

# Emerging Technologies

Emerging technologies are those technologies that are currently being developed or will be developed in the near future, and which will alter the business and social environment.

# These technologies include the following:

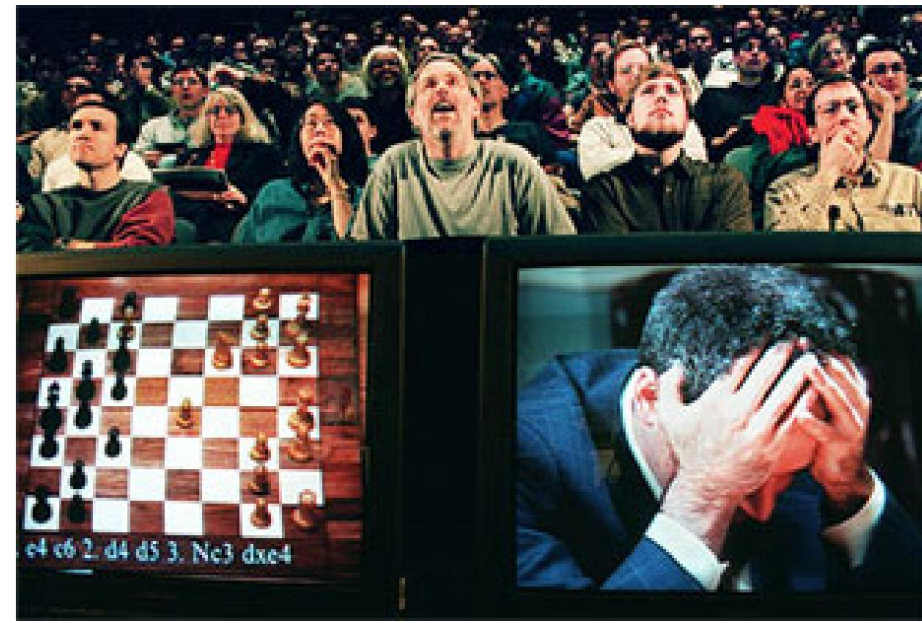
- 1) Artificial intelligence
- 2) Biometrics
- 3) Robotics
- 4) Quantum cryptography
- 5) Computer assisted translation
- 6) 3D and holographic imaging
- 7) Virtual reality

# Artificial intelligence

This is a computer science that is focused on creating computer systems that simulate human intelligence.



# Developments in AI:



- 1) **Game playing:** Computers developed to play games against human players.
- 2) **Expert systems:** These are systems that have been programmed to make decisions based on information they are given.
- 3) **Language translation:** This type of AI involves computers that can understand different human languages as they are spoken to them.
- 4) **Robotics:** Robotic artificial intelligence is where machines are programmed to imitate a human.

# Impacts of AI on everyday life:

- 1) Accurate prediction of weather:** AI software will soon be used to sift through weather data more accurately than humans can and will be used to predict approaching storms and automatically issue warnings.
- 2) Increased leisure time:** Robotic vacuum cleaners are becoming more and more popular. These can detect walls and other objects in order to vacuum around them. People can leave them running whilst they enjoy extra spare time.
- 3) Safer transport:** Cars that can self-park already exist and it is predicted that cars that drive themselves will be available soon. These could drastically reduce road accidents.
- 4) Increased Personal safety:** Modern home alarm systems use artificial intelligence software that can tell the difference between the home owners and intruders. The software automatically alerts the police when intruders are detected.
- 5) Improved medical care:** Robotic surgery assistants are being used to quickly and accurately pass the correct surgical tools to doctors.



# Biometrics

Biometrics is where parts of a person's body are used for identification purposes. For example:

- 1) Fingerprints:** These are impressions embedded at the end of human fingers and thumbs. Fingerprints kept in a database can be matched to those left at crime-scenes to help identify the culprit.
- 2) Eye recognition:** Eye scans analyse the iris which is the coloured ring that surrounds the pupil.
- 3) Face recognition:** This is where the shapes of individual's faces are analysed.
- 4) Voice recognition:** Pitch, tone and frequency of voices are unique and can be analysed to identify people.

