THE

PRINCIPLES

OF

LIGHT AND COLOR

INCLUDING AMONG OTHER THINGS

THE HARMONIC LAWS OF THE UNIVERSE, THE ETHERIO-ATOMIC PHILOSOPHY OF FORCE, CHROMO CHEMISTRY, CHROMO THERAPEUTICS, AND THE GENERAL PHILOSOPHY OF THE FINE FORCES, TOGETHER WITH NUMEROUS DISCOVERIES AND PRACTICAL APPLICATIONS.

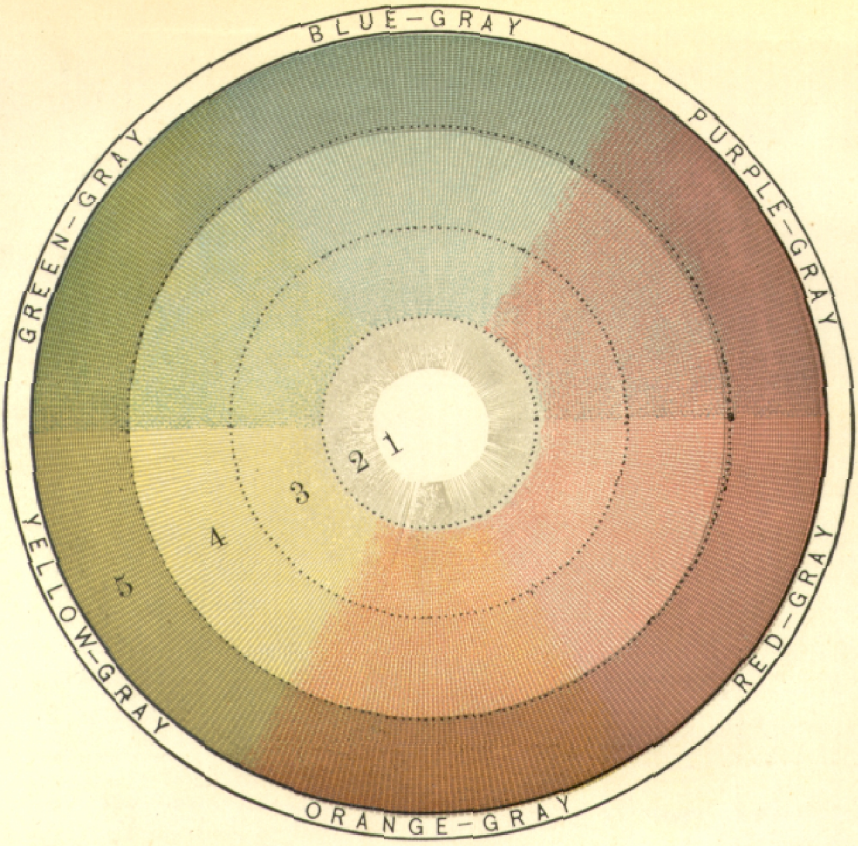
ILLUSTRATED BY 204 EXQUISITE PHOTO-ENGRAVINGS, BESIDES FOUR SUPERB COLORED PLATES PRINTED ON SEVEN PLATES EACH.

By EDWIN D. BABBITT.

