'Let's get Practical'
– How Science Works

OCR

To see or not to see – Part 2

Apparatus:

Cardboard, or other stiff material – size 30 x 60 cm
A map pin
A pencil
Scissors
1 piece of string - length 60 cm
A small plastic cup
One piece of wood – 15 cm x 2.5 cm x 2.5 cm
A protractor
Glue
Coloured pens
A partner

Reference: Gateway Science Suite Biology Modules B1d, B2e
Twenty First Century Science Suite Biology Module B6.1 – Brain and Mind

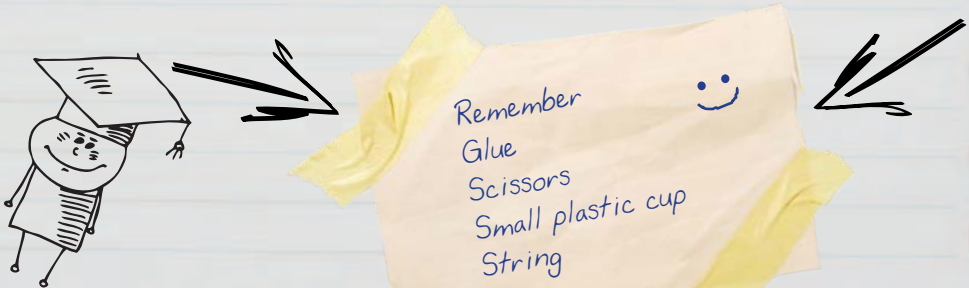
Peripheral Vision

We are not usually aware of our eyes' limitations.

This experiment is basically a large protractor that lets you test the limits of your *peripheral vision*. With the help of a friend, you can measure how much you can see out of the corner of your eye. You will find that you can detect motion at a wide angle, colours at a narrow angle, and detailed shapes at a surprisingly narrow angle.

Procedure

Stick the map pin, point down, halfway along the 60 cm edge of the cardboard. Tie the pencil to one end of the string, and wrap the other end of the string around the map pin to improvise a compass. Draw a half-circle with a 30 cm



radius. Now shorten the string and draw another, smaller half-circle, about 2 cm in diameter. Cut these both out, as shown in figure 1. The small circle should be just big enough for your nose.

Now place the map pin at the edge of the half-circle, directly across from the nose hole. This will be your focus object.

Use glue to attach the plastic cup to the bottom of the board. The cup will serve as a handle.

Use the coloured pens to draw different coloured shapes (e.g. rectangles, squares, triangles etc.) on the faces at one end of the length of wood. This will allow you to reveal only one shape at a time.

Using the cup as a handle, hold the cardboard up to your face and put your nose in the centre hole. Have your partner hold the wood so that it is against the curved side of the base, as far from the focus object as possible. Keep your eyes on the focus object.

Have your partner keep moving the coloured shape toward the focus object. Note the angle at which you first detect colour. Then note the angle at which you first see the shape itself. Have your partner used a different shape and repeat the experiment. You'll probably find that your partner has to move the wood surprisingly close to the focus object before you can make out colour or shape.

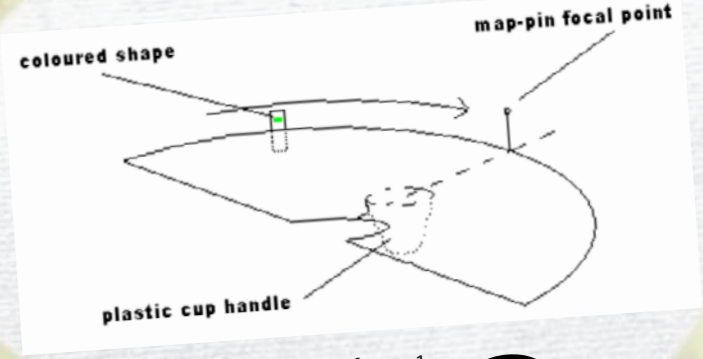


figure 1

What's going on?

Your *retina* - the light-sensitive lining at the back of your eye - is packed with light-receiving cells called *rods* and *cones*. Only the cones are sensitive to colour. These cells are clustered mainly in the central region of the retina.

When you see something out of the corner of your eye, its image focuses on the periphery of your retina, where there are few cones. Thus, it isn't surprising that you can't distinguish the colour of something you see out of the corner of your eye.

The rods are more evenly spread across the retina, but they also become less densely packed toward the outer regions of the retina. Because there are fewer rods, you have a limited ability to resolve the shapes of objects at the periphery of your vision.

Generally, you are not aware of the limitations of your peripheral vision. You think that you have a clear view of the world because your eyes are always in motion. Wherever you look, you see a sharp, clear image.

Interestingly, your peripheral vision is very sensitive to motion - a characteristic that probably had strong adaptive value during the earlier stages of human evolution.

You almost always need an assistant to help. As the coloured shape approaches the centre of your field of view, the temptation to cheat and move your eyes to look at the object becomes nearly irresistible. An assistant can watch you, and stop the experiment when you give in to temptation and move your eyes to look!