Wholemovement of the circle

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Wholeness is the most practical context in which to process information. The circle is Whole. It is a comprehensive tool for modeling patterns of forms and spatial organization inherent in our universe. Folding paper plates circles demonstrates the concept and process of movement within the Whole. Wholemovement generates individualized expressions of endless differences within the singularity of the circle.

How we process information is determined by cultural conditions. Our educational system values past experiences of selected groups of people over present individual experience. That is how we define ourselves. We learn past processes used to solve past problems. This decreases our ability to see meaningful connections within a greater context. Connecting across diverse disciplines, bridging cultural and individual differences is a problem when viewed as separated pieces needing to be connected. Our condition of mind is a construct that supports methods of processing information by separating pieces. A greater understanding is emerging showing only the interactions of endless connections of extraordinarily diverse relationships, all principled to the movement of the Whole.

We accept the circle as image. This is not questioned. We draw pictures of circles, traditionally using parts to construct fragmented symbols to explain 2-D and 3-D geometry and other mathematically related concepts. These image symbols are important in the development of mathematics. The symbol is the first step in abstracting information from its spatial context, allowing for greater manipulation of parts. By constructing images and using logic to find connections, we piece symbols together, looking to find some kind of greater meaning. Our fascination with images and parts, as beautiful as they are, has diminished our understanding of the Whole. We only make larger, more complex parts.

The circle is infinitely large as it is small. Movement goes into and out from this infinite boundary. Rotation at 90° to the circle plane is concentric to endlessly large and smaller circles. There is no center to the circle. The center is assumed, taking importance from the tool traditionally used for drawing circles. We make one point of the compass a center and through the function of the radial distance we move the other point into the image of a circle. There are other ways to draw pictures of circles without the center. The center is an important concept. The image of the circle is misleading, it is only a symbol. We have forgotten the spherical nature of the circle.

The sphere is the only form that demonstrates the concept of Wholeness. When compressed to a single plane, the sphere is reformed to a circle disk. Nothing is lost, only compressed. Like any compressed information it can be decompressed. Through movement of the circle shape, information is revealed and generated from nothing but the circle itself. The circle offers a challenge to reconsider how we process information.

The word *geometry* means "earth measure", to measure the things of the earth. The earth is spherical. The sphere is Whole. *Measure* is about movement from one location to another. Comprehensively, the word *geometry* means "Wholemovement", the movement of the whole to itself. (Can we get any bigger in our thinking? God in everybody's largest concept moves in some way to self-initiate creation.) Spatial patterns are proportional divisions of movement into the Wholeness of this energy creation. The circle is a compressed, reformed sphere. Everything we know about geometry and spatial patterns are parts within this compression. Spherical Wholeness is the nature of the circle we have lost to the image.

THE PAPER CIRCLE

The paper plate circle is as full as it is empty. Everything is in the Whole of this circle. The question is, "How do we get some of everything out of it?" The answer I like best came from a first grade student. He said, "We have to make space." (I can imagine God having that thought.) In discussing how we would make space, we decided to fold the circle. That decision was based on information from observation and discussion about the circle itself. It has a circumference and it moves, we moved the circumference to itself.

In folding the circle in half it is observed that everyone imagines two points on the circumference, puts them together and lines up the edge before creasing. Actually marking two points on the circumference and touching them together perfectly folds the circle in half, with no need to line up the edge. Everyone puts two points at different places on the circumference, but ends up with the same fold revealing four points and a line. Any two points on the circumference touched together will fold the circle in half. Any point on the circumference in relationship to the end points of the diameter forms a right triangle. Connecting all four points, by drawing straight lines between them, shows that everyone has a differently proportioned quadrilateral with two bisectors. There is a lot of information to observe and much discussion in this first fold of the circle.

Within this information is the directive for what to do next. We need to discuss the qualities of this first fold and some of the information that has been generated before making the next fold. What happens first is principle, and is important to all that follows.

