CHAPTER 7 SPATIAL DATA EDITING

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Location Errors

- Location errors refer to the geometric inaccuracies of digitized features.
- Location errors can be examined by referring to the data source for digitizing.

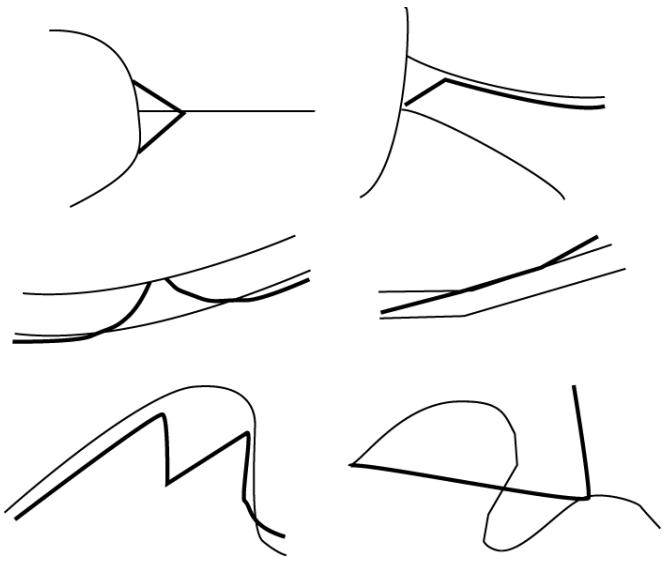

Figure 7.1
Common types of digitizing errors from tracing. The thin lines are lines on the source map, and the thick lines are lines from tracing.

Spatial Data Accuracy Standards

In the United States, the development of spatial data accuracy standards has gone through three phases:

1. U.S. National Map Accuracy Standard, revised and adopted in 1947
2. Accuracy standards for large-scale maps proposed by the American Society for Photogrammetry and Remote Sensing in 1990
3. National Standard for Spatial Data Accuracy established by the Federal Geographic Data Committee in 1998

Topological Errors

Topological errors violate the topological relationships either required by a GIS package or defined by the user.

Types of Topological Errors

Topological errors with geometric features:
undershoot, overshoot, dangling node, pseudo node,
direction error, label error

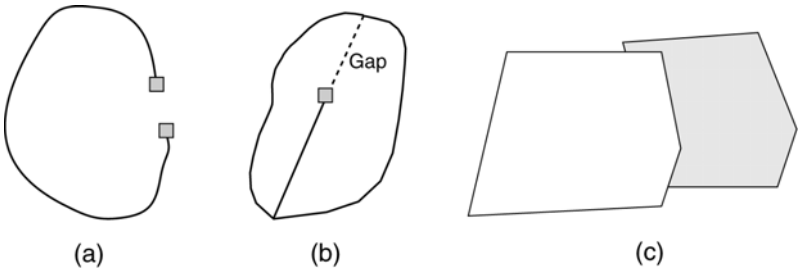

Figure 7.2
(a) An unclosed polygon, (b) a gap between two polygons, and (c) overlapped polygons.

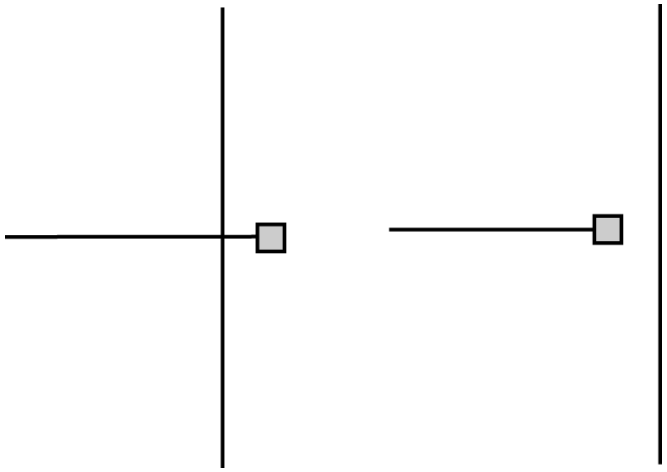

Figure 7.3
An overshoot (left) and an undershoot (right). Both types of errors result in dangling nodes.

