



Curve stitching density plots

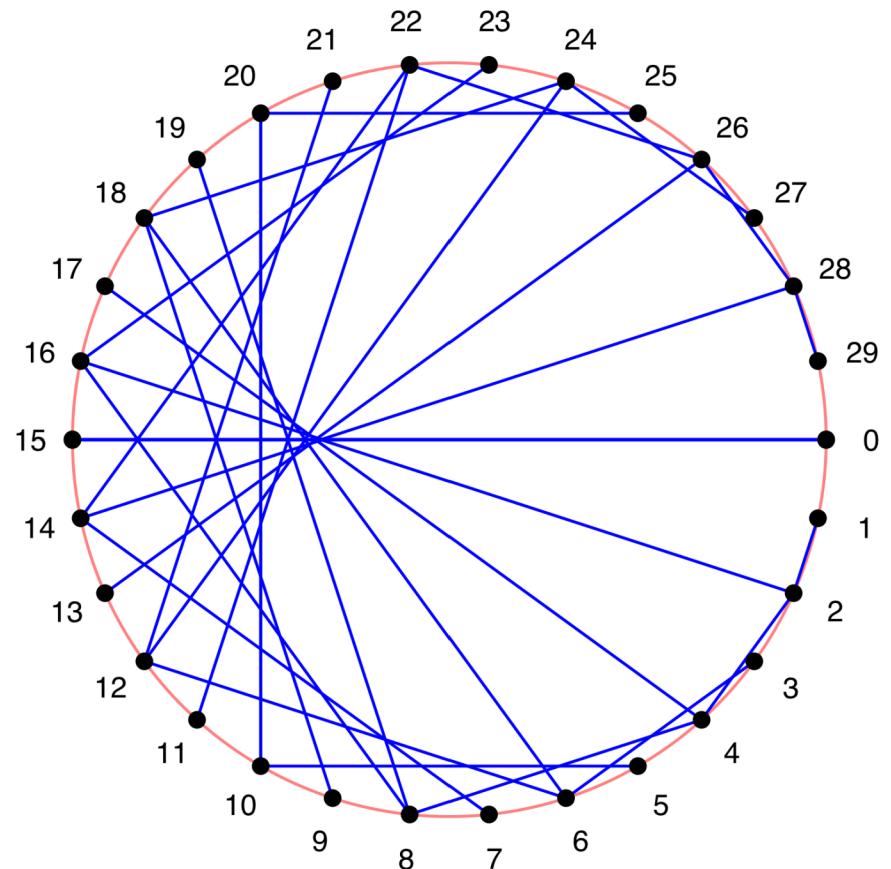
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Basic curve stitching

- Traditional method
 - Place N points along curve
 - Connect pairs of points: $(point_i, point_{f(i)})$
- Example
$$f(i) = (k * i) \bmod N$$
where $k=2$ and $N=30$



Simple modification

- Change

Connect ($point_i, point_{f(i)}$)

$$f(i) = (k * i) \bmod N$$

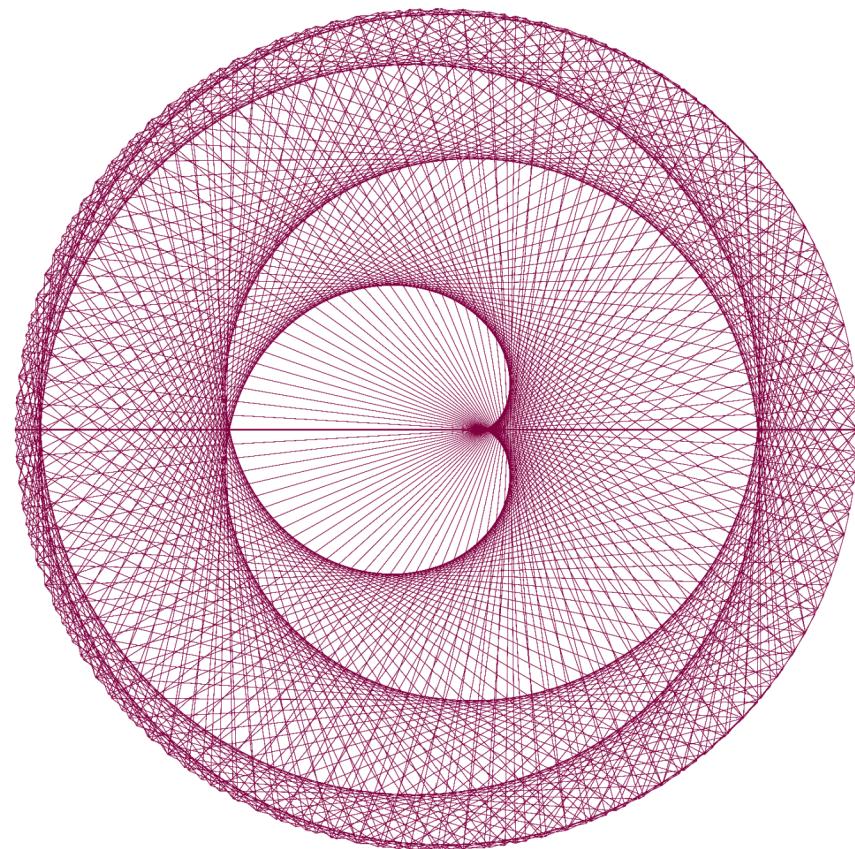
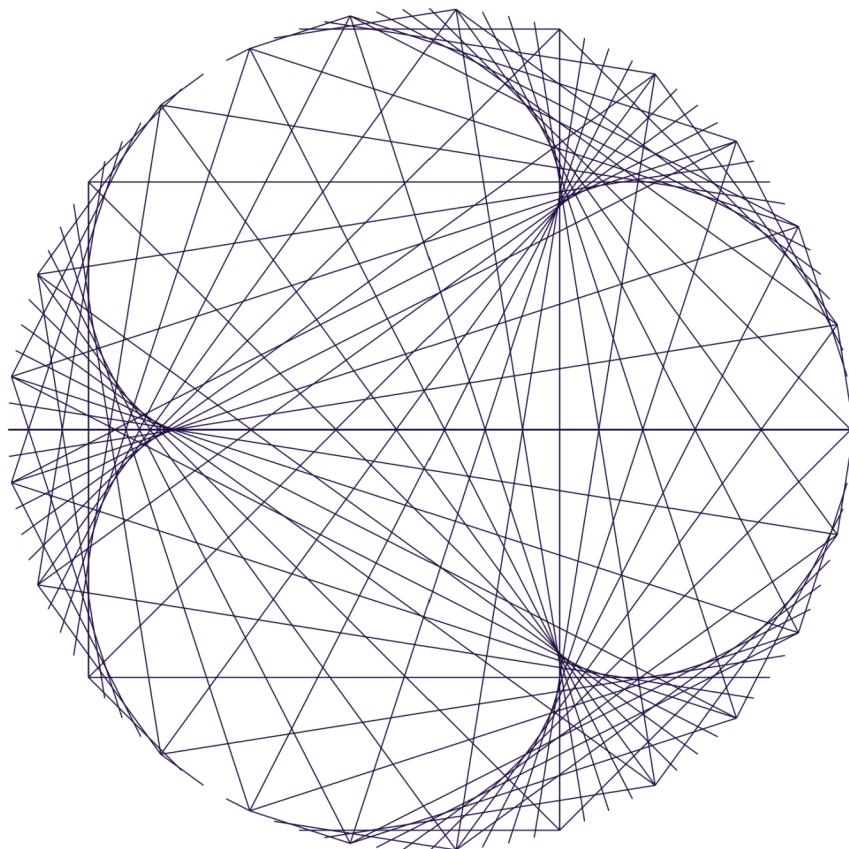
To

