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A student-led approach to explore and implement immersive-visualisation experiences and design pedagogies across urban planning program and programs with geospatial minor

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- About visualisation and geo-visualisation
- Media for visualisation
- Geo-visualisation for learning and teaching
- Resources
- Measuring effects of visualisation methods on student's learning

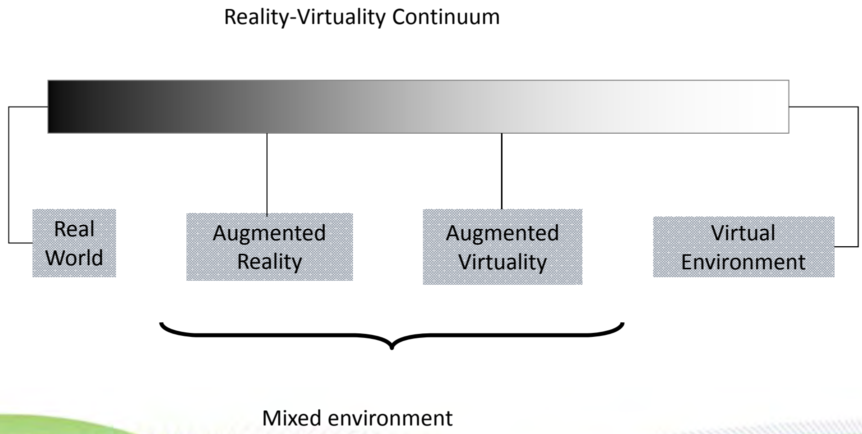
Why visualisation?

- "The non-scientific audience … wants abstraction minimized, information content maximized… with the whole package digestible and non-threatening. This suggests the use of a visual realism approach that shows information…"
  - *Ian Bishop (1994)*

Why visualisation?

- Visualisation constructs the artificial environment, whether it is past, present, or future in a way that it feels like real
- Advantage of creating the artificial world would be that you can manipulate the world unlike the real-world
  - Simulation of effects of sea level rise is the most popular application
  - Visualising impact of different planning schemes
  - Visualisation of impact on resources
  - Additionally, one can visualize difficult concepts.

Visualising reality



Media and tools for visualisation

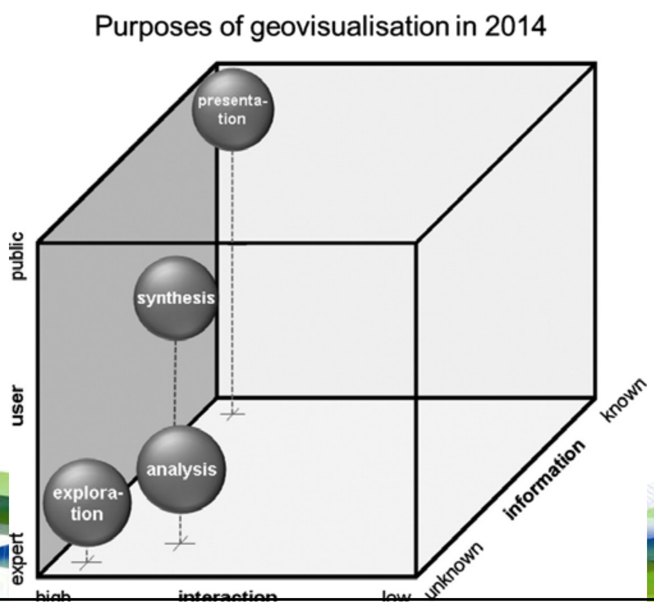
- Printed materials
- Desktop
  - Web
- Smart devices
- Large format displays
  - Immerse Lab
  - Cube
- Immersive environment
  - CAVE2
- Head mounted devices

- Specialised tools
  - GIS software
  - Image processing software
  - 3d tools
  - Gaming tools
- Generalised tools
  - PDF documents
  - Images
  - 3d models
  - Animations

Geographic visualisation

- Referred as Geo-visualisation
- Application of any graphic designed to facilitate a spatial understanding of things, concepts, conditions, processes or events in the human world

Why geo-visualisation

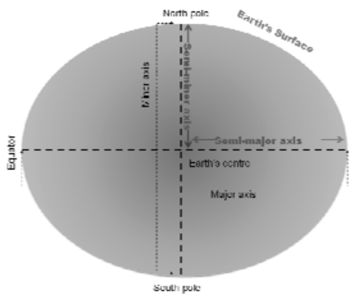


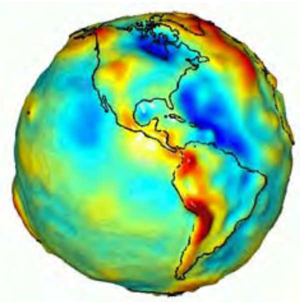
Visualisation and geo-visualisation for learning and teaching

- For conceptual understanding
  - Datums
  - Coordinate system
  - Map projection
  - Data models
  - Image interpretation
  - Spectral bands
  - Urban forms
- For understanding application to the real-world
  - Fly-throughs
  - Interactive globes
  - Panorama
  - Layers

Datum types (datums)

- Defining the shape of the earth to provide a 3d framework for a coordinate system

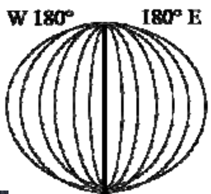


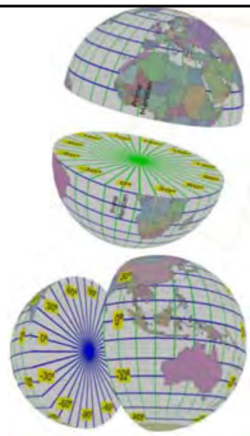


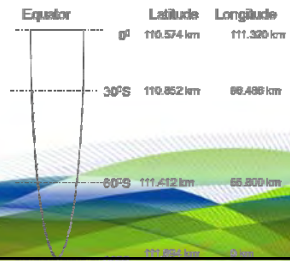
CAVE2 examples

Coordinate system for the earth

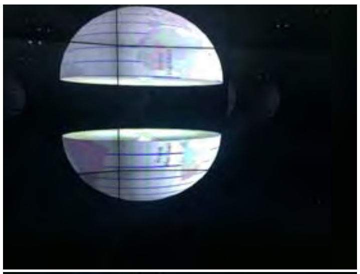
- Geographic coordinate system location geographic information on a spherical or spheroidal surface
- Latitude and Longitude values are used define geographic coordinate system
- Spherical coordinates are defined by
    - Centre of mass
    - Rotation along equator
    - Prime Meridian

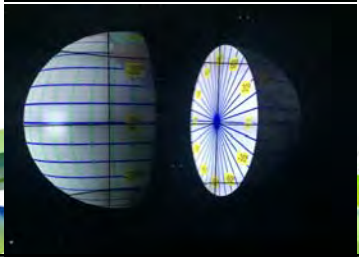


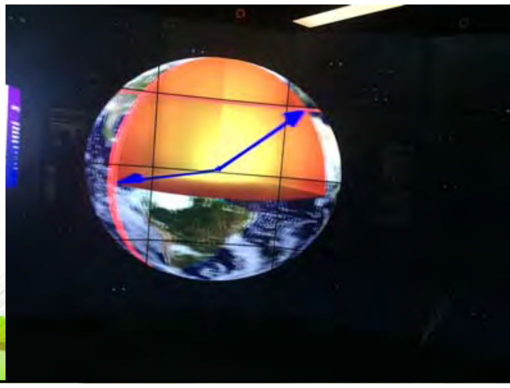




CAVE2 examples



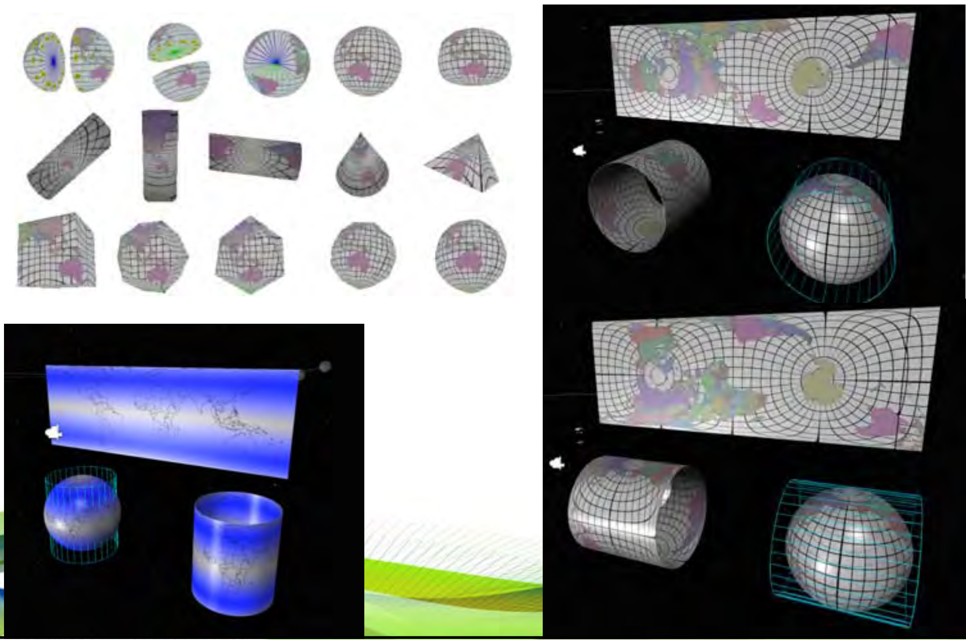




Coordinate systems for maps

- Map projection
- A mathematical transformation so that a geographic area on the three-dimensional surface of the earth can be displayed on a two-dimensional surface (paper map)
  - Map projection distorts the following:
    - Shape
    - Area
    - Angle
    - Distance

3d and CAVE2 examples



3d and CAVE2 examples

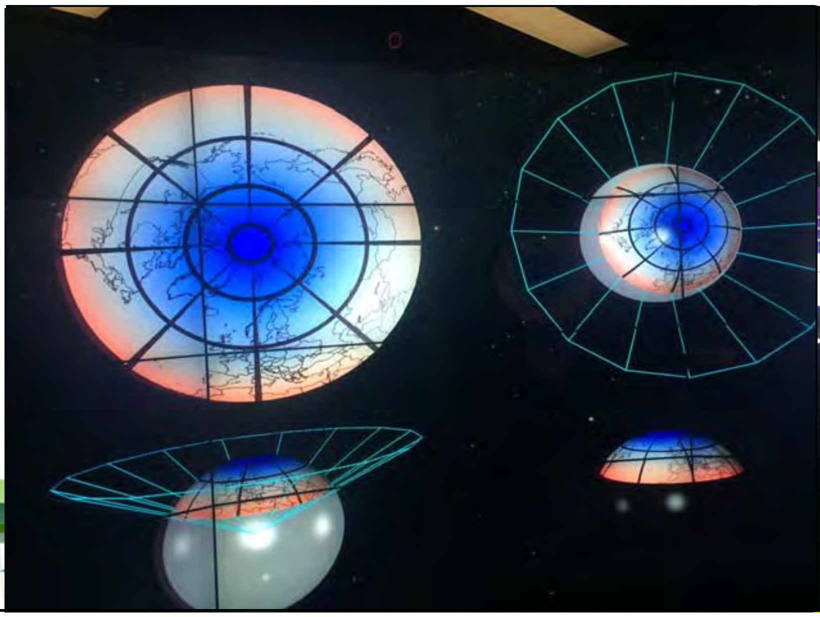
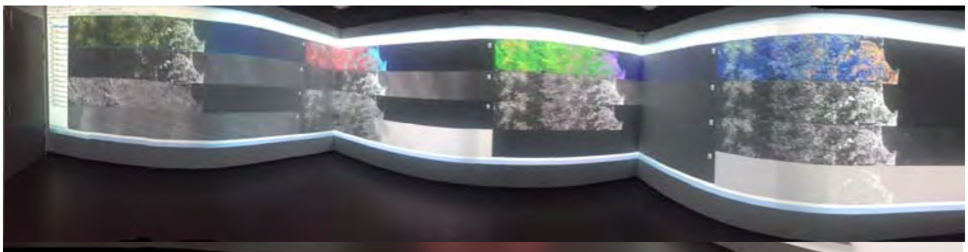


Image interpretation and spectral bands

- We utilise large format display (Immerse Lab at USC) to:
  - Let students explore spectral bands, and how different earth surface features interact differently with electromagnetic spectrum
  - To practice elements of visual image interpretation

Examples from the immerse lab




3d scenes: creation and subsequent navigations

- 3d scenes
  - With realistic models
  - With blocks
  - Light detection and ranging (LiDAR) data sets

Panorama view

- A panorama is an unusually wide picture that shows at least as much width-ways as the eye is capable of seeing
- We use large format display to simulate field surveys

Understanding change in the landscape

- Utilise modern media such as Google Earth together with the large format displays (the Immerse Lab)
- Time series data
  - Landsat image archive (from 1970s, better resolutions since 1988 onwards)
  - High resolution aerial photographs (since 1960s)

Approach to measure effect of learning resources on students

- Lectures were flipped for Datum, coordinate system and map projection
- Students were asked to rank various all the learning approaches

Learning approaches (n=55)	Score Likert (1-10)
Pre-recorded lecture slides	7.5
PDF learning resources	7.4
Tutorials	7.1
Group discussions	6.4
Briefing in the Collaboration Studio/CAVE2	6.3
Demonstration with light bulb and glass globe	5.0
Combination of all the resources and activities	4.8

Issues related to integrating geo-visualisation techniques into planning education

- Two areas of planning education affected:

1. Courses in which students are required to generate future options for a community and spatial area:
   - Each project is different – planning expertise and community working with students.
   - Different virtual reality generated for every planning project.
2. Courses in which immersive experiences and geo-visualisation tools are used to assist a community in understanding the potential effects of a proposed development:
   - GIS layers provide detail about physical constraints on development (e.g. floodable land), State and regional, and
   - Detail about planning scheme or State Codes which affect the nature of expertise needed to report effects of development and potential conditions on development (e.g. steep land – geotechnical advice)
   - 'Fly through' experience – effect of development on surroundings – unique for each development

Preliminary feedback

- In each application of geo-visualisation tools or immersive technology, student group is split:
  - Some like the experience and want to learn how to generate the images.
  - Others prefer the more organic approach to design – pen and pencil still dominate – sometimes intimidated by the technology.
- High cost of generating images and visualisation tools – each year planning projects different.
- A student project lasts on an average of 13 weeks- students have little time to understand the technology – focus is on project detail rather than generating the virtual reality – need different support people in planning program.

Conclusions

- 21st Century is blessed with a variety of visualisation media, and interoperability among them.
- For an effective student learning, a variety of visualisation resources should be created that can be utilised across multiple media to cater the diversity of the learners.
- Modern visualisations may not replace conventional learning and teaching, therefore aim should be to augment learning with new visualisations resources.

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