Geogebra, Math, and Optical Illusions
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GeoGebra Code for Circle Illusion

1. Define the outer circle **C1=Circle[(0,0),4.2]**. This circle will be centered at the point (0,0) and will have a radius of 4.2.

2. Make **Slider** with variable *a* = 0 to 2*pi and increment 0.05. Set the slider to *a* = 0. Under *Animation*, choose *Increasing*.

3. Define the point **P=(2;*a*)**. This will be used as the center of the inner circle. Notice that as *a* changes, the point P will move.

4. Define the inner circle **C2=Circle[P,2]**. This circle will be centered at the point P and have a radius of 2.

5. We will now split the outer circle into slices by drawing eight diameters. We do this using a sequence:

   Sequence[Segment[(4cos(i*pi/8),4sin(i*pi/8)),(4cos(i*pi/8+pi),4sin(i*pi/8+pi))],i,-3,4]

   This creates list1: {8,8,8,8,8,8,8,8}

6. To construct the dots that will be used to create the illusion, we need to find the intersection point of our inner circle with each of the lines created in the previous step. Since the circle will intersect each line at two places, we need to construct two lists:

   Sequence[Intersect[C2,Element[list1,k],1],k,1,8]

   Sequence[Intersect[C2,Element[list1,k],2],k,1,8]

   The first creates list2: {(0.59,-1.41),(2,-2),(3.41,-1.41),(4,0),(3.41,1.41),(2,2),(0.59,1.41),(0,0)}

   The second creates list3: {(0,0),(0,0),(0,0),(0,0),(0,0),(0,0),(0,0),(?,?)}

7. Next, we create a final list that will chose only one intersection point based on the location of the inner circle.

   Sequence[Element[If[0<=a<t*pi/8,list2,t*pi/8<=a<t*pi/8+pi,list3,list2],t],t,1,8]

   This creates list4: {(0.59,-1.41),(2,-2),(3.41,-1.41),(4,0),(3.41,1.41),(2,2),(0.59,1.41),(0,0)}

8. Finally, to animate, right click on the slider and select *Animation*. You will now have dots that appear to move in a circle!

www.geogebra.org/apps