Connect ($point_\theta, point_{f(\theta)}$)

$$f(\theta) = k * \theta$$

- Works with parametric equations
- Simplifies code

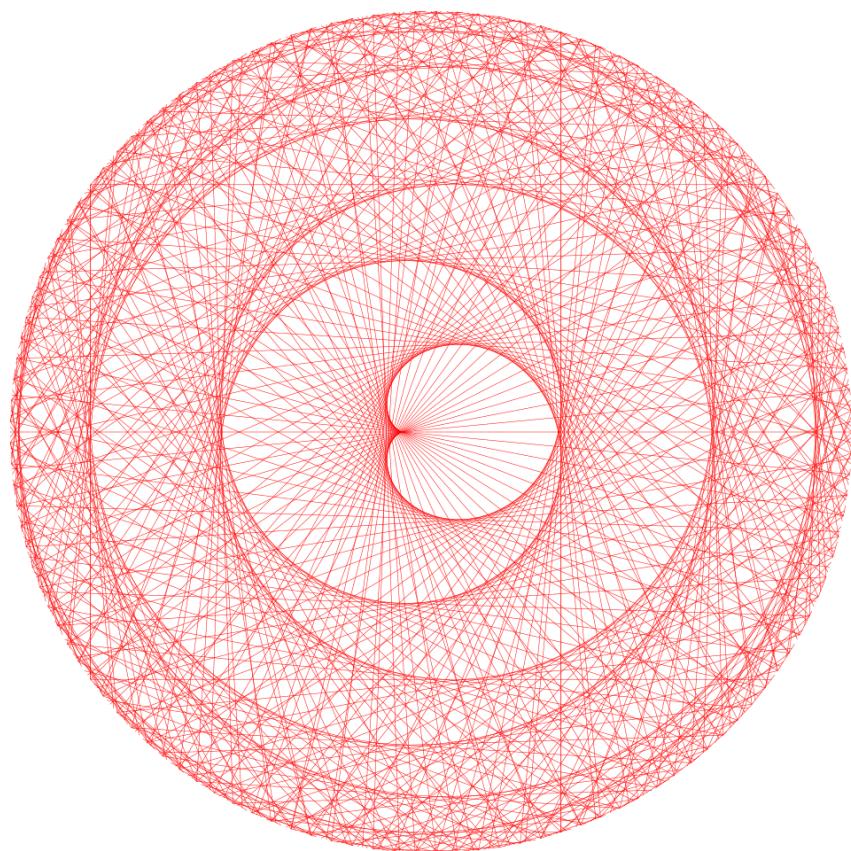
Examples



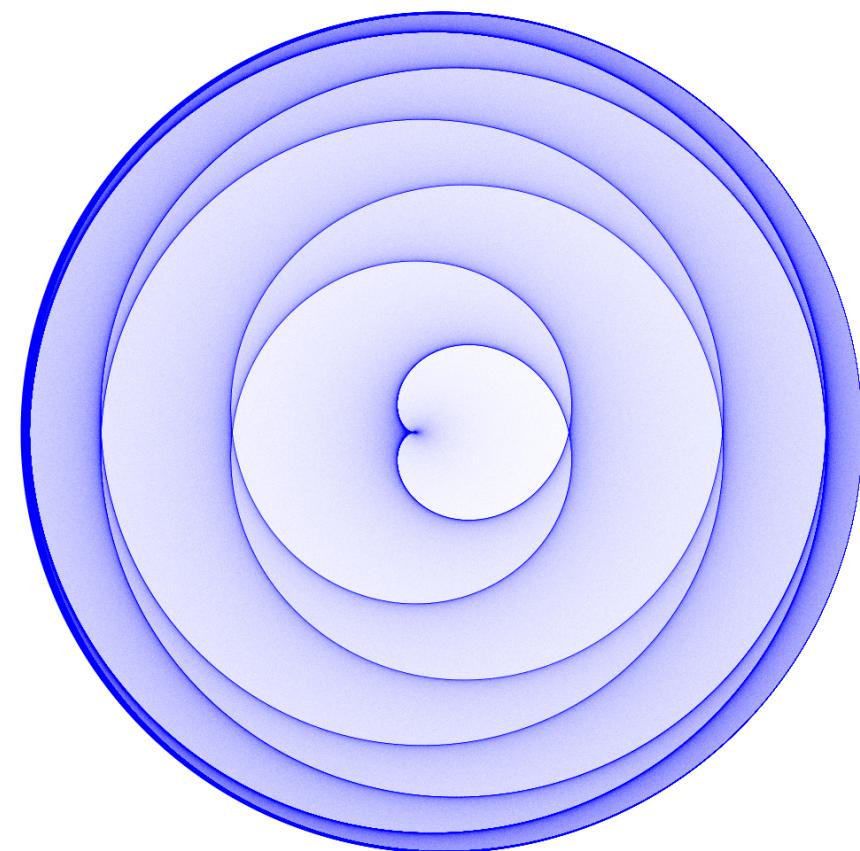
Density Plots

- Create an MxN matrix and initialize all entries to 0
- Perform S times
 - Randomly choose θ and calculate $f(\theta)$
 - Randomly select a point P on line with points $(point_\theta, point_{f(\theta)})$
 - Map point P to position in matrix
 - Increment value at position in matrix by 1
- Convert the counts in matrix to an image

