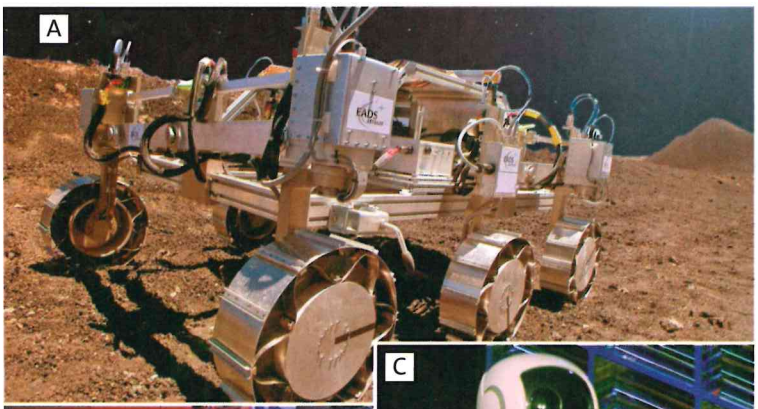
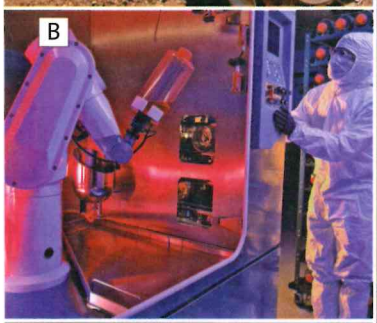
11 Robotics

Switch on

Work in small groups. What could these robots be used for? Compare answers with others in your group and provide reasons to support your answers.





Reading

How robots work

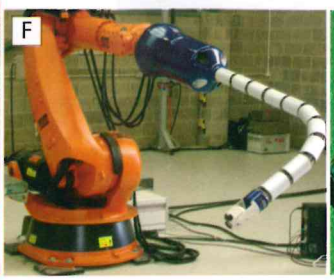
1 Study the opening sentences for each paragraph in this textbook extract. Predict the topics of each paragraph.

First sentence	Possible topics
1 Robots have five basic components: a movable structure, a motor, a power source, a sensory system, and a processor.	
2 The motor provides the physical power to move the structure.	
3 In the same way that humans depend on sight, hearing, taste, smell, and touch to make sense of the world, robots require a sensory system in order to function.	
4 Heat sensors may be important for robots working in extreme conditions.	
5 The brain of a robot is the processor.	

2 Try to answer these questions before you read. Compare answers with others in your group.

1 In what ways can robots move?
2 What kinds of motor can robots have?
3 What kinds of power source can robots have?
4 What does the sensory system do?
5 What does the processor do?

3 Now read the text to check your predictions in **1** and your answers in **2**.



In this unit

- predicting text content by sampling key sentences
- listening and note-taking
- ways to describe causing, preventing, and enabling links
- how to improve your presentation skills
- sharing ideas on how to solve a problem

Robots – moving, powering, feeling, and thinking

Robots have five basic components: a movable structure, a motor, a power source, a sensory system, and a processor. The entire robot may move, on legs in the case of Honda's Asimo, on wheels, or on caterpillar tracks in the case of Urbie, or only one part may move, such as the arm of an industrial robot.

The motor provides the physical power to move the structure. It may be electric, pneumatic, or some form of heat engine. All motors require a source of power. In the case of mobile robots, the usual source is a battery. The problem with batteries is that they are heavy and run down quite quickly. In future there may be robots which use biological fuel which they collect as they move. Compressed air, in tanks for mobile robots or directly from a compressor for fixed robots, is the power source for pneumatic systems.

In the same way that humans depend on sight, hearing, taste, smell, and touch to make sense of the world, robots require a sensory system in order to function. Sensors feed information to the processor. The information provided depends on the function of the robot. Location is important for most robots. Industrial robots must be capable of placing items or performing actions in exactly the right place. With some robots, location is controlled by placing electronic tracks for the robot to follow. Container handling in ports can be done by robotic vehicles following such tracks.

Heat sensors may be important for robots working in extreme conditions. Sensors which measure the pressure exerted by robot arms or pincers are important for robots which pick up or handle delicate items. For robots which walk or climb stairs, information on weight distribution and balance is important. Robots which look for some types of explosive need sensors which can detect chemical smells. Robots which have to navigate over unfamiliar ground, such as the Mars Rover, have digital cameras to help them identify obstacles and select navigable routes.

The brain of a robot is the processor. It controls the operation of the robot. It is programmed to allow the robot to carry out a series of actions and to respond to feedback from the sensory system. In the case of a simple robot, such as a domestic vacuum cleaner, the program may instruct the robot to turn 90 degrees when it collides with an obstacle.

Problem-solving

1 Robotic vacuum cleaners which can clean floor surfaces by themselves are becoming more common. Work with a partner to list the kinds of sensors they need.

2 🎧 Listen to this short talk by a Sales Rep at a trade fair about how a robotic vacuum cleaner works. Note down information about one of the types of sensor it uses. Your teacher will advise you which type to listen for. Note what the sensors detect and how they do this.