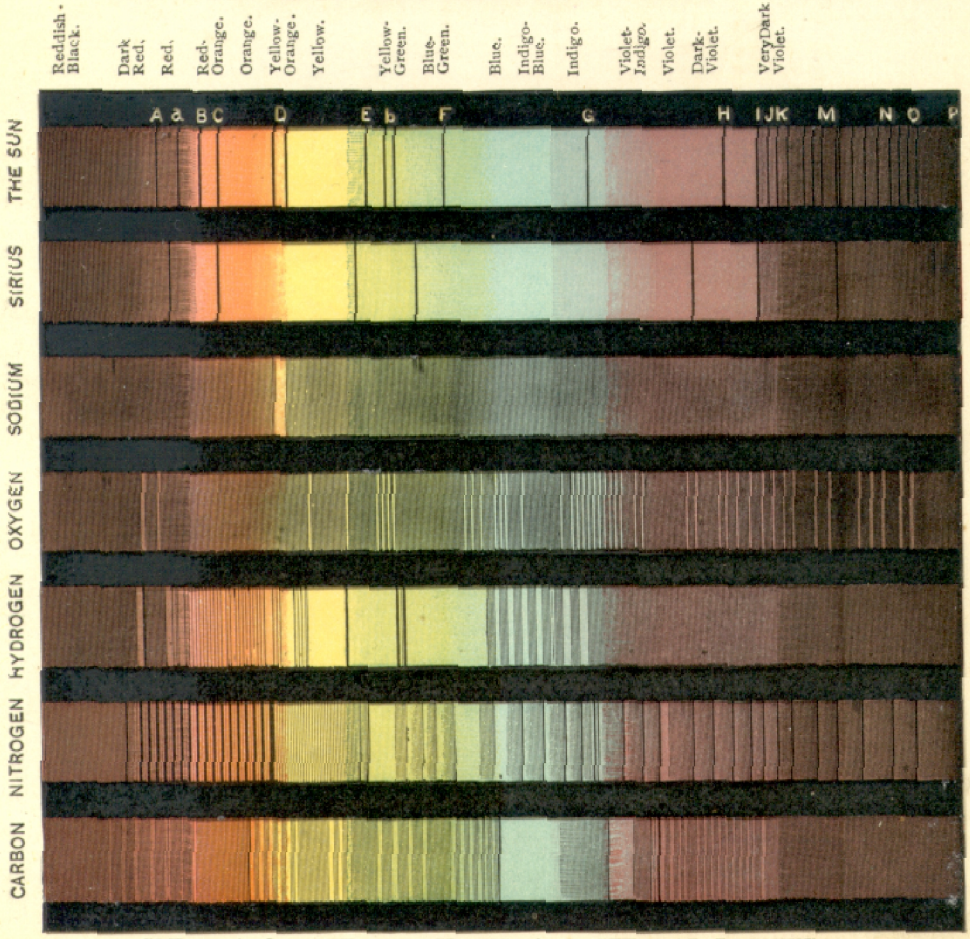
"Study the Light; attempt the high; seek out
The Soul's bright path."—*Bailey.*

NEW YORK:
BABBITT & CO.,
SCIENCE HALL, 141 EIGHTH STREET.
1878.

BABBITT'S PRINCIPLES OF LIGHT AND COLOR.—PLATE I.

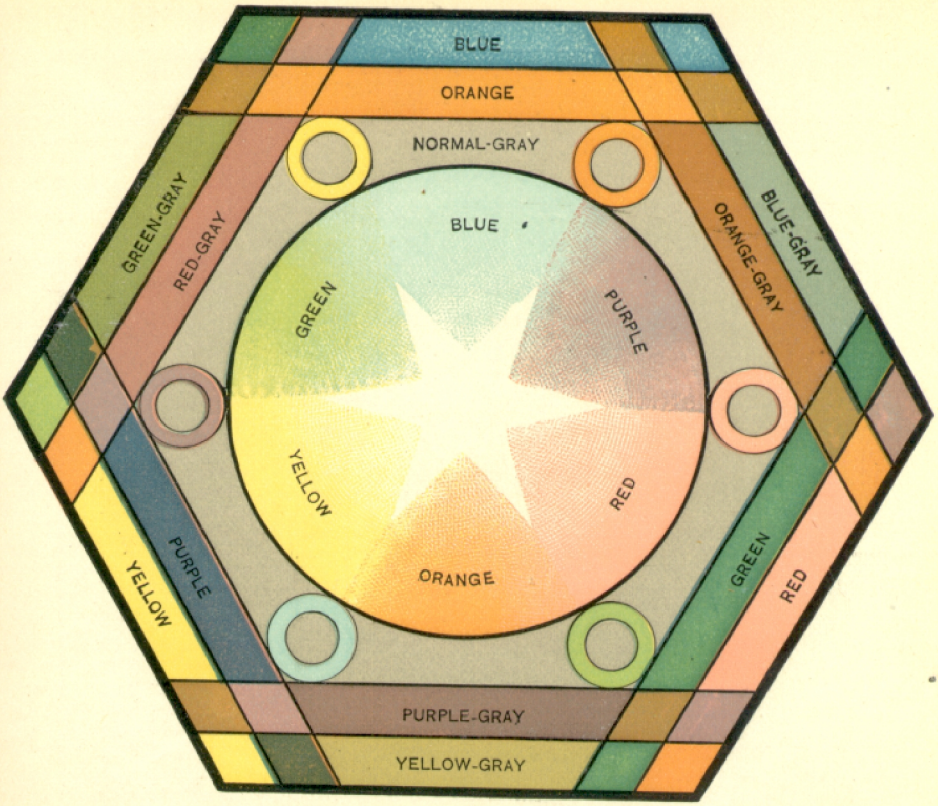


VARIOUS SHADES OF GRAY ARRANGED IN ANALOGICAL HARMONY.



