

ONE, TWO & THREE

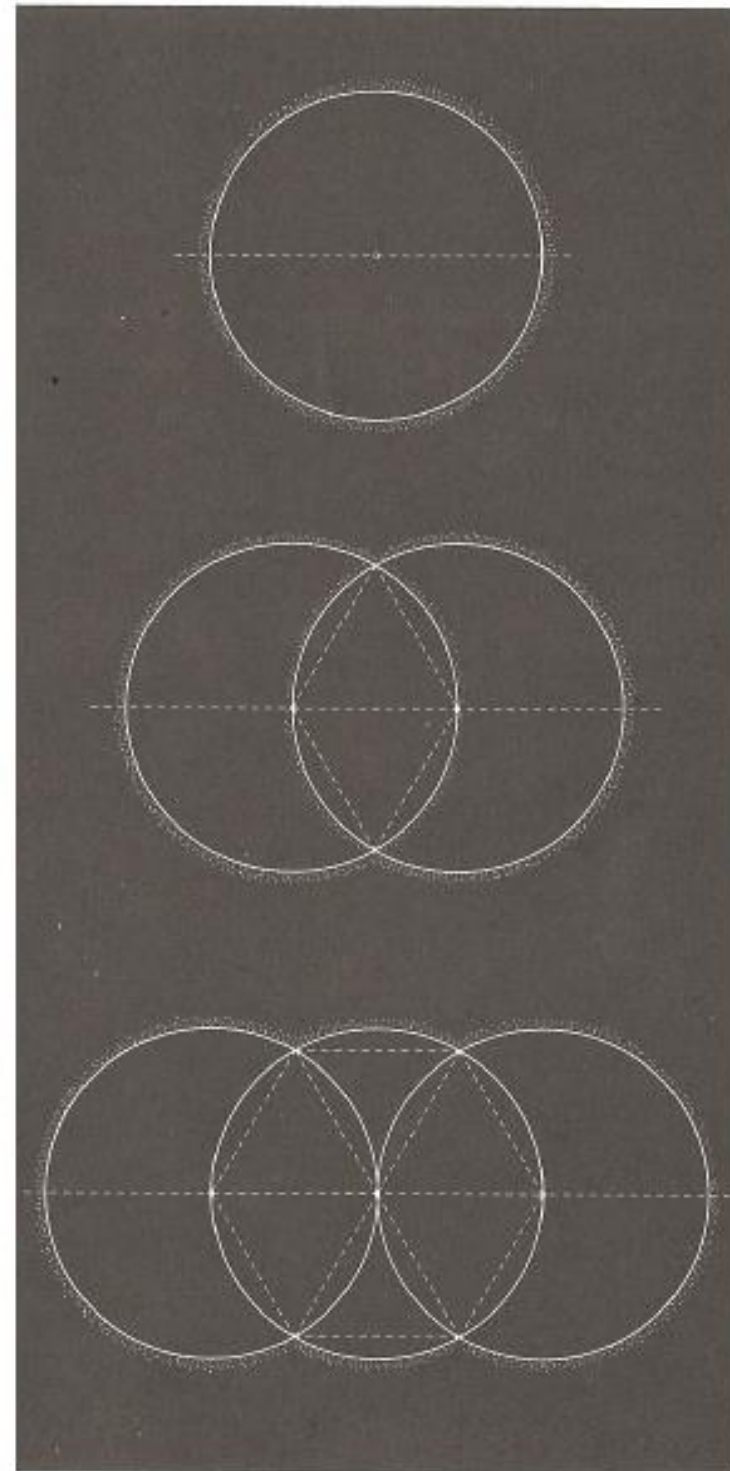
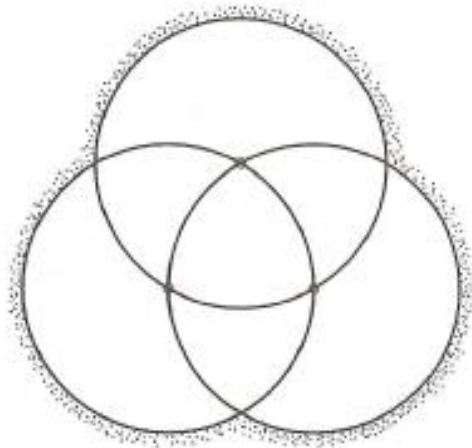
playing with circles

Get a ruler, compasses, something to draw with and something to draw on. Draw a horizontal line across the page. Open the compasses and place the point on the line. Draw a circle (*top*).

Where the circle has cut the line, place the compass point and draw another circle, leaving the compasses at the same opening as before. When one circle is drawn over another like this so that they pass through each others' centers, then an important almond shape, the *vesica piscis*, literally "fish's bladder", is formed. It is one of the first things that circles can do. Two equilateral triangles have been defined (*opposite center*).

A third circle can be added to the line as before, normally on the other side of the forming circle, this simple act defining all six points of a perfect hexagon (*lower opposite*). Alternatively, the third circle can be added as shown below to produce an elegant triangular form.

Circles thus effortlessly produce perfect triangles and hexagons.