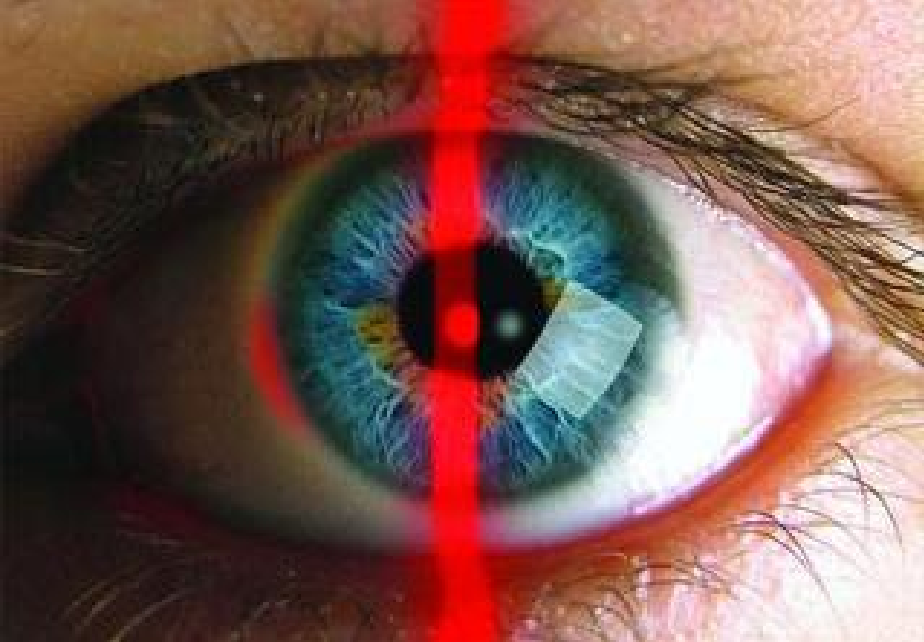
All of these parts of the human body are **unique from person to person** and can be used to **authenticate identity**.

Before biometric methods can be useful, people have to perform a process known as '**biometric enrolment**'.

Biometrics are beginning to be used **in place of passwords and physical locks** as a means of **security**.

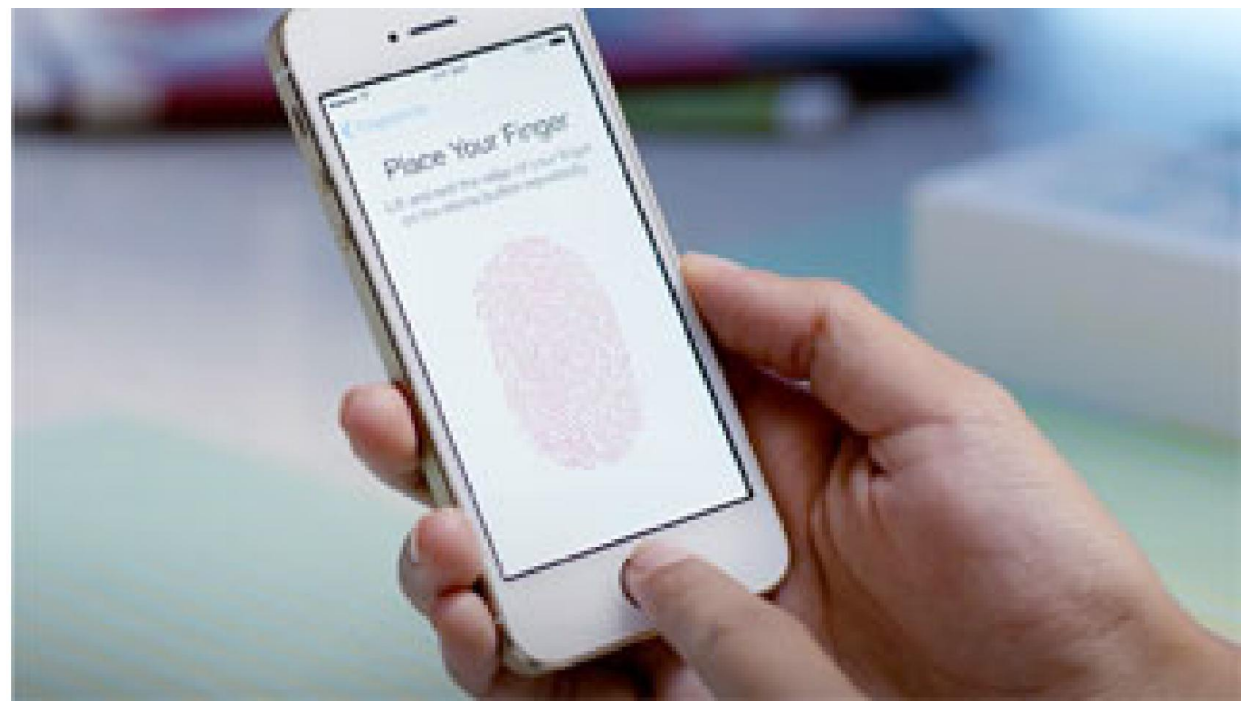
Biometrics have advantages over these older methods as **body parts cannot be lost, forgotten or stolen** as can be the case with passwords and keys.