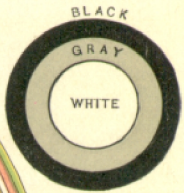
SPECTRA OF THE SUN, SIRIUS, AND SEVERAL ELEMENTS.

BABBITT'S PRINCIPLES OF LIGHT AND COLOR.—PLATE II.

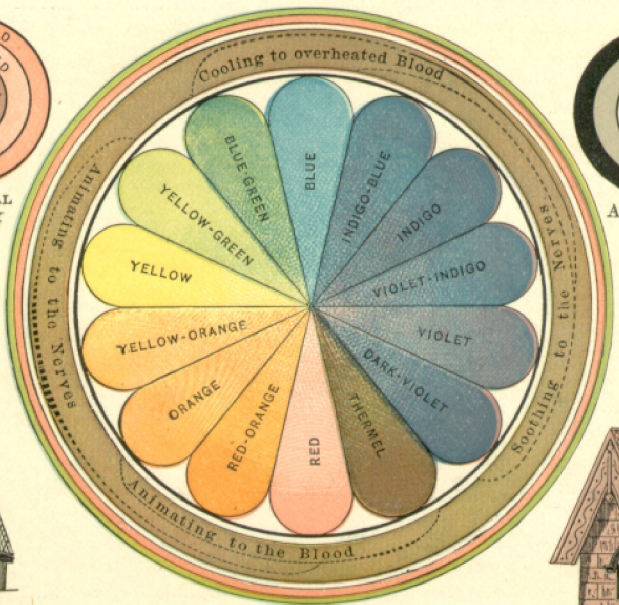


CHROMATIC HARMONY OF GRADATION AND CONTRAST.

ANALOGICAL HARMONY



ACHROMATIC COLORS



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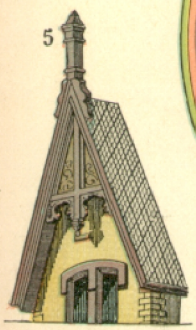
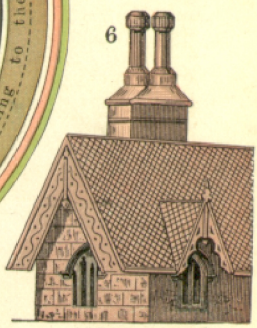


CONTRASTING HARMONY

CHROMATIC COLORS PLACED OPPOSITE THOSE WHICH FORM A CHEMICAL AFFINITY WITH THEM

6



ANALOGICAL HARMONY

In the above elaborate combination of colors the artist has found it impossible to get every feature accurate, although he has many beautiful and pure tints. The grays on both plates I. and II. are not sufficiently subdued, the chromatic colors standing out too brilliantly, the red, for instance, in the house, fig. 6, being too strong, etc. For description of plates see pp. 63, 65, 66, 69, 71, etc. The spectra are described on p. 217.

PREFACE.

THE preface of my work is like a Hebrew book; it begins at its very end. Having spent several years in developing this large volume, what is my excuse for thrusting it out upon mankind? None at all unless human knowledge and upbuilding can be enhanced thereby.

