

CHAPTER 1

PERFECTION

I am the circle. Within a plane, I am the set of points equidistant from a designated center. I am the perfect shape, and I boast a list of properties that no other shape can lay claim to.

Every point of my composition is equal. Segments containing midpoints and corners form the triangle, square, and every other polygon. An ellipse has two points closest to its center and another two points farthest from its center. A crescent has two vertices as well as midpoints to each of its arcs. Indeed, every shape other than mine contains points of special character, altering their status among other points within the assembly. Only I am composed of points that are all truly equal; the equality defines beauty along with perfection.

As all my points are equal, I am the only planar shape that remains unchanged by any rotation of any angle. Rotate a square by a multiple of other than 90 degrees, and it is obvious that you have altered its orientation. But rotate me through any angle, and you will perceive no change in my perfect and beautiful configuration.

I form the optimal boundary of an enclosure because the area enclosed by me is the largest area that can be enclosed within a boundary of fixed length. A triangle, square, ellipse, crescent, or any other shape with a perimeter that is the same length as my circumference, encloses a smaller area than mine. Perfection is optimal as well as beautiful.

2 PERFECTION

Every line through my center forms a line of reflective symmetry about my center. Place a mirror perpendicular to any line about my center, and the semi-circle in front of the mirror is self-complementary so that its image with itself forms a perfect circle. Attempt this with an equilateral triangle, and unless the mirror is perfectly placed on one of only three lines of symmetry, the component in front of the mirror is not self-complementary. An ellipse has but two lines of symmetry through its center; an isosceles triangle and crescent have only one; and a scalene triangle, like most arbitrary shapes, has none. This infinite set of symmetries expresses itself only through my perfect shape in which every point is equal.

Inscribe an equilateral triangle within me, and every line of symmetry of the triangle is also a line of symmetry of mine. This is true for a square, an octagon, a dodecagon, a heptagon, a myriagon, or any other regular polygon, one with sides of equal length. Perfection dominates the imperfect as I dominate the polygons.

My dominance of the polygons also expresses itself in the attempt of a set of regular polygons to reach perfection. Order the regular polygons by the number of sides. Then, as one indefinitely climbs up the hierarchy, the shape of the polygons approaches my perfection. Indeed, by going far enough along the hierarchy to a target polygon, the points of all the subsequent polygons can be made as close as any arbitrarily small distance to my points. While they come close to me, only an insignificant fraction of the points settle on my perfect frame. I dominate the polygons. As they strive to reach me, they strive for perfection, but can never attain it.

My perfection inspires humans in all their endeavors. For three millennia engineers have used me to transport materials across the land whether by horse-powered cart, human-powered bicycles, steam-powered locomotive, or diesel-powered 18-wheelers. Circular gears drive mechanical devices; any other shape would cause uneven wear on the equipment. Electric power generators rotate through a circle yielding controllable voltage, current, and power output.

My symmetry inspires scientists to search for symmetry in nature. They have discovered the cyclic nature of time and stamped its daily rhythms on a circular clock. In the Northern Hemisphere, the North Star is a fixed center about which all other stars rotate along a circular pathway. Toss a stone into a lake, and a scientist confirms that the waves ripple across the lake's surface in concentric circles. I provide the pattern for the eye of a hurricane and the rainbow.

Just as mathematicians have discovered an impressive list of properties that I possess, artists and architects pay homage to my beauty. The artist adorns figures of religious admiration with a halo. Light enters a house of worship through a circular stained-glass window.

As I set the standard of equality, I am the foundation of many religious and political philosophies. Monotheism places all humankind equally about God; men are the points of a circle with God as their center. Both communism and democracy strive for the equality of citizens, one through an equal distribution of goods, the other through representative government via universal plebiscite in which every citizen has an equal vote in an electoral process.

I am a universal ideal pursued by engineers, scientists, mathematicians, artists, and philosophers. They pursue me because of my perfection. But like the polygons, humankind's pursuit is in vain for perfection is impossible to attain and so easy to destroy. A bicycle wheel is never in perfect true. Lay it on its side, and it doesn't evenly rest on its surface. Even with the naked eye, one can perceive a blip as it rotates. By adjusting the tension in the spokes, one can reduce a blip, but never eliminate it, and during the course of adjustment, a new blip always arises. Once close to true, a small bump in the road perturbs the wheel yet farther from perfection.

Human philosophical and social efforts toward a perfect circle of equality meet with similar road bumps. A system of privilege blanketed the democratic ideals of ancient Athens as citizenship was limited to a small select group. Others had limited or no rights, while some of the others were no more than the property of their slave-possessing owners. Over 2000 years after Athens' zenith, an assembly of men in the city of Philadelphia founded an independent nation vested on the circle of equality with God at its center as evidenced by the words of America's Declaration of Independence:

We hold these truths to be self-evident, that all men are created equal, that they are endowed by their Creator with certain unalienable Rights, that among these are Life, Liberty and the pursuit of Happiness.

Echoing Athens, many of the very signers of this esteemed document left Philadelphia and returned to their estates where slaves who enriched America's founders were not among the equally created men, but were property.

It is not surprising that my perfect ideal cannot be achieved by human beings who are endowed with such imperfect character; human beings' character imperfections leach into their engineering, arts, philosophies, and institutions. So these very humans, with their imperfect character, have looked to nature to find me. Their first impressions of me as a true physical entity reflect their naivety and the immaturity of their science. Neither the stars' apparent path, the concentric waves, nor the rainbow's arc achieve my perfection. Just as a bump on the road perturbs the wheel away from true, nature introduces a wobble on the earth's axis perturbing the apparent path of the stars, and ripples on a lake perturb the concentric waves, and nonuniformity of the atmosphere perturbs the rainbow's arc. Not only am I too perfect for humankind; I am also too perfect for nature. I exist not as a fact, but as an ideal.

It is through the investigation into planetary motion that human beings revealed my true status as Utopian and not material. Humans unveiled the ellipse and replaced my perfection with its form. The scientists and mathematicians who contributed to the unveiling of the ellipse did so not in a vacuum, but with preconceived notions seeded in their instinct as well as those that society stamped on them. It was a monumental achievement to overcome humanity's obsession with perfection and find truth.

While scientists and mathematicians led the investigation, they were not the only participants. Because of the ramifications of this discovery on philosophy,

4 PERFECTION

religion, religious institutions, and the relation between the state and religious institutions, the highest levels of the ecclesiastic community weighed in on the debate attempting to influence its outcome. In doing so, they exposed themselves, and all except the most fervent noted that not only was the pathway of the heavens imperfect, but the institutions guiding humanity's moral precepts were themselves following an imperfect path. With the discovery of the ellipse, humans evicted me from their view of nature and their perception of their own self and institutions.

I am an ideal worth pursuing, but in pursuing me humanity has discovered a far more diverse universe with a far more interesting set of possibilities than I have to offer. Humanity has also established institutions that, however imperfect, are far more dynamic than those that claimed perfection. *Shifting the Earth* tells the story of how this unfolded.