Learning to Code with SVG

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Lesson Plan:	Coding Dashed Circles in SVG on a 600 by 600 grid
Objective:	Hands-on learning of SVG by drawing dashed circles and reusing them.
Lab Time:	Approximately 1/2 hour, not including Lecture time. Students should test each path command before adding each additional command.
Age range:	4-8th grades, or any age student unfamiliar with SVG
Requirements:	Familiar with a simple text editor Ability to save file with a .svg extension. Understanding of circumference of a circle. Understanding of how scaling can be used to reduce or enlarge an object.
Resources:	http://steamcoded.org/lessons/grid600x600.svg http://www.w3schools.com/svg/default.asp https://www.w3.org/TR/SVG11/ Free eBook for iBooks: *Learn SVG Interactively*, by Jay Nick
Lecture:	This lesson will draw 1 circle element on a 600x600 grid. The circle will be stroked with a dashed line. By calculating the circumference of the circle, the dashed line can be made to finish perfectly, creating even spacing all the way around the circle. The circle element will be reused, reducing it's size each time using the scale transformation.
Procedure:	Have students get an SVG template with 600x600 grid from: http://steamcoded.org/lessons/grid600x600.svg.txt Copy the code and paste it into a text editor. Save the file as ellipses.svg then open in a browser. Keep the text editor and browser windows open. Add SVG elements where indicated using the instructions on page 3 (see below). **Important:** Students should save the file and refresh the browser after adding a few SVG element to their file to make sure they don't have errors. When complete, change the style attribute of the first <g> element from "display:initial" to "display:none" which hides the grid Then change the style attribute of the second <g> element from "opacity:0.5" to "opacity:1"
Take Away:	Students should gain an understanding of how circumference is used to create an evenly spaced dashed line around a circle. And, how scaling can be used to reduce the size of an object.
Additional Activity	Students can experiment with different dashed lines, i.e. dash to gap ratios, to create an evenly spaced dashed line. And try circles with a different radius
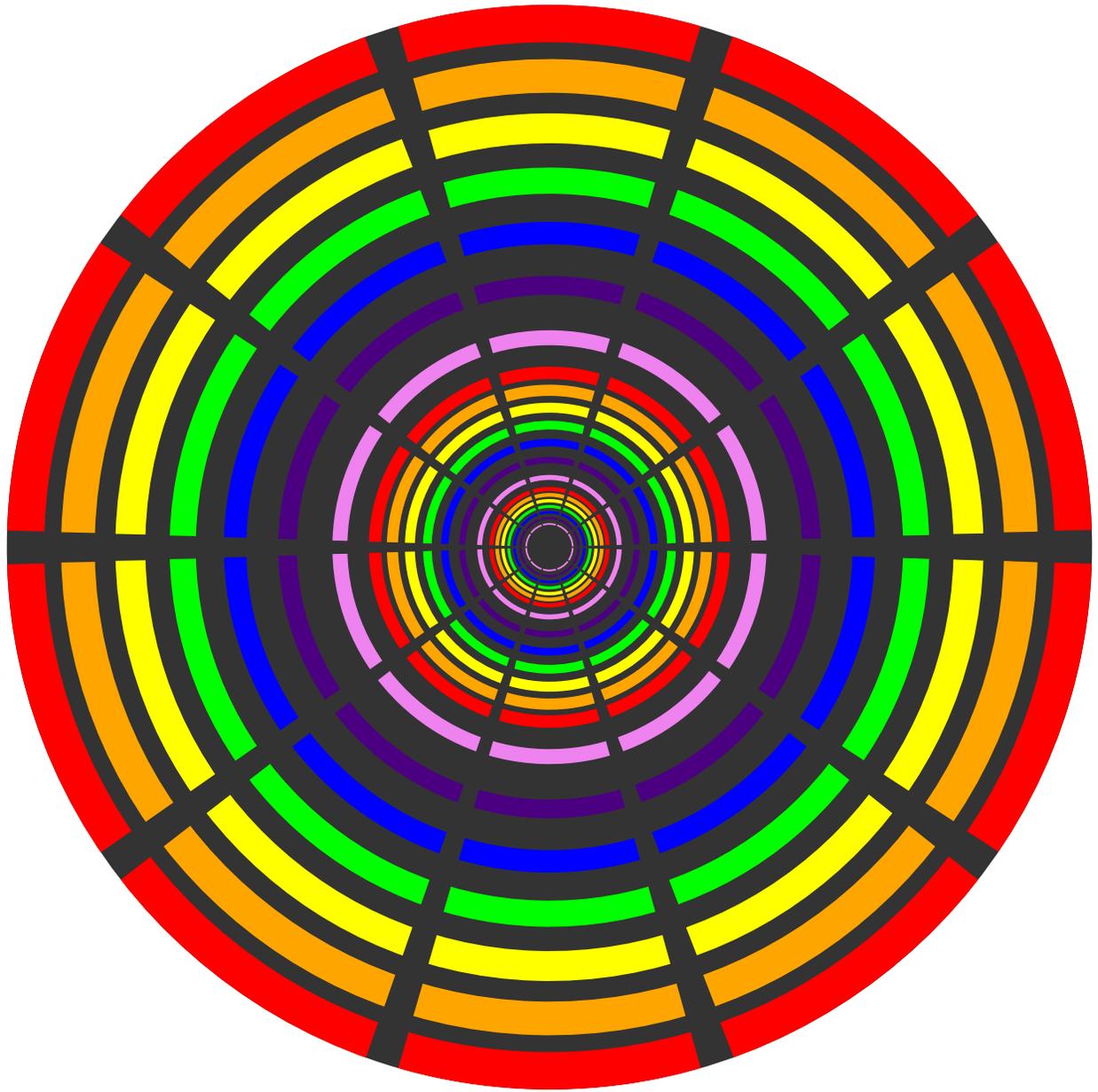
STEAMCODED.ORG

