

Participatory Strategic Planning Using a Virtual Reality Environment

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1. Introduction

The Brundtland Commission (WCED, 1987) identified the importance of information and participation in issues relating to the management and planning of change. Subsequent policies on sustainable development (Scottish Executive, 2006; United Nations, 2005) emphasise needs for education and capacity building to increase levels of public and professional engagement in environmental decision-making. This paper describes the use of virtual reality tools, in a mobile theatre, to facilitate information dissemination and consultation with 'hard to reach' public audiences, such as children, on issues of landscape change.

2. Background

2.1 Public Participation

Arnstein (1969) defined a multi-level participatory classification within three main levels: (i) educational (primarily information dissemination), (ii) active participation (public opinions sought and considered in expert decision-making), (iii) citizen power (direct influence on the decision-making process). Sheppard (2005) argues that the impact of participation is linked to the level of involvement, with greater impact from more citizen power, which is one aim of public policy (Scottish Executive, 2007).

Visually representing the real world, and potential alterations, is essential for landscape planners to communicate their thinking to the wider public (Ball, 2008; Bishop, 2007; Lange and Bishop, 2005). The Scottish Executive (2007), in reforming the planning process, also noted that 3D modelling has potential for "engaging communities and assisting planners and Councillors to visualise and assess the visual impact of development proposals". One tool being used to support such engagement is a virtual reality theatre, with associated software tools, for use in public venues.

2.2 Participation in Local Plan Development

The Loch Lomond and The Trossachs National Park Authority is preparing a new local plan which will inform decisions pertaining to land use and development. In spring 2007, the Authority ran consultation events throughout the Park to elicit public aspirations and fears over future land use. Over 900 people attended 26 events, but few younger or disadvantaged people were attracted (The Loch Lomond and the Trossachs National Park Authority, 2007).

With the Park Authority, the Macaulay Institute developed a programme of events, the aims of which were to engage younger people in the planning process, eliciting opinions on preferences for, or concerns over, future land uses. The outputs would contribute to the Park Authority's 'issues report', for use in a subsequent phase of the consultation on plan development.

2. Methods

2.1 Audience

In June 2007, events run at Gartocharn and Killin, in central Scotland, attracted 147 children, plus teachers, Park Rangers, the Park Board and Community Councils. To attract participation, the events were designed to align with the school Geography curriculum, addressing themes of conflict in the countryside, landform development, National Parks, and citizenship.

2.2 Virtual Reality Theatre Facility

A mobile virtual reality theatre (the 'Virtual Landscape Theatre', www.macaulay.ac.uk/planning) was central to these events, in which 3D models of western Scotland and the Park were projected. The theatre comprises a curved screen (8 m x 6 m x 3 m), with three projectors through which rendering of landscape models was distributed. The theatre was designed for use in public venues, such as halls and schools, with audiences of 16 at a time.

2.3 Virtual Reality Models

Two categories of model were used (Table 1), created in ESRI ArcScene, but rendered using packages best suited to model purpose. Vega Prime (MultiGen-Paridigm, 2007), was used for a regional model, for landscape interpretation and feature recognition. An interface developed in Octaga Professional (Octaga, 2007) provided interactive movement of features in models, including hotkeys to: (i) switching between images (*e.g.* 1:50,000 map and aerial images); (ii) introducing new features (*e.g.* houses, wind turbines, trees); (iii) 'drag and drop' features, guided by the audience. Feature icons were colour coded as green (*i.e.* more/good) or red (*i.e.* fewer/bad).

Table 1. Summary of 3D models used in the Virtual Landscape Theatre

Description	Model(s)	
	Regional	Local Models
Purpose	Land use interpretation, features identification, Park delimitation	Identifying options for future land use and discussion of local issues
Extent	100 km x 100 km	20 km x 30 km
Image source	Landsat Thematic Mapper, June 2001	Aerial photography
Data resolution	25 m x 25 m	2 m x 2 m
Elevation source	Ordnance Survey 1:50 000 DEM	Ordnance Survey 1:10 000 DEM
Distributed rendering software	VegaPrime, with 'clickable' attributes	Octaga/Octaga Professional, with feature interactions

2.4 Event operation

Presentations were tailored to suit age-range and Geography class, with ‘ice-breakers’ and introduction to the event, Park familiarisation, and tests of feature identification using the regional model. The local models supported detailed consideration of options for future land uses (Figure 1), as set-out below, with an electronic voting system used to record participant answers, and prompt group discussion.

- (i) Identify features in the VR model (to familiarise with the area and voting equipment).
- (ii) Vote on changes likely to impact on the local landscape, and priorities for the event.
- (iii) Select and place icons of features of specific types of change.
- (iv) Group voting on choice of change and placement, with reconsideration of choices in (iii) above if the group votes accordingly.
- (v) Evaluation and feedback questions.



Figure 1. Overview of south Loch Lomondside, showing a merging of aerial and Ordnance Survey 1:50 000 map imagery during a period of audience voting.

The locations of the features were recorded for conversion into Shapefiles for further reporting and analysis. In addition, the group voting on each feature was recorded, as were images of the three projection screens, for supporting documentary information.

3. Results

3.1 Group Recommendations

Voting from each audience group was recorded individually, and pooled for the two venues, with reporting on factors such as age, organisation and residence in or out of the Park. Broadly, the results suggest:

- (i) A preference for limited wind turbine development in and around the Park to cater for local needs.
- (ii) Limited expansion of housing supply, and building design, consistent with the character of villages in the Park.
- (iii) Disagreement was apparent with respect to provision of shops in the south of the Park, between those living in the Park (reporting a lack of clothes, sports and convenience food shops), and those outside (arguing that sufficient shops exist close-by). In the north-east, a similar lack of shops was reported, plus no dentist or ambulance provision, but too many public houses.

Figure 2 shows the siting of icons of features around Killin during one session. The green trees indicate an extension of woodland sought upslope of the village, and both red and green wind turbines indicates some audience disagreement as to renewable energy provision.

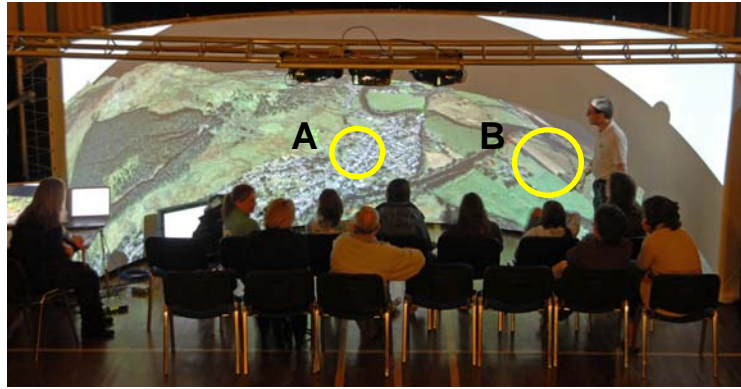


Figure 2. Audience discussion on future changes in land use around Killin. ‘A’ icons of green trees indicating a preference for further woodlands upslope of village; ‘B’ red and green wind turbines.

Electronic voting was also used to provide pupils and teacher feedback on the event, such as relevance to work in the Geography class, awareness of selected issues, limitations of outputs, and reactions to technology.

4. Discussion

Designing event structure and materials was possible by linking the event themes to specific items in the primary and secondary school Geography curriculum. Effectiveness and impact of theatre and tools is hard to assess without a directly comparable type of event using different tools. However, feedback from teachers, Community Councils and Park Rangers suggests a high level of effectiveness of the approach, as an extension of the conventional consultations, with some new issues identified.

The nature of audience interaction with the models appears to have been appropriate to satisfy the aims of the participation. Based on voting results from feature recognition (e.g. lochs, islands, mountain peaks, villages, woodlands), the virtual environment provided materials with levels of familiarity suitable for credible suggestions for consideration of existing and new features. Audience surveys suggest that the package (*i.e.* the evidence of recording views, relevant models, the facility and its interactivity) supported material participation, beyond that of information dissemination. The level of influence on final decisions remains to be assessed after completion of the process of plan development.

5. Conclusions

Attendance numbers and reported levels of relevance and interest across ages, suggest this mechanism provided a means of enabling young people to input to the planning process, supporting information dissemination (e.g. land use interpretation), consultation (eliciting opinions), and collaboration (public and private stakeholding bodies). The impact will be assessed through the process of plan development, including follow-up activities by teachers on the issues raised, in the context of the Geography curriculum. The final feedback is being compiled for the Park Authority in the form of information sheets as per their main format of reporting, with further such events planned for public consideration of the issues raised during the wider consultations.

6. Acknowledgements

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Biography

David Miller is Head of the Integrated Land Use Systems Group at the Macaulay Institute. He leads research into landscape change, public preferences, spatial modelling and the representation of land use change. He is responsible for developing knowledge transfer strategies for target audiences, including elected representatives and the general public.