SPLINT
SPatial Literacy IN Teaching

University of Leicester

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Computing infrastructures for virtual and augmented reality

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In **virtual reality** (VR), the participant is completely immersed in an artificial world.
In contrast, **augmented reality** is only *partly* immersive, such that both virtual and real worlds are combined in the user's view.

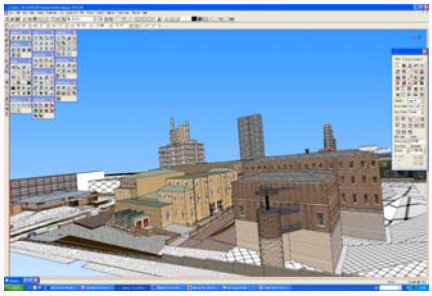
Two-phase approach

Pre-trip

Virtual reality for training & familiarisation

Teaching vignette

Imagine that you are teaching the students about GPS technology, and wish to explain how locational accuracy varies with satellite geometry and the surrounding geographical environment. An inherently 3D task, important to understand in a fieldworking context.



Based on our detailed 3D campus model (above) we have created an immersive GPS teaching tool (below). A student is able to navigate across the campus (currently in a tank!) and assess the accuracy & availability of the GPS in different urban situations. In the figure below for example, some satellites are blocked by the building on the right. Numerical accuracy data are updated & displayed in real time as the student 'moves' across campus.

This poster represents leading edge technologies, but the simpler ones (e.g. GPS enabled PDAs)are not being ignored. Rather, a progression of 2D to 3D to immersive 3D tools are being explored at our field locations.

simple ⟶ complex

New to Leicester in 2006 was the installation of a small virtual reality theatre, seating 12 people. Our VR laboratory is small, providing an intimate and relatively immersive visual experience. However, class sizes frequently exceed the numbers the theatre can accommodate. Moreover, the fixed nature of the theatre means that there is a danger that our SPLINT work could become too inwardly focused. With these points in mind, we have also purchased a portable passive stereo projector rig and screen that can be set up in larger lecture halls on or off campus.

VR related software installed in the visualisation suite and adjoining theatre includes Multigen Paradigm's Vega Prime to manage the virtual environments plus Creator for urban and/or abstract modelling together with Plenoptics Photogenesis. Bionatics RealNat and Blueberry are assisting us with the representation of realistic natural landscapes.

In addition to the use of VR as a field preparation environment, we are developing a mobile headset system using GPS, Emagin Z800 headsets and Intersense Inertial Cube 3 sensors that will allow students to see individual co-located views of virtual representations. Currently highly experimental, this work can be considered "horizon watching"; gaming headsets are rapidly reducing in price and high street game-boxes are converging in graphics power on professional VR installations. Models created for use in our VR theatre can also be viewed through our AR equipment.

Within SPLINT, our aim is to encourage students themselves to develop 3D VR representations; VR laboratories elsewhere can often be seen as the territory of research staff only. Two BSc students received student bursaries to develop VR projects last summer, while another 3rd year BSc student recently undertook an independent dissertation project visualising vegetation and topography relationships in the Tabernas badlands of SE Spain.

On-site

Context-aware augmented reality

Teaching vignette

Imagine that you are in the field with students, overlooking a river valley system shaped by uplift and river capture. Having given the students time to explore the landscape and think about its origins, consider how helpful it would be if you could assist the students to visualise how the landscape before them has changed over time using a computer-generated virtual model of landscape evolution based on exactly the same field of view they are observing in the field now. This is the type of development that we are currently working on, with Spanish dryland environments as our geographical foci, where varied visual and audio information layers are brought together using a range of technologies to enhance the student's spatial context.

The developments you see here, based initially on our campus, are moving us closer to this goal.

AR Software is currently being written by Leicester & Virtalis Ltd, to a specification designed jointly with the School of Geography University of Nottingham.