

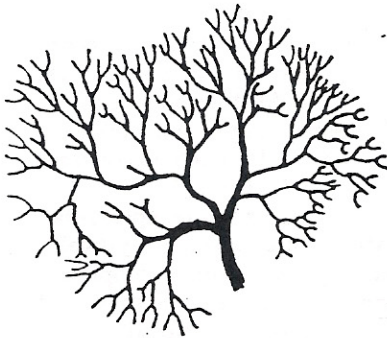
Fundamental Patterns

"Nature's forms are the most practical and functional and most efficient in terms of space, materials, energy, and time. Nature's patterns teach us how to get the most from the least."
—Michael S. Schneider

Mollison says, "Learning a master pattern is very like learning a principle; it may be applicable over a wide range of phenomena, some complex and some simple. As an abstraction it assists us to gain meaning from life and landscape and to comprehend allied phenomena." The two tables summarize the basic physical and geometrical patterns.
—Patricia Michael

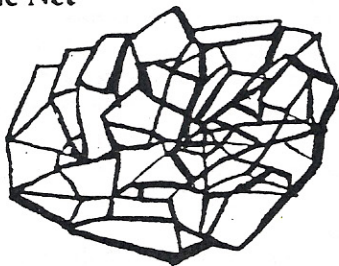
Table A : The Basic Physical Patterns

The Branch



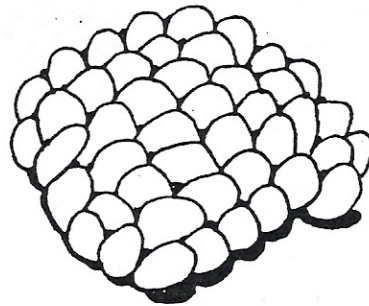
The Branch gathers, collects and distributes the flow of water, air, energy, or material. It increases exchange and transport and anchors them. You can see patterns of branching in trees, in blood vessels, and in the flows of water. Vaginal fluid drawing sperm dries in a pattern of branching. Naturally flowing water collects and distributes as branches. There are orders of magnitude of branches. It is unusual to have more than seven orders in a system; five is more common.

The Net



The Net or Mesh is useful for sorting, collecting, filtering, and small surface exchange. It distributes both tension and force. In nature we find this pattern in spider webs and birds' nests. We can use the pattern to strengthen and reinforce. For instance, straw mulch is very stable; when stacked at different angles it is not easily moved by wind or rain.

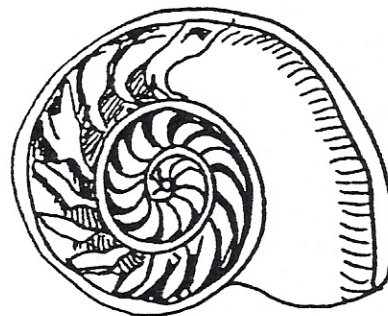
The Lobe



The Lobe provides surfaces for exchange, edges, or interfaces where two things meet. The edge is the most productive and fecund part of a system, where the most interesting things happen.

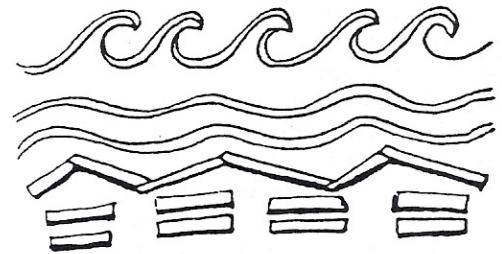
This is the best pattern for bioremediation because it provides lots of surface for growth. For instance, to provide natural wastewater treatment, build stacked rocks with lots of places for things to grow and clean the water, and lots of opportunity for water's movement, bubbling and gushing. Lobular patterns are seen in clouds and the flow of sheets of water across an almost-flat surface. The Great Lakes—formed by retreating glacial ice sheets—form an immense lobular pattern.

