

# Projection Augmented Relief Models (PARM) Overview

The Projection Augmented Relief Model (PARM) technique is a form of geographic visualisation where digital mapping and imagery is projected down onto a physical landscape model, sometimes utilising a touchscreen interface and a monitor. This results in a holographic effect which attracts and holds attention but also provides a true 3D frame of reference for displaying patterns in space and through time in a broader landscape context, either for public display or decision support.

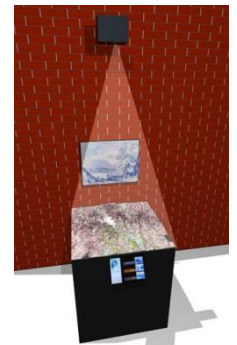
**Background** The development of the PARM idea stemmed from a collaboration between geographer Gary Priestnall and artist Jeremy Gardiner on the 'Towards Pervasive Media' project at the University of Nottingham. The residency focussed on a shared interest in landscape representation and digital media and aimed to find ways to present complex interrelationships between landscape themes using the English Lake District as a study site. The result was a blueprint for a system fusing 3D prototyping and digital mapping which would allow physical landscape models to be textured with alternative image overlays through projection.

**Building the models** Landscape models are created from digital terrain data typically derived from airborne radar or laser-scanning, cropped to size using ArcGIS software. This is then processed using the Maya Expert software into paths to drive a Computer Numerically Controlled (CNC) milling machine by Jake Durrant at Ravensbourne, London. Various densities of modelboard are used, with larger models being tiled together and mounted, a typical final model being at least 60cm x 60cm.



**Developing the system** The use of a prototype at a series of public events and demos informed the design of the full PARM system. Viewers showed a general fascination with the raised relief effect, commenting on geographical characteristics such as relative positions or heights of features and to point out familiar places or often trace out familiar routes they had taken when visiting the actual landscape. People often viewed the model from many different angles and distances. When the model was placed on the floor, many viewers crouched down to obtain a more oblique view point reinforcing the need for placement at table top height. For many the passive sequence of projected layers was engaging enough, but on occasions people wanted to revisit a previous sequence or step to a particular sequence when attempting to describe something to another person. Some types of projected image were particularly effective,

including a hillshade map derived from the digital terrain data which emphasised relief through shadowing. Satellite imagery offered a generalised map of land cover types many of which are related to relief. Animated sequences including routes travelled proved popular and held attention. As a result of the findings from prototype demonstrations a refined system included basic interaction via a touchscreen, a monitor to display associated information, and higher definition models and projection has been developed. A new software environment to control the display and interaction across multiple displays was written in HTML5 by James Goulding, Horizon Digital Economy Research Institute, Nottingham.



**Public installations** The first public PARM installation was developed for the Wordsworth Trust museum and focussed on 'Spots of Time', key events in Wordsworth's childhood that had connections with specific places in the landscape but which also related to poetry created in adulthood. The aim was to raise awareness of the importance of place and memory in Wordsworth's work, but also to encourage visitors to study the original manuscripts on display elsewhere in the gallery space. Visitors can select from three sequences via a touchscreen, each of which presented an extract from the manuscript synchronised with an audio narration along with animated map and image sequences projected onto the physical landscape model of the central Lake District. Analysis of observation data (working with Stuart Reeves, Horizon) is revealing interesting forms of interaction which appear unique to the non-flat component of the display, where the raised relief promotes touching and tracing actions along with discussion relating to places, routes and areas.



**Decision Support** Many of the proposed benefits of using PARM stem from the belief that it offers an intuitive display of landscape, which removes much of the mental effort required by viewers when constructing a mental picture of a landscape. Several PARM displays being developed as tools for spatial knowledge sharing to communicate spatiotemporal patterns in

the geosciences (linked to GIS in some cases) or for collaborative planning activities, including a portable setup (pictured right being used at the Johnson Observatory, Mount St Helens, USA).



## Reference:

Priestnall, G., Gardiner, J., Durrant, J., and Goulding, J. (2012) Projection Augmented Relief Models (PARM): Tangible Displays for Geographic Information, Proceedings from Electronic Visualisation and the Arts (EVA) London, 2012. [\[Web link\]](#)

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