopping online. They require online traders to provide customers with a full description of the products available, product prices, delivery charges, methods of payment accepted and information on how products can be returned. A customer has the right to cancel an order, and be given a full refund, for physical products (up to 14 days from the date received); if they download digital content they will not be entitled to cancel their order.

If a customer purchases DVDs or Blurays (high definition video or games discs) and breaks the security seal, they lose the right to cancel their order. This also applies to digital goods that are tailor-made by a company, such as a digital wedding album. Companies are also not allowed to charge for items customers place in electronic shopping baskets until the customer goes to the 'checkout' and agrees to purchase items. For products sold online that include digital content, the supplier must provide details on hardware and software compatibility.

Data Protection Act 1998

Personal data is data about an individual. The Data Protection Act 1998 controls how this personal information can be used by organisations. The legislation protects the rights of individuals whose data is being held. The Act has strict rules that must be obeyed when using and storing personal data and these are known as the 'data protection principles'. The main principles of the Data Protection Act 1998 are that personal data should:

- be processed fairly and lawfully with the consent of the data subject.
- be used for the specified purpose only.

- be adequate and relevant for its intended purpose.
- be accurate and up to date.
- not be kept for longer than necessary.
- be processed in accordance with the rights of the data subject.
- be held safely and securely.
- not be transferred outside the European Union without adequate protection.

Organisations which do not comply with the terms of the Data Protection Act 1998 can be prosecuted. It is therefore critical that organisations have procedures in place to ensure that data is held securely, that it is accurately maintained and that it is used appropriately.

Organisations are encouraged to have policies in place to ensure that any such data they hold is both accurate and up to date. Ensuring that data is up to date may involve regular contact with **data subjects**, asking them to verify currently held details. There should also be measures in place to protect the integrity and physical security of personal data held, such as access rights, firewalls and backup procedures.

Organisations should also provide regular staff training to raise awareness of data protection issues and their responsibility for ensuring the terms of the Act are complied with. Data subjects should also be made aware of their rights under the terms of the Act.

Organisations must employ a **data controller** who is responsible for controlling the way in which personal data is processed.

The government employs an **information commissioner** who is responsible for enforcing the Act and promoting good practice to organisations responsible for processing personal data, as well as making the general public aware of their rights under the Act.

Copyright Designs and Patents Act 1988

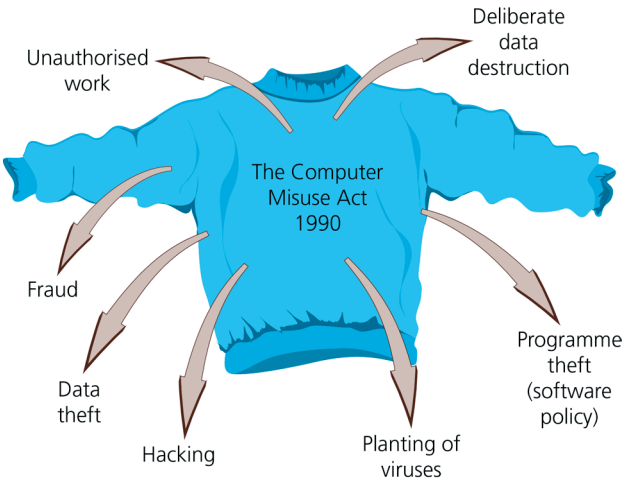
This Act is designed to protect the property rights of those individuals and organisations that create and produce material based on original ideas. Material of this kind is referred to as 'intellectual property' and this includes computer software. The Act helps to deter piracy – the illegal copying (or downloading) and distribution of software without permission.

Many organisations use computer networks to carry out their business activities. When they purchase a software package to install on their network, they must also purchase a **software licence** to cover the number of users (or computers) using the software. If the organisation wants more users to access the software package at a later date, then they have to purchase more licences. Any organisation distributing software without a proper licence is breaking the Copyright Designs and Patents Act 1988. Software producers can subscribe to organisations such as FACT (Federation Against Copyright Theft) to protect against illegal use of their software.