The Spiral



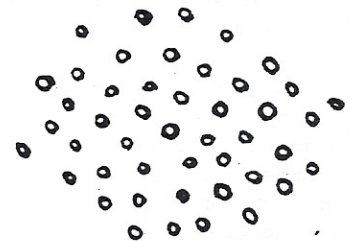
The Spiral, found in water swirling down a drain, the shell of a snail, and in tornadoes, has the function of speeding up or slowing down, of concentrating or dispersing, depending on which way the flow is going. Branches off the stem of a plant go in a spiral, maximizing exposure to the sun. Thermal convection in air provides an effortless ride for migrating geese or human glider pilots.

The Wave



The Wave patterns—streamlines, zigzags and flows—provide pulsation, timing and the possibility of measurement over time into a system. Waves are found in water, of course, but also in static fixtures such as swales on contour. Your heartbeat is a wave pattern.

The Scatter



The Scatter pattern introduces the element of chance into a system. It breaks things up and slows them down. Δ

Table B: The Fundamental Numerical And Geometric Patterns

(Taken from Schneider, *A Beginner's Guide to Constructing the Universe*)

Schneider calls pattern the principal by which the universe is designed: "On every scale, every natural pattern of growth or movement conforms inevitably to one or more of the simple geometric types. Identifying shape and patterns and knowing what principles they represent allows us to understand what nature is doing in any given situation and why these principles are applied in human affairs."

1. Monad, Point or Circle

The circle represents both equal expansion from a point and rotary motion, or cycles. In ancient times the circle symbolized the number one. A circle is an expanded point. The smallest particle is a point. The entire Universe came from one point. The point is the center of the circle. A point with a circle was the Egyptian, Chinese, and Mayan glyph for light. The circle represents nature's universal cycles, circulation, circuits, orbits, periodicities.

All cycles have rising and declining phases. When a wheel turns, the outside moves faster than the center because it has farther to go. This is the principle that wheels, cranks, gears, dials, knobs, levers, belts, and ball bearings use to magnify, diminish, or transfer mechanical power. When something turns faster than our nervous system can register, then it is perceived as solid, one sound, one thing, one smell, taste, etc. Cooperating with nature requires that we recognize the existence of, and learn how to design with, the waves of its omnipresent cycles.

A circle expresses the most efficient geometric space in which for human creations to occur. Of all shapes the circle encloses the most area with the smallest perimeter. A round shield gave the ancient soldier maximum protection behind the largest area while employing the least material and having the least weight.

A manhole cover is round because it is the only shape that won't fall into its own hole. Ring roads provide the greatest access to a city center using the least pavement.

2. Dyad, Line

The principal of the dyad is polarity. The dyad is the basis of every creative process. Everything that originates from the tree of knowledge carries in itself duality, says the Zohar, a mystical Jewish text. The ancient Sumerian words for woman and man are also those for one and two. It shows up as rhythmic oscillation

between opposite poles, as close as our own heart beat, and as far away as quasars pulsing at the edge of the universe. Polarity, balance, harmony, pattern, and wholeness are basic to all sciences. The dyad's fundamental characteristic is the existence of a pair of distinct but equal opposites that seek to unite in an urge to return to unity.

3. Triad, Triangle

Triangles bestow strength, balance, and efficiency of space, energy, and materials. Three is the number of transformation, rebirth, and success.

The Sumerians counted man, woman, many. Older cultures often count one, two, many. Karpman identified the transactional analysis game of the triangle (victim, rescuer, and persecutor) as the transition from tension in family dynamics to harmony. If one can identify these positions in relationship dynamics and move away from them, most problems can be solved in a win/win solution.

A triangle encloses the smallest area for the greatest perimeter. It is the only polygon structurally rigid by virtue of its geometry alone. It is synergetic in that its stability and superior strength are not predicted by any of its parts, which, by themselves, do not have these properties. We need triangles to create self-supporting structures. The more triangles it has, the more weight a structure will support. A triangular level with a plumb bob is one of the oldest and most efficient of leveling devices. Triangular structure gives the rose's thorn and shark's teeth their bite, the wedge and axe their splitting power. We use triangles in our designs for reasons of superior structure, strength, efficiency, balance, visual appeal, and symbolism.

