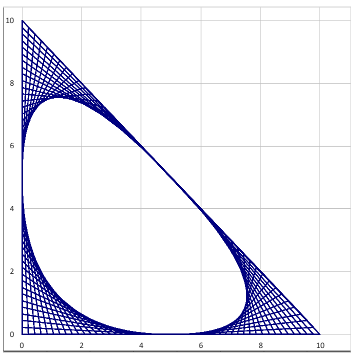
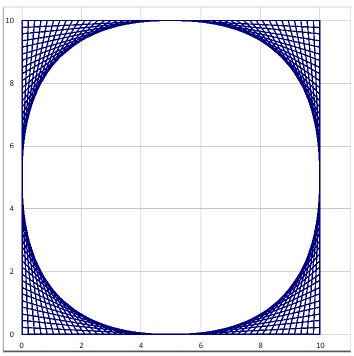
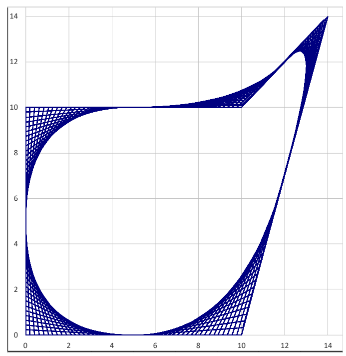
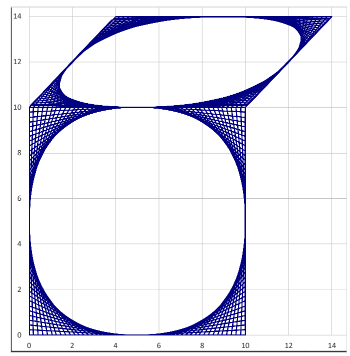
What changes once we leave our regular polygonal world? The role of *V*

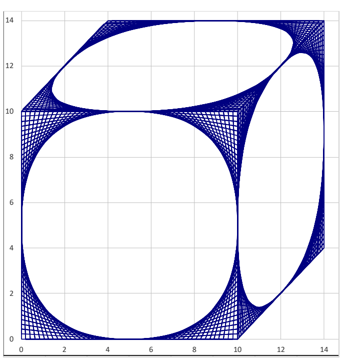
We relied on regular polygons in order to eliminate the need to think about exactly where vertices are located. They are equally spaced around the circle, and that is that. In our new world, we eliminate the parameters ***n*** and ***J*** and replace them by a single parameter, ***V***, together with (***x***, ***y***) coordinates that are user provided (in the four-color version of the model). The differences are set forth in this table. (**Note:** The *Bridges* paper and the *Excel* file do not italicize letters.)

What changes / **What does not**	**Polygons String Art model**	**Beyond Polygons model (*Excel* file name: 4ColorAestheometry.xlsx)**
How vertices are determined	Click ***n***	User types in their own (***x***, ***y***) coordinates of each vertex (up to 40 per color)
How the **VF** is determined	Click ***n*** and ***J***	User types in how many coordinates to use, ***V***
Calculation of VCF	VCF = GCD(***n***, ***J***)	There is no VCF as the only move is a "jump" of 1
Number of **V**ertex **F**rame (VF) lines	V_{used} = ***n*** /VCF	***V*** (As we see below, ***V*** can be less than vertices provided.)
Subdivisions, ***S***	**No change (*S* and *P* values are entered by typing (like *Four Colors* files) rather than by arrow keys.)**	
Number of Subdivisions per line, ***P***		
Calculation of SCF	SCF = GCD(***P***, ***S***·V_{used})	SCF = GCD(***P***, ***S***·***V***)
Lines in image	***n*** /SCF·***S*** /SCF = V_{used}·***S*** /SCF	***V***·***S*** /SCF

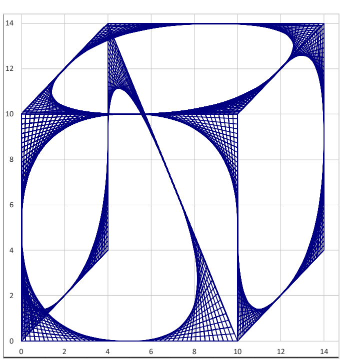
Since ***S*** and ***P*** work the same in both models, we only need to worry about ***V*** (we put aside setting coordinates for a moment) in order to focus attention on ***V***, ***the number of vertices used****. The VF connects vertex to vertex until the last* ***used*** *vertex, the next vertex is the initial vertex* (The *Handout* sheet in the file explains ***V***, ***S*** and ***P*** using a Brunes Star.)

About *V*. The screenshot from ***Excel*** file sheet **4a** shows the completed image together with 20 (x, y) coordinates at bottom right based on (***V***,***S***,***P***) = (20,47,23). The rest vary ***V*** from L to R, ***V*** = 3, 4, 5, 8, with 12 and 16 below. The 1st coordinate here is (10,0) so *the VF always closes back to this point*. With ***V*** = 3, this creates a triangle, the ***V*** = 5 comma starts the (top or side?), 6 shows it is the top which is finished at ***V*** = 8. ***V*** = 12 finishes the side but vertex 16 is in the back-upper-left corner. ***Excel*** file sheet **4c** varies ***V*** so you can see how a ***V*** = 5 heart gets pierced by an arrow at ***V*** = 20.



V=12



V=16

20	47	23	
V, # of vertices used. V < 21	S, # of subdivisions per side	P, # of subdivisions between Points	primes
You can change the yellow cells			2
Note : Keep V*S<1000 (or pattern will not repeat)			3
Vertices	X	Y	5
1	10	0	7
2	0	0	11
3	0	10	13
4	10	10	17
5	14	14	19
6	4	14	23
7	0	10	29
8	10	10	31
9	10	0	37
10	14	4	41
11	14	14	43
12	10	10	47
13	0	10	53
14	0	0	59
15	4	4	61
16	4	14	67
17	4	4	71
18	14	4	73
19	14	14	79
20	10	10	83
999			89
999 above means "vertex not used"			97

You can write notes in the green cells

Try V = 4, 8, 12, and 20 … then do the same on sheet 4b

To see how this is built out, vary V from 3 to 20

For the most complete graph, make sure P has no divisors in common with V or S.

This is why the list of primes < 100 is provided in column D.

Sheets