Biometrics is still a very new technology and is **not yet 100% accurate**.



# Impacts of Biometrics on everyday life:

- 1) Better airport security:** Iris recognition is already in use in some airports. Travelers have their eyes and iris scanned into a system and this data is later matched up when the person is performing airport checks.
- 2) Increased building security:** Fingerprint access to buildings have been replacing the older methods of locks and keys. This methods ensures that only authorised people can enter restricted buildings or rooms.
- 3) Reduced car theft:** Cars already exist that use fingerprints to only unlock their doors or start the engine for the fingerprint that is registered. This means that the doors will not unlock for a print that is not recognised and makes the car harder to steal.
- 4) More secure mobile phones:** Mobile phones contain our lives. We used our phones for everything from social media to shopping online. They need to be as secure as possible in order to protect the valuable data that they contain.



# Robotics

Robots are used to perform a wide range of **physical tasks**.

Robots are either **automated** (controlled by a computer chip) or **manually controlled** by a human.

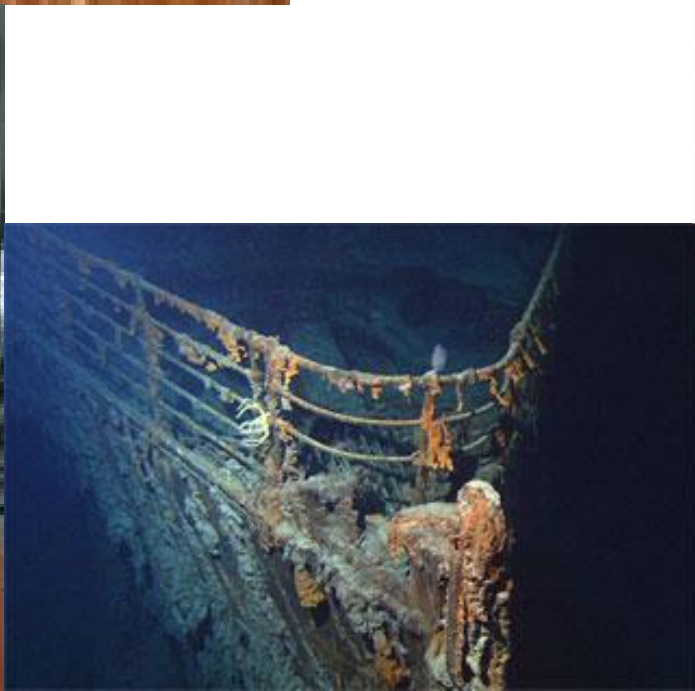
There are 4 different types of robots:



- 1) **Manufacturing robots** (used to perform repetitive tasks such as welding)
- 2) **Carrier robots** (used by the military to carry heavy loads over dangerous terrain)
- 3) **Domestic robots** (used in homes to perform cleaning tasks such as vacuuming)
- 4) **Exploration robots** (used to visit and send images from places such as Mars)

# Typical tasks that robots can be used for are:

- 1) Dangerous jobs: E.g. disposing of bombs, spray painting or cleaning up nuclear waste. Note: these are all jobs that could harm or kill a human.
- 2) Exploring extreme environments: E.g. inside volcanoes, planets or the depths of the ocean. Note: humans cannot visit these environments due to lack of oxygen and high pressure / heat levels.
- 3) Repetitive manufacturing jobs: E.g. production lines, packing and welding etc. Note: these jobs can also be performed by humans but robots can do them much faster and more efficiently.
- 4) Moving heavy objects: E.g. installing large engines, moving pallets of items etc.