3 Now exchange information with others in your class to complete the table.

4 🎧 Listen again and check your answers.

Sensors	Notes
dimension sensors	
object sensors	
cliff sensors	
wall sensors	
dirt sensors	

Gadget box

The DeLaval Voluntary Milking System can milk 60 cows three times a day. Cows decide when they wish to be milked. The robot checks if the cow is ready, milks the cow, compares its production with previous yields, and cleans itself before the next cow enters.

What would be the main advantage for dairy farmers?

Language spot

Causing, preventing, and enabling links: *cause to, make, prevent, stop, allow to, enable to, let*

In technology we often have to describe the relationship between actions. Study these pairs of actions about robots. What is the relationship between each pair?

1 a *The object sensor detects an obstacle.*
  b *The robot changes direction.*
2 a *The cliff sensor reports a sudden drop ahead.*
  b *The robot does not move in that direction.*
3 a *Caterpillar tracks are fitted to the robot.*
  b *It can move quickly on rough surfaces.*

In pair 1, one action *causes* another action. In pair 2, one action *prevents* another action. In pair 3, one action *enables* another action.

Note how we can link each pair to show the relationship between them.

1 *The object sensor detects an obstacle, which* ***causes*** *the robot* ***to*** *change direction.*
The object sensor detects an obstacle, which ***makes*** *the robot change direction.*

2 *The cliff sensor reports a sudden drop ahead, which* ***prevents*** *the robot (from)* ***moving*** *in that direction.*
The cliff sensor reports a sudden drop ahead, which ***stops*** *the robot* ***moving*** *in that direction.*

3 *Caterpillar tracks are fitted to the robot, which* ***allows / enables*** *it* ***to*** *move quickly on rough surfaces.*
Caterpillar tracks are fitted to the robot, which ***lets*** *it move quickly on rough surfaces.*

In the examples, *which* refers to the preceding action. In these cases *which* + the active verb can be replaced by the *-ing* form of the verb. For example:
The cliff sensor reports a sudden drop ahead, ***preventing*** *the robot (from) moving in that direction.*

» Go to **Grammar reference** p.120

1 Complete the gaps in this text with the correct form of the appropriate verbs.

allow (to)	enable (to)	make	stop
cause (to)	let	prevent	

Land mines kill 800 people every month and _____[1] people returning to their homes after a conflict is over. Comet III is an experimental mine-clearing robot developed at Chiba University in Japan. It is fitted with caterpillar tracks, _____[2] it move quickly over rough ground. For mine-hunting it has six legs, _____[3] it to walk delicately through mine fields. It takes 20 seconds to calculate each step. Slow processing speeds _____[4] Comet III from moving more quickly, but faster processing chips should _____[5] Comet III to reach human walking speeds in future.

Comet III has stereo vision provided by two digital cameras. This _____[6] it navigate by itself without the help of remote control. Comet III has metal detectors and ground-penetrating radar, _____[7] it to detect different types of mine. A reflected signal from a mine _____[8] Comet III to probe gently to uncover the mine. Vibration or pressure can _____[9] a mine explode, so the work must be done with care.

Sometimes the ground is very hard, which _____[10] the probe uncovering mines. Newer models fitted with drills and an air hose will _____[11] the robot do this safely. A robotic hand will _____[12] the robot to pick up rocks.

2 Decide on the relationship between each of these pairs of actions. Then link them using an appropriate verb.

1 The power sensor reports low battery current to the processor.

The robot cannot move.

2 The bumper is pressed in.

The object sensor reports an obstacle to the processor.

3 The sensors detect a 'cliff'.

The robot reverses.

4 Infrared signals from the robot are reflected by a wall.

The robot changes direction and moves parallel to the wall.

5 Dirt hits the acoustic impact sensor plates.

The plates vibrate.

6 The sensors detect the vibration and pass a signal to the processor.

The robot cleans the area again.

It's my job

1 Before you listen to Jaako Ikonen, Senior Manufacturing Systems Engineer, answer these questions with a partner.

1 What do you think Jaako's responsibility is?

2 One of his products involves biosensors. What do you think a biosensor is?

3 What do you think is the difference between mechanization and automation?

2 🎧 Now listen and check your answers.

3 🎧 Listen again to find the answers to the questions.

1 What did he study at college?

2 Why did the mobile phone company need to automate?

3 What does a blood glucose monitor do?

4 Why must the process of manufacturing the monitors be automated?

Speaking

Assessing explanations

A good way to prepare for presenting information to others is to practise in small groups first.

1 Work in groups of three, A, B, and C.

Student A Go to p. 110.
Student B Go to p.113.
Student C Read text C below.

2 A plays the role of Speaker first, telling the others about their text using only notes to help. B plays the role of Reporter, taking notes from A's talk and reporting it briefly. C plays the role of Assessor, listening carefully to both talks and judging how accurately B has reported. If there is disagreement, you can refer to the texts.

3 Continue until each member of the group has played the part of Speaker, Reporter, and Assessor once.

4 Discuss in your group which parts were the easiest and the most difficult to play, and what would help you to play these parts better.

