**3D-laser scanners**

3D-laser scanners are now a tried and tested technology. They can be used to create 3D scans of buildings to a high degree of accuracy and detail. A number of 3D-scans can be spliced together using software to generate highly interactive 3D-models.

1. These statements describe features of 3D-laser scans and the 3D-models that can be generated from the scans.
2. Discuss how each of these features might be useful for the conservation programmes at Herculaneum and Pompeii.
3. Rank each feature in order of importance.

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| --- | --- |
| **Features of 3D-laser scans and 3D-models** | Can create instant cross-sections and plans of buildings. |
| Creates an accurate visual record of the state of a room or building. | 3D models give opportunities for academics and the general public to visit virtually, or to explore buildings that are closed for conservation work. |
| Past or present 2D photographs can be overlaid onto a 3D model. | Measurements can be made from 3D scans that are accurate to within one or two millimetres. |
| Geographical information systems (GIS) allow extra detailed information to be added and accessed at any point in a 3D model. | A 3D scan can be a starting point for creating a reconstruction of rooms and buildings. |

3D-laser scanners

1. Read this extra information about 3D-laser scans and 3D-models.

Use this information to confirm or to change your ranking for question 1.

* Experts from various fields can use cross-sections and plans to devise joint conservation plans for buildings, and for artwork on walls and floors.
* Visible records of a room or building give an objective basis from which to monitor and evaluate environmental risks.
* Overlaying past photographs onto a 3D model allows monitoring of long-term decay.
* Adding photographs onto a 3D model allows an almost continuous monitoring of decorative features and a structures state of decay.
* 3D scans can be combined to produce an animated virtual walk through a building.
* Information about environmental measurements, past conservation work, proposed conservation methods and plans, dates, materials used and so on can be added electronically at any point in a 3D model.
* 3D models provide common ground for discussion between all the different consultants working together to find solutions for complex conservation problems.

**UV-C Irradiation**

Irradiation is the process by which an object is exposed to radiation.

UV-C is a type of short-wavelength, high energy ultra-violet radiation that is harmful to living tissue. Most UV-C radiation from the Sun is blocked by the ozone layer of the atmosphere.

UV-C irradiation can be used to destroy biological growth on wall paintings, mosaics or other objects. The process can be carried out in situ, but needs to be carefully controlled to ensure that it does not cause damage to the underlying structure.

1. Organise the following statements in order to explain how UV-C radiation can be carried out safely to destroy biological growths on ancient artwork.

|  |  |
| --- | --- |
| Samples are created using the correct composition of pigments and backing material. | The wavelengths of light reflecting off each sample is measured to determine its colour precisely. |
| The appropriate distance is one at which the biofilm is completely destroyed and the colour of the red, green and yellow pigments are unaltered. | Algae that is growing on the original sample is identified. |
| Fragments are analysed to identify the chemical composition of red, green and yellow pigments. | Original fragments are obtained that are as similar to the artwork as possible. |
| The colour of each sample tested is compared to a control of the same initial colour. | Optical microscopy is used to assess how effectively the biofilm has been destroyed by counting cells and comparing to a control sample. |
| These are grown across the surface of each sample. | Samples of each colour are exposed to UV-C at a range of distances, for 8 hours a day on consecutive three days. |

1. Make a list of the specialist skills that will be needed to carry out this work.
2. What work might need to be carried out before this work is completed?

**Conservation of a wall mosaic**

Wall mosaics are made of many tiny tiles called tesserae. Different colours of tesserae are made of different materials. They are embedded in mortar and the gaps between them filled to give a finished surface.

In order to restore a badly preserved mosaic can involve a complex set of processes.