Coding Dashed Circles in SVG on a 600 by 600 grid

To get started copy the code of this image into your editor:
http://steamcoded.org/lessons/grid600x600.svg.txt and save the file as dashedcircles.svg and open the file in a browser.

1:     Append the following attributes to the <g> element with style="opacity:0.5;"
        Add style: "stroke:red;"
        Add attribute: transform=translate(300,300)

2:     Create a <circle> element centered at (0,0) with radius: 290
        Add attribute: style="fill:#333;stroke:none;"

3:     Create a group element <g> with id="i1"

4:     Create a <circle> element with id="c1" centered at (0,0) with radius: 280
        Add attribute: style="fill:none;stroke-width:20px;stroke-dasharray:158.337,17.593;"

        Circumference = 2*π*r = 2*π*280 = 1759.3
        Creating 10 segments requires each to be 175.93
        Dividing each segement with a dash to gap ratio of 9 to 1 yields dash of 158.337 and gap of 17.593

5:     Add a <use> element with attributes:
        xlink:href="#c1"
        transform="scale(0.9)"
        style="stroke:orange"

6:     Create additional <use> elements like step 5
        scaling each 0.8, 0.7, 0.6, 0.5, 0.4, and
        stroke each yellow, lime, blue, indigo, violet

7:     Add a <use> element outside group with id="i1" with attributes:
        xlink:href="#i1"
        transform="scale(0.333)"

8:     Add another <use> element attributes:
        xlink:href="#i1"
        transform="scale(0.111)"

9:     Add a rotate transformation after the translate(300,300) to rotate the image 1.8 degrees
        transform="translate(300,300) rotate(1.8)

        This will rotate the entire image by 1.8 degrees. Since 17.593 is 1/100 of the circumference, 360/100 = 3.6. Rotating 1/2 of the 3.6 = 1.8 degrees centers the image for a clean look.

        When complete, change the style attribute of the first element from "display:initial" to "display:none" which hides the grid. Then change the style attribute of the second element from "opacity:0.5" to "opacity:1"

Coding Rotating Ellipses in SVG on a 600 by 600 grid

Answer Sheet

Common mistakes are missing double quote marks around attribute values, missing space between attributes, missing the start < and ending /> tags, using a semicolon where a colon is required and vice-versa, and not putting elements in the correct order.

```
1:   <g style="opacity:0.5;stroke:red;" transform="translate(300,300)">

2:   <circle cx="0" cy="0" r="290" style="fill:#333;stroke:none;" />

3:   <g id="i1">

     </g>

4:   <circle id="c1" cx="0" cy="0" r="280"
     style="fill:none;stroke-width:20px;stroke-dasharray:158.337,17.593;" />

5:   <use xlink:href="#c1" transform="scale(0.9)" style="stroke:orange;" />

6:   <use xlink:href="#c1" transform="scale(0.8)" style="stroke:yellow;"" />
     <use xlink:href="#c1" transform="scale(0.7)" style="stroke:lime;" />
     <use xlink:href="#c1" transform="scale(0.6)" style="stroke:blue;" />
     <use xlink:href="#c1" transform="scale(0.5)" style="stroke:indigo;" />
     <use xlink:href="#c1" transform="scale(0.4)" style="stroke:violet;" />

7:   <use xlink:href="#i1" transform="scale(0.333)" />

8:   <use xlink:href="#i1" transform="scale(0.111)" />

9:   <g style="opacity:0.5;stroke:red;" transform="translate(300,300) rotate(1.8)">
```