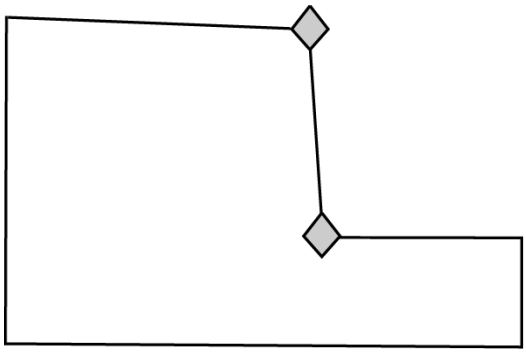

Figure 7.4
Pseudo nodes, shown by the diamond symbol, are nodes that are not located at line intersections.

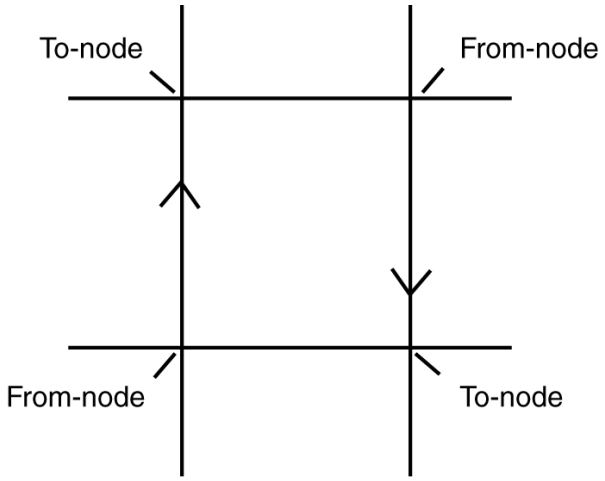

Figure 7.5
The from-node and to-node of an arc determine the arc's direction.

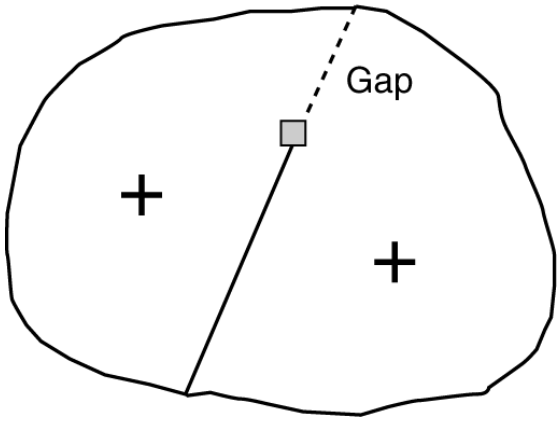

Figure 7.6
Multiple labels can be caused by unclosed polygons.

Topological Errors

Topological errors between layers: boundaries not coincident, lines not connected at end points, overlapping line features, etc.

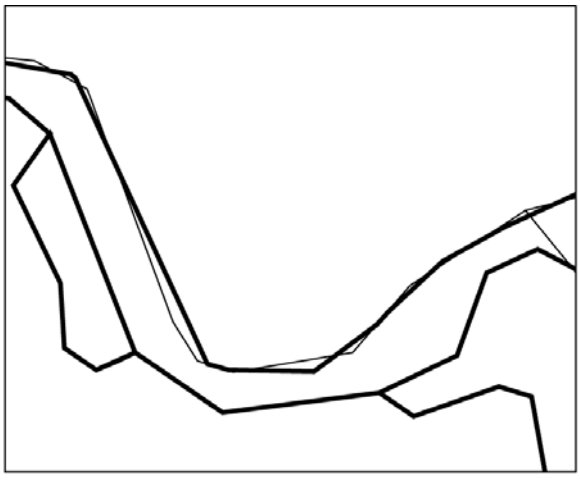

Figure 7.7
The outline boundaries of two layers, one shown in a thicker line and the other a thinner line, are not coincident at the top.

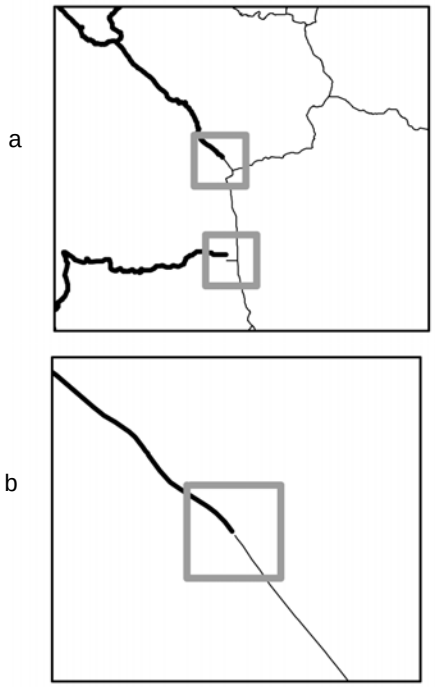

Figure 7.8
Line features from one layer do not connect perfectly with those from another layer at end points. (b) is an enlargement of the top error in (a).