PRINCIPLES

There are seven qualities evident in the first fold of the circle. *Wholeness* as spherical context is reformed into a circle. All other shapes are parts, limited to the number of sides. This is the difference between circumference and perimeter. The Whole in *movement* to itself is folded in half, revealing a ratio of 1:2, one Whole moving in two parts. This *division* shows one of endless diameters, without separation. *Duality* through movement generates two congruent parts showing symmetry of opposite orientation. It creates inside and outside, a reciprocal positive and negative spatial movement. The circle traces its spherical origin as it is moved in both directions around the diameter axis. The *triangulation* of this right-angle movement is the pattern of the tetrahedron: one point moving off the circle plane generates four points in space. The points, lines, planes, angles, sectors, all the parts show *consistency* to that first movement of the circumference. The *inner-dependency* of each individual part to the Whole determines the interdependent relationships between all parts. Parts are interactive and multifunctional expressions within the Whole. How we describe the relationships between parts determines whether we are "doing" geometry, algebra or trigonometry, art or science, or philosophy, or just talking about our observations of what is there.

These seven principle qualities of the first movement of the circle are directives to all subsequent pattern formation. They are universal, echoing familiarities found in all human activities. We are reflections of patterns in nature. The nature of the circle is inclusive. It is important to consider what happens first. We may describe these qualities differently, or find others, but without principle, we are lost in an endless flow of parts.

Space is necessary for us to think, to move through, and to experience what we don't know. We must learn to free our thoughts, to imagine movements yet to be formed, to play in awe, and wonder at the magnificence of this time/space environment. Geometry is about space, intervals, and the interaction between locations where connections reveal themselves. Movement can be so fast it appears solid, so spread out it appears to be no movement at all. Geometry, like music, without intervals does not exist. Space allows us to grow, to look beyond to a more comprehensive place of understanding. Returning geometry as primary information to learning and teaching mathematics matters little if there is no space in which to move.

Formulas work because of the contextual formfunctioning of spatial interaction of the circle. *AB=BA* describes the dual function of a diameter movement in two directions. The Pythagorean theorem is the 90° function of touching two opposite points together. An isolated triangle floating on a page is missinformation; it is missing the spatial context that gives meaning to the triangle. Meaning is not inherent to any part. It is the context that gives meaning to the parts. The greater the context, the greater the meaning. This is as true for human interaction as it is for understanding geometry.

THREE

One Whole, two parts. Three. The ratio 1:2 is the greatest, most general, thing we can say about what happens with the first fold. This directive reveals three options to proportionally fold the half-folded circle again. Each option shows a different number of diameters, changing the divisional symmetry. Folding 3 times in a ratio 1:2 creates 3 diameters: 6 spaces. Folding 4 times in a ratio 1:2 creates 4 diameters: 8 spaces. Folding 5 times in a ratio 1:2 creates 5 diameters: 10 spaces. The ratio1:2 generate symmetries of 3-6, 4-8, and 5-10. Three diameters are primary before 4 and 5. The process for developing 4 and 5 diameters is inherent to the 3, the different is in proportional division of the circumference. Numbers quantify parts, and describe qualities of spatial organization. The first fold reveals 1, 2, and 3: diameter, duality and triangulation. 1+2+3=6. Six is the number of edges to the tetrahedron, also number of intervals to a hexagon formed of 3 diameters. The tetrahedron is a number pattern of 10: 4 points and 6 edges. Ten is a symbol using the diameter and the circle in separation. Ten is 4 spheres and 6 points of connection. The tetrahedron is the first spatial measure of the circle/sphere; a structural pattern from which all else is derived.

Fold the folded circle two more times in the ratio 1:2. One point of the semi-circle is moved around the circumference, half way between the opposite point and the new forming edge point. The opposite point is moved behind, making a "Z" configuration, proportionally dividing the semi-circle into thirds. Eyes are made to see proportionally, no measuring. Make all points and edges even, then crease the cone shape. The open circle shows three equally spaced diameters. The amount of information in the circle has greatly increased. There are 7 points and 6 intervals, a number pattern of 13. (1+3=4) Four reflect the number of points in the first fold, and the four spheres in the minimum non-centered system of the closest packing of spheres, the tetrahedron. The vector equilibrium, a pattern of 13 closest packed spheres is the minimum centered spherical system. It can be fully formed using four regular tetrahedra. Four folded circles form a spherical vector equilibrium. Thirteen is the pattern of spherical order. Counting similar parts develops intimacy with patterns and forms usually not experienced. Numbers reveal patterned connections that are not obvious in other ways.

RECONFIGURATION OF THE CIRCLE

It is important to explore how many ways the three diameter folds can be used to reform the circle. These configurations are basic to everything the circle will do, on all levels of complexity. The hexagon (6) is always flat. By partially folding in one radius, an interval is created forming a pentagon pyramid (6-1=5). Closing the interval, a square base pyramid is formed (6-2=4). Bringing the 2 end points of the semi-circle together forms a tetrahedron pattern (6-3=3). The altitude of each pyramid increases as the perimeters decrease. The square-based interval (6-2=4) collapses with the inside flap forming 2 tetrahedra joined by a common surface. By raising the flap to the opposite inside the two tetrahedra are now joined by a common edge. This creates 2 formed tetrahedra and 2 tetrahedral intervals, a pattern of 4 tetrahedra. This configuration can be moved into a helix pattern of 3 tetrahedra. The hexagon will reform into an in-out 3 pointed star. The star collapses into a rhomboid and further into an equilateral triangle pattern. The semi-circle is a trapezoid pattern. The hexagon 6 reconfigures into the 5, 4, and 3, which are primary expressions of the circle folded three times consistently to the ratio1:2.

Touching the end points of one diameter together, a diameter folded to itself, forms 2 tetrahedra joined by a common edge. A bobby pin will hold them closed. In the same pattern of edge-to-edge joining, join 2 units of 2 tetrahedra forming a quadrilateral interval. Make another set of 4 tetrahedra and join in the same way forming a spherical vector equilibrium pattern of 13 points, using 4 circles. This sphere shows 6 diameters, 8 triangle and 6 square intervals. The triangle spaces are tetrahedra, the square spaces hold octahedra. Four of these spheres form a tetrahedron: six form an octahedron: fourteen will form a cube pattern. They are three individualized parts separated out from the closest packed order of spheres. The internal planer divisions of these spheres in spherical order reveal different forms and combinations of polyhedral relationships.

It is just as important for young children to experience this kind of spherical information as it is for them to experience the sphere as a "ball" for amusement and competition. Children, even at 5 and 6 years old, can understand these spherical patterns as easily as they understand rules for playing baseball. The sphere is the pattern source for all they will ever learn. The Whole, will then become their playground.

FORMING THE TETRAHEDRON

There are four primary things necessary to understand about spatial formation. The *sphere*, the *sphere*, the *sphere*, and the *sphere*. Four spherical locations in space and six points of connection is the number ten, the tetrahedron. Four points define the tetrahedron, six points define the octahedron. The tetrahedron and octahedron are two aspects of the same spherical pattern, even though they can be individually separated as polyhedra. This unity is not unlike seeing the first fold of the circle where space is generated when the circle moves away from the single plane showing four point locations on the circumference with six lines of connection. Both circle and spherical forms of movement show ten as a number description of the tetrahedron pattern. This consistent pattern development is reflected through many different forms. Division of the spherical ovum is a tetrahedral reformation, a pattern we share in common. In multiples the sphere gives continuity to genetic interaction, giving form to our lives.

Three diameters show six points on the circumference. Touch every other point (1:2) to the center point and creased. This forms a two-frequency equilateral triangle. Each triangle edge length intersects individually with the three diameters, generating a new point on each diameter. Touch the end point of one diameter to the new point of intersection on the same diameter and crease. Do all diameters, one at a time. (Overlapping creates inaccuracy.) The equilateral triangle is now divided into four congruent triangles. Bring the end points together forming a tetrahedron, and tape edges. In discussing the information folded in these lines forming the tetrahedron, basic vocabulary and geometric functions can be demonstrated and discussed. Hundreds of reformations, and innumerable systems can be developed using these nine creased lines.

