3D Cartographic Techniques

Nathan Shephard and Kenneth Field
This presentation will be mostly demo’s…

…but we also wanted to introduce some terms…

…and provide reference material for later…

…so…
A call to arms!
Why create 3D views?

“It’s cool, man!”

Which really means…

• See vertically stacked content

• Show data in an easy-to-understand form

• Invite imagination and understanding

3D is *how humans see the world*
Classic first attempt at 3D symbology...

Population sticks

- Manchester: 2.8m
- Birmingham: 2.7m
- Liverpool: 1.5m
- Leeds: 1.5m

Use a isometric / axonometric view

No useful information—
Bad information—
Labels
Real-world size symbols
3D View: **Four Main Elements**

**Surfaces**
- A ground (primary) surface
- Plus optional other surfaces

**Textures**
- The “cover” on top of the surfaces (eg: aerial imagery, cartographic maps, etc)

**Features**
- That live on / relative-to the ground
- That know their own absolute z’s

**Marginalia and effects**
- Reference aids (eg: north arrow, TOC, …)
- Atmospheric effects (eg: lighting, fog, rain, …)
Photo-realistic Scenes

For 3D cartographers…
…they’re kind of boring
…it’s not really cartography

DESIGN REQUIREMENTS?
→ Look outside

USEFULNESS?
→ Changes to the status quo

AUTHORING OPTIONS?
→ Mood effects (lighting, rain, fog, …)

Beautiful, ray-traced Cityscape for Rotterdam, showing proposed new buildings with a setting sun and water reflections
Cartographic Scenes

For 3D cartographers…

…it’s cartography

DESIGN REQUIREMENTS?
→ As rich / full as for 2D maps

USEFULNESS?
→ Powerful, eye-catching, immersive

AUTHORING OPTIONS?
→ Size, Shape, Offset, Textures, Text …
Styles of Scenes

Photo-realistic (Real-World)

Augmented Reality

Cartographic (Representative)
Types of 3D Worlds

Global

Global Coordinate System (WGS84)
Curvature of the earth
‘Global’ context

Local

Projected Coordinate Systems
Fishtank area-of-interest
‘Relative’ context
Beware, 3D can be evil…

Perspective distortion = lying

Content can be hidden = lying

Continuous scale = symbols change across scales

Easy to get disoriented = annoying

Large amounts data = slow

Hard to author = scary
3D View: Familiar Symbols

Objects
  Trees
  Stylized shapes

Colours
  Green is good

Use realistic elements
  “Walls” as barriers
3D View: **Attribute-driven symbols**

Change symbols based feature information:
- Size
- Color
- Transparency
- Rotation
...

- Street light coverage
- Wind vectors through a proposed development
3D View: **Super Powers**

Fly around
Use X-ray vision
Expose invisible things
Go underground
See using radar
Demo time
Get ready to live…
Checklist for authoring better 3D scenes

- **Message** – what should the viewer see / learn?
- **Delivery** – pictures, videos, interactive scenes?
  - Occlusion, measurements, before/after, …
- **3D canvas type** – global, or local?
  - Is an Axonometric / Isometric representation required?
- **Symbology** – realistic, thematic, augmented reality?
  - Size, Shape, Color, Textures, Transparency, …
- **Mood** – Scene properties, such as shadows, lighting, haze
  - Gotham versus Pasadena
- **Guide users** – bookmarks, labels, popups, fly-throughs, voice-overs, …
- **Be creative** – the z-axis does not have to be only for ‘z’ or ‘time’
3D Guidelines (review at your leisure)

• Use dictates structure - Promotional maps require less structure. Thematics require more structure
• Impact - 3D can be powerful, eye-catching and immersive. Use to support attention-grabbing needs
• Content - Simplification and Generalisation have never been more important. Clean. Simple. Functional
• Texture - Avoid flat colours…add textures
• Natural realistic not photorealistic
• Symbols - Mimetic symbols support easier recognition
• Typography - Still important but don’t overload. Rotate with scene if possible but not to be overbearing
• Projection - Use axonometric where possible to maintain scale particularly for analytical map functions
3D Guidelines (review at your leisure)

- Sky and haze – avoid sky but include haze which aids depth cue perception
- Space-Time Cubes - Good for linear data, OK for point, poor for area…try not to overload or stack (beware of ‘inner holes’)
- Z value does not have to depict height or time, use it to show ‘what’s important’
- Scene control - Avoids occlusions by supporting multiple views but avoid too much rotation
- Bookmarks - supports easy camera reposition, highlight key view points
- Interaction - Allow data to be recovered, overcomes measurement limits
- Narration - Guides and improves interpretation
One more thing
Actually...a few more things
The book

In the UC store

esripress.esri.com
Another book
(Summer 2018)
(Summer 2019)

By Nathan Shephard

Mapping With Altitude

By Nathan Shephard

* Working Title
The MOOC
esri.com/mooc/cartography (Sep 5th 2018)
The URLs

- esri.com/arcgis-blog
- carto.maps.arcgis.com
- cartonerd.com
- adventuresinmapping.com
- mapdesign.icaci.org
Other sessions

**How to Make a Great Map** (Ken Field/Wes Jones)  
**Tuesday 14:30** | **Thursday 14:30**

**Amazing and Inspiring maps** (Ken Field/John Nelson)  
**Wednesday 10:00** | **Thursday 10:00**

**Creating Thematic Maps** (Ken Field/John Nelson)  
**Wednesday 08:30** | **Thursday 13:00**

**3D Cartographic Techniques** (Nathan Shephard/Ken Field)  
**Tuesday 13:00** | **Wednesday 16:00**

**Map Design for Representing Relief** (Ken Field/John Nelson)  
**Wednesday 14:30** | **Thursday 08:30**

**ArcGIS Pro: Mapping and Visualisation** (Edie Punt/Craig Williams)  
**Tuesday 14:30** | **Wednesday 16:00**

**Design Story Maps for Emotional Impact** (John Nelson/Jennifer Bell)  
**Tuesday 10:00** | **Thursday 16:00**

**Choosing the Right Basemap** (John Nelson/Andrew Skinner)  
**Thursday 14:30**
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