# Impacts of Robotics on everyday life:

- 1) Increased personal time:** If robots can carry out domestic chores, this frees up more time for us to spend as we wish. This could mean more time spent at work or for more enjoyable activities such as socialising.
- 2) More efficient manufacturing:** Robots can manufacture products such as cars much faster and cheaper than humans can. This means that companies can make more products at less cost and this means greater business profits.
- 3) Loss of jobs:** Due to higher and cheaper productivity, robots are taking over the manufacturing jobs that used to be carried out by humans. This means that humans are missing out on employment on assembly lines and factory work.
- 4) Safer working environments:** Robots can safely carry out tasks that are too dangerous for humans. For example: spraying cars with toxic paint, defusing bombs on battlefields and search and rescue operations in buildings destroyed by earthquakes.

# Quantum cryptography

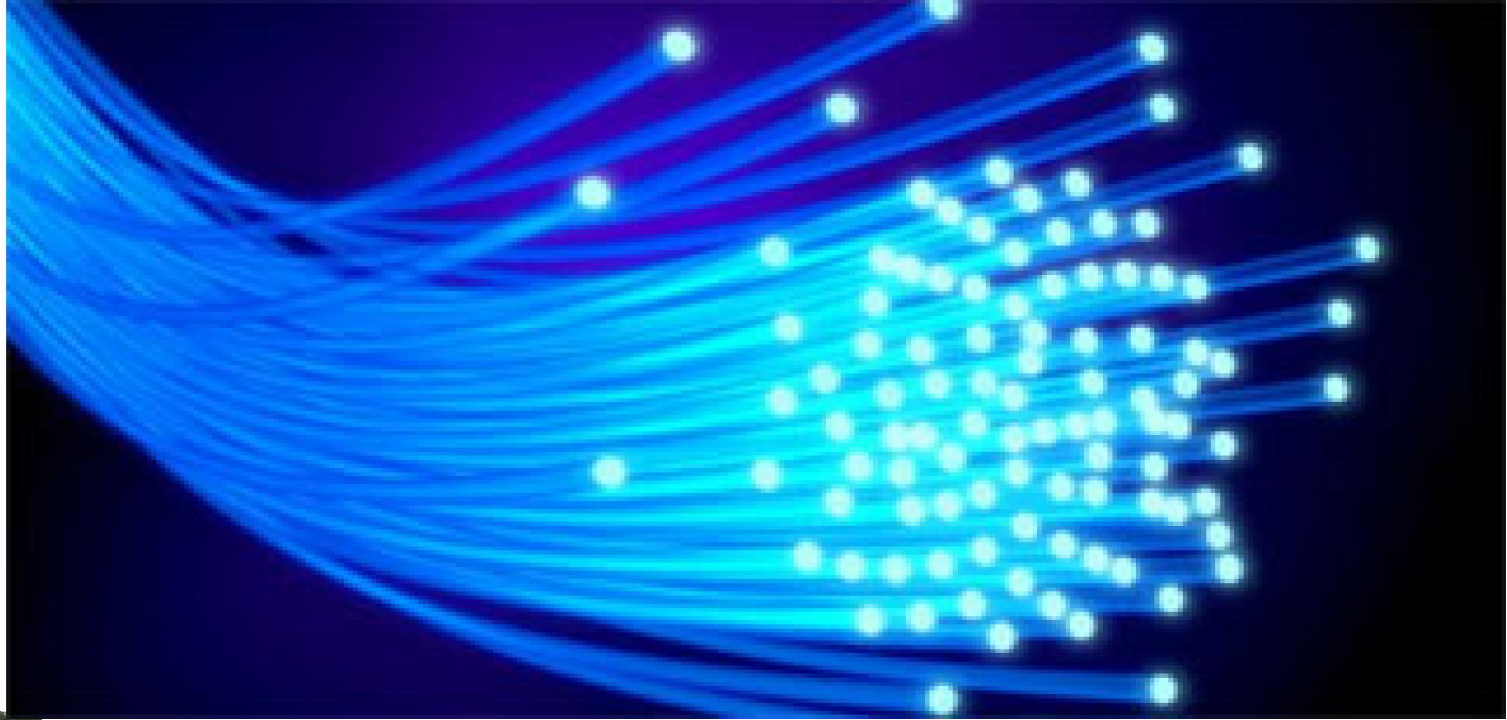
Quantum cryptography (encryption) is an emerging technology that allows messages and data to be sent with complete privacy.