The first fold of the circle shows relationship is about touching. The relationship of two points touching is expressed as a line perpendicular to the movement halfway between, a structural dynamics observed in all balanced relationships. When points touch, the line will be where it needs to be. Out of touch causes miss alignment. Carbon, a four point tetrahedral pattern, is fundamental bonding for life formation. Bonding is a touching that is reflected in touching point locations of the circle.

Spherical order shows point-to-point connections. The polyhedron form shows two more options, edge lines and surface planes. Points, lines, and planes are three parts of spatial formation. They can be used to define objects, show symmetry, indicate means of connection, and to describe movement. Using them to describe a linear progression from point to line to plane to volume is an abstract concept that supports drawing pictures in an attempt to explain space. Nature does not manifest in this way.

REFORMING THE TETRAHERON

Between the 2-frequency triangle and the tetrahedron is the octahedron pattern. Joining two half open tetrahedra edge-to-edge forms a regular octahedron. Four open tetrahedra, three around one in a spiral pattern, joining on half-edges, reforms into a spherical icosahedron. Sixteen triangles are used to form 20 faces. This is the third of three triangular polyhedra of the Five Plutonic Solids. Using four more tetrahedra to stellate the tetrahedron forms its own dual. In the same manner stellating the octahedron, with four tetrahedra placed equally around, forms a larger solid tetrahedron. Four more tetrahedra complete the stellation of the octahedron showing two 2-frequency intersecting tetrahedra in opposite orientation. Connecting the points with tape or string, shows the stellated octahedron as a cube pattern. Using the icosahedron, place four tetrahedra equally around finding the tetrahedron pattern with an icosahedron center. Adding four more tetrahedra equally spaced, the cube pattern with an icosahedron center is formed. Stellating all 20 faces and stringing the points, we see the dodecahedron is dual to the icosahedron. Further stringing of the stellated icosahedron reveals pentagon stars, the golden ratio and interpenetrating cubes. The square and the pentagon are again revealed as relationships of tetrahedra, generating out from that first fold into the circle.

All five regular polyhedra have been formed using only tetrahedra. These five formed patterns are fundamental to the arrangements of all known spatial systems. This is only the first step into a process that models the beauty and complexity of form, transforming and reforming systems that are observed throughout nature. At the same time they inform us about the abstracted information. These patterns are modeled by using paper plate circles, and masking tape to hold them together. There is no measuring or cutting.

TRIANGULAR GRID

Individually fold all six points on the circumference to the center point, and touch each diameter end to opposite end. This forms a triangular gird making a hexagon star around the three diameters. Three parallel lines 90° to each diameter divide the diameters into four equal segments, and the circle into 12 equal sectors. The second set of three diameters are bisecting lines of a different proportional division. This 4-frequency diameter circle opens potential for hundreds more reconfigurations. An octahedron can now be formed using one circle, and two circles formed an icosahedron instead of four.

To expand the grid, touch the six end points to the two new points of intersection on each diameter. Do each diameter separately. This generates three sets of seven parallel lines perpendicular to, and dividing each of the three diameters into eight equal sections. Much like an octave in music, endless arrangements and variations of spatial compositions are possible by playing the intervals. This progression of dividing the 3 diameters can continue from 2, to 4, 8, 16, 32, 64, etc.

Options are tremendously increased by reforming the tetrahedron with the circumference folded to the outside; not possible in any other method of modeling. The stellated octahedron with the circumferences folded out becomes the rhomboid dodecahedron. There are many transformations that can be observed by opening points into polygons, and closing in surfaces to points. Many curved-surface configurations can be created using the circumference in combination with the straight edges.

Folding the circle allows rediscovering what we already know, at the same time exploring things we don't know. This process provides the greatest possible context to a discipline based on fragmented information, static construction, and rigorous methods of linear thinking. Wholemovement is a direct expression from the compressed circle/sphere form. It is 2-D and 3-D geometry, math, and all the other things we do when using patterns of spherical order.