1. Decide on the most likely best order for the following processes needed to restore a wall mosaic.

|  |  |
| --- | --- |
| Loose tesserae are reset. | A sample of original mortar is removed and tested. |
| A graphic and photographic record is made of the mosaic. | Thoroughly cleaned to take off microorganisms such as lichens, algae and moss. |
| Any modern materials used in earlier repairs is removed. | Gaps in the mosaic where tesserae are missing, are filled with mortar and made level with the rest of the mosaic. |
| Gaps behind tesserae can be filled by injecting grout\* into holes drilled between tesserae. *\*Mortar made with very fine powders.* | Identical materials to the original are used to make fresh mortar to repair the mosaic. |
| Gaps between the tesserae are filled with grout. | Spectroscopy is used to identify exactly what it is made from. |

1. What other factors need to be thought about in order to conserve a wall mosaic in situ?

**Herculaneum Scrolls**

The charred remains of about 1,800 scrolls was discovered in 1752 during excavations of Herculaneum. Together they make up the only known intact library from antiquity, with the majority of the collection now preserved in a museum in Naples.

The villa in which they were found is thought to have been owned by the father-in-law of Julius Caesar.

Experts have attempted to unroll about half of the scrolls through various methods over the years and many have been destroyed in the process.

1. Skim-read the article from the Smithsonian Magazine to find out about the latest attempt to read the scrolls:

<https://www.smithsonianmag.com/history/buried-ash-vesuvius-scrolls-are-being-read-new-xray-technique-180969358/>

2. Take notes using the review grid.

**Article:**

**Buried by the Ash of Vesuvius, These Scrolls Are Being Read for the First Time in Millennia**

**Review grid – Herculaneum Scrolls**

**Outcome(s) of each technique:**

**Methods used for ‘reading’ scrolls:**

**Reflections:**

**Overview/summary of the article:**

**Roman wall painting techniques**

In both Herculaneum and Pompeii, many wall paintings have been found on walls not just of rich villas, but also inside private houses and public buildings.

Depending on the function of the room, walls might be painted with imaginary architecture, still life, mythological scenes, or purely decorative motifs.

Wall paintings can reveal much about Roman society.

1. Skim-read the article from the Royal Society of Chemistry (RSC) about wall painting techniques in Herculaneum and Pompeii.

<https://edu.rsc.org/download?ac=15147>

2. Take notes using the review grid.

**Article:**

**D003: Wall painting techniques (Royal Society of Chemistry)**

**Review grid – Wall painting techniques**

UV-C Irradiation – possible answers

**Other useful information:**

**Implications for conservation:**

**Steps and methods used for Roman wall paintings:**

**Overview/summary of the article:**

1.

* Original fragments are obtained that are as similar to the artwork as possible.
* Fragments are analysed to identify the chemical composition of red, green and yellow pigments.
* Samples are created using the correct composition of pigments and backing material.
* Algae that is growing on the original sample is identified.
* These are grown across the surface of each sample.
* Samples of each colour are exposed to UV-C at a range of distances, for 8 hours a day on consecutive three days.
* Optical microscopy is used to assess how effectively the biofilm has been destroyed by counting cells and comparing to a control sample.
* The wavelengths of light reflecting off each sample is measured to determine its colour precisely.
* The colour of each sample tested is compared to a control of the same initial colour.
* The appropriate distance is one at which the biofilm is completely destroyed and the colour of the red, green and yellow pigments are unaltered.

2.

* The piece of artwork will need to be tested for damp, and structural integrity.
* Remedial work to get rid of damp, to protect the artwork in situ and to ensure that it is structurally sound may need to be undertaken to avoid a recurrence of biological growth over its surface.

Conservation of a wall mosaic – possible answers

1.

* Thoroughly cleaned to take off microorganisms such as lichens, algae and moss.
* A graphic and photographic record is made of the mosaic.
* Any modern materials used in earlier repairs is removed.
* A sample of original mortar is removed and tested.
* Spectroscopy is used to identify exactly what it is made from.
* Identical materials to the original are used to make fresh mortar to repair the mosaic.
* Loose tesserae are reset.
* Gaps behind tesserae can be filled by injecting grout into holes drilled between tesserae. (Grout is like mortar, but it is made with very fine powders.)
* Gaps between the tesserae are filled with grout.
* Gaps in the mosaic where tesserae are missing, are filled with mortar and made level with the rest of the mosaic.

2.

 Dampness and humidity.

 Rain.

 Good drainage is needed, and shelter that allows for good ventilation.

 Protected from humans and wildlife.

Biological growth needs to be periodically gotten rid of (cleaned with chemicals or using UV-C Irradiation).