Encryption is where digital data and files are scrambled so that only authorised people are allowed to read it.

Unauthorised people attempting to read the data would see illegible nonsense instead of the real information.

Older methods of encryption were based around mathematics but quantum cryptography uses physics instead. This makes the encryption impossible to break.

In quantum cryptography, messages are encrypted using photons. These are tiny packets of light.



# Some impacts of quantum cryptography

- 1) Completely secure voting:** Citizens of countries have the right to vote-in new governments but history is littered with examples of where these votes have been tampered with in order to influence election outcomes. Securing votes with quantum encryption methods ensures that they cannot be tampered with or changed.
- 2) Completely secure communication:** Messages sent by the military often include the locations of squadrons or special op's teams. If enemy forces intercepted these messages it could have severe consequences. Using quantum cryptography to secure the messages would eliminate the risk of them being read or heard by unauthorised ears.
- 3) Completely secure bank transfers:** Any electronic transfer of money, such as at ATM's or buying goods online, will be completely secure. Some banks are already using quantum cryptography for the purposes of securing money transfers.
- 4) Completely secure personal information:** Health records, bank details and other types of personal information will be absolutely secure from hackers and other people wishing to commit identity theft crimes.



# Computer assisted translation

CAT is where a human translator uses **computer software** to **help** in the translation process.

Current CAT tools are **not always 100% accurate**. They need a human to check for errors.

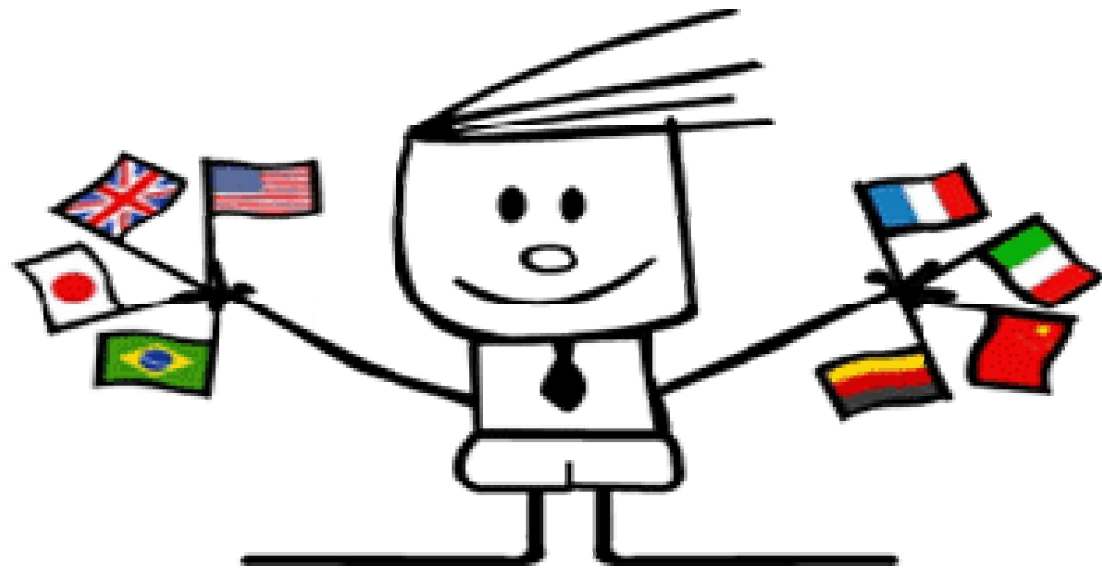


# Examples of different types of CAT tools are:

- 1) Spell checkers:** These are usually built-into word processing software and can automatically flag-up spelling errors and suggest translations of miss-spelt words. Most word-processors allow the user to select the language in which to spell-check.
- 2) Translation memory software:** Translation memory software are databases which store translated text as the human translator works through it in order to be reused in the future. Translated text is built-up in the database's memory and can be accessed by other translators in order to speed up their translation jobs.
- 3) Language search-engine software:** These are Internet based systems which allow translators to enter any text that they want translating and also to select which language they want the text translating into. The software will then search through a large collection of translation memory databases to try and find a match with the text entered into the search engine. If a match is found, translated text will be shown on-screen.