Comparison for $k = 1.125$

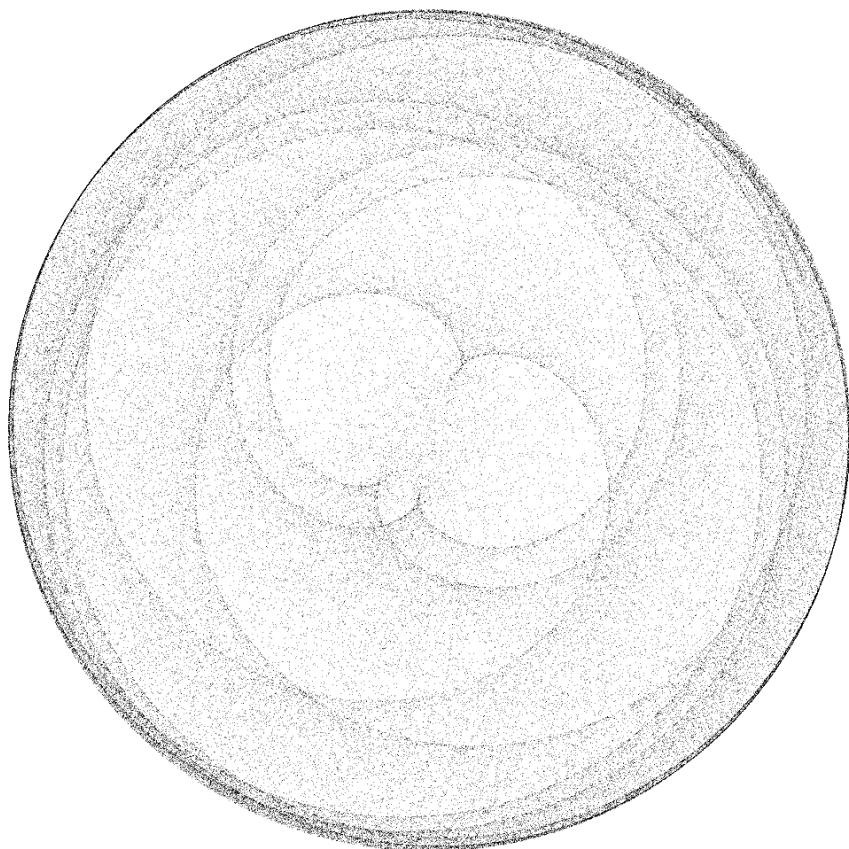


$N=500$

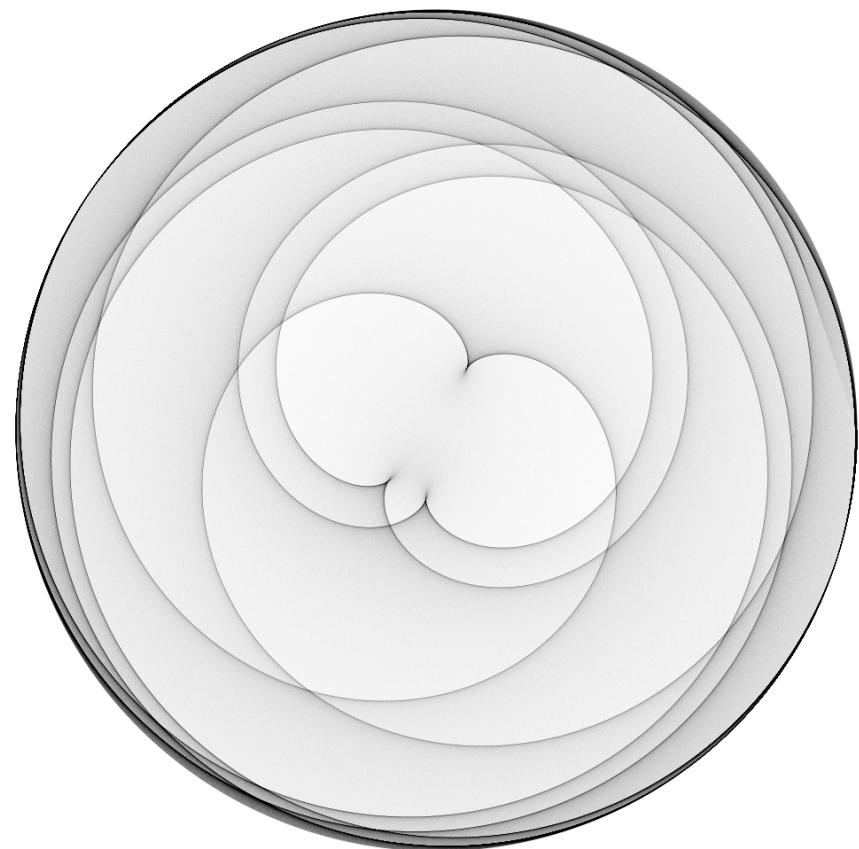


$S=100,000,000$

Effect of S value



S=100,000, time=1.9 sec



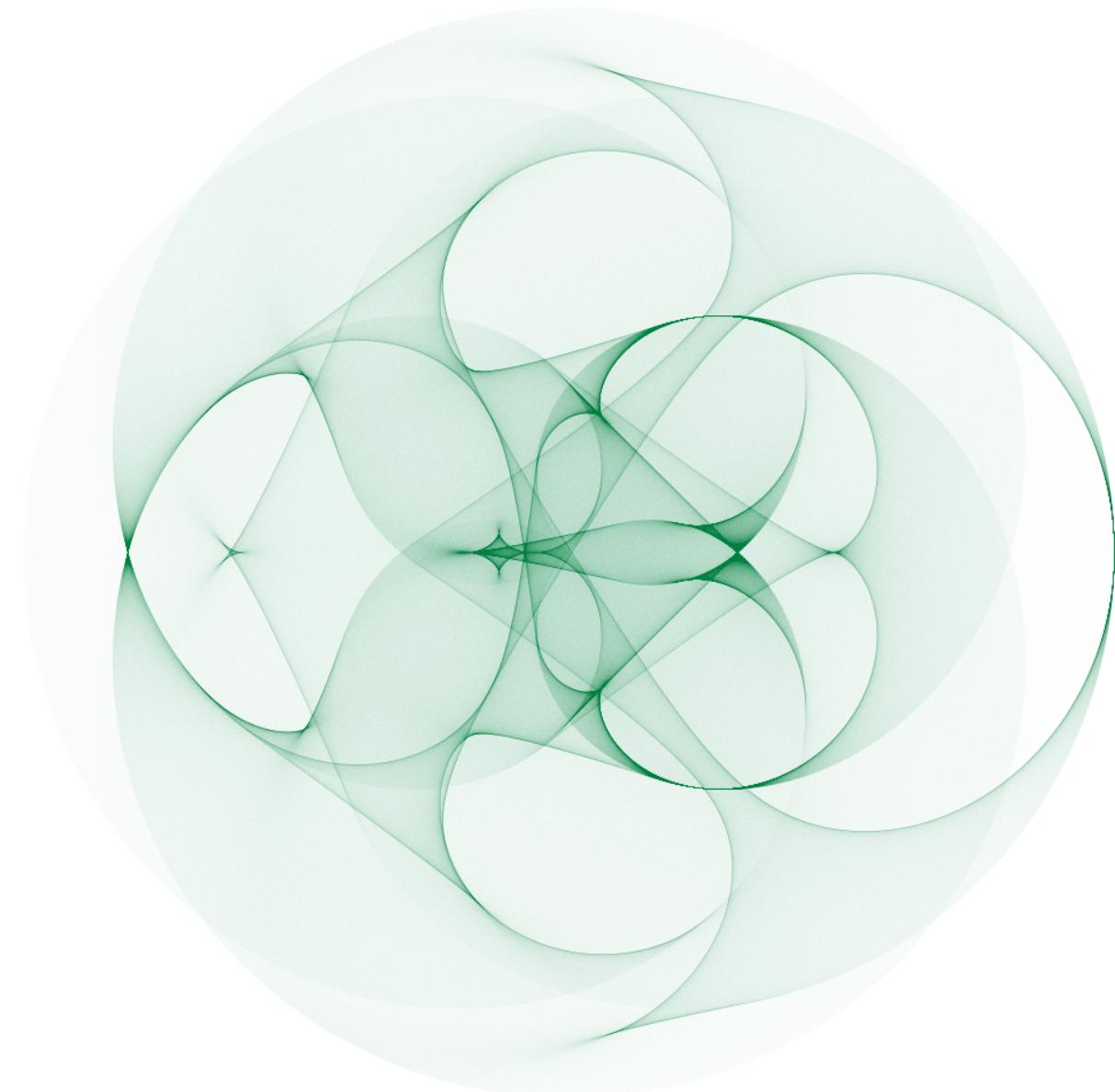
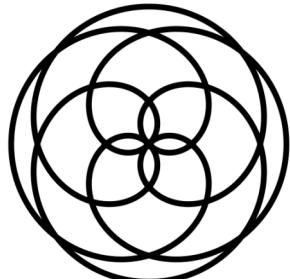
S=100,000,000, time=181.2 sec

Curve variations

- No reason to limit curves to circles
- Density plots can be created from any set of parametric equations
 - Closed curves here, but not required
 - Equations used here based on θ , but could be time-based as well

