

# HYBRID MODELS

## Inputs:

- a.) Trunk or branch profile – closed polygonal surface – simple.
- b.) Branching structure – open polylines.
- c.) Canopy – simple/complex surfaces or disturbed meshes.
- d.) High resolution image of plant material to be modeled/rendered (\*.tif, \*.tga, \*.jpg). For accurate branching and habit consult a reference such as Hightshoe's "Native Trees Shrubs and Vines for Urban and Rural America."

## Note:

This method seems to work best with multistemmed understory trees without a central leader.

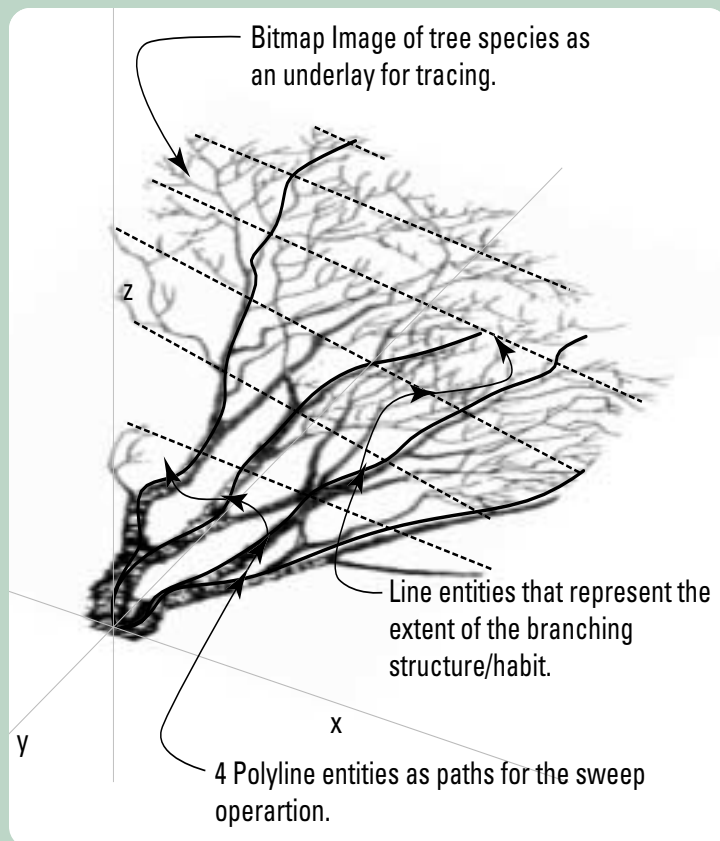
## Overview:

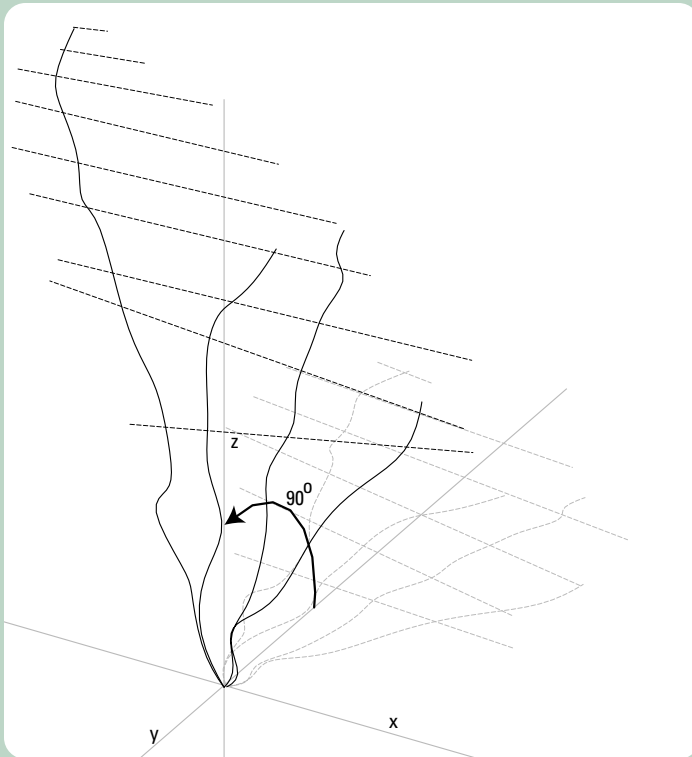
The hybrid combines a more complex branching and trunk structure with the simple canopy surfaces of the "Layered Canopy" tree. The complex branching and trunks are swept shapes. The swept shapes use paths derived from tracing the branch structure of an image, and a simple closed form for the trunk or branch profile. In the end the complex branching is then combined with the layered canopy shapes, envelopes, or leaf entities, to form the hybrid model. Many types of hybrids tree models are possible through skillful combination of the entity types described throughout this chapter.



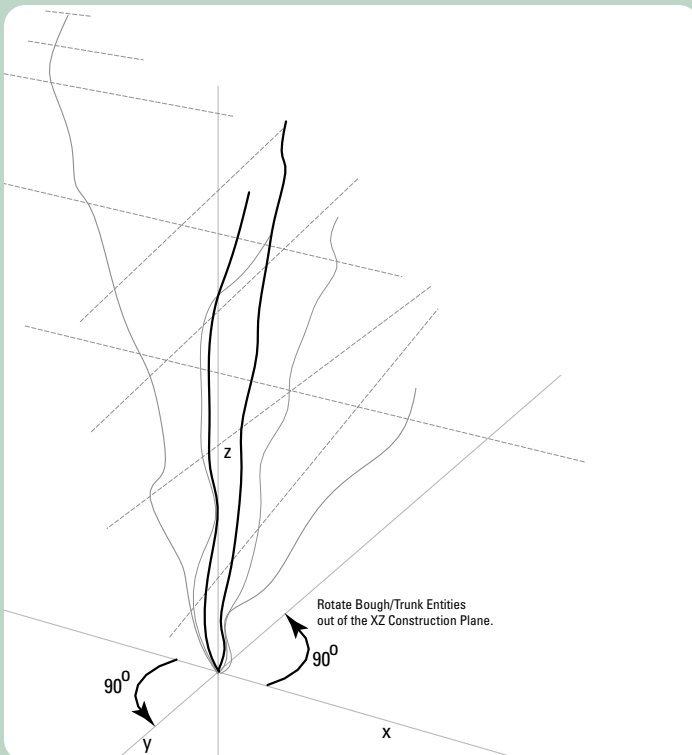
## Process:

1. In the CAD or modeling application – place the image of the tree you wish to represent as an "underlay" for tracing tree structure and habit.
2. On the XY construction plane, using the polyline command trace individual branches or the trunk as one entity from base to tip. This will result in a series of paths along which you will sweep trunk and branch profiles.
3. On a separate layer, generate a series of line entities that represent the extent of the branching structure or canopy.





3. In three dimensions rotate the paths, and the line entities so that they will be perpendicular to the XY construction plane.



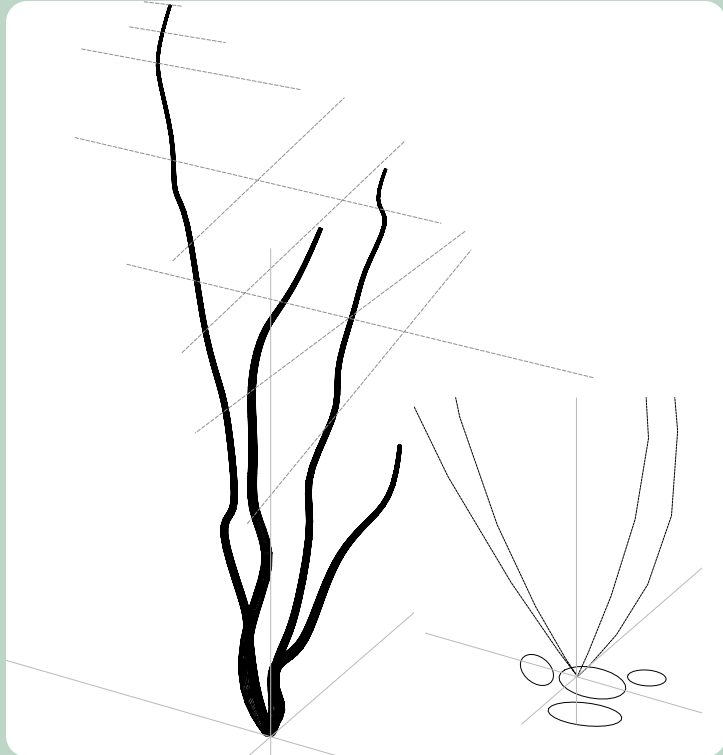
4. Even though the paths are perpendicular to the construction plan they are 2-dimensional. Using the rotate command, rotate the paths individually around the "origin," so that they begin to define or suggest volume.

5. With either a closed polyline, circle, or ellipse, model the diameter of the trunk or branching structure.

6. Using the sweep command sweep the trunk profile along the traced path of the trunk or central leader. The resulting solid entity will be the trunk entity.

