# Using a Square to Create an Ultimate Triangular Zig-Zag Image Sequence

Jack Campbell nudged me into thinking about changing a jump instead of changing n to explore new zig-zag image sequence patterns. The zig-zag jump pattern is: If i is odd, then $J_i = i$, and if i is even, then $J_i = n-i = 48-i$. As noted elsewhere, the first jump set ends at vertex 12, 1/4 of the way around the circle (and the top half of the zig-zag pattern is created). The second set of 23 jumps completes the right half, the third the bottom half and the fourth the left half. The end of the fourth jump set is the starting point, vertex 0. You should be able to follow this on the vertex frame, VF, shown to the right.
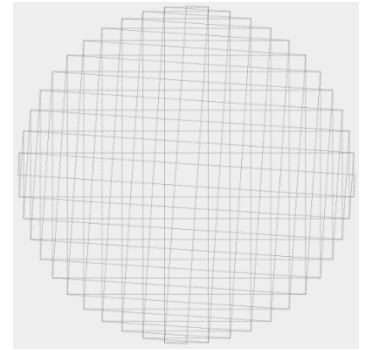
If 4 were added to **any** jump (or combination of jumps), the zig-zag is interrupted but the vertex would end at 16, 1/3 of the way around the circle and the image would have 120° rotational symmetry meaning that these 23 jumps would end back at the top once the third jump set is finished.

The most parsimonious solution would be to do that addition at either the first or last jump, rather than somewhere in the middle. The next four images show the VF adding 4 to J_1, J_7, J_{14}, and J_{23}. Each has 759 1587-line images per sequence.
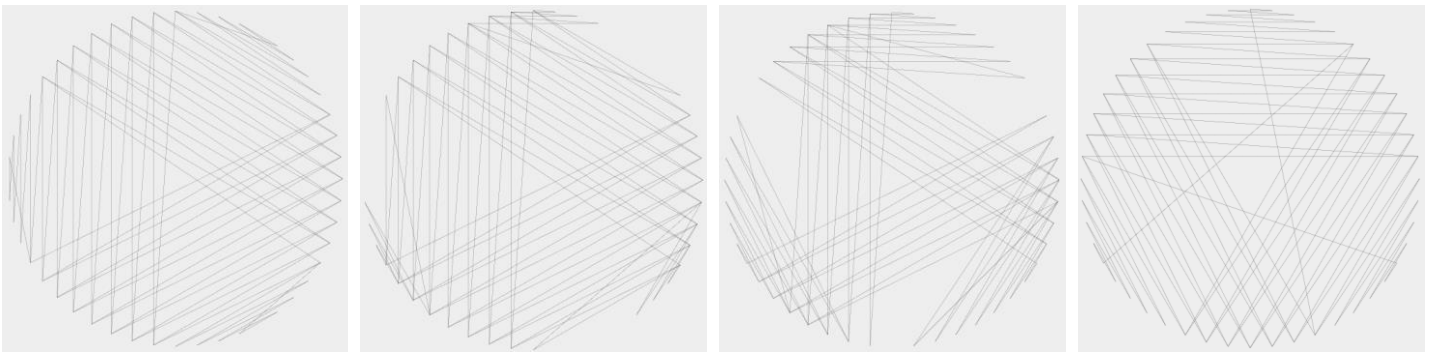
$J_1 = 5$: Notice that except for the first jump, the third (and final) set is IDENTICAL to the fourth (and final) jump set for the square zig-zag VF). $J_7 = 11$: The first 6 jumps of the first set and the last 16 jumps of the third set are the same as above (7+16 = 23). $J_{14} = 38$: The first 13 jumps of the first set and the last 9 jumps are the same as above (14+9 = 23). $J_{23} = 27$: The first 22 jumps of the first set are the same but none of the last set are the same. Note also, as discussed here, the innermost equilateral triangle is now larger as it is based on a jump of 22 rather than 23.

Each version provides interesting and different image sequences. And the same would go wherever you add 4 to the initial jump value.

Adding Jumps to get to Vertex 16. An alternative to changing jumps to disrupt the zig-zag sequence is to note that each set of two jump moves one vertex lower on each side. Since we need to move to 16 from 12, we need 4 sets of two jumps or a total of 31 jumps. The 93-line VF of this image sequence is to the left. There are 1620 2511-line images in the image sequence since we set S to 27 given n/VCF = 3. The next image shows 3 corkscrews given P = 241. The P = 278 image shows three leaves. The final image shown is the P = 1256 porcupine. Other images you encounter include a triangular folded ribbon at P = 862, three curling arcs at P = 1108 and 1160, or triangles at P = 701 and 1025.

8,2-Stars. Use this same idea in reverse. If the last jump of the first set ends at vertex 6 or 42, the image is VCF = 6 and the image has 45° rotational symmetry. Reduce *Total Jumps* to either 12 or 11. Both produce different image sequences.