SIX AROUND ONE

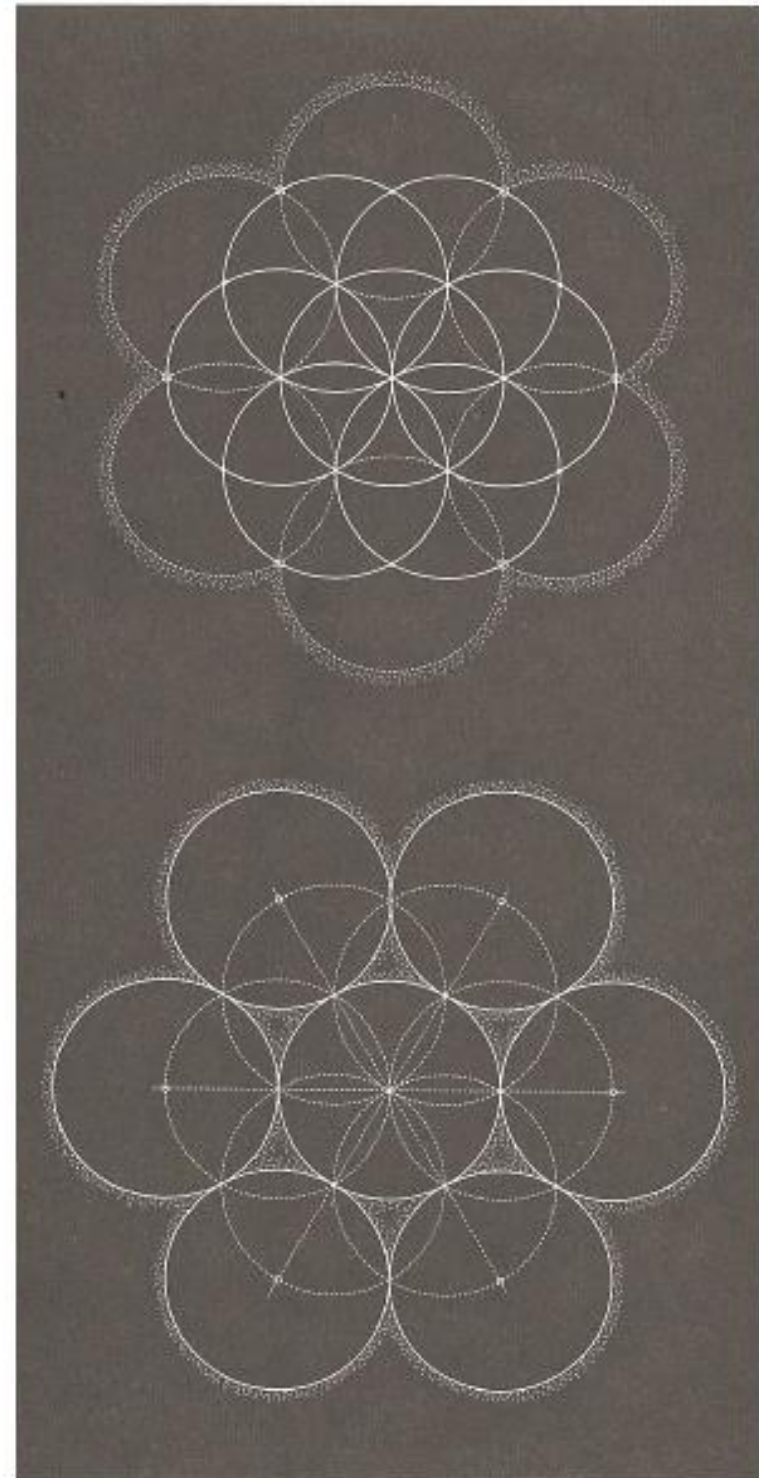
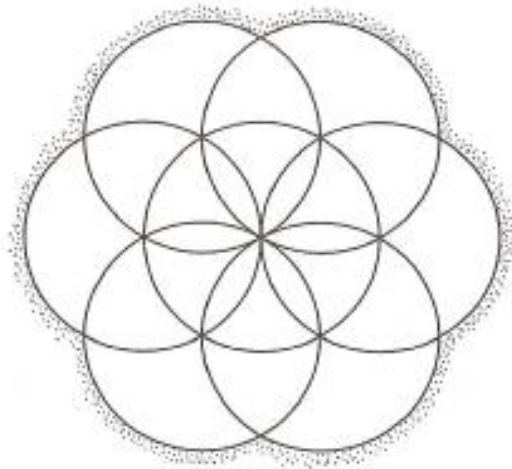
or twelve or even eighteen

The six points of the hexagon give rise to the flower-like pattern shown below. Alternatively it can be drawn by “walking” a circle around itself—something most children have done at school, whether under instruction or just playing with compasses.

We are now seeking the lower diagram opposite, and need the centers of the six outer circles. One way is to extend the flower, lightly drawing the six circles shown dashed in the top diagram above, to give us the six centers. Otherwise we can draw straight lines as shown in the lower diagram. Both ways work.

We can now see that six circles fit around one. We can push glasses, coins or tennis balls together to see it, yet it is extraordinary really. “Six around one” is a theme which the Old Testament of the Bible opens on, with the six days of work and the seventh day of rest.

There is indeed something very sixty about circles.



TWELVE AROUND ONE

how to draw a dodecagon

As one produces six, so six produces twelve. Here the arms of a six-pointed star extend from the flower to intersect the outer rims of the six circles. Beautifully, this forms a perfect overall division of space into twelve parts (*shown opposite*). The twelve-sided polygon is called a dodecagon, which means “twelve sided”.

The dodecagon is also made from six squares and six equilateral triangles fitted around a hexagon—can you see them all opposite? In addition, the shape divides into its factors, three, four and six, as four triangles, three squares, and two hexagons (*lower row opposite*).

Shown below is the three-dimensional version of the same story. A ball naturally fits twelve others around it so that they all touch the center and four neighbors. You see this arrangement in apples and oranges in every market stall. The shape made is called the *cuboctahedron* and is closely related to the tetrahedron and cube we saw on page five. Most crystals grow along these lines.

Twelve is the number which fits around one in three dimensions in the same way that six fits around one in two dimensions. The New Testament is a story of a teacher surrounded by twelve disciples.

