ArcGIS Multi-Scale and Generalization

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Produce Many Information Products from One Database

Collect Once, Use Many Times
ArcGIS for Mapping Organisations
Addressing all Operations

- Collect
- Produce
- Share

Collect

- Workflows
- Features
- Products

Produce

- Specifications
- Data Models
- Production Management

Manage

Share

- Cloud
- Maps
Generalisation Workflow

- Divide Data
- Data Generalization
- Symbolization
- Cartographic Generalization
- Finishing

Cartographic Partitions
Extract and Clip
MapReduce

Simplify
Thin
Aggregate
Exaggerate

Feature Class Representations

Conflict Resolution

Merge Data
Product processes
Layout
Printing\Exporting
ArcGIS Generalization Framework

Cartographic Representations

Geoprocessing tools

ModelBuilder & Python

Partitioning

Esri Production Mapping
Collapse Road Detail tool
Thin Road Network tool

- Removes less significant roads from display
- Retains representative pattern and connectivity
- Visibility controlled by attribute, easy to modify
Merge Divided Roads tool

- Create a single highway feature from multiple lanes
- Create a single road from a boulevard
- Merge only equal-class roads together
Resolve Road Conflicts tool

- Adjust roads to show visual separation
  - multi-lane highways, boulevards, dead-ends, roundabouts
- Less significant roads moved to accommodate more significant roads
Propagate Displacement tool

- Conflict resolution may introduce spatial discrepancy
  - Adjust adjacent features to reestablish relationships
- Use displacement output from other tools
  - Merge Divided Roads tool
  - Resolve Road Conflicts tool
Resolve Building Conflicts tool

- Separate buildings from each other and from barriers
  - Suppress excess and small buildings
  - Retain relative density and pattern
  - Adjusts visibility, size, spacing, and orientation
Delineate Built-up Areas tool

- Use dense groups of buildings to define built-up area polygons using edge features
An Optimization Approach

- Contextual tools use an optimization approach
- Applies constraints, reflexes, and actions
  - Constraint: “buildings cannot should not be closer than x from another building”
  - Reflex: “a building cannot be moved onto a road.”
  - Actions: “move building away”, “move building back”, “suppress building”
- Underlying optimizer kernel seeks to improve the overall system satisfaction by applying actions
  - Balance competing constraints
  - Find a ‘good enough’ solution in finite time
Feature based 8.x – 9.3.1

- Simplify Line
- Simplify Buildings
- Simplify Polygon

Production Mapping Extension 9.0 – 10.2.2

- Smooth Polygon
- Smooth Line
- Merge Underlying Polygons
- Increase Line Length
- Thin Hydro Network
- Orthogonal Features
- Thin Spot Heights

Contextual 10.0 – 10.2

- Merge Divided Roads
- Resolve Road Conflicts
- Resolve Building Conflicts
- Collapse Road Detail
- Detect Graphic Conflicts
- Delineate Built-Up Areas
Recent Development (EPM) – Skin of Earth tools

- Generalize\Smooth Shared Edge
Recent Development (EPM) – Skin of Earth tools

- Fill Gaps
• Cartographers from JUPEM provided generalization rules

• We built python scripts, models, and WMX workflows
Exaggeration Tools

• Orthogonal Features – *Extend Polygon Sides*

• Natural Features – *Increase Polygon Area*
Exaggeration Tools

- **Merge Underlying Polygons** – expands the width of or replaces features under a line to ensure legibility of the line
Reduce Feature Count

- **Delete Polygon and Extend Lines** – Removes polygons, keeps connected lines

- **Convert Polygons** – Removes small features, ensuring topology rules are honored
Civilian Topographic Model (CTM)
Enabling Production Mapping for Topographic Mapping

Derived from NSGI FDD
https://github.com/esri/ctm
Generalization Samples 25K – 50K

- Generalization models for Civilian Topographic Model
  - Available on GitHub
  - Includes sample data
Multi-Scale Vector Tiles
Vector Map Tiles

- Compact and fast
- Dynamic symbology
- Multi-Scale
- On the fly generalization
- Can rotate or reproject
- In ArcGIS 10.4 - Online Beta now
ArcGIS Earth

- Easy to Use
- World to local scale
- Imagery & basemaps
- View, Measure
- KML aware
ArcGIS Pro 3D Cartography

Terrain Block Diagram

Thematic Buildings

3D Hex Election Map

2D/3D Comparisons

Global Mapping