Am I laboring under a vain delusion when I assert that no science whatever, excepting pure mathematics, has thus far reached down to basic principles—that in spite of the wonderful achievements of experimental scientists, no definite conceptions of atomic machinery, or the fundamental processes of thermal, electric, chemical, physiological or psychological action have been attained, and that because the correlations of matter and force have been misapprehended? If I am deluded and cannot depend upon the thousand facts that seem to sustain me and clear up so many mysteries, it is certainly a sad matter, for then no one will be made the wiser for my labors; if I am right, and so many scientists are wrong in their conceptions of force, then too there is a melancholy side to the question, for great will be the trouble of having to pull up old stakes and put down new ones, and some opinionated persons will be so indignant at having dear old beliefs attacked, that if unable to demolish my facts in fair discussion will present one-sided views of them, or attack the author himself. I hope and pray that I may be duly abused, however, by all such crystallized conservatives, otherwise it will show that my efforts to advance this great cause of truth have been but feeble. After all, if this work shall develop some new and better foundations of scientific truth, scientific men themselves should rejoice at it even if it does cause a little trouble to adjust themselves to new conditions, for the more truth they get, the more luminous and triumphant will their pathway of progress become, and they will be able to build a superstructure upon these new foundations that is far more magnificent than any which my own limited efforts could achieve.

My discovery of the form and constitution of atoms, and their working in connection with etherial forces to produce the effects of heat, cold, electricity, magnetism, chemical action, light, color, and many other effects, was announced during our centennial year, 1876, in some New York and Chicago papers, and my ideas have been brought to still further maturity since. Having acquired this knowledge, it seemed quite possible at last to crystallize the subjects of

Light, Color, and other Fine Forces into a science, and learn their chemical and therapeutical potencies as well as many of their mystic relations to physical and psychological action.

Before reaching out into the unknown and invisible it was important to establish briefly the laws of the known and visible, the misapprehension of which has led scientists into various errors, as it seemed to me, hence my first chapters. Before being able to understand Light and Color, with any exactness, it was absolutely necessary to investigate the working of atoms, and the general laws of the fine forces, so that we may not always have to move in the dark when considering them. Hence my chapter on the Etherio-atomic Philosophy of Force. Whatever may be thought of my details of atoms, it seems quite impossible that a thoughtful mind should dispute the correctness of their general features, so absolutely capable are they of being demonstrated by facts.

It is quite time that the wonderful world of light and color which is invisible to the ordinary eye, and which is capable of being demonstrated by spectrum analysis and otherwise, should be made known, especially as so many mysteries of nature and human life are cleared up thereby, and such marvelous powers of vital and mental control are revealed.

I would especially ask one favor of all critics, which is, that they will examine and weigh well all departments of the work before they condemn, for it has cost too much thought and careful investigation to have it rudely and hastily passed upon. Comprising, as it does, so large a field of heretofore untrodden ground, there certainly must be some errors in spite of all my great care and desire for exact truth.

I have chosen a diluted sky-blue tint for my paper, not only because it is soothing to the nerves of the eye, but as I deem it, handsome. Calendered white, or yellowish paper is known to be irritating to the retina.

The beautiful engravings of this work, many of which have the steel plate finish, have been executed by the sun under the control of the Photo-Engraving Co., 67 Park Place, N. Y. For the very careful and conscientious labors of this company I am greatly indebted. The Superintendent, Mr. J. C. Moss, was the first, I believe, to bring these finest solar relief plates into practical use.

I owe a word of acknowledgment also to Mr. John Fahnestock, of 25 Rose St., N. Y., for the colored plates, which for beauty I have not seen surpassed on either side of the ocean.

EDWIN D. BABBITT.

SCIENCE HALL, N. Y.

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CHAPTER FOURTH.—THE SOURCES OF LIGHT.

CHAPTER FIFTH.—CHROMO CHEMISTRY.

CHAPTER SIXTH.—CHROMO-THERAPEUTICS, OR CHROMOPATHY.

CHAPTER FIRST.

HARMONIC LAWS OF THE UNIVERSE.

I. LIGHT.

LIGHT reveals the glories of the external world and yet is the most glorious of them all. It gives beauty, reveals beauty and is itself most beautiful. It is the analyzer, the truth-teller and the exposer of shams, for it shows things as they are. Its infinite streams measure off the universe and flow into our telescopes from stars which are quintillions of miles distant. On the other hand, it descends to objects inconceivably small, and reveals through the microscope objects fifty millions of times less than can be seen by the naked eye.* Like all other fine forces, its movement is wonderfully soft, and yet penetrating and powerful. Without its vivifying influence vegetable, animal and human life must immediately perish from the earth, and general ruin take place. We shall do well, then, to consider this potential and beautiful principle of light and its component colors, for the more deeply we penetrate into its inner laws, the more will it present itself as a marvelous store-house of power to vitalize, heal, refine and delight mankind.