C

FIRST – For Inspiration and Recognition of Science and Technology – is a US organization founded by Dean Kamen, inventor of the Segway. FIRST has run an annual Robotics Competition since 1992 for teams of high-school students. Teams have six weeks to design and construct a robot to solve a particular task, which differs each year.

Teams usually consist of about 25 students with three or so professional Engineers who volunteer to assist them. They often include subteams who look after different aspects of the design of the robot, such as pneumatics, control systems, mechanics, and electrics.

Each team is supplied with a standard set of components including a remote control receiver and transmitter, a microprocessor and software, motors, sensors, a power pack, and mechanical parts.

More than 1,300 teams from seven countries, although mainly from the US, took part in 2007. FIRST also organizes robotics competitions for younger students.

We should have – in rather cheap machines – human level intelligence in well under fifty years.
Hans Moravec
Research Professor in the Robotics Institute of Carnegie Mellon University, 1990

Webquest

FIRST is not the only robot competition available. Work in small groups to research some others and report back to the class what you have found out. You should get information about what the rules are, where the competition is held, and what type of competition it is. Is it based on a competitive sport, such as football, or is it a race or a challenge?

These sites may help:

www.dcs.shef.ac.uk/~noel/competitions.html
www.ecsel.psu.edu/~avanzato/robots/contests/
http://robots.net/rcfaq.html#LNK077
http://cswww.essex.ac.uk/staff/hhu/competition.html
http://robogames.net/index.php

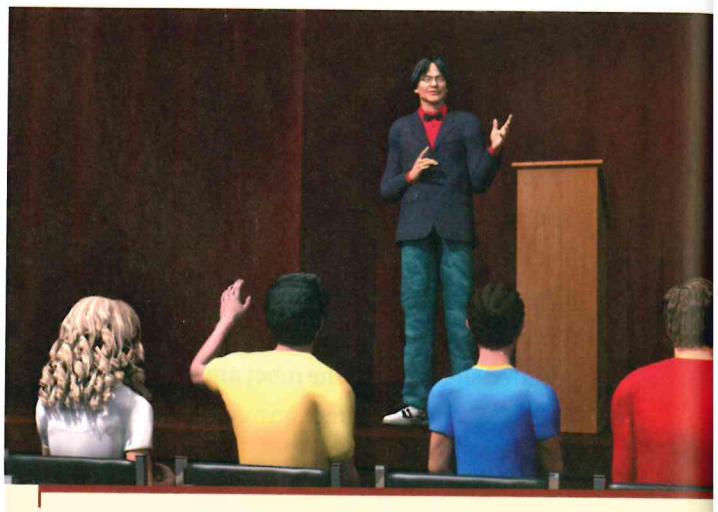
Make your point

Parts of a presentation

1 Lee Avatar has sent you headings for parts of a presentation and some phrases. Put the phrases under the correct headings.

a I'm going to talk about / tell you about …
b Thank you for your attention.
c We can see that …
d I'm Tom Huber from Allied Industries and it's a pleasure to be with you today.
e We've looked at X, Y, and Z.
f Let's look now at …
g It's my view that …
h Good morning, afternoon, etc. …
i I'll be happy to answer any questions you may have.
j I've discussed X, Y, and Z.
k It seems clear that …
l The purpose of my talk is …
m I want to turn now to …

2 Make a short presentation (maximum three minutes) to your class / group on any aspects of robotics. Use the phrases in **1**.



STARTING YOUR PRESENTATION

Greet your audience
_____ 1

Introduce yourself
_____ 2

Say what you're going to do
_____ 3
_____ 4

Move to a new point
_____ 5
_____ 6

ENDING YOUR PRESENTATION

Remind your audience of your main points
_____ 7
_____ 8

Make your conclusion
_____ 9
_____ 10
_____ 11

Thank the audience
_____ 12

Invite questions
_____ 13

Project

1 Work in groups. Imagine that you have entered a competition to design one of these robots:

a a robot helper for old people

b a robot pet animal

c a robot fruit picker

Decide together

1 the actions the robot should be able to perform

2 how it will move from place to place

3 the power source it will use

4 the sensors it will need

5 its approximate size and weight.

You can look for ideas on the Web.

www.bbc.co.uk/science/robots/techlab/sub_selector.shtml

www.seanet.com/~garyteachout/robots.html

2 As a group, present your proposals to the other groups. Give reasons for your decisions. Use the phrases from *Make your point*. Be prepared to answer questions about your proposals.

3 As a class, agree on the best proposals for each type of robot. You can combine proposals from different groups.

Checklist

Assess your progress in this unit. Tick (✓) the statements which are true.

- ☐ I can predict text content
- ☐ I can link pairs of actions
- ☐ I can share ideas on how to solve a problem
- ☐ My reading and listening are good enough to understand most of each text in this unit

Key words

Adjectives
acoustic
extreme
infrared
movable
navigable

Adverb
parallel to

Nouns
automation
caterpillar tracks
explosive
impact
power source
sensory system

Verbs
exert
navigate
program

Note here anything about how English is used in technology that is **new** to you.