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futuroscope education

EDUCATIONAL GUIDE

ROBOTS AND MAN

Teachers' guide

The objective of this guide is to provide teachers with activity suggestions to assist them in creating an educational project or to be included as a more general educational visit to the park.

SUMMARY

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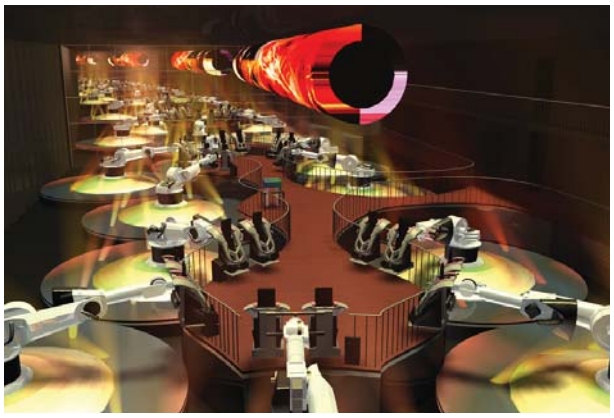
ROBOTS AT FUTUROSCOPE



Dances With Robots

This unique entertaining attraction is presented in a new high tech building housing ten giant robots who dance to an unusual and original choreography of different musical sequences (salsa, disco, hip-hop…).
Visitors choose to observe from a mezzanine or be a dancer with each robot taking two passengers in articulated seats. In either case the experience is thrilling, creating a whirlwind of fun.

Robot Dancers

Robots, seven metres high from the automobile industry turn on six separate axes with the ability to compose innumerable combinations of movement. Thanks to its tried and tested industrial track record it is capable of speeds close to that of a Formula 1 car and uses speed and force to lift objects gracefully and securely weighing up to 500kg. These Robot Dancers are developed by the company 'KUKA', one of three industrial robotics world leaders.

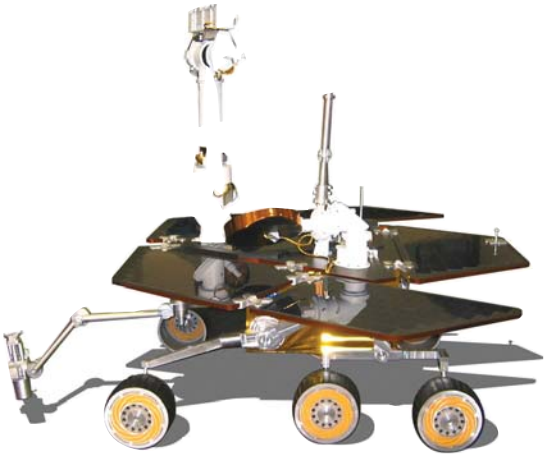
This attraction is restricted to people over 1.20 metres in height.

The choreography

The attraction was conceived by Kamel Ouali a well known French choreographer, creating a unique artistic performance: making robots dance. Parallel to this robotic ballet, projected on to a screen 33 metres long is a choreographed sequence by some of his best dancers. Kamel Ouali is teacher of modern jazz and hip-hop at the Academy of International Dance at the Conservatoire de Saint-Denis et de la Courneuve.

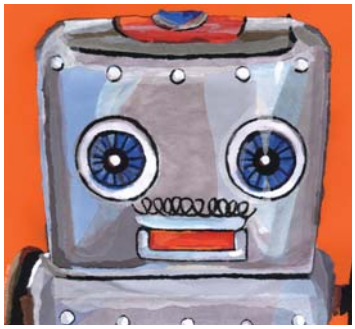
Robot Spirit Explorer

At the entrance of *Cosmic Collisions.*



Strange robots

At Digital City, a collection of funny, kit form, painted, paper and metal robots.



GUIDE FORMAT

The robot theme is rich and diverse, strongly anchored in the imagination of everyone, especially the young. The topic covers a variety of subject areas including; Science, Design and Technology, ICT, Media, Art and Design and in this case Modern languages.

Uses of the theme are numerous

These are just examples of uses; the list is by no means complete:

- What exactly is a robot? How can we recognise a robot? From an automaton with artificial intelligence, a story of robots.
- Where are the robots? What purpose do they serve? Discover their field of application.
- Is there is a science of robots? Discover the complexities of robotics, its different areas of scientific specialities and its associated techniques.
- Who creates and builds robots? The trades associated with robotics, the industry building robots.
- Why are we so fascinated by robots? Science fiction in literature and the cinema.

