Weiler Atherton Algorithm for Polygon Clipping

Outline

- Weiler Atherton Algorithm
- Summary

Polygon Clipping Algo: Weiler-Atherton

- Clip a fill area that is either a convex polygon or a concave polygon
- By tracing around the perimeter of the fill polygon
- searching for the borders that enclose a clipped fill region
- Follow a path (either counterclockwise or clockwise) around the fill area that detours along a clipping window boundary whenever a polygon edge crosses to the outside of that boundary
- In most cases, the vertex list is specified in a counterclockwise order

Weiler Atherton Algorithm

- For a counterclockwise traversal of the polygon fill area vertices

  1. Process the edges of the polygon fill area until an inside outside pair of vertices is encountered

  2. Follow the boundaries from the exit-intersection point to another intersection point with the polygon
     - If this is a previously processed point, proceed to the next step
     - If this is a new intersection point, continue processing polygon edges until a previously processed vertex is encountered

  3. Form the vertex list for this section of the clipped fill area

  4. Return to the exit-intersection point and continue the polygon edges

Weiler-Atherton Algorithm(Cont.....)

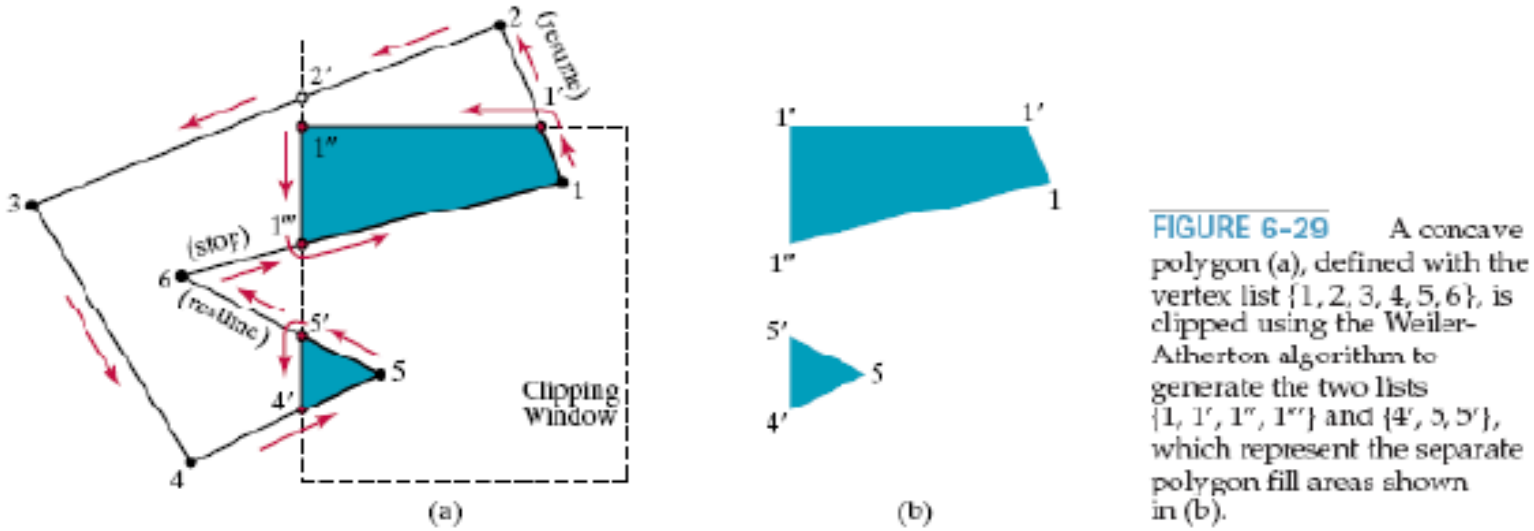
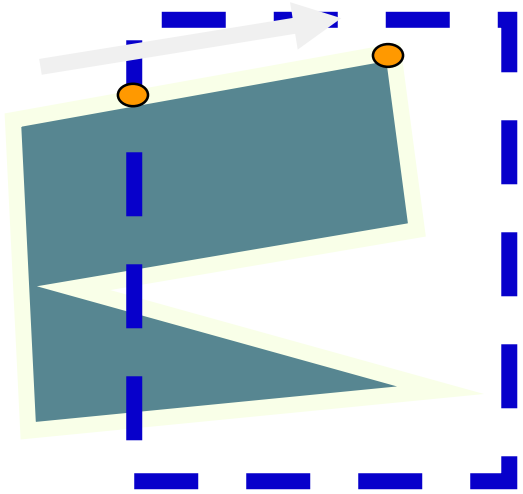


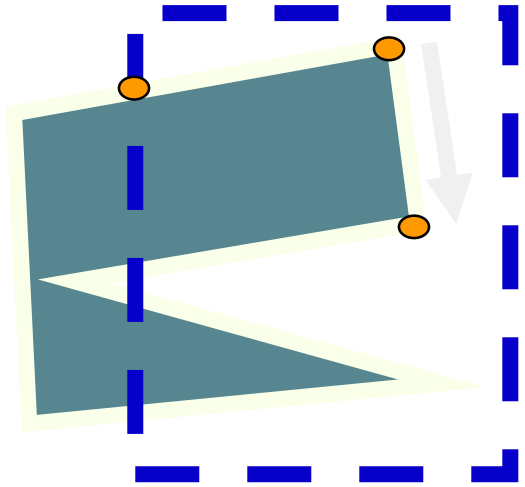
FIGURE 6-29 A concave polygon (a), defined with the vertex list {1, 2, 3, 4, 5, 6}, is clipped using the Weiler-Atherton algorithm to generate the two lists {1, 1′, 1″, 1‴} and {4′, 5, 5′}, which represent the separate polygon fill areas shown in (b).

Weiler-Atherton Algorithm(Cont.....)

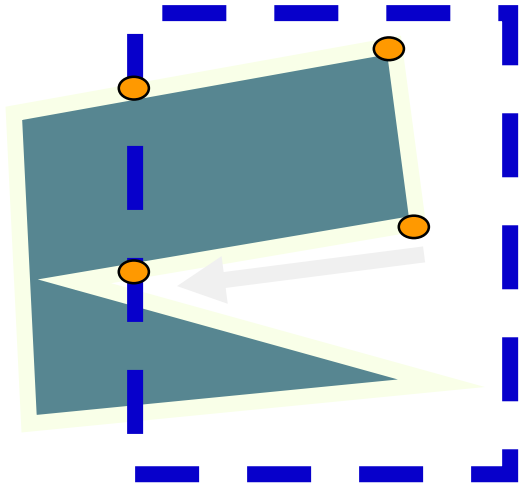
- Example:



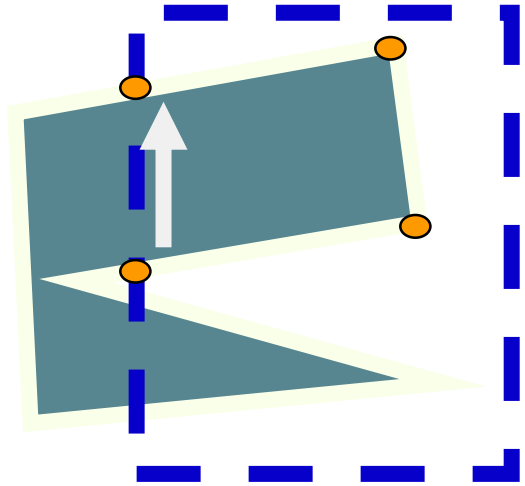
Out -> In
Add clip vertex
Add end vertex



In -> In
Add end vertex



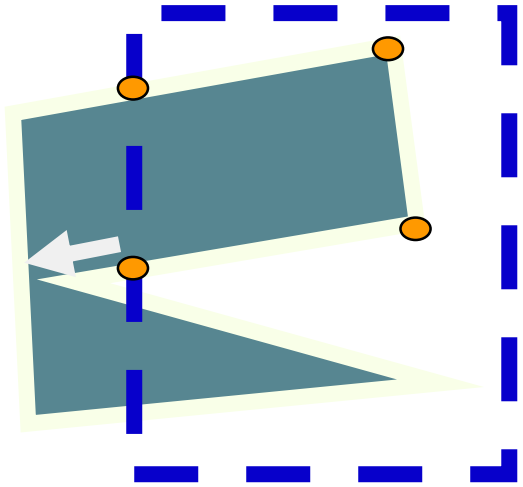
In -> Out
Add clip vertex
Cache old direction



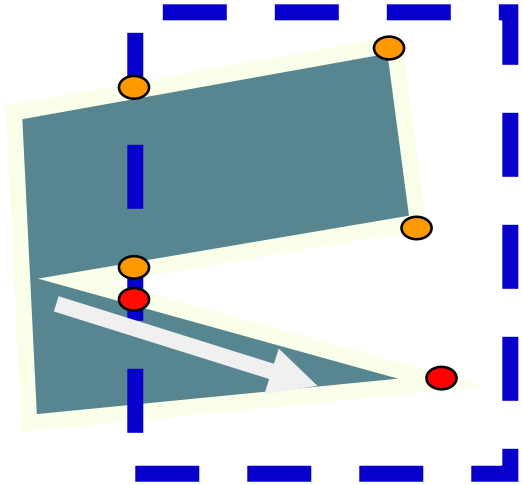
Follow clip edge until
(a) new crossing found
(b) reach vertex already added

Weiler-Atherton Algorithm(Cont.....)

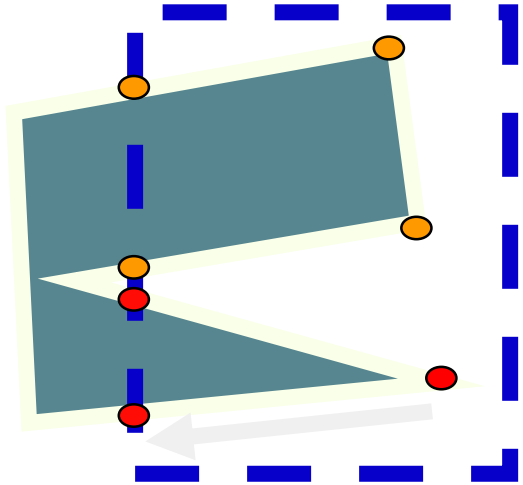
- Example (cont'd):



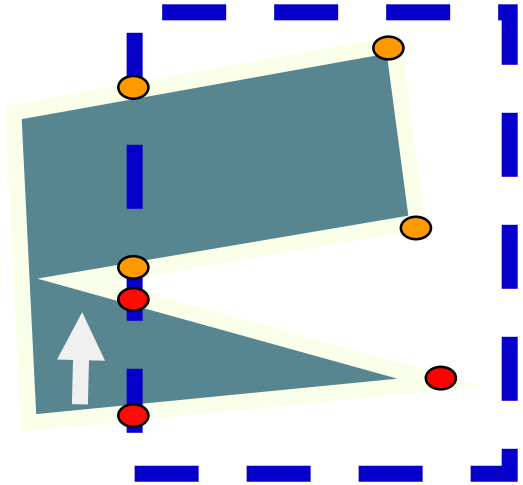
Continue from cached vertex and direction



Out -> In
Add clip vertex
Add end vertex



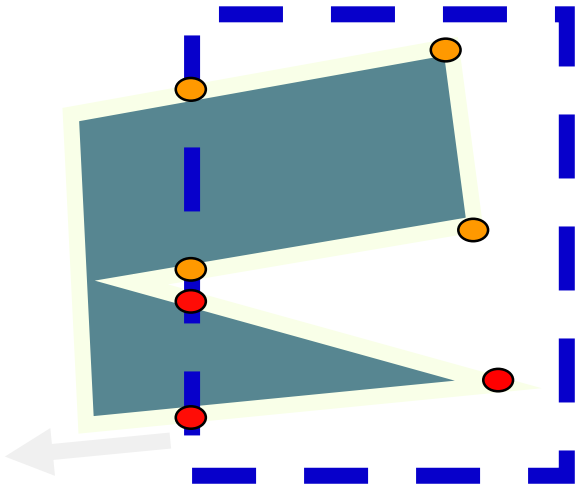
In -> Out
Add clip vertex
Cache old direction



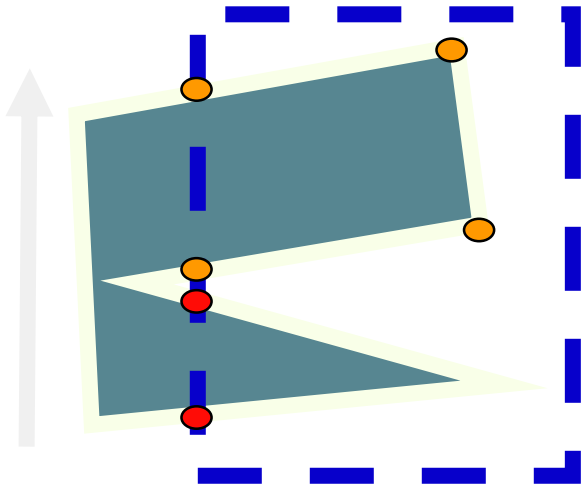
Follow clip edge until
(a) new crossing found
(b) reach vertex already added

Weiler-Atherton Algorithm(Cont....

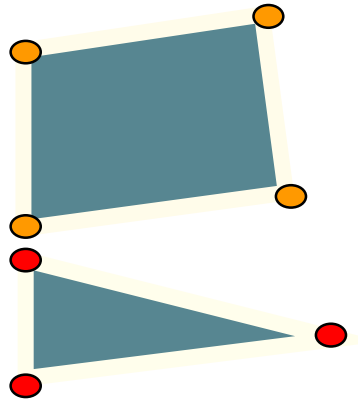
- Example (cont'd):



Continue from cached vertex and direction



Nothing added
Finished



Final Result:
2 unconnected polygons

Text Clipping

- Clipping method depends on how characters are generated
- The simplest method is to use the all-or-nonestring-clipping strategy
- An alternative is to use the all-or-none character-clipping strategy
- A third approach to text clipping is to clip the components of individual characters

Text Clipping

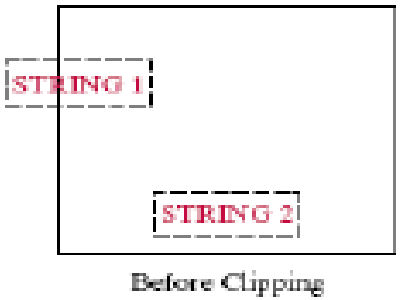


FIGURE 6-33 Text clipping using the coordinate extents for an entire string.

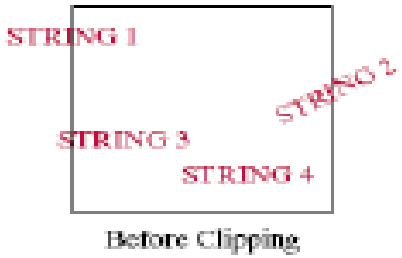


FIGURE 6-34 Text clipping using the bounding rectangle for individual characters in a string.

FIGURE 6-35 Text clipping performed on the components of individual characters.

Summary

- Difficulties:
  - What if the polygon recrosses an edge?
  - How big should your cache be?

Resources

- https://en.wikipedia.org/wiki/weiler-atherton-algorithm
- https:// www.tutorialandexample.com/polygon-clipping/
- https://iq.opengenus.org/weiler-atherton-algorithm