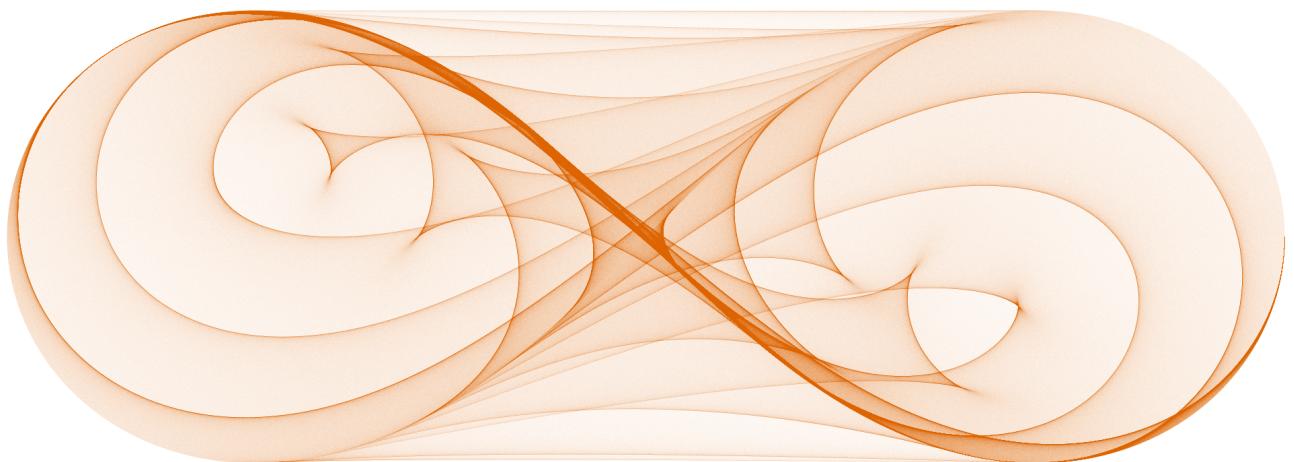
Example: rose curve

- Source



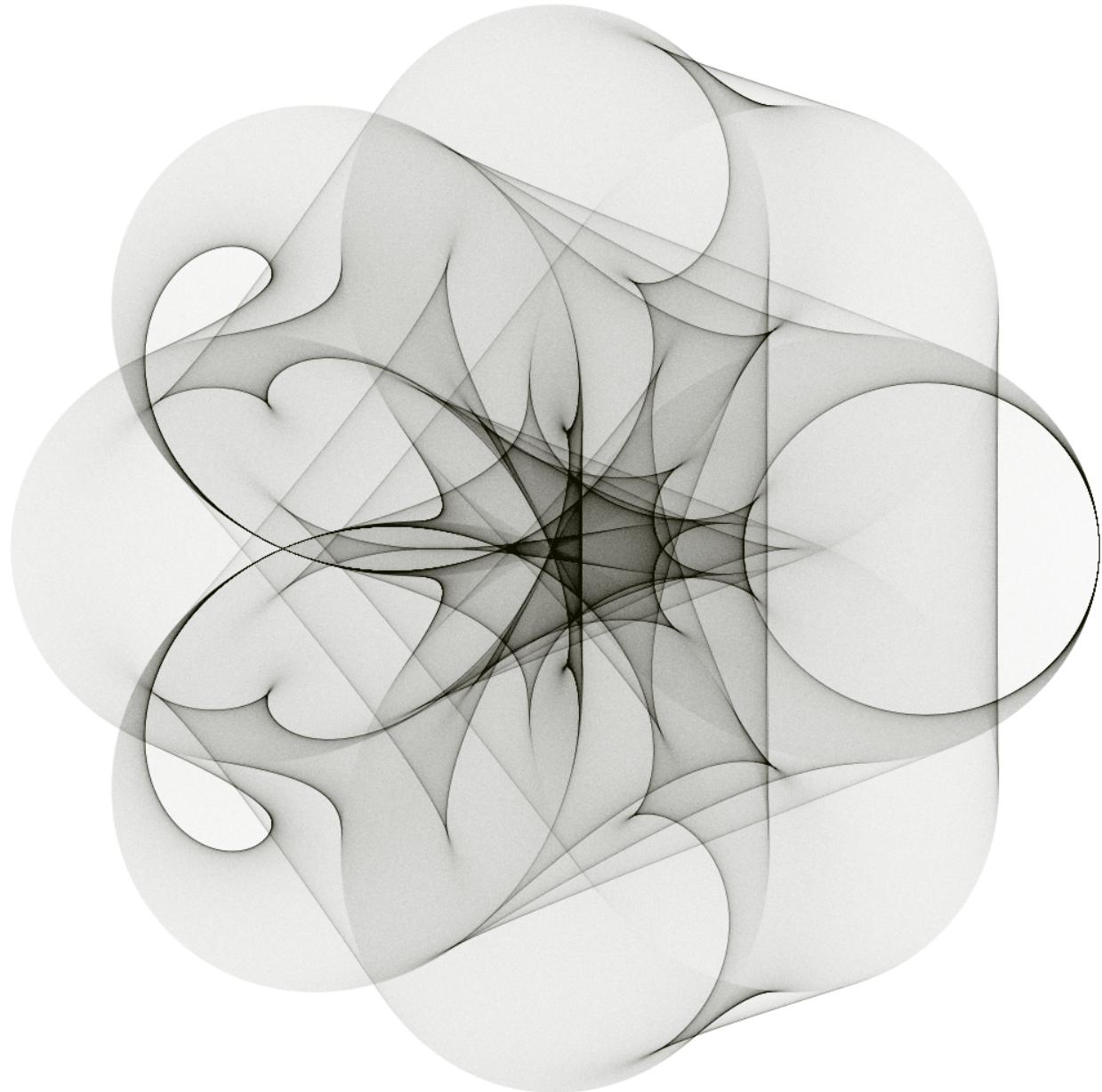
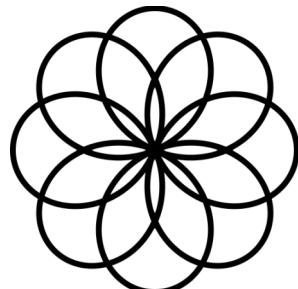
Example: lemniscate

- Source



Example: hypotrochoid

- Source

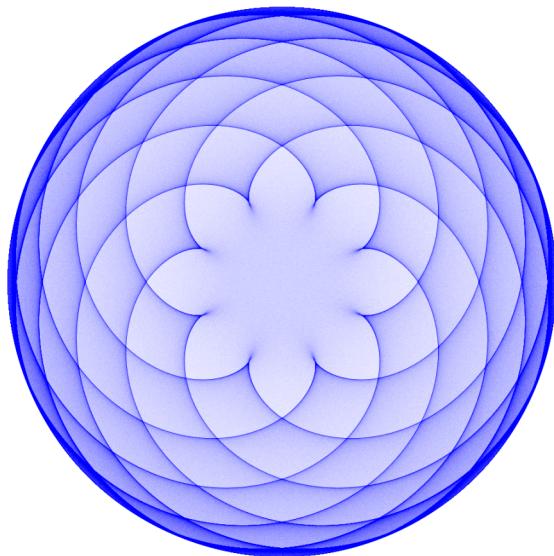


Curve displacement

- Previous images connect two points traveling at different speeds on one curve
- Two curves can have
 - Different sizes, and/or
 - Different positions

Examples

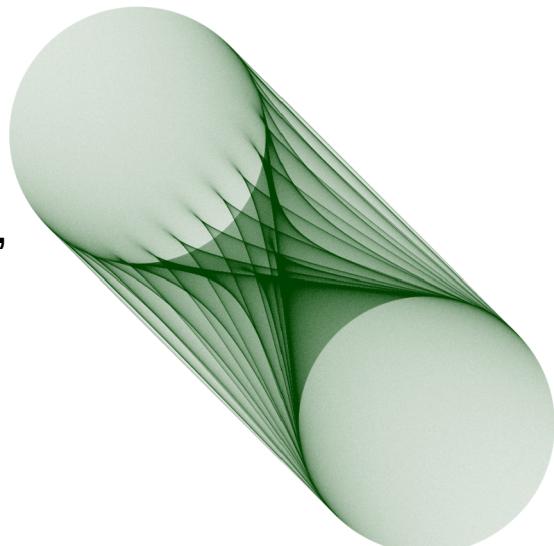
One circle



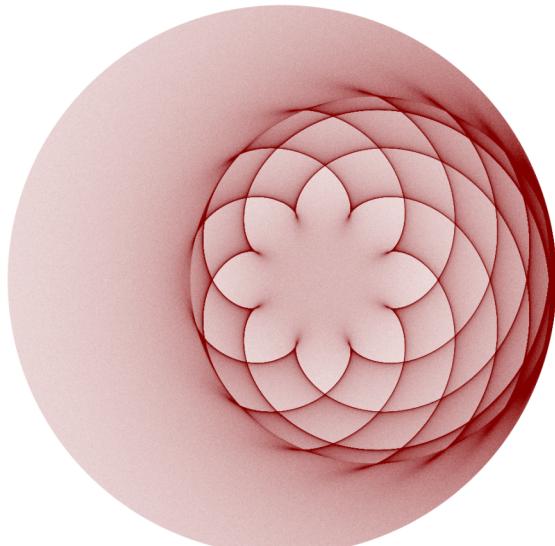
Two circles,
different radii



Two circles,
different
positions



Two circles,
different sizes
and positions

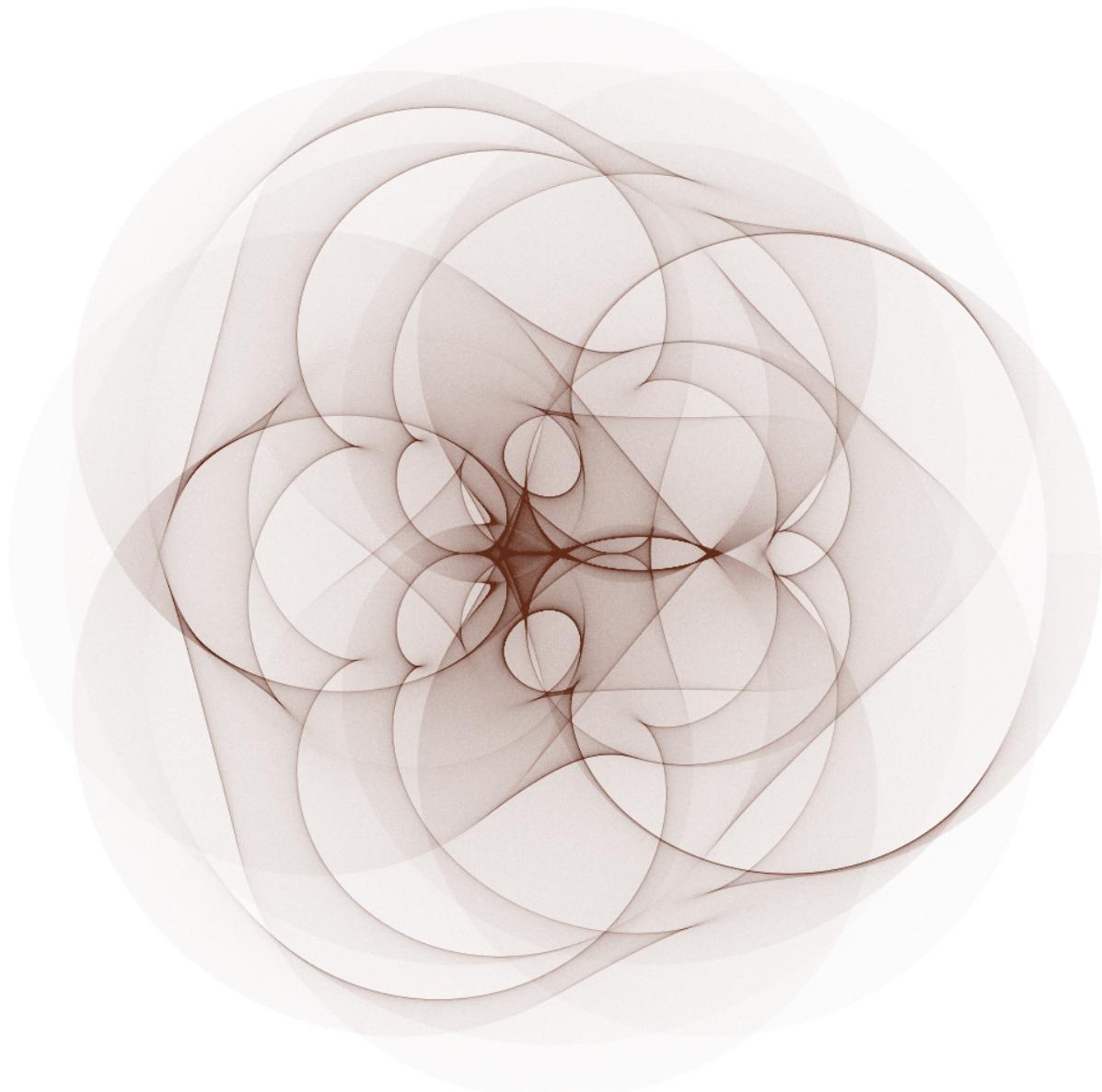
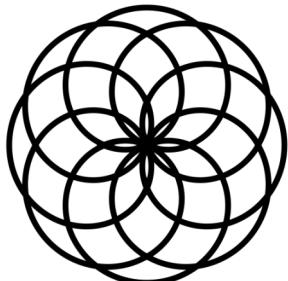
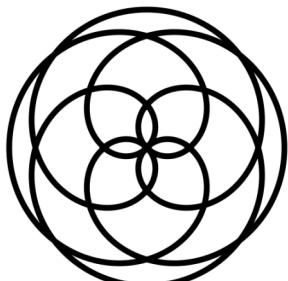


Combining curves

- Additional variations quickly become obvious
 - Same curve, different parameters
 - Two different curves
 - More than two curves

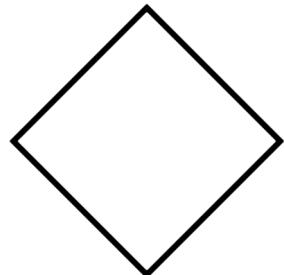
Example: two rose curves

- Source

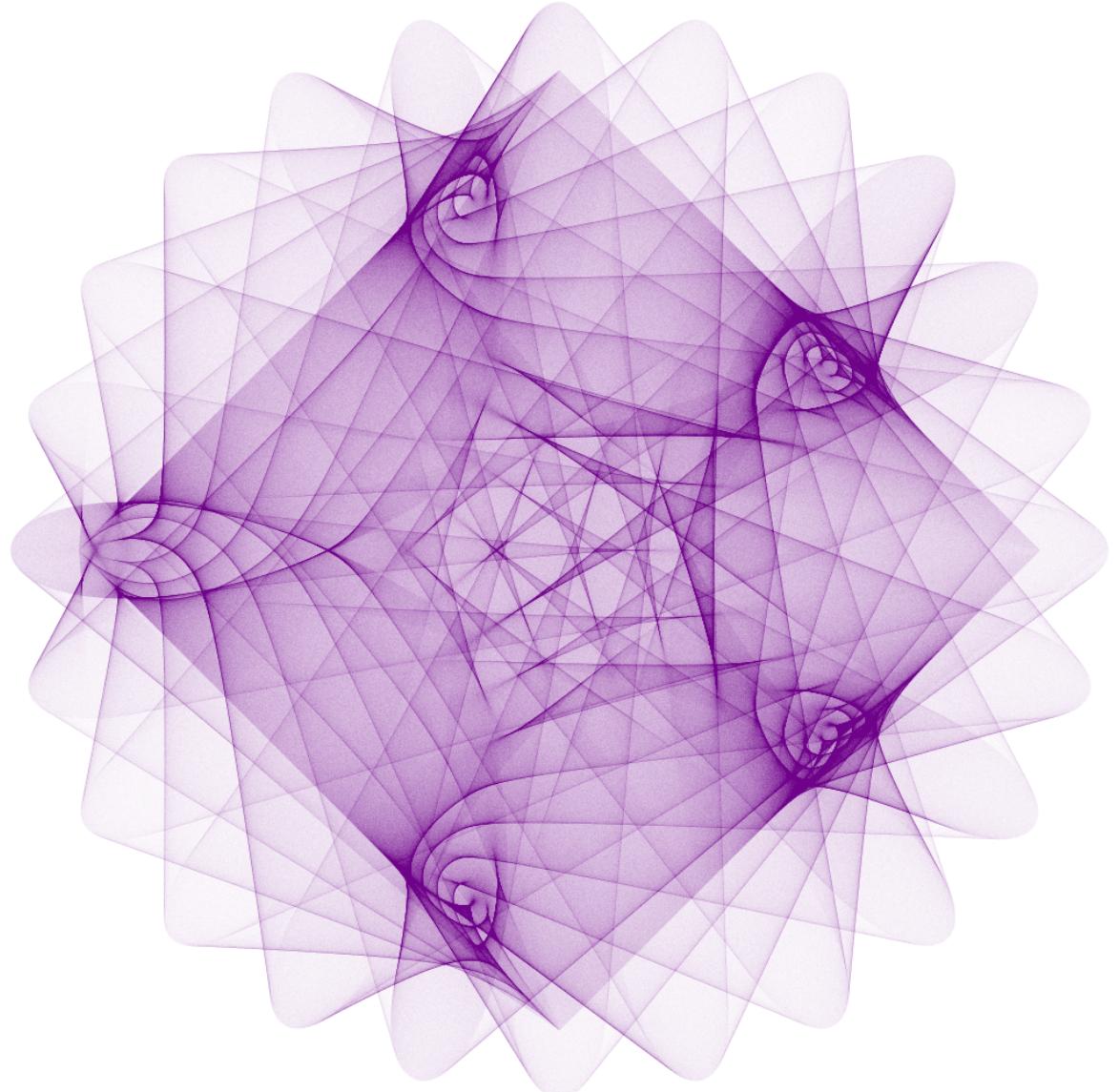
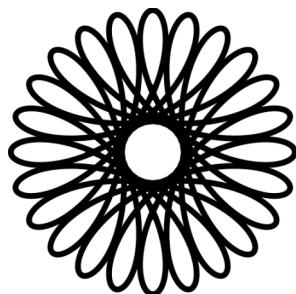


