









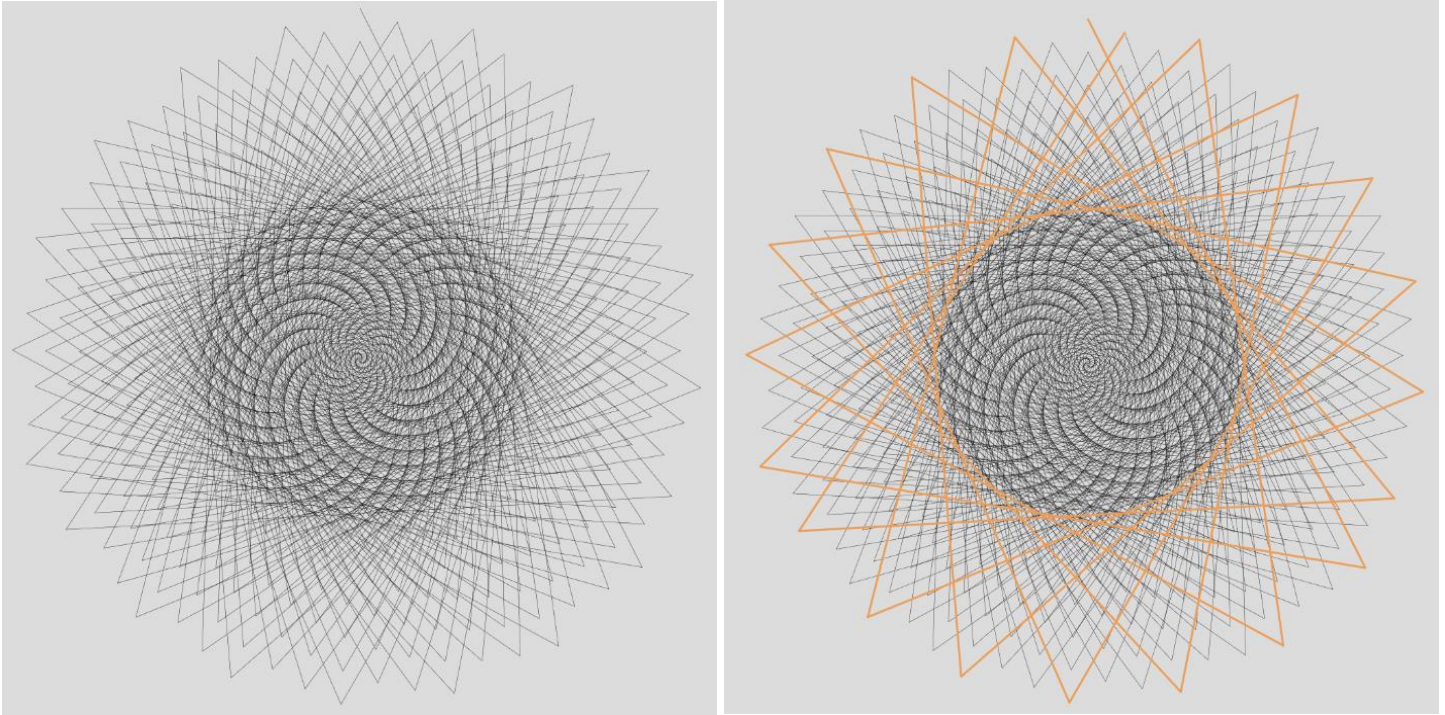





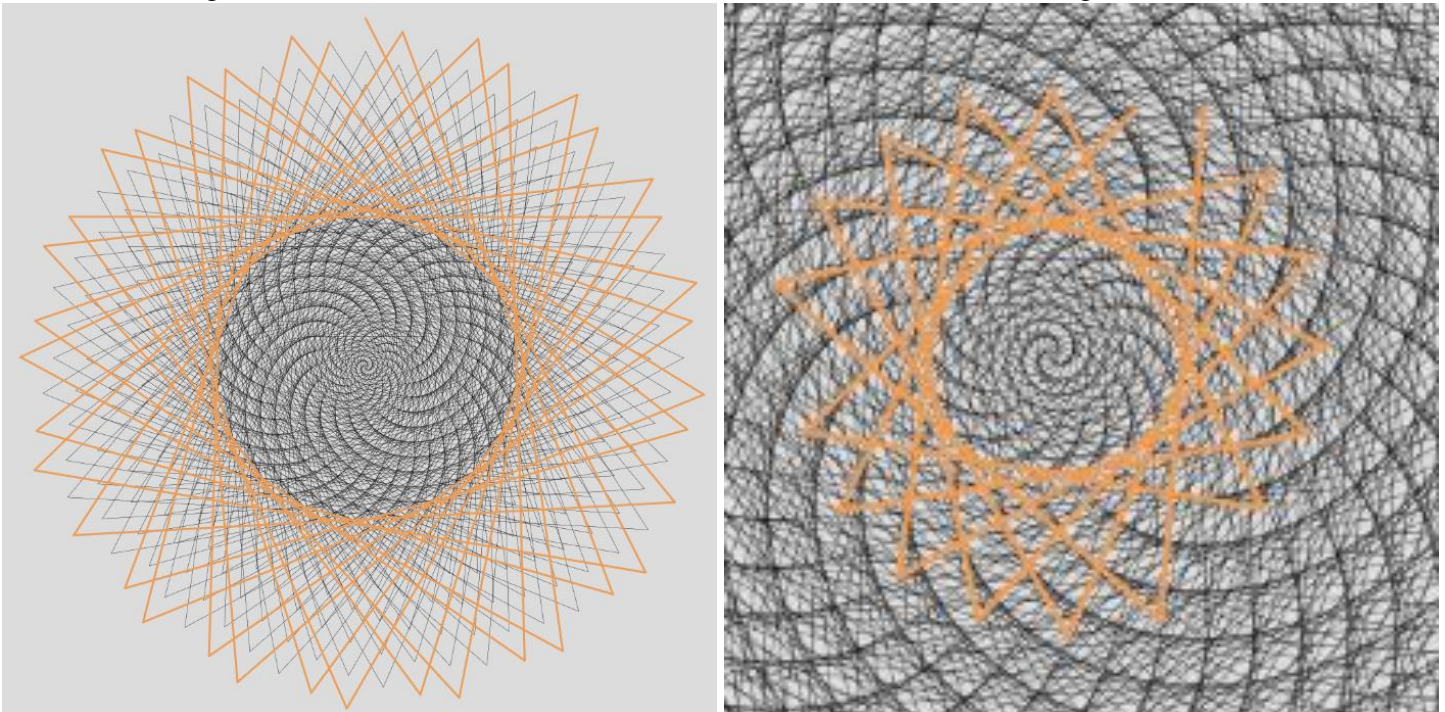
Competing Swirls Create Sunflowers


The 4 images below show competing clockwise, , and counter-clockwise, , swirls at various parts of the same image. The  curves use the leading half of each line segment (note that there are 20 lines starting the  curves) and  curves use the ending half of line segments. If you look carefully at the upper right image, some starts of the  curves do not have ending lines covering those curves. Perhaps the easiest not covered  curve to see in the upper right is the opening that exists between vertex 0 and 55. This curve is covered by the end of the 37th line in the lower left on the vertex 56 (or -1) radius. Note how close each a/b is to $2.85 = n/J$. The 20  curves are longer than the 37  curves.

At left is $n = 57, J = 20, r = 600$. At right, note the 20th line ends on the vertex 1 radius, ; $20/7 = 2.857 > 2.85 = 57/20$.



At left below, the 37th line ends on the vertex 56 (-1) radius, ; $37/13 = 2.846 < 2.85$. Bottom right is a blow-up of the middle range, a  17,6-swirl $17/6 = 2.833 < 2.85$. At the center of the blow-up, note the  3,1-swirl, $3 > 2.85$.



By counting in the blow-up, you can verify that there are 17  curves and 6 jumps in the [cracked-open](#) 17,6-star.