II. NATURE OUR GUIDE.

1. But light is one of the fine forces of nature, and we cannot understand it until we learn the laws of the fine forces generally. Nor can we understand the fine forces themselves, until we become acquainted with the coarser elements upon which, or in connection with which, they act. And we cannot apprehend this interrelation of the finer with the coarser, without a knowledge of the fundamental principles of force, and the great central harmonic laws of nature and mind in unison with which all things

* A London Optician has constructed a lens which will magnify fifty million times.

must work. There has been too much mere superficial presentation of these matters. Unless we can go beyond mere external phenomena to basic principles, we must still build upon conjecture and work more or less in the dark. It is proper, then, that we should inquire into the general constitution of the universe, and get a clear conception of universal law before we can go with entire correctness into the details of any subject whatever, just as it is important to consider details, more or less, before we can comprehend the whole.

2. Why should we thus go to nature as the standard of ultimate appeal? First, because we are a part of nature and amenable to its laws; 2dly, because nature bears the stamp of divinity upon it, and therefore its laws are perfect. Is it consistent for the theologian to disparage nature so long as he admits that its source is that of absolute perfection.* Can imperfection ever come from perfection? Do not effects ever resemble their cause? To gain a knowledge, then, of nature's laws is to acquire the perception of divine harmony, by the aid of which all science, art, social life, government and religion may be measured. Without this knowledge we may use many brilliant words, and indulge in the most plausible speculations, but this is merely to build upon the clouds instead of the eternal rock-work of truth.

3. Many writers of the present day are presenting noble glimpses of the real teachings of nature, among whom is Ruskin, who has opened many blind eyes. Chevreul, of France, discovered to the world the laws of contrast in colors, and many artists and scientific writers have been revealing rich lessons from the infinite treasure-house. It has occurred to me, how-

* The late Prof. Taylor Lewis, one of the prominent theological writers of the day, speaking of nature in the *N. Y. Independent* of Dec. 30, 1874, says:—"Our oracle may but mock us as Crœsus was mocked by the ambiguous answer of Apollo. Our deepest understanding of nature may bring us a new peril, requiring a new study. * * * It would almost seem as though there were some truth in the old legend that nature had been cursed for man's sake." Thus illogically talks this scholarly gentleman about the peril of studying the workmanship of him who, as he admits, is the Divine Perfection. The only danger lies in ignorance of these laws, and to see danger in them is to look superficially at the matter. Throughout all nature is such amazing system, such law, such unity in the infinite diversity, such simplicity in the midst of complexity, that it is not difficult to understand its fundamental principles, if we can only bring to the task minds which are not preoccupied with old theories.

ever, that some more definite crystallization of principles may be arrived at, and with the reader's permission I shall now pause for a little time in making the attempt to arrive at these fundamental harmonies of things, so that we may go with open eyes into these marvelous fields of the fine forces, and also be the better able to regulate our art as well as our science.

III. UNITY.

The Law of Unity is universal through all matter and mind, and is the expression of wholeness, oneness, centralization and organization.

1. Unity exists in absolutely all unimpeded natural growth, and as we have seen that nature's development is on the law of perfection, we may be sure that unity is a universal harmonic law. The different methods by which nature expresses unity are almost infinite in number. Being a law of vast importance, a few examples will be given.

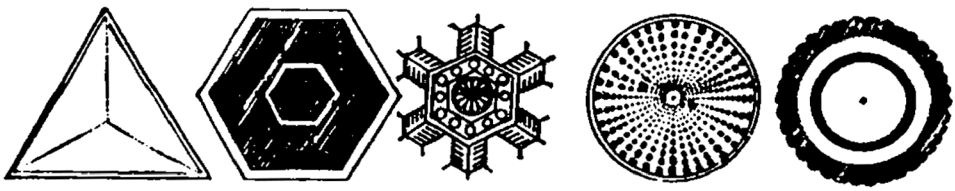


Fig. 1. Triangle. Fig. 2. Fig. 3. Snow Crystals. Fig. 4. Fig. 5. Microzoa.

Fig. 1 is a *triangle*, a form common in many crystals, and when equilateral, has three points at the angