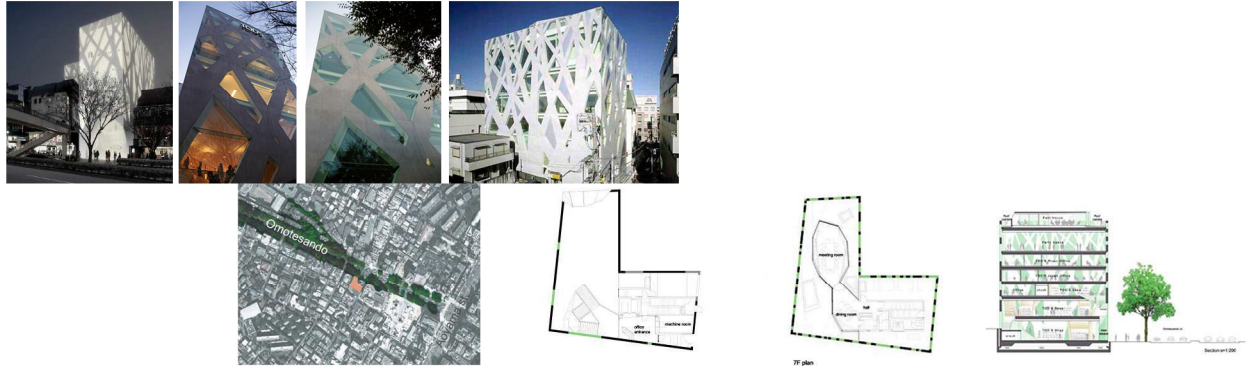


## Tod's Omotesando

Tokyo, Japan



*The facade of criss-crossed concrete braces reinterprets the silhouettes of the elm trees lining the street. The Tod's building, located on Omotesando, the famous tree-lined avenue in Tokyo's Aoyama district, is wrapped in a skin of criss-crossed concrete braces and glass that mimics the trees lining the street.*

The concrete braces also serve as space dividers inside the building where the natural materials, stone, wood and leather, reflect the quality of Tod's leather goods. When the spaces between the braces are lit from within at night it creates the effect of silhouetted tree branches.

Total area: 2,448.84 square meters

Completed: 2004

Architect: [Toyo Ito & Associates](http://www.ito-architects.com/)

General contractor: Takenaka Corporation

Structural Engineer: OAK Inc.

Mechanical Engineer: ES Associates Co., Ltd.

Lighting Engineer: Lightdesign Inc.

Manufacturers (furniture): Modar s.r.l.

Fixtures and fittings (shop): Garde U.S. P CO., Ltd.

The branching design was based on Ito's Serpentine Gallery Pavilion (2002) in London.

< Source :: Toyo Ito & Associates : <http://www.arcspace.com/architects/ito/tod/tod.html> >

## Recursion

In programming, the ability of a subroutine or program module to call itself. It is helpful for writing routines that solve problems by repeatedly processing the output of the same process.

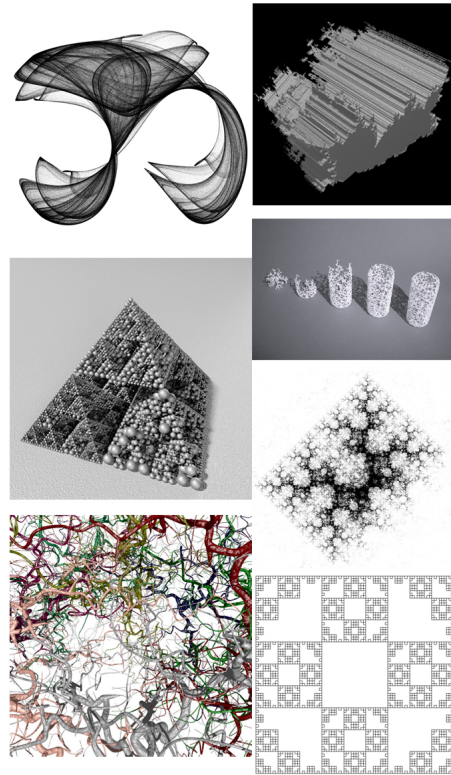
< source : <http://computing-dictionary.thefreedictionary.com/Recursive+algorithm> >

## Fractal

A fractal is a rough or fragmented geometric shape that can be subdivided in parts, each of which is (at least approximately) a smaller copy of the whole. Fractals are generally self-similar (bits look like the whole) and independent of scale (they look similar, no matter how close you zoom in).

Many mathematical structures are fractals; e.g. Sierpinski triangle, Koch snowflake, Peano curve, Mandelbrot set and Lorenz attractor. Fractals also describe many real-world objects that do not have simple geometric shapes, such as clouds, mountains, turbulence, and coastlines.

Benoit Mandelbrot, the discoverer of the Mandelbrot set, coined the term "fractal" in 1975 from the Latin fractus or "to break". He defines a fractal as a set for which the Hausdorff Besicovich dimension strictly exceeds the topological dimension. However, he is not satisfied with this definition as it excludes sets one would consider fractals.



< source :  
<http://computing-dictionary.thefreedictionary.com/fractal> >

## Results

**PROCEDURE** drawTree1;

**VAR**

```
maxLevels, i      : INTEGER;  
initBendAngle, initBranchAngle, trunkRatio, branchRatio  : REAL;  
branchAngle, heightScale, bendAngle, level, antiTrunkRatio, stageWidth  : REAL;  
SW, SH, theight, lastMaxlevels , startAngle, x, y: REAL;  
r, g, b          : LONGINT;  
Txt              : ARRAY [1..100] of STRING;  
Outpt           : DYNARRAY[] of CHAR;
```

```
PROCEDURE drawTree(x, y, a, rad, level : REAL);
  VAR
    cx, cy : REAL;
  BEGIN
    cx := x + cos(a) * rad * trunkRatio;
    cy := y + sin(a) * rad * trunkRatio;
    LineTo(cx, cy);
    IF level > 0 THEN BEGIN
      a := a + bendAngle;
      level := level - 1;
      drawTree(cx, cy, a - branchAngle, rad * branchRatio, level);
      MoveTo(cx, cy);
      drawTree(cx, cy, a + branchAngle, rad * branchRatio, level);
      MoveTo(cx, cy);
      drawTree(cx, cy, a, rad * antiTrunkRatio, level);
    END;
  END;
```

```
PROCEDURE createInfoOfTR( pX, pY : REAL; tx : STRING; valueOf : REAL);
  BEGIN
    TextOrigin(pX, pY - 60);
    Outpt := "";
    Outpt := Concat(Outpt, tx, valueOf);
    Layer('Text');
    CreateText(Outpt);
    Layer('Layer-1');
  END;
```

```
BEGIN
(* set maxLevel of tree *)
  maxLevels := pmaxLevels;
(* determine the level of tree *)
  IF maxLevels < 5 THEN BEGIN
    maxLevels := 5;
  END;
  IF maxLevels > 9 THEN BEGIN
```

Seong Ki LEE

```
        maxLevels := 9;
    END;
(* set values of tree *)
    initBendAngle := pinitBendAngle;
    initBranchAngle := pinitBranchAngle;
    trunkRatio := ptrunkRatio;
    branchRatio := pbranchRatio;
    heightScale := 2.5;
    stageWidth := 900;
    theight := ptheight;
    SW := stageWidth;
    SH := theight;
    bendAngle := (initBendAngle * PI / 180);
    branchAngle := initBranchAngle * PI / 180;
    lastMaxlevels := maxLevels;
    antiTrunkRatio := 1 - trunkRatio;
    startAngle := Deg2Rad(pstartAngle);

(* draw the tree *)
    FOR i := 0 TO maxLevels DO BEGIN
        x := SW / 2;
        y := SH - 100;
        i := i + 1;
        PenFore(8 - i);
        MoveTo(x, y);
        drawTree(x, y, startAngle, (SH - 100) * heightScale, maxLevels);
    END;
(* put the text into the stage *)
```

Seong Ki LEE

{ Create a multiple line text object at 0,0 }

FillPat(0); { alternatives : 6, 7, 8, 12 }

TextJust(1); { 1 : left, 2 : center, 3 : right }

TextVerticalAlign(3); { 1 : Top of text box, 2 : Top Baseline, 3 : Text centerline, 4 : Bottom baseline, 5 : Bottom of text box }

TextSize(500);

createInfoOfTR(x-100, y - 10, 'Maximal Level : ', maxLevels);

createInfoOfTR(x-100, y - 20, 'Height : ', theight);

createInfoOfTR(x-100, y - 30, 'Initial Bending Angle : ', initBendAngle);

createInfoOfTR(x-100, y - 40, 'Initial Branch Angle : ', initBranchAngle);

createInfoOfTR(x-100, y - 50, 'Initial Start Angle : ', startAngle);

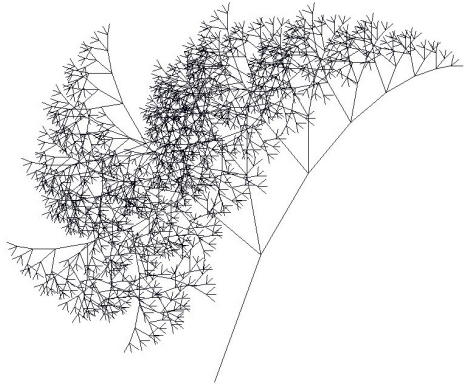
createInfoOfTR(x-100, y - 60, 'Branch Ratio', branchRatio);

createInfoOfTR(x-100, y - 70, 'Trunk Ratio', trunkRatio);

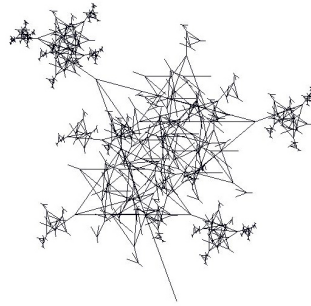
END;

RUN(drawTree1);

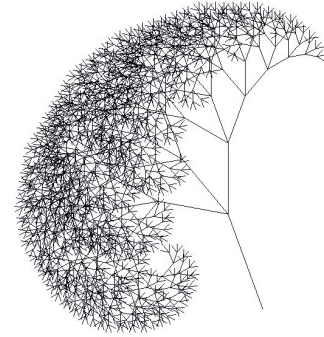




Maximal Level : 7  
 Height : 300  
 Initial Bending Angle : 30  
 Initial Branch Angle : 40  
 Initial Start Angle : 1.22173247639603  
 Branch Ratio: 0.7  
 Trunk Ratio: 0.4



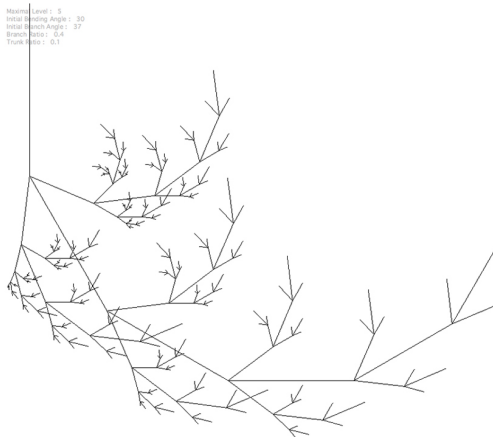
Maximal Level : 6  
 Height : 300  
 Initial Bending Angle : 35  
 Initial Branch Angle : 35  
 Initial Start Angle : -0.986217719376  
 Branch Ratio: 0.7  
 Trunk Ratio: 0.7



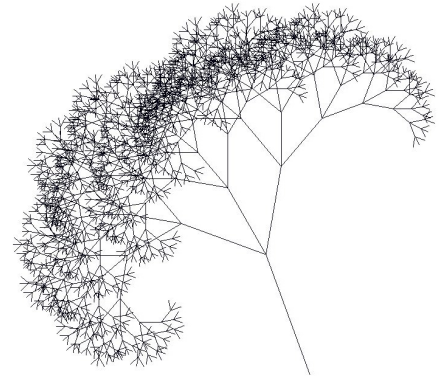
Maximal Level : 7  
 Height : 300  
 Initial Bending Angle : 20  
 Initial Branch Angle : 40  
 Initial Start Angle : 1.91986217719376  
 Branch Ratio: 0.7  
 Trunk Ratio: 0.3



Maximal Level : 7  
 Height : 300  
 Initial Bending Angle : 30  
 Initial Branch Angle : 20  
 Initial Start Angle : 1.5707963267949  
 Branch Ratio: 0.3  
 Trunk Ratio: 0.5



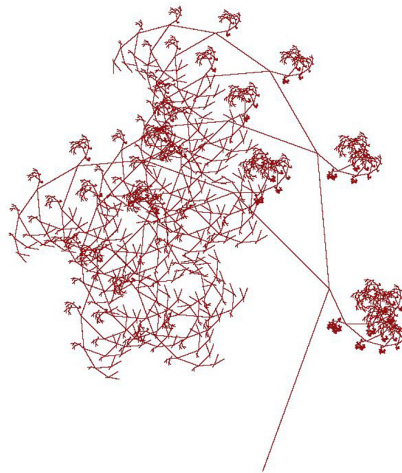
Maximal Level : 4  
 Height : 300  
 Initial Bending Angle : 30  
 Initial Branch Angle : 37  
 Branch Ratio : 0.4  
 Trunk Ratio : 0.7



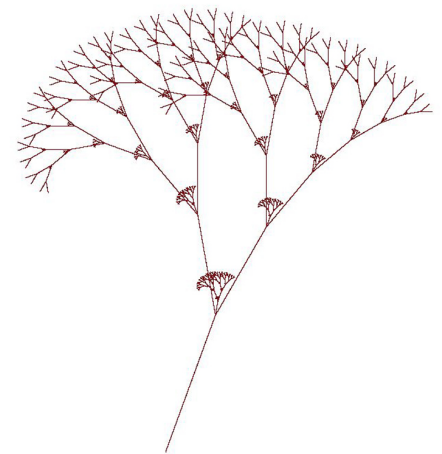
Maximal Level : 7  
 Height : 300  
 Initial Bending Angle : 10  
 Initial Branch Angle : 40  
 Initial Start Angle : 1.91986217719376  
 Branch Ratio: 0.3  
 Trunk Ratio: 0.4



Maximal Level : 7  
 Height : 300  
 Initial Bending Angle : 30  
 Initial Branch Angle : 20  
 Initial Start Angle : 1.22173247639603  
 Branch Ratio: 0.7  
 Trunk Ratio: 0.2

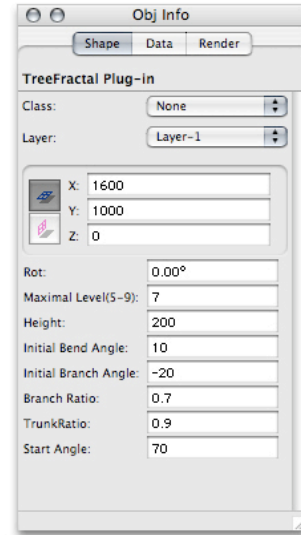
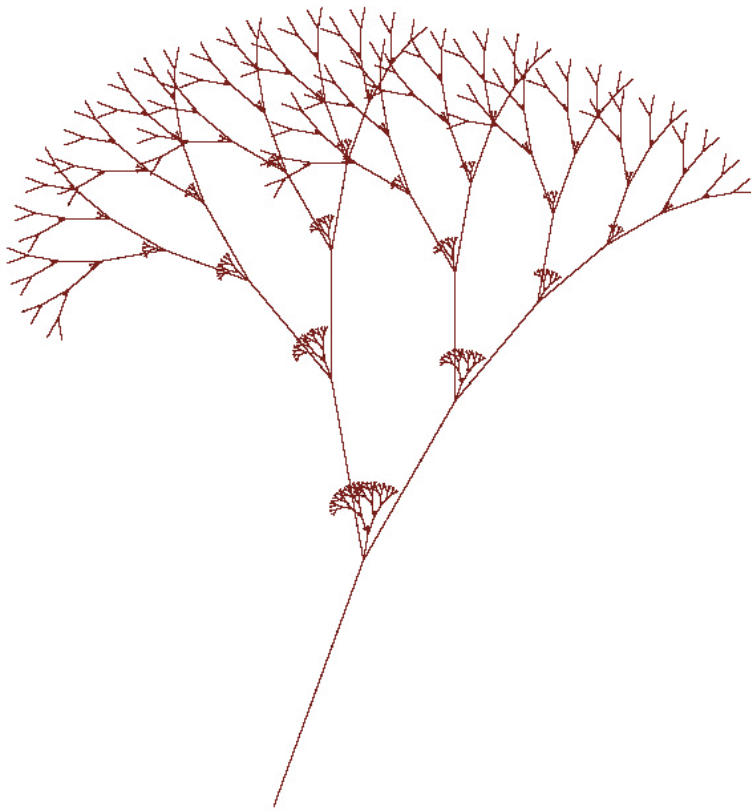


Maximal Level : 8  
 Height : 300  
 Initial Bending Angle : 45  
 Initial Branch Angle : 20  
 Initial Start Angle : 1.22173247639603  
 Branch Ratio: 0.7  
 Trunk Ratio: 0.2



Maximal Level : 7  
 Height : 300  
 Initial Bending Angle : 10  
 Initial Branch Angle : 40  
 Initial Start Angle : 1.22173247639603  
 Branch Ratio: 0.7  
 Trunk Ratio: 0.8





Maximal Level : 7  
Height : 200  
Initial Bend Angle : 10  
Initial Branch Angle : -20  
Initial Start Angle : 1.22173047030003  
Branch Ratio : 0.7  
Trunk Ratio : 0.9