Example: square and hypotrochoid

- Square

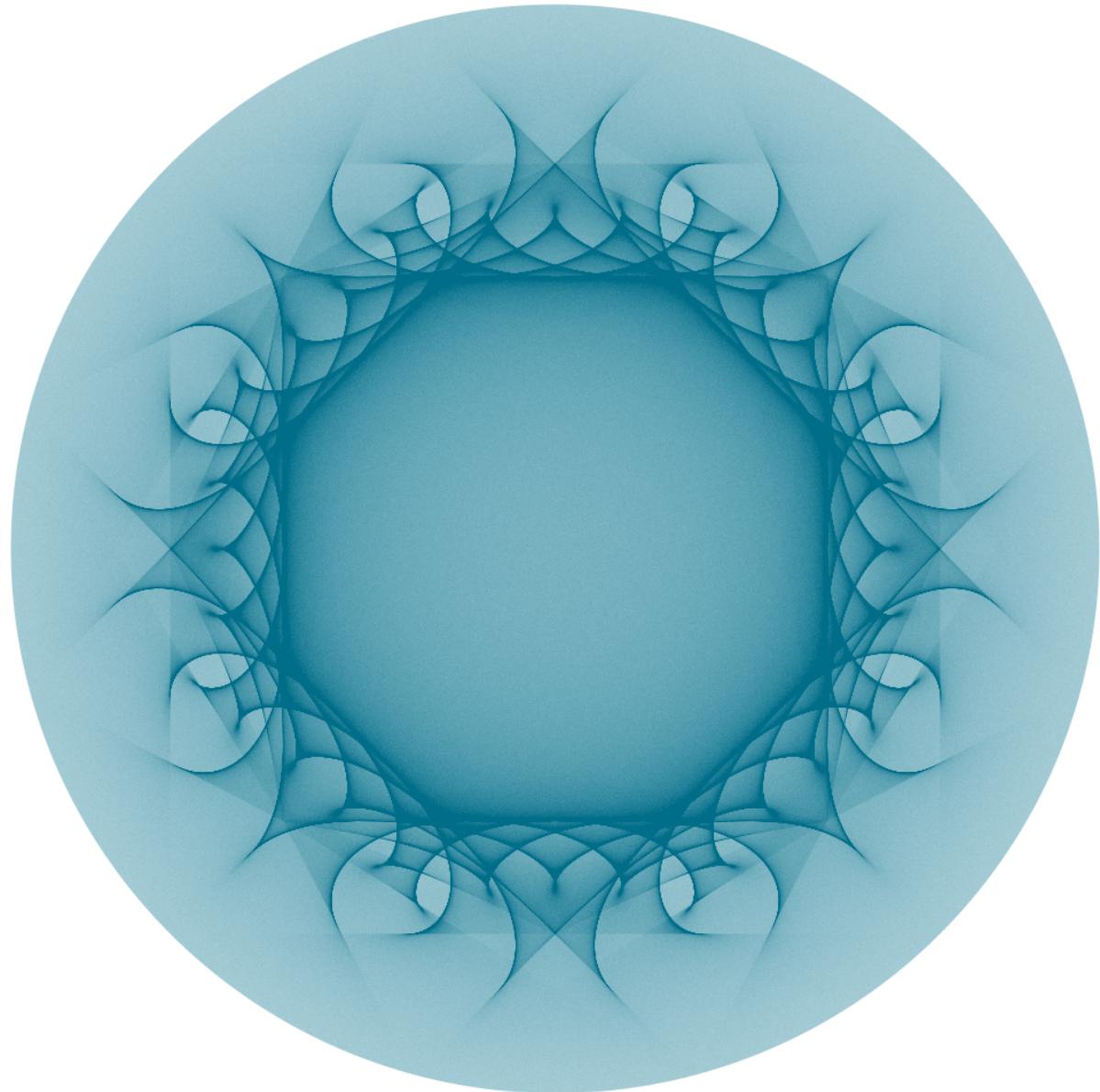
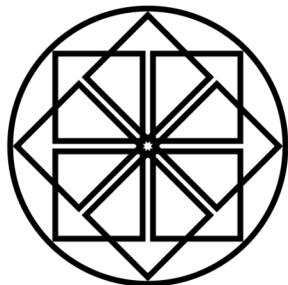


- Hypotrochoid



Example: circle with 8 squares

- Source



Current and Future Work

- 3d
- Animation
- Coloring strategies

Code examples

- Sample Python code available at
<https://github.com/nicholsonja/Bridges-2019>

Questions?