# Impacts of Computer Aided Translation on everyday life:

- 1) More accurate documents:** Spell checkers can quickly scan your word processed documents and automatically find spelling errors. Miss-spelt words can be quickly corrected to produce an error-free document.
- 2) A more multilingual society:** Anyone with an Internet connection can access tools such as Google Translate and the vast collection of language databases that the tools can search through. This makes accessing other languages much easier than in the past and makes it easier for people to learn these new languages.
- 3) Quicker and more efficient translations:** Foreign visitors to countries can be communicated with much easier through these CAT tools. They are especially useful in places like embassies where a wide-range of foreign visitors may need to communicate with local officials about problems or ask for advice etc.



# 3D and holographic imaging

This is a technique where images are made to **appear three-dimensional** and to actually have **depth**.

Holograms work by taking **two regular two-dimensional images** of the **same object** and laying one on top of the other.

The two-dimensional images need to have been **shot at different angles**.

Two different types of **laser beams** are used to record the two-dimensional images onto a **single photographic plate**.

This creates **one single image** that incorporates the angles of the original two-dimensional images. This produces a 3D effect.

When viewing the image, human eyes see it from slightly different angles. The brain combines them into a three-dimensional image.



# Impacts of 3D Imaging on everyday life:

- 1) Improved security: Credit cards, ID cards, software and some bank notes include holograms as a way of trying to prevent forged duplicates being created. Forgeries don't usually include a hologram as they are difficult and expensive to reproduce.
- 2) Better movie experiences: These provide the viewer with a much more immersive experience.
- 3) Greater data storage: It is thought that the technology behind holograms will eventually be used to provide the means to store large amounts of data. Companies have already produced discs that use holographic layers that each have the potential to hold a massive 3.9 terabytes.

# Virtual reality

Virtual reality is where computers are used to create an artificial environment that users can interact with as if it were real.

Virtual reality is not really meant for gaming purposes. It is used for more serious purposes such as:

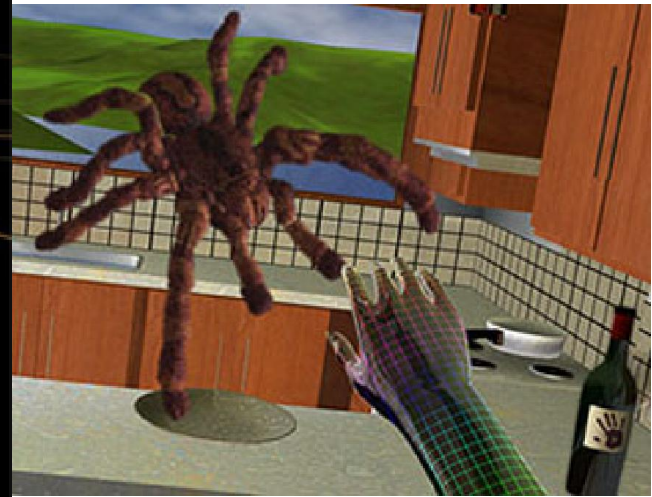
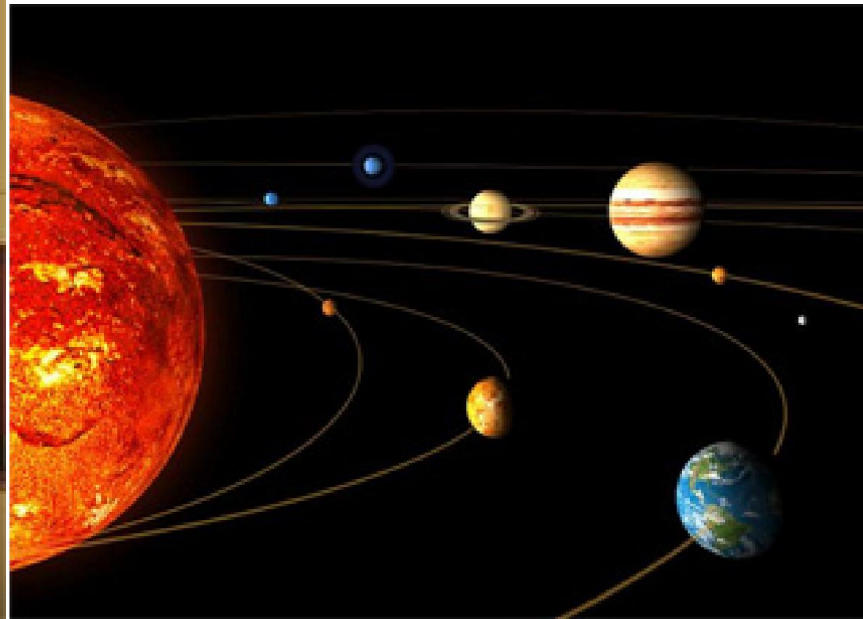
- 1) Allowing architects to walk around a virtual version of their design (this gives a better idea of what the finished building will look like)
- 2) Training soldiers in combat (flight simulation, battlefield simulation)
- 3) Training surgeons (virtual patients can be operated on to provide experience to trainee surgeons).

