USING SCREEN-BASED VIRTUAL REALITY LANDSCAPES TO PREPARE STUDENTS FOR THE FIELD

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www.see.leeds.ac.uk/virtual-landscapes/
Virtual Landscapes

- Create screen-based virtual reality environments.
- Built with Unity 3D.
- Enhance training students receive in preparation for fieldwork.
- Replicate aspects of the mapping experience - *not a fieldwork replacement* as they cannot teach key observational skills.
Mapping & Field Skills

- Designed as in-class exercises with paper field slips and notebooks.

- Virtual landscapes populated with ‘outcrops’ with ‘notebook’ entries giving information on the rocks.

- “Three River Hills”: original world, complex geology.

- “Lighthouse Bay”: simple geology, better looking.
For students unable to access the field due to mobility or health issues, virtual worlds are used to develop field skills and offer an alternative fieldwork experience. They also allow an alternative assessment that more closely matches the desired learning outcomes for the module.

**Mapping & Field Skills**

- Using grid references.
- Plotting outcrops and readings on a field slip.
- Interpreting data and decision making skills.
- Thinking in 3D.
- Constructing a geological map, cross section and stratigraphic column from own data.
Use in the Class Room

- Easier to focus on learning and teaching the skills in a classroom than in the field.
- Students made the same mistakes they make when learning in the field.
- “Outcrop capture” – get ’em on the map fast; worry about the geology later.
Results in the field

- Staff reported time saved in the field as basic skills already embedded and increase in student confidence.

- “I feel/felt better prepared for the field”
  - Pre-trip 69%
  - Post-trip 60%

- “I found the virtual training a useful experience mapping”
  - Pre–trip 80%
  - Post–trip 71%
Accessibility Benefits

- Create alternative field trips for students with health/mobility issues.

- Hand specimens and thin sections, photographs.

- Assessment: Field report, map, cross section etc.

- More closely matches learning outcomes.

- “Hybrid trips”: Recreate specific localities for students who can attend field trip but not reach every outcrop.
Other worlds and future plans

• More alternative and hybrid field trips.
• Site investigation type fieldwork.
• Interactive block models demonstrating outcrop patterns.
• Other subjects.
• Research.
Summary

- Game-based training environments.
- Learn basic skills before going into the field.
- Develop 3D visualisation skills.
- Field skills training for those unable to access the field.

Results:
- Increased confidence in field skills.
- Time saved in the field.
- Improved performance.

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Using Interactive 3D Block Models of Geological Maps in Geoscience Education

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1. Introduction

We have created a series of screen-based virtual reality terrains, using the Unity 3D game engine, to demonstrate the 3D interaction of geology with topography and the drainage patterns produced. These virtual terrains block models can be rotated, enlarged, walled and flown around.

A geological map expresses the 3D relationship between geology and topography in a 2D form. To understand and interpret a geological map it is necessary to be able to visualise the 2D map in 3D. However, 3D visualisation and 3D geological relationships are concepts many students struggle with and only fully appreciate once in the field.

The works are built using the Unity development platform and requires the UnityPlayer plugin. The development team are using Unity 5's features, developed by Unity Technologies, to provide the best 3D graphics technology needed to develop a computer game (little 'zombie' effect). Our works are designed for PC access but not mobile platforms.

2. 3D Geological Maps

We have taken the traditional block diagram of a valley with two sides and a geological unit running through it, used to teach outcrop patterns and created:

1) A natural unstructured landscape complete with rock outcrops can be mapped, allowing a student to create their own field map, which can then be compared with the 3D answer (figures 1, 2 and 3).
2) A series of interactive 3D geological map block models (figures 4, 5 and 6).
3) A 3D block model of the topographic map (field) (figures 7 and 8).

3. Classroom Use

These interactive block models of geological maps have been used in a first year island biodiversity geological science maps course at Leeds, UK (Dodd et al., 2018). They were used in class to cover the concepts of outcrop patterns, such as river in the valley, the locations and apparent thickness of units with different rock types and changes in valley height caused by erosion patterns. These were introduced to the lecturer, with the students given a paper copy of the maps and time to explore the maps both during the indoor and outdoor class time.

The natural landscape version was used with a group of twenty second year biology students for a 10-week period (2016). They generated their own geological maps of the area and compared how they had done against the answers. This was followed by a discussion on how understanding the relationship between the geology and the topography shown by outcrop patterns can help in the creation of geological maps.

All our virtual landscapes are freely available online at www.see.leeds.ac.uk/virtual-landscapes/

4. Evaluating Student Response

A direct comparison between the student output using the interactive maps and the pre-course year's output is difficult due to the change in teaching staff. However, the lecturer commented following the interactive block mode that the students were impressed with the project and were developing 3D visualisation and mapping skills, with at least partly responsible for the increase in the average mark from 65-75%.

The overall response was also positive.

"Exploring the geological maps in 3D made it easier to understand and visualise.

Watching both groups use the landscape has enabled us to refine and support their experience and instruction."