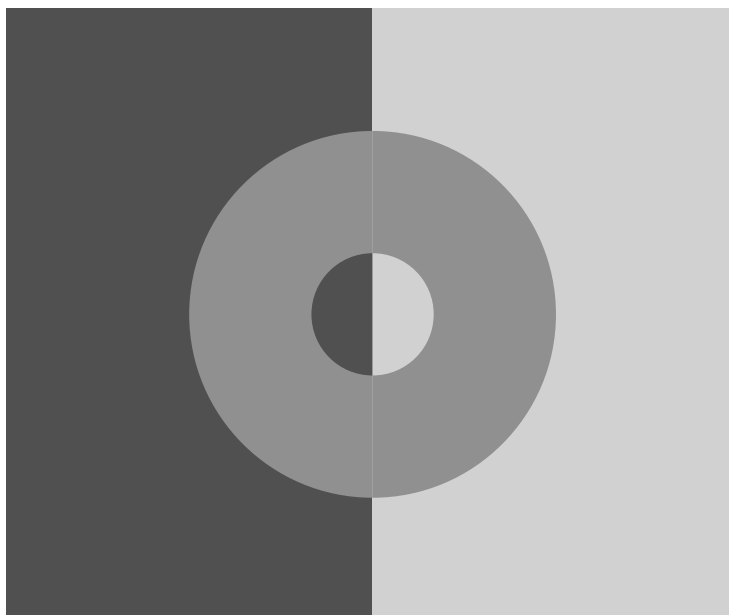


*In these labs you should work through the problems on the sheet and type your answers into a Microsoft Word document. When you have completed the tasks, print the document and hand it in.*

*Your answers can benefit from having small sections of R output and graphs copied and pasted into your word document. It can be useful to limit the width of output produced by R so that it fits into your document. You can change the width of output produced by R with a command like: `options(width=50)`.*

*The labs will count for 1 mark in the current assignment. They will be graded on a 0-1 basis. Don't forget to put your name and student ID on the document.*

In class I showed a color illusion called a Kofka ring. The figure is shown below (although it probably won't copy very well).



In this lab we'll draw the ring in various ways.

The figure is made up of two symmetric halves. Each half consists of a plain gray rectangular background with a semicircular “C” shape superimposed. To make things simple we'll assume that the line dividing the two halves is at  $x = 0$ . Then we can just concentrate on drawing the right and produce the left side as a mirror image.

The rectangular background is 3 units wide and 5 high. The  $x$  and  $y$  coordinates of the corners can be stored as follows.

```
xb = c(0, 3, 3, 0)
yb = c(-2.5, -2.5, 2.5, 2.5)
```

We can use the `polygon` function to draw the shape.

The semicircular part is a little trickier. We need to join together two semicircles – the inner one has radius 0.5 and the outer one has radius 1.5. Here is how we can compute the outline.

```
a1 = seq(pi/2, -pi/2, length=72)
a2 = seq(-pi/2, pi/2, length=72)
xc = c(1.5 * cos(a1), 0.5 * cos(a2))
yc = c(1.5 * sin(a1), 0.5 * sin(a2))
```

We can draw the figure as follows:

```
windows(width = 4, height = 3.5)
par(mai = c(0.25, 0.25, 0.25, 0.25))
plot.new()
plot.window(xlim = c(-3.5, 3.5),
            ylim = c(-3, 3),
            xaxs = "i", yaxs = "i")
# Draw the right side
polygon(xb, yb, col = "gray75", border = NA)
polygon(xc, yc, col = "gray50", border = NA)
# Draw the left side
# The only difference is we make the x coords negative
polygon(-xb, yb, col = "gray25", border = NA)
polygon(-xc, yc, col = "gray50", border = NA)
```

What you need to do now is to reproduce the figure, but with the left side shifted up by 0.5 and the right side shifted down by 0.5. Also, try shifting the two halves apart by a small amount (0.01, 0.05 ?) and see what happens.