As they walk around the virtual environment users will experience things in a similar way to the real world. For example:

1. Objects get smaller as you walk away from them (and bigger as you move closer)
2. The direction of sounds change as you move around
3. Objects in the virtual world appear the same dimensions as they would in the real world (for example dogs are smaller than us but elephants are bigger).

# Equipment needed to create the virtual reality experience includes the following:

- 1. Eye Goggles:** These produce the 3D images that make up the artificial world. The goggles project slightly different views into each eye and this fools your brain into thinking that the scene is 3D. Virtual chairs look solid and so on.
- 2. Special Gloves:** The gloves detect your hand and finger movements which are input into a computer and processed. As users touch or use items in the virtual world, the computer can carry out these commands and make them happen. This allows the user to interact with the virtual world and perform tasks such as moving objects or switching on lights etc.
- 3. Headphones:** These control what users hear in the virtual world. For example: Distant sounds will be quieter than sounds that are close by.
- 4. Powerful Computer:** A very powerful computer is needed to create the virtual environment and to process/output data sent into the system by the user's actions. For example: The computer produces graphics that appear as walls, outdoor scenes and objects such as trees.



# Impacts of Virtual Reality on everyday life:

- 1. Improved medical surgeons:** Surgeons can be trained using virtual patients. This allows them to practice over and over until they have perfected a particular surgery without risk to a real patient. For example: Imagine a new surgeon performing surgery on you and accidentally cutting off your leg!!.
- 2. Larger and stronger buildings:** Virtual buildings allow architects to walk around to experience what the building would look like when completed and check for potential errors before the actual building is constructed. Virtual buildings will also be able to be tested against factors such as earthquakes to see what effects they would have on the current design. This allows architects to modify designs quickly and cheaply and will, potentially, allow for the development of much larger and safer buildings than we currently have.

**3. More effective treatment of phobias:** VR is being used to help patients overcome phobias and anxieties. People can experience a tame, controlled version of what they are afraid of. Slowly the person becomes used to the situation and can relax. For example: Someone might be terrified of spiders and so they could be gradually introduced to larger and larger virtual spiders (the virtual spiders would be controlled by the therapy team as well).

**4. Training in dangerous situations:** VR can be used for training in dangerous situations where it is impossible to practice the real thing. For example: A large fire in an office building could never be set up in reality, but it could in a virtual environment. This will allow workers to practice emergency evacuation in a safe environment.

**5. More realistic education:** VR can give students the opportunity to learn in a much more interactive way. For example: Astronomy students can learn about the solar system by engaging with the objects in the virtual environment. They could look around stars, move planets and track the orbits of comets. This approach is likely to allow students to retain knowledge much better than reading text out of a book.