4. Tetrad, Square

The fundamental principle of the tetrad is depth. Three points define a flat surface, but it takes a fourth to define a solid. Four is the principle of three-dimensional space. It represents the four states of matter in classical western thought and in the worldview of the indigenous peoples of the Americas: earth, air, fire and water.

5. Pentad, Spiral

This symbolizes the principle of regeneration. Pentagonal symmetry is the

supreme symbol of life. The quintessence of nature encompasses and infuses the four elements with the life they cannot create by themselves. The spiral's role in nature is transformation. Every "thing" is not something static but a process, a dynamic energy event.

6. Hexad, Hexagon

The hexad stands for strength, for it is a double triangle. Six represents the maximum efficiency of material, labor, and time by using straight lines to approximate the efficient circle. A beehive is a mere 1-1/2 pounds of wax, but holds four pounds of honey. In the human lung, alveoli form a hexagonal net.

7. Heptad

This figure represents non-scaleable nature. Seven is mystical, almost unseen. It represents a complete but ongoing process, a periodic rhythm of internal relationships. Traditionally every seventh year was a "year of release" when a field was allowed to lay fallow, debts were forgotten and slaves were freed. In the Judaeo-Christian-Muslim tradition, the seventh day of the week is a day of rest. The seven-note scale is meant to model the hidden side of macrocosmic design, the universe ruled by mathematical harmonies of music. There are seven spectrums of visible light (ROY G BIV - Red, Orange, Yellow, Green, Blue, Indigo, and Violet, the colors of the rainbow). There are seven crystal systems and seven chakras.

8. Octad, Octagon

Eight represents internal structure. Octagons as starting frames are used to explore a form's internal structures and patterns. The Periodic Table contains eight groups or types of elements. The eight white keys of the piano comprise an octave, a fundamental structure of Western music.

9. Enead

Nine, is the birth of a new whole. Nine is the greatest single digit within the Decad, or first ten digits. Ancient mathematical philosophers called nine "the finishing post" and "that which brings completion." Nine-fold forms seem to be associated with the process of birth. One arrangement of nine points forms an X. From this nine-pointed core comes the secret for constructing the mythic labyrinth. △



Patterns of Branching

Shapes: Forks, bilateral symmetry, explosion and double explosion.

Purpose or Function: Collection and distribution of nutrients or physical properties, such as energy. Diffusion and infusion of materials and heat. The most efficient way to reach all points in a large area while moving the shortest possible distance (less weight and stress). Multiple branches help to preserve information, and permit regrowth in case of damage. A common pattern for small flowerheads—yielding a dense array of florets to attract insects; or barbs for protection, or for seed dispersal.

Examples in Nature:

Forks: Trees, roots, leaves, antlers, feathers, blood vessels, river systems

Bilateral symmetry: evergreens, ferns, leaf veins

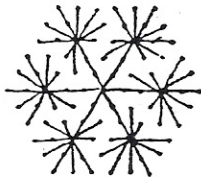
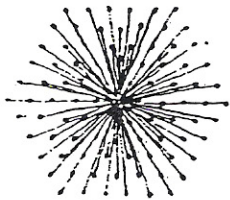
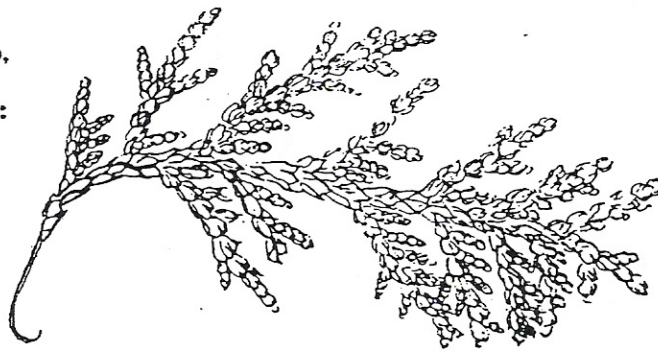
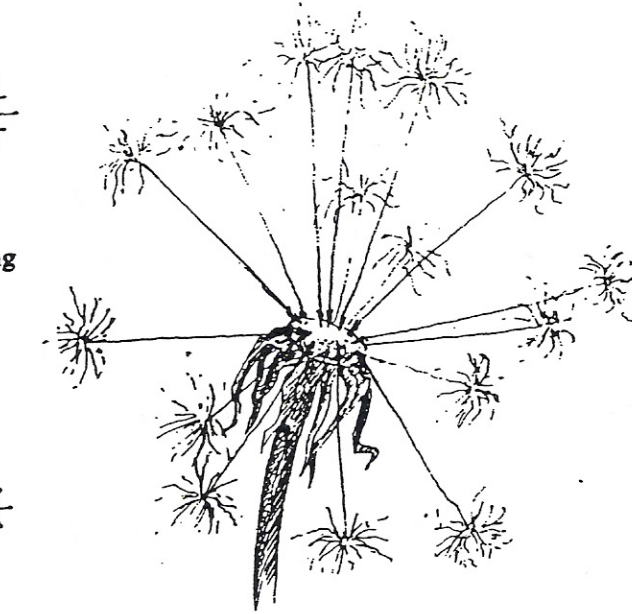
Explosion and double explosion: seed pods, clover blossoms, Queen Anne's lace, wild parsnip, goatsbeard, other umbel flowers.

Examples in Garden and Permaculture Design: garden pathways; heat exchange.

Forks



Bilateral Symmetry



Explosion and Double Explosion

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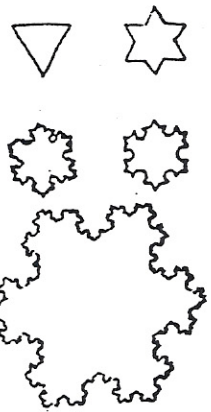
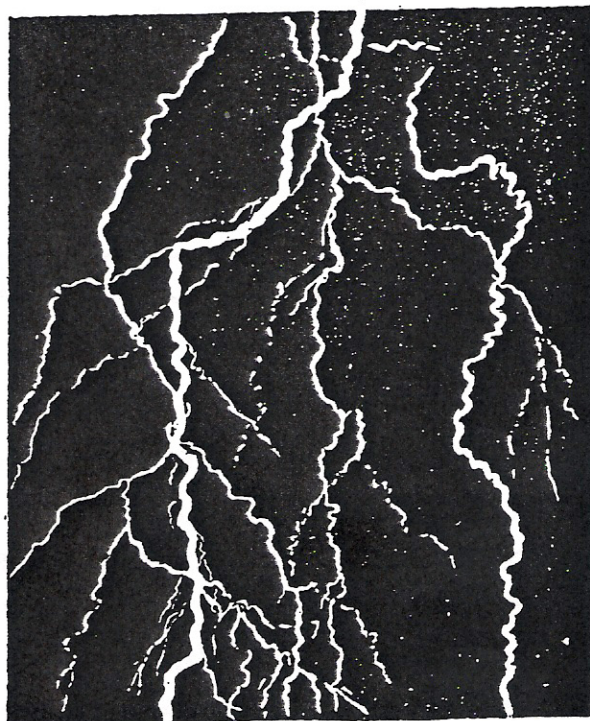
Shape: Fractals, Scatter patterns

Purpose or Function: Self similarity—repeated duplication of shape on smaller scales (iteration); detail looks like larger picture. Irregular complex structures.

Examples in Nature: rocky coastlines, ferns, lichens, tree branches, roots, clouds, frost crystals, snowflakes, fault lines, lightning, neuronal nets, information nets

Associated Mathematical Terms: fractal geometry, nonlinear equations, chaos dynamics

Examples in Garden and Permaculture Design: pathways, networks, clusters



Fractal: iteration