

Terminology

Weather forecasting	Weather forecasting is the application of computer programs to predict the state of the atmosphere for a future time and a given location.
Computer aided design	CAD is the use of computers to create, analyse, modify or optimise the design of a product or building.
Robotics	Robotics is the use of computers to design, construct and operate robots in many settings.
Computer generated graphics	Computer generated imagery (CGI) is the process of using computer graphics to create, or contribute to, images in art, printed media, video games, films and television.
Animation	Animation is the process of manipulating figures/ images to appear as moving figures.

Weather forecasting

Weather forecasting involves the use of super computers and a huge amount of data regarding weather conditions around the world to predict what weather will be experienced the next day or in the near future.

Numerical weather prediction (NWP) began in the 1950s using a mathematical computer model of the atmosphere.

The first part of the Meteorological Office's latest supercomputer arrived in 2015 and was fully installed by 2017. Now complete, this new computer has 460,000 cores, which deliver a peak performance of 16 petaflops. It has 2 petabytes of memory for running complex calculations and 24 petabytes of storage for saving data. This processing power has allowed weather forecasts to be refined to 1 km areas with increased accuracy.

In order to know what the weather will do in the future, forecasters first need to know accurately what it is doing now. Recordings of weather variables are made 24 hours a day across the globe. These are passed to the world's major weather forecasting centres and used in conjunction with satellite pictures to get a picture of what the atmosphere is doing now. These are called observations. The computer models are run several times a day, and meteorologists work through the clock to check that the forecast is going to plan. If it is not, they will amend any forecasts going out.

Computer aided design

Computer aided design software (CAD) is the use of computers to help in the creation of a design. The software is used to improve the designer's productivity, improve the quality of the design and improve communication. This is done by producing detailed documentation which provides diagrams for the producers of the product.

Advantages of using CAD software

- greater accuracy
- objects and drawings can be created in 2D, and 3D
- images can be viewed from any angle
- powerful scaling, rotation and reflection options
- libraries of engineering components which can be imported
- links to packages to calculate costs.

Robotics

Robotics is the combination of computer science, electrical and mechanical engineering. Robotics can be seen as the use of control systems and information technology to reduce the need for humans to work on repetitive tasks in the manufacture and production of goods, such as cars.

Characteristics of a robot

- Movement: a robot needs to be able to move in three or more axes.
- Energy: a robot must be powered using electricity, solar power or batteries.
- Sensing: a robot needs to use sensors to detect changes in its environment such as the presence of a new piece of equipment.
- Intelligence: a misnomer in reality, but robots must be programmed to carry out a particular set of tasks and must be reprogrammable should the nature of its tasks be altered or upgraded.

Advantages of industrial robots

- **Efficiency:** robots can be programmed to perform certain tasks more quickly than people; they are designed to carry out the particular task with a high degree of accuracy.
- **Quality:** due to their high degree of accuracy robots are able to produce products of a higher quality.
- **Working environment:** robots can be used in working environments that may be hazardous for human beings.
- **Productivity:** robots can be programmed to work continuously throughout the day and night and therefore result in higher productivity.

Computer generated graphics

Computer graphics deals with generating images in digital photography, films, computer games, video and on computer displays. Images are stored in two formats:

- **Vector graphics:** created using objects and coordinates. A vector has length and direction. In general vectors can be thought of as geometric shapes.
- **Bitmap graphics:** a bitmap graphic is made up of individual pixels. A pixel is an individual picture element and the resolution of an image is the width x height or pixels per square inch.

Computer Generated Imagery

Computer Generated Imagery (CGI) is used in films and video games to create characters, scenes and special effects, sometimes described as CGI animation. CGI imagery can be either 2 dimensional (2D) or three dimensional (3D).

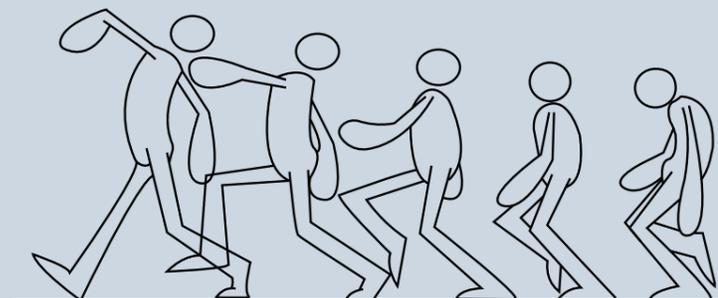
Since the 1970s computer generated imagery has been used in many high-profile films including the Star Wars films, Pirates of the Caribbean and the reworked Jungle Book film.

CGI is used for visual effects because the quality is often higher and effects are more controllable than other more physically based processes, such as constructing miniatures for effects shots or hiring extras for crowd scenes. CGI also allows the creation of images that would not be feasible using any other technology.

Animation

Animation is the process of manipulating still images so that they appear to move. Traditionally, images were painted on transparent celluloid sheets and photographed to be shown on film. Generally, animations are now computer-generated using software applications such as Flash or more recently HTML5.

Stop motion animation is a film making technique where physical objects are manipulated in small increments between individual photograph frames; these are then combined to appear as if the objects are moving when the series of frames is played back.



Expert systems

An expert system is a computer application that uses artificial intelligence to solve problems in a specialised area that would normally require a large amount of human expertise.

An expert system is made up of two components, a knowledge base and an inference engine. A knowledge base is an organised collection of facts about the speciality. An inference engine is the code that is used to access the facts in the knowledge base in response to inputs from a user.

The facts for the knowledge base will have been gathered from experts in the speciality, as will observations of behaviours and outcomes. The knowledge base is usually presented in the form of 'if...then' rules; if a particular condition is true, then a flowing inference can be made. The knowledge base of an expert system will contain many thousands of rules. Sometimes a probability factor will be applied to the inference so that the outcome can, for example, be regarded as 90% probable with some other outcomes suggested as possible.

Expert systems are commonly used in medicine, both in hospitals, doctors' surgeries and online.

The quality of an expert system is dependent on the quality of knowledge gathered from human experts used to build the knowledge base. It is important to realise that problems vary from situation to situation and therefore the solution gathered from the expert system may not be as refined as the decision that a human expert may suggest. It takes a long time to develop and refine an expert system which then may take much effort to maintain and ensure that knowledge is up to date.