Topological Editing

Topological editing ensures that digitized spatial features follow the topological relationships that are either built into a data model or specified by the user.

1. Topological Editing on Coverages
2. Editing Using Map Topology
3. Editing Using Topology Rules

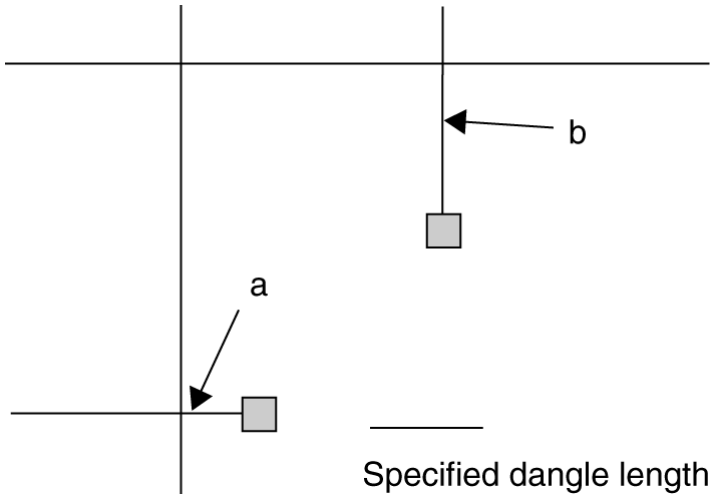

Figure 7.9
The dangle length can remove an overshoot if the overshoot, such as *a*, is smaller than the specified length. The overshoot *b* remains.

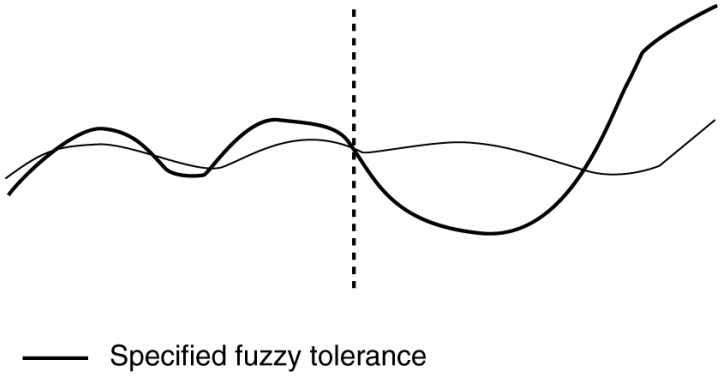

Figure 7.10
The fuzzy tolerance can snap duplicate lines if the gap between the duplicate lines is smaller than the specified tolerance. In this diagram, the duplicate lines to the left of the dashed line will be snapped but not those to the right.

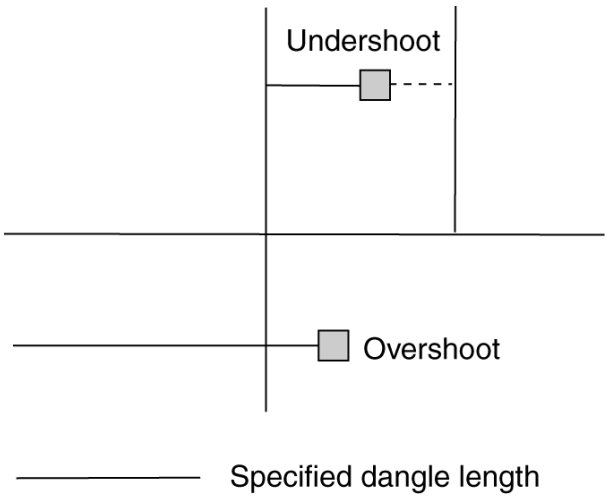

Figure 7.11
A large dangle length can remove the overshoots, which should be removed, and the undershoot, which should not be removed.

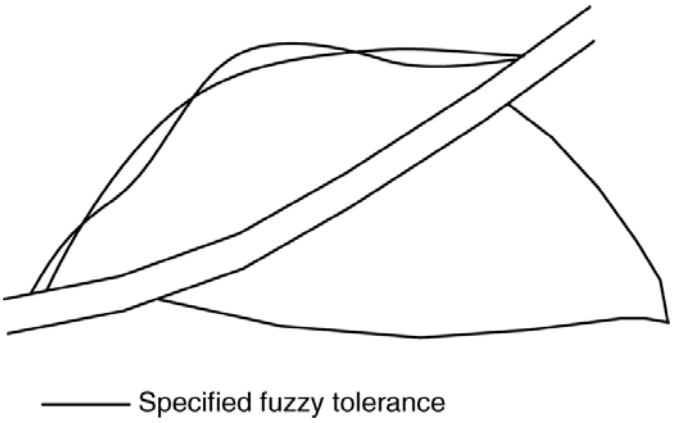

Figure 7.12
A large fuzzy tolerance can remove duplicate lines (top), which should be removed, as well as features such as a small stream channel (middle), which should not be removed.

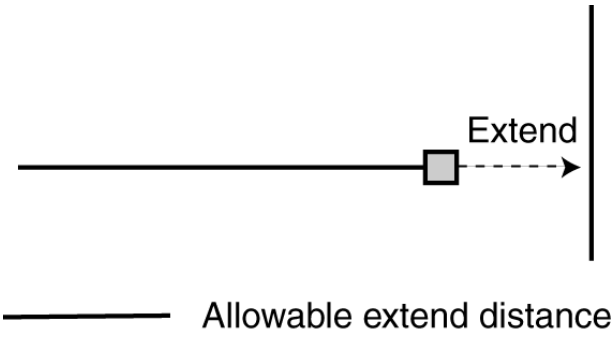

Figure 7.13
The allowable extend distance can remove the dangle by extending it to the line on the right.

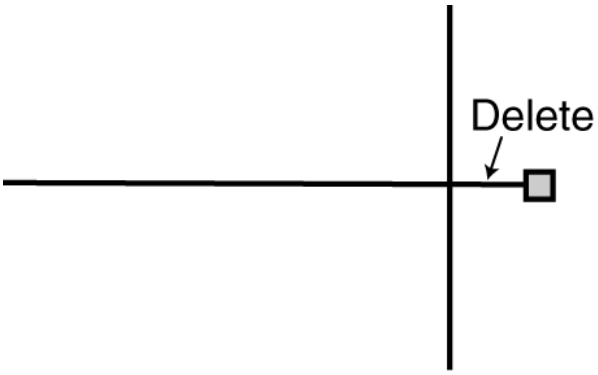

Figure 7.14
To remove the overshoot *a*, first select it and then delete it.

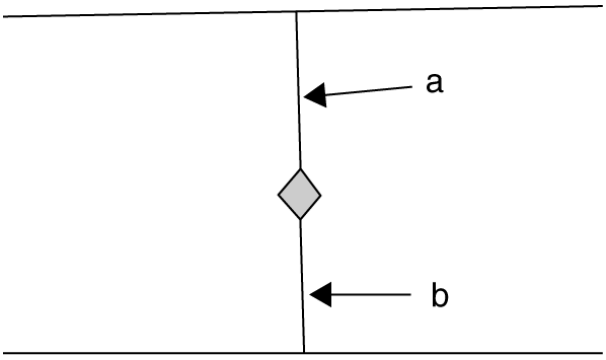

Figure 7.15
To remove the pseudo node, select *a* and *b*, assign the same ID value to both, and un-split them.

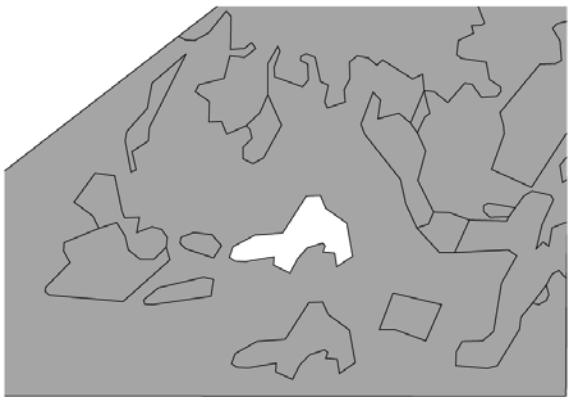

Figure 7.16
After a polygon of a shapefile is moved, a void area appears in its location.

Nontopological Editing

Nontopological editing refers to a variety of basic editing operations that modify simple features and create new features from existing features.

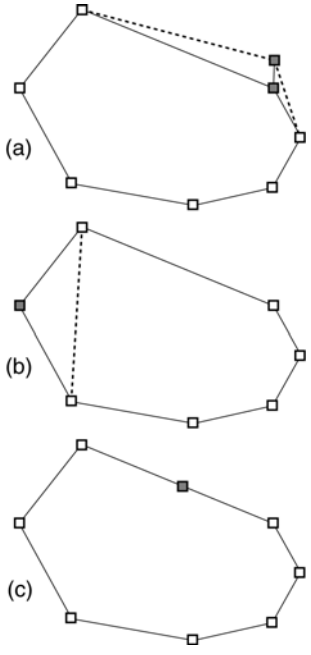

Figure 7.17
Reshape a line by moving a vertex (a), deleting a vertex (b), and adding a vertex (c).

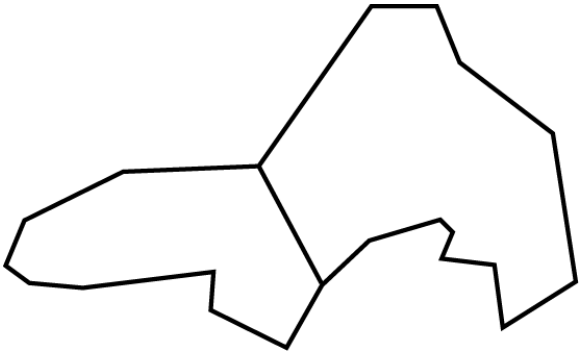

Figure 7.18
Sketch a line across the polygon boundary to split the polygon into two.

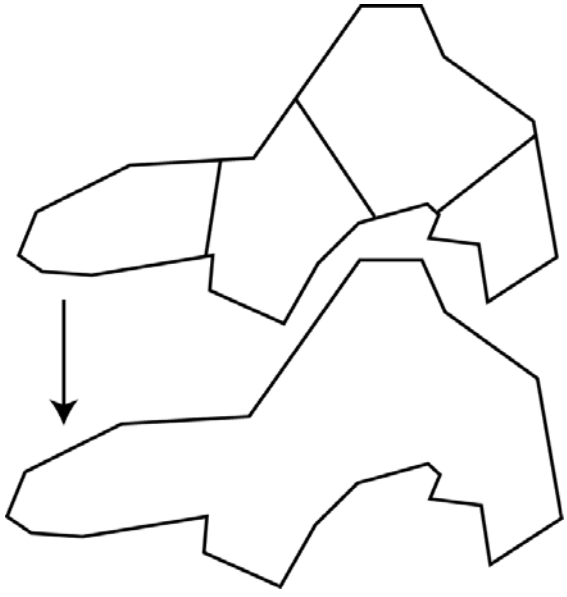

Figure 7.19
Merge four selected polygons into one.

Edgematching

Edgematching matches lines along the edge of a layer to lines of an adjacent layer so that the lines are continuous across the border between two layers.

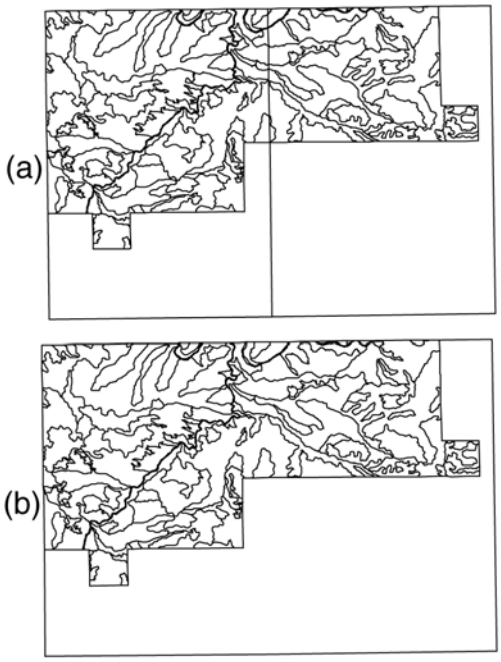

Figure 7.20
Edgematching matches the lines of two adjacent layers (a) so that the lines are continuous across the border (b).

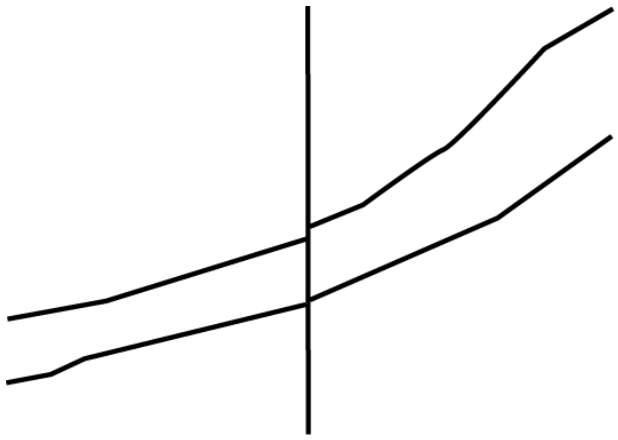

Figure 7.21
Mismatches of lines from two adjacent layers are only visible after zooming in.

Line Simplification and Smoothing

- Line simplification refers to the process of simplifying or generalizing a line by removing some of its points.
- Line smoothing refers to the process of reshaping lines by using some mathematical functions such as splines.

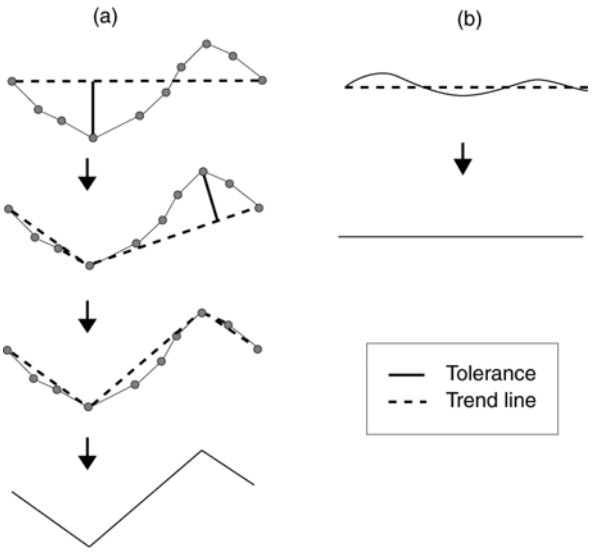

Figure 7.22
The Douglas-Peucker line simplification algorithm is an iterative process, which requires use of a tolerance, trend lines, and calculation of deviations of vertices to the trend line.

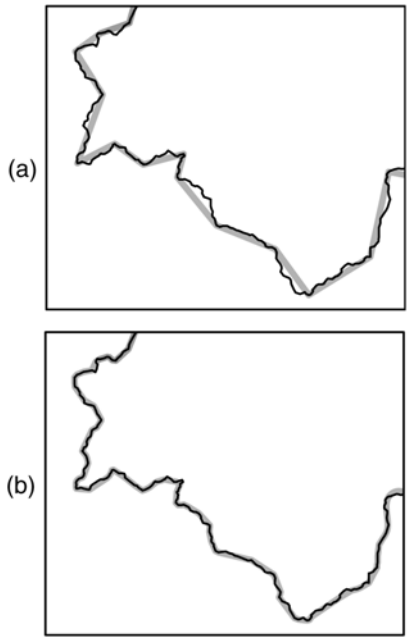

Figure 7.23
Result of line simplification can differ depending on the algorithm used: the Douglas-Peucker algorithm (a) and the bend-simplify algorithm (b).

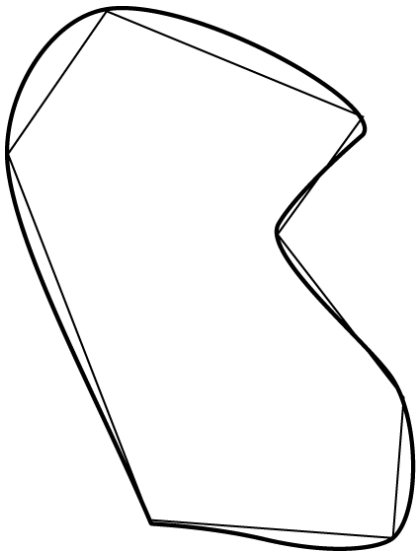

Figure 7.24
Line smoothing smoothes a line by generating new vertices mathematically and add them to the line.

Land Management Information Center at Minnesota Planning: NSSDA statistic
http://www.gda.state.mn.us/pdf/1999/lmic/nssda_o.pdf
Laser-Scan: Radius Topology
http://www.1spatial.com/products/radius_topology/index.php
Ordnance Survey: Master Map
http://www.ordnancesurvey.co.uk/oswebsite/