

The Leonardo da Vinci Machines Exhibition

Design By Nature

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SECONDARY

Level 5

Art/ Design Creativity Technology/Science

DESIGN BY NATURE

Time Frame : 1 hour(1 planned Activity) + LdV Exhibition visit

Suitable VELS Outcomes

Art LEVEL 5

Creating and Making

Students, independently and collaboratively, plan, design, improvise, interpret, evaluate, refine, make and present arts works that represent and communicate ideas and purpose. They experiment with, select and use appropriate skills, techniques, processes, media, materials, equipment and technologies across a range of arts forms and styles.

Design Creativity Technology LEVEL 5

Investigating and designing

Students use various strategies and sources of information to investigate and research a range of factors relevant to more sophisticated design briefs to which they have contributed. During the design process they clarify their understanding of design brief requirements and their design ideas by gathering, responding to and providing feedback to others. They develop evaluation criteria from the design brief to inform their judgments during the design process. They use a variety of drawing and modelling techniques to visualise design ideas and concepts. Students demonstrate understanding of design elements and principles and use appropriate technical language.

Science LEVEL 5

Students explain the relationships, past and present, in living and non-living systems, in particular ecosystems, and human impact on these systems.

Download Student Activity sheets on Leonardo's Natural Design to accompany Exhibition visit.

For Leonardo teaching resources: refer to School Programs Resource list

Context

Leonardo da Vinci learnt much about the principles of movement by observing, examining and recording species in the natural world. He documented his work using carefully annotated and scrupulously detailed drawings in sketchbooks.



THE
LEONARDO
DA VINCI
MACHINES
AN EXHIBITION OF GENIUS

Design by Nature

Leonardo's curiosity about examining the world around him was broadly reaching. This unit of work can be used to integrate with a range of curriculum studies; it is intended as an **introduction to design inspired by nature.**

(excerpt taken from : Leonardo's Machines, Da Vinci's Inventions Revealed, Edited by Mario Taddei and Edoardo Zanon, text by Domenico Laurenza.)

Leonardo's Zoological studies

*During the time of 1485- 1490 when Leonardo was in Milan, his notes (found in a manuscript that was stolen in the nineteenth century but later recovered) demonstrated that LdV was pursuing two main paths in his research on human flight: studies on the fundamental laws of natural flight and its imitation, and studies on the dynamic potential of the human body and the elaboration of the mechanisms able to use this potential to the fullest. The fundamental idea behind the flying machine was the imitation of the flight of winged creatures. Some of the studies on this folio deals with flight as found in nature. Here, Leonardo depicted various airborne creatures: a **flying fish**, a **bat**, a **dragonfly** and another flying insect. Leonardo compared four-winged flying animals with animals with membrane-covered wings. He was interested in the differences, but above all in the similarities. The comparative zoological studies are thus connected to those on the flying machine. The type of mechanical wings Leonardo designed during this period (which were found in Manuscript B) are either double wings or membrane covered wings, in imitation of the bat or flying fish.*

Teacher Overview

This Unit of Work encourages students to explore ways in which much human-made (synthetic) design is the result of close observation of the natural world. Optional activities encourage close observation of natural world, in a manner that Leonardo practiced.

The planned activities support a visit to the exhibition of Leonardo da Vinci's inventions. This unit of work is designed as a springboard from which many kinds of curriculum projects may follow. The exhibition visit is intended to consolidate the learning outcomes of activities previously undertaken.



Design by Nature

Student Challenge

When seeking solutions to problems such as human powered flight Leonardo da Vinci looked to nature as a mentor. Students consider ways that natural design has inspired synthetic design and understand about dependence of human kind on nature for learning about how things work. Students closely observe, compare and model bird wingspans and find their own efforts consolidated by LdV's experiments in understanding flight.

Useful and recommended background reading to complement exhibition visit:

Janine Benyus : 'Biomimicry, Innovation Inspired by Nature' *Perrenial, New York* or www.biomimicry.net

Activity 1

Learning about Design inspired by Nature

Teacher presents to class a range of examples of design that has been inspired by nature. Use articles, pictures, photographs, drawings, artefacts and online research opportunities.

Eg. Zebra = zebra crossing
Cockleburs = Velcro fastening
Shark skin = swim streamline suit
Cats = cats eyes
Octopus = bunji ropes
Beetle shape = design of Volkswagen car
Termite mounds = passive cooling in buildings
Kingfisher beak = Japan's Shinkansen (fast train) 500 series nose profile
Gecko= gecko tape
Animals skin = Camouflage

Ask student pairs to make a poster and explain to class their findings.

Homework: Investigate other examples of how we mimic nature. Collect 2 ideas about design that has been inspired by nature.



Design by Nature

Activity 2:

Introduce Leonardo da Vinci's life and machines.

LdV's famous series of flying machines are based on a long study of the workings of birds' and insects wings. They sometimes proved dangerous. One demonstration ended in a crash that nearly killed one of Leonardo's servants but others managed to fly in modern times, such as the giant pyramid parachute that has been successfully tested in Canada and Africa.

Research wings

Compare the wingspans of 4 flying creatures (birds/ mammals). (eg. Pelican, wedge-tailed eagle, cockatoo , bat, dragonfly).

Optional activity

In a group of 2 make a model of the wing span and identify the parts. Eg. stretched skin, cartilage, contour feathers.

Wing span model making.

Equipment: 2 mm thick wire, nylon (material that stockings are made from, or similar) blu-tack (to form nodes, when 2 wire lengths or more, meet) measuring tape.

Demonstrate how to assemble materials to produce a 3-dimensional shape.

Students will need to take note of dimensions.

In pairs, ask students to construct a model of their creatures' wingspan. (Wedge-tail eagle model-makers may need to create a 1: 2 scale model!)

Optional activity

Wing span sketching

Students make a sketch based on the wing span they have modeled, annotating the parts which are skin (membrane) and cartilage (rigid support).

Students present their models and sketches to class. Discussion: How can studying these wings have been useful to people?



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Activity 4: visit to Exhibition

'Inspired by nature'.

Students are asked to choose an LDV exhibit which is based on flight. This might be:

- Hang-glider
- Flying Machine
- Glider
- Flapping Wing Experiment
- Study of a wing in One Piece
- Parachute

Activity 5: *post Exhibition visit*

Exhibit findings from the museum and present to class (presentations could be filmed). Discuss LDV's sketchbooks.