This guide offers:

- Activity suggestions related to some of the challenging problems outlined in this document.
- Documented resources for teachers not familiar with the subject.

THE STUDY SHEETS

The study sheets are predominantly to be filled in by the student. Existing in a Pdf format they can be easily printed off or photocopied. The task areas can be completed individually or in small groups. Only a few of the sheets can be completed entirely during a visit to the park. Others require documentary research to be carried out prior or after the visit. The manner in which the study sheets are used is left to the discretion of the teacher.

Entry point into the programmes

- Preparing students to familiarize themselves with companies or technical objects playing a major role in the domain of robotics.
- Study of science fiction as a literary genre, arguments, study of the image and reflecting on its usage as a medium of communication.
- The apprehension of using robotics in automated projects and systems.
- Study of industrial system techniques, understanding the structure and functionality of automated systems.

ANSWERS TO STUDY SHEET

Study Sheet 1 - WHAT IS A ROBOT?

1 Diagram to read from top to bottom: machine, robot, computer.

2 Relationship: Computer – Intelligence; Robot – Intelligent tool; Machine – tool

3 Completed table to read from top to bottom: robot; machine; computer; machine; robot.

Study Sheet 2 - ROBOTS AT FUTUROSCOPE

1/6-2/6: See the documentary file

3/6.

1. The American space mission is called the Mars Exploration Rover (MER).

2. The mission's objective is to geologically study the planet Mars.

3. The launch rocket is called Delta II.

4. The trip lasts about 8 months.

5. The word "rover" replaced the term "astromobile".

6. Origin of the word "Spirit": from a nine year old girl who entered a competition by the LEGO company to name the robot.

7. Diagram completed (from top left hand in a clockwise direction): Panoramic cameras, Antennas, Wheel, Robotic arm, Solar panel.

8. Solar panels.

5/6.

1.The KUKA industrial robots are classified according to their weight handling capacity.

2. The robot used is a KR 500/1 TUV.

3. It belongs to a group of robots handling heavy loads.

4. Diagram:

1 Access platform,

2 Command box,

3 Robot KR 500/1 TUV.

3.1 In-line wrist,

3.2 Arm,
3.3 Shoulder,
3.4 Stabilising system,
3.5 Rotation frame/bed,
3.6 Base unit,
3.7 Support,
4 Protection grill,
5 Gondola.

5. The robocoaster has 6 axis.

6. The gondola is fixed to axis 6.

6/6.

* Height required for secure operation is 6.303 metres.
* Diameter required for safe 360° operation is 9.396 metres.
* Height of plinth on which robot is fixed: 1020 mm.
* The hatched area represents the secure area for people when the robot is in operation.
* For the robot to perform its choreography, it needs to be connected to the system control box.

Activity suggestions

Ask students to choose a robot model that particularly impressed them during their visit to Futuroscope, and ask them:

• Write describing the robots form, size, colour, tasks performed and its character.

Can it see, touch, communicate and move? Use the appropriate technical vocabulary where possible.

• Write an argumentative text in favour of the robot you chose.

Study Sheet 3 - OLIVIER, ROBOTIC PILOT

1, 2 & 3 Olivier's passion is automobiles. He works at Renault SAS. Domain: The robotics.

4 Stages of manufacture: Stamping out, assembling, painting, assembling equipment.

5 Improve speed of production, reduction of tedious tasks carried out by humans. Limit the risk of errors, reduce accidents at work, and increase the economic level of output (Quality)

6 Principal responsibilities: Assure the interface between the suppliers of robots, related equipment and factories.

7 With the manufacturing managers, maintenance managers, and the methods managers

8 New car project – New factory – Definition of needs – specifications list- manufacturing at suppliers – Validation – Test at pilot site – Put into production – Increase production levels – Improve speed. Training: from the phase of 'test at pilot site' to 'Increase production levels' for the production operators and maintenance technicians.

9 Knowledge of computing is required, real time, electronic, electrotechnic, slavery/bonded to

10 Production of 'minutes', visiting suppliers, factories – improving computerisation – Training (production operators and maintenance technicians)

11 Manufacturing manager – Maintenance manager – Methods manager – Production operators – Maintenance technicians.

12

S.A.S. (Société par Actions Simplifiée) - Company of Simplified Shares : A 'SAS' is a company structure whereby each associate (minimum 2, no maximum) is only responsible from a risk point of view for the equivalent of his amount of his own shares in the company. Minimum capital investment is 37000 Euros. Members of the S.A.S. openly decide the management structure and the collective decision making process. The S.A.S. can not have just one member.

Reliability: To make reliable. In whom we have confidence. A device that can function in a reliable manner over a fixed period of time.

Interface: To put physically in place communication rules between two systems.

Specifications List: A document provided by the client to suppliers, describing as explicit as possible the requirement of services outlining all aspects of delivery including, constraints, technical conditions of production, operations and quality.

Connected: That which has a direct relation with another entity.

Supplier: A person who supplies merchandise or access. Server (Servo Control): A state of servitude (slave). An action of control.

Study Trail

Carry out a detailed research project on training activities and jobs related to robotics.

DOCUMENTARY FILE

WHAT IS A ROBOT? HOW DOES IT WORK?

The word "robot", despite the appearances, is difficult to define

It's a word often used for objects that have very little in common with each other. The term also can be attributed to robot painters or welding robots in the automotive industry as well as toy robots or those that explore Mars or humanoid robots.
Dictionary definitions find it difficult to cover the diversity of the subject. For example the "Hachette" dictionary refers to a robot as a machine equipped with a memory and a programme capable of substituting a human for carrying out certain tasks. The term for robot should cover at least two criteria:

• A robot is a machine that is capable of moving or to move one of its constituent elements
• A robot is capable of realising various tasks reproducing characteristics of those of a human or animal.

Robots should also be capable of adapting to their environment.
Each robot has its proper function, according to its functions and mechanical properties (structure, sensors) and software. The most basic robots have three basic components that assure: mobility (excluding wheels), sensorial detection and intelligence (computer).

Modern day Robots around the world and at Futuroscope

Since the 1990's robots have been on the increase. We find them in most human activities. In fact they are omni-present in certain areas of our lives. They now have various classifications.
The various classifications are numerous, including:

In chronological order

-1st generation robot: Of a minimalist nature, they carry out such tasks as painting or welding on an assembly line; it relies on electronic components, it is not too different to a robot as it is still dedicated to a single task.
-2nd generation robot: It has integrated sensors that can examine the environment visually and physically allowing it to alter its comportment according to what it perceives.
-3rd generation robot: It is capable of making decisions; it's the first step towards artificial intelligence.

In order of their technical level

(classification established by JIRA – Japan Industrial Robot Association)

• **Class 1:** Human controlled Manipulators
• **Class 2:** Robots whereby the operation by itself is non movable
• **Class 3:** Robots whereby the movement of the robot can be modified
• **Class 4:** Robots capable of producing by themselves an action learned from an operator during an initial manual operation.
• **Class 5:** Robots digitally controlled; the difference with class 4 being that the robot learned the task from a digital programme.
• **Class 6:** Autonomous robots, intelligent and capable of understanding and adapting to its environment so it can carry out its objectives.

According to their field of application

We can look at those of the CNRS (French Centre for Scientific Research):

• **Robots that explores an area in stead of a human**
These areas could be dangerous, inaccessible to man, or the nature of the work is difficult or impossible; such as the robot used by fire brigades; in the nuclear energy industry, window washing or sewer cleaning;
• **Robots that provide a service to human beings:**
Can be arranged as follows: surgical robots allowing greater precision and can even be manipulated from a distance; domestic robots alleviating humans of boring tasks (robot vacuum cleaner or lawn mower), industrial robots of which there are many applications (automotive industry, pharmaceuticals, food manufacturing); The automotive industry is the largest consumer of robots in the world; in this category we can arrange them as robots of leisure and learning; at Futuroscope: robot dancer KUKA.
• **Robots inspired directly by living beings (human or animal):** the development of androids (in time, maybe, the android home could carry out all domestic functions) and pets.

ROBOTS AND THE FUTURE

It is certainly difficult to project ourselves into the future. We can however, take from work already done in particular in Japan and the United States; give some ideas of the future of robots:

- Miniature robots
- Robots that communicate between themselves
- Development stronger links with biology and the utilisation of living organisms to manufacture or use in robots (test have already been carried out for areas such as sensors)
- The pursuit of efforts in the domain of artificial intelligence and of the conscience (developing androids amongst others)

It is very difficult to determine what will become of all this research. As said by Philippe Coiffet (director of the French Centre for Scientific Research) “there will be a large invasion of robots in all areas similar to that of the modern day computer. The robot of everyday use is only two decades away”. Further he says: “We will never see a machine more intelligent than humans, but we will see… machines more competent than a human to carry out a number of services. We should therefore get ourselves ready to welcome our new companions”.

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