**Variation:**

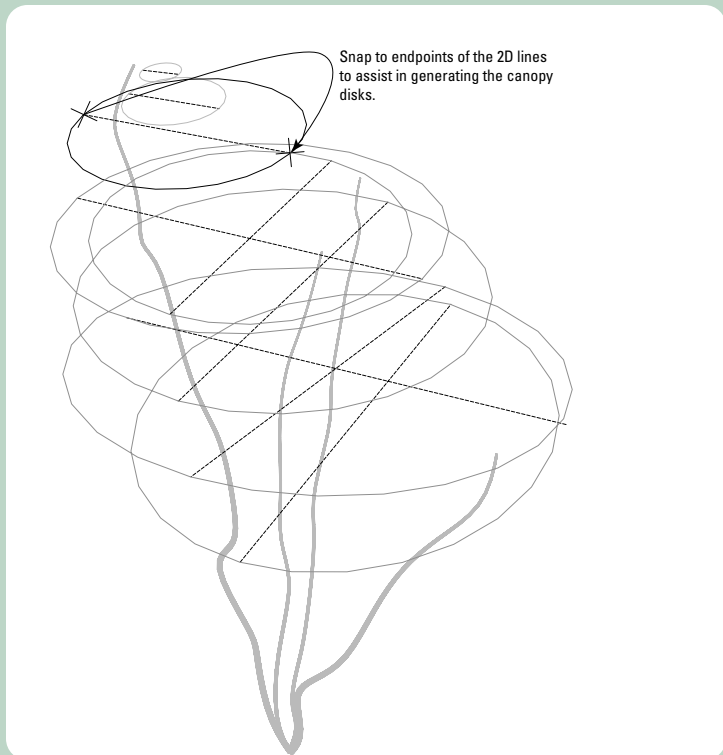
In the sweep operations there are many options for transforming the swept object, providing variations and irregularities. The swept object can be scaled or rotated along the path. These options are set during the command.



7. The line entities that represent the extent of the tree branching structure will be used as a guide in constructing the canopy disks. Make sure the XY construction plane is current and activate the endpoint snap.

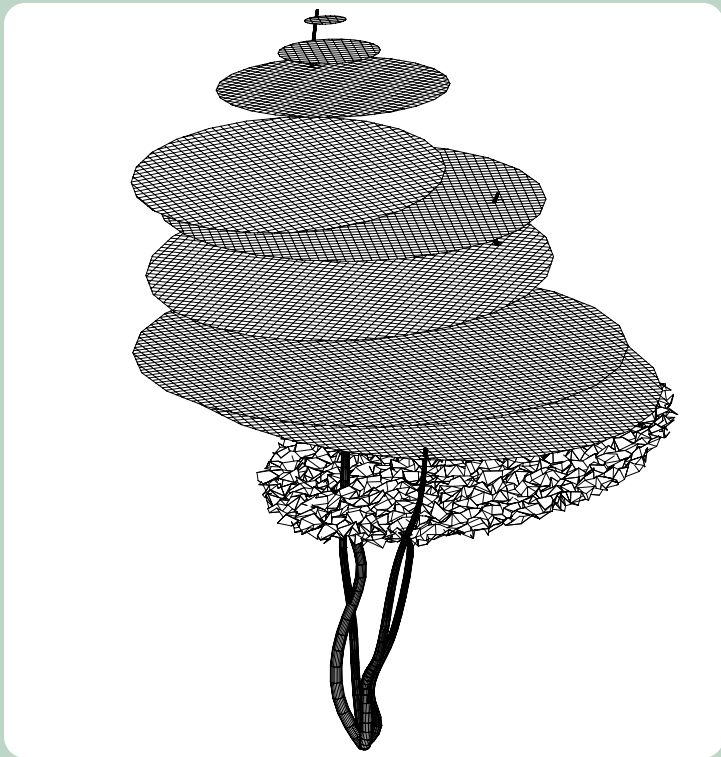
8. Using an ellipse, circle or rectangle, generate a series of surfaces to represent the canopy. The "endpoint snap" will allow you to use the canopy extent entities as guides for constructing the geometry.

9. Anticipating material assignments in a rendering application, make sure that the canopy entities are on a different layer than the trunk entities.





*Hidden-line representation.*



*Variation: To add texture to the canopy wafers, mesh the polygonal faces and then disturb the points in the mesh.*

**Variations:**

- a. "Disturbed Wafer" canopy with swept trunk entities.
- b. "Disturbed Wafer" canopy with Silhouette/Cutout Branching Structure.



- a. Canopy envelope with silhouette branching structure.
  - b. Canopy envelope with swept branching structure.
- [The procedurally derived canopy and envelope were generated with "Tree Professional" by Onyx Computing. The method for generating the procedural tree is covered in the next section.]



- a. Procedurally derived canopy with swept branching structure.
  - b. Procedurally derived canopy with silhouette branching structure.
- [The procedurally derived canopy and envelope were generated with "Tree Professional" by Onyx Computing. The method for generating the procedural tree is covered in the next section.]