Enforcing and controlling the Copyright Designs and Patents Act 1988 requires an organisation to have policies ensuring employees are aware of the terms of the Act and the consequences of being in breach of it. The organisation is responsible for monitoring which employees have access to licensed software. Employees are only allowed to have authorised programs on their computers. Unauthorised software downloaded from the internet is not permitted.

Computer Misuse Act 1990

This Act is designed to protect users against computer misuse, including unauthorised access to computer systems and the deliberate hacking of computers to plant viruses or install malicious software such as spyware.



▲ Key aspects of the Computer Misuse Act 1990

The Act states that it is illegal to gain unauthorised access to change passwords and computer settings (to prevent users from accessing their accounts), or to modify software and data stored in a computer system.

Tasks

Use the internet to research examples of when these laws have been enforced.

Ethical impact of technology on society

Internet misuse can be seen across society:

- The theft of usernames and passwords, which are then used to access websites and make transactions, such as the purchasing of games or music.
- Piracy, where users illegally download copyrighted materials from the internet
- Phishing, where hackers use official-looking online adverts or emails to trick users into providing personal details.
- Websites created to promote violence and negative behaviour in society.
- Plagiarism, where students copy and paste materials for coursework assignments and sign it off as their own work.
- The misuse of the internet in the workplace, when employees spend too much time using the internet for personal use such as booking holidays.

This has resulted in the creation of 'acceptable use of the internet' policies that employees must agree to in their employment terms and conditions.

- Sharing of personal data between companies without prior permission, which is then open to misuse.
- Use of the 'dark web', which is a collection of websites that exist on an encrypted network and cannot be found by using traditional search engines. The searches may contain links to illegal material including terrorist activity.
- Use of pornography.

Our personal data can often be collected without us being fully aware of it:

- Loyalty cards used by supermarkets allow organisations to collect data about our shopping habits. This data is then used to inform their marketing and advertising departments.
- CCTV cameras monitor our activity in city centres and shopping malls.
- Mobile phones can transmit your geographical location at any point in time when you make or receive a phone call.
- By analysing credit or debit card transactions, customer information on shopping patterns can be obtained and sold on to third parties.

Social networking

Social networking involves subscribing to websites such as Facebook, Instagram and Twitter, to connect with others to share photos, videos and personal messages. Some individuals misuse these platforms by:

- searching for profile pages that contain personal information such as addresses or phone numbers. Problems can occur when users fail to manage their accounts to ensure no personal information is publicly available.
- posting racial and religious hatred (even though social networking sites discourage this use in their terms and conditions).
- stealing identities. Criminals can create an account to impersonate someone's identity with the intention of committing a crime. It can result in the victim being held responsible for the consequences of the crime.

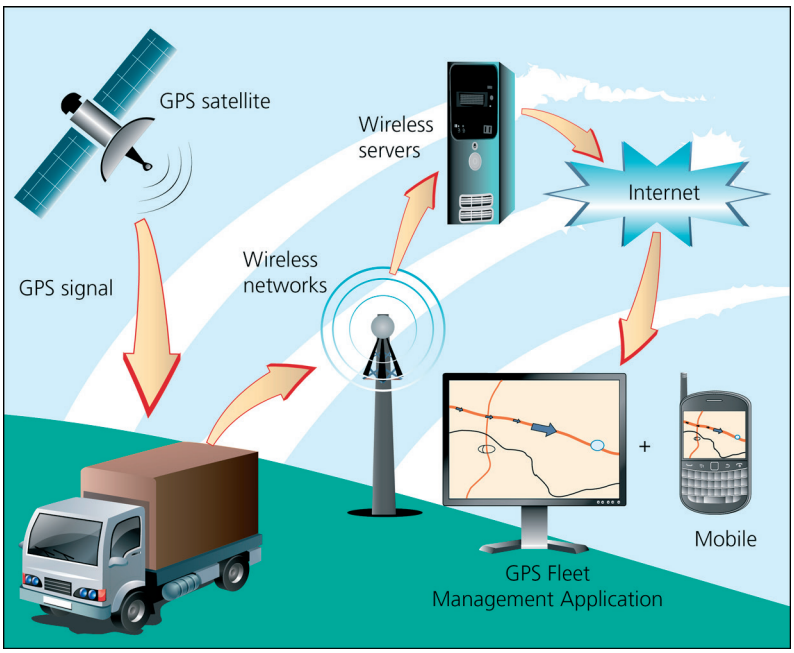
GPS (global positioning system)

GPS (global positioning system) uses a number of satellites orbiting around the Earth that provide real-time information such as the geographical location of an individual. When a user makes a mobile call or is driving a car with a GPS enabled, data about their location can be tracked. If this is done without consent, this can infringe on an individual's right to privacy.

GPS systems can also be used in a positive way by:

- helping to track individuals who need to be monitored through the use of a tracking device. This could be offenders who are on 'home arrest' or vulnerable patients such as dementia sufferers who could wander off and get lost.

- the tracking of buses, taxis and company vans to help monitor and inform customers of arrival and departure times of services and goods.



Data available anywhere at any time

The increasing uptake of cloud-based services, with cloud servers situated in different countries, has implications for the security and privacy of personal data. Privacy laws vary in different countries, for example EU (European Union) laws differ from those in non-EU countries. If personal data is processed in a country with less strict laws, this could adversely impact the security of such data.

Tasks

Research how different social media apps protect users' personal data.

Impact of digital technology on employment

Increased job opportunities

Digital technology is changing the world of work and is a major influence on increasing job opportunities. There are now more opportunities for employment in information technology (IT) with specialist jobs in hardware and software technologies:

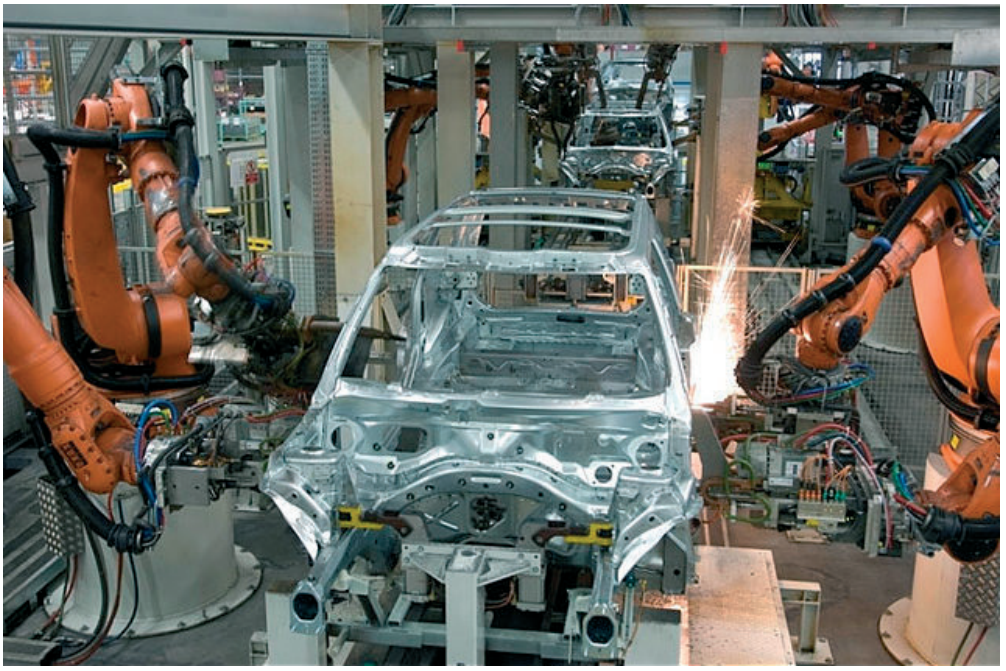
- Software engineers are required to develop and maintain programming code for new software. Larger organisations often employ their own in-house team(s) of software engineers. A typical software engineer will design, write and test programming code and is usually an integral part of a project development team.
- Digital media and design jobs include app and web designers, computer game designers and developers, computer-generated imagery (CGI) producers for the film industry and positions in audio and visual (AV) communication.
- There is a greater demand to protect people from hackers, online scams and fraud. This has led to more employment opportunities for forensic

computer analysts. These jobs focus on analysing business data ensuring that computer systems owned by organisations are secure from malicious attacks.

- Organisations such as banks and hospitals use database systems to store, manipulate, retrieve and backup information using database software which provides job opportunities for database administrators.

Job displacement

Modern countries have encouraged the development of technology skills in their workforces to help generate higher levels of economic growth. Therefore digital technologies have been introduced to many aspects of employment. This has changed the way some jobs are carried out. In manufacturing, for example, robots now carry out the work of a number of manual workers. Jobs that are highly repetitive and tedious for humans are often carried out by robots as in the car manufacturing industry, which uses robots for assembling and painting cars. In warehouses, heavy stock is moved from one place to another using computer-controlled forklift trucks.



An automated car assembly plant

Office clerical jobs now require greater use of generic software, such as databases and spreadsheets to store and manage data, and multimedia software to produce more professional documents and websites. These advances have led to organisations reducing specialised office staff and encouraging existing staff to learn new skills.

Tasks

Produce a list of new jobs created due to the developments in digital technology.

Changes in work patterns

The development in technology has led to changing work patterns for employees and their employers. The development of 'smart' technology such

as smartphones and the development of 'smart techniques', such as cloud computing, have been major influences on our work patterns.

As cities become more congested, the environmental pressure to reduce our carbon footprint has encouraged many employees to work from home rather than using transport to travel to and from their workplace. This also helps employers reduce their overhead costs as large offices do not require renting.

Teleworking is the use of ICT to work from home. Portable wireless technology such as tablets and other mobile devices, the internet and video conferencing allows more people to carry out their work at home. Employees can log on to a company's intranet from home and still be contacted at any time using instant messaging or email.

Because of the ease of contact between office and home for the home worker, the boundaries between home and work have become less defined and employees can find this difficult to manage. There is no clear cut-off point for the end of the working day if you are always contactable, especially if you work for a global company with workers in different time zones. Businesses who want to operate in the global marketplace must be available 24 hours a day, seven days a week because of the time difference between countries. This and the upsurge in 24-hour call centres has meant that employers are now using a 'global' work base where employees from other countries carry out tasks within the business. Local employees also have to work in shifts to cover daytime and night-time hours.

Need for upskilling

In a fast-changing technological work environment people require continuous training to enable them to carry out their job. For example, office workers have to be continually trained in new software and hardware.

For the employer to ensure that staff are fully motivated in the workplace, they need to offer relevant training courses. This helps to boost morale and improve retention levels. In digital technological workplaces it is also important to ensure employees receive training for the most up-to-date software so productivity levels can continue to increase.

Digital-technology-related health and safety issues

In today's society, computers are fully integrated into the workplace. This has resulted in a great number of employees working at computers for long periods each day. There are a number of health problems and injuries that can arise because of the prolonged use of computer technology.

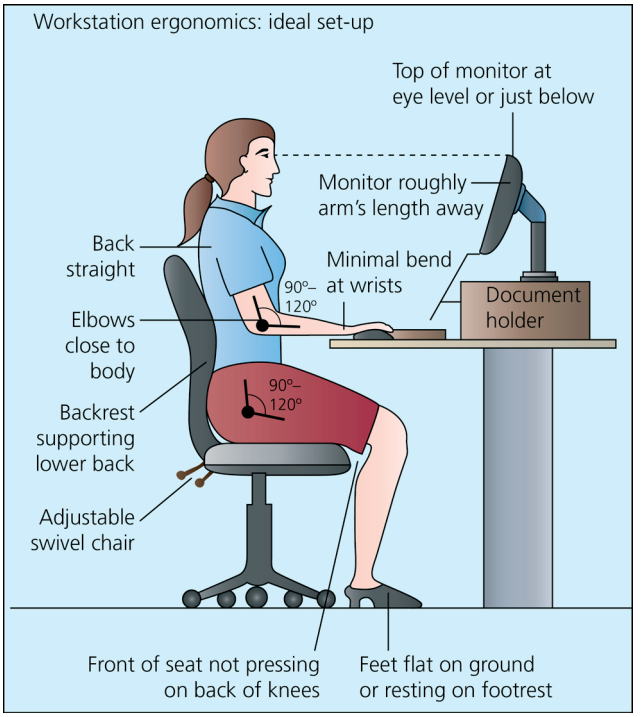
The Health and Safety at Work etc. Act 1974 ensures that employers have obligations to provide a safe working environment for employees who carry out their work while using a computer. The law states that organisations should have a company policy on health and safety and that employees should be aware of the contents of this policy.

There are various health problems associated with the regular use of computers.

Health problem	Description	How can it be reduced?
Repetitive strain injury (RSI)	A range of conditions affecting the neck, shoulders, arms and hands. Caused when an employee is using the same muscle groups to perform the same actions over and over again, such as working at a keyboard all day. Can result in a condition of the wrists known as Carpel's Tunnel syndrome.	Take regular breaks. Use **ergonomically** designed keyboards and mouse. Use appropriate furniture, such as adjustable swivel chairs. Use a wrist rest underneath the keyboard to avoid Carpel's Tunnel syndrome. Use a foot rest.
Eyestrain	A common problem caused by over-exposure to computer screens. Can lead to headaches, blurred vision and an overall deterioration in a user's eyesight. This condition can cause discomfort resulting in less work being done.	Use anti-glare screens. Use swivel bases on screens to deflect light away from the users eyes. Use screens that have adjustable brightness and contrast. Have good lighting in the office. Provide regular free eye tests.
Back pain	Can be related to the poor posture while sitting at the computer for prolonged periods. Could lead to mobility problems.	Use adjustable chairs that allow height adjustment and backrest tilting. Take regular breaks and regularly exercising muscles. Provide training for improving desk posture.

Other safety issues that should be given priority in the workplace include:

- regularly carrying out portable appliance testing (PAT testing) on hardware devices.
- using proper cable management for cables to and from computers.
- providing controlled air conditioning for a more comfortable working environment.
- correctly locating appropriate fire extinguishers (such as CO_2 that are suitable for electric fires).
- not eating or drinking near computers.



▲ Workstation ergonomics: the ideal set up

Checkpoint ✓

- Consumer Contracts Regulations 2013 specify customer rights when shopping online.
- Data Protection Act 1998 controls how personal information can be used by organisations.
- Copyright Designs and Patents Act 1988 makes it illegal to copy and distribute software without permission.
- Computer Misuse Act 1990 protects computer users against crimes.
- GPS (global positioning system) uses a number of satellites orbiting the Earth to provide real-time information such as the geographical location of a person.
- Digital technology is changing the world of work, increasing new job opportunities.
- Teleworking is using ICT to work from home.
- Health problems associated with the regular use of computers include repetitive strain injury (RSI), back strain and eye strain.

Practice questions ?

1 a) State four principles of the Data Protection Act 1998. [4 marks]
   b) Name and describe two other laws associated with ICT. [6 marks]
2 Briefly explain the roles of the information commissioner and the data controller. [4 marks]
3 Describe three ways in which the internet can be misused. [6 marks]
4 Describe two ways in which social networking can be misused. [4 marks]
5 Identify four jobs that have been created due to developments in digital technology. [4 marks]
6 What is meant by 'teleworking'? [2 marks]
7 Describe three advantages of teleworking to an employee. [6 marks]
8 State three health problems associated with ICT and explain how each can be minimised. [6 marks]
9 Identify three ways in which an organisation can assist in making the workplace safer. [3 marks]

Glossary / Index

Term	Description	
3D	Three dimensional. An image which creates the illusion of depth.	Unit 2, Ch 13
7-bit ASCII table	Also known as Standard ASCII, uses 7 bits to represent each character. Only 128 characters could be represented in the character set.	Unit 4, Ch 22
8-bit ASCII table	Also known as Extended ASCII, uses 8 bits to represent each character. A further 128 characters can be represented in the character set, totalling 256 characters.	Unit 4, Ch 22
A/B testing	End users are presented with different versions of a digital application; statistical analysis is carried out to determine which is most successful.	Unit 2, Ch 16
Absolute cell reference	An absolute cell reference is when a formula is copied to other cells; part of the cell reference does not change as the formula is modified.	Unit 1, Ch 4
Abstraction	Filtering out details about the problem that will not be required for the solution.	Unit 4, Ch 23
Accessibility	The ability to personalise digital applications to support user by any user.	Unit 2, Ch 12
Agile	A method of developing a system where small sections are developed, tested and reviewed by the user. Feedback from the full development team, including the user, is used to improve the small section. Development happens in short bursts called 'sprints' which could last 1–2 weeks.	Unit 4, Ch 23
Algorithm	A set of step-by-step instructions representing the solution to a problem.	Unit 4, Ch 23
Algorithm design	Creating a step-by-step set of instructions that represents a solution to the problem.	Unit 4, Ch 23
Alpha testing	Involves simulating the real-world environment the application has been designed for, normally carried out by a small number of users and prior to beta testing.	Unit 2, Ch 16
Analogue signal	A continuous varying signal that represents a physical quantity such as sound, temperature or light.	Unit 1, Ch 1
Anti-virus software	Software which scans files stored on a computer system looking for a virus, and compares these to a known database of viruses. It can eliminate a virus.	Unit 1, Ch 7
Application software	Applications software are programs designed for an end user to do a particular task, such as word-processing and spreadsheet programs.	Unit 1, Ch 2
ASCII code	Acronym for the American Standard Code for Information Interchange. ASCII is a code for representing English characters as numbers. Each letter assigned a number from 0 to 127. For example, the ASCII code for the letter A is 65.	Unit 4, Ch 22
Attribute	Heading given to each item of data stored about a single database entity.	Unit 2, Ch 11
Backup	A second copy of a file made and stored on a different storage device in case the original file gets lost, or becomes corrupted or physically damaged.	Unit 1, Ch 7
Bandwidth	Refers to the amount of data that can be transmitted over a network in a fixed amount of time. It is measured in bits per second.	Unit 1, Ch 6
Batch processing	Data is collected over a period of time such as a day and then is processed together at a later time such as overnight.	Unit 1, Ch 2
Beta testing	Carried out just after alpha testing and before the final version of the application is released commercially.	Unit 2, Ch 16
Binary digIT/ bit	Has a value of 0 or 1 and is the smallest unit of computer storage.	Unit 1, Ch 1

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CCEA
GCSE
DIGITAL TECHNOLOGY

This title has been written to help ensure students' successful progress through CCEA's GCSE Digital Technology specification. Our expert authors provide insight and guidance for the mandatory Digital Technology unit and each of the Multimedia and Programming optional units. Each section incorporates challenging tasks and activities to test essential knowledge and skills required for the examined and controlled assessment units.

- Features comprehensive coverage of the examined Digital Technology unit
- Builds students' Multimedia and Programming skills and capabilities (depending on their chosen pathway) through clearly focused content and activities to assess understanding and aid progression
- Provides students with contexts to apply digital technology skills
- Develops problem-solving skills with selected tasks for each pathway
- Helps students prepare for success in externally examined and controlled assessments with opportunities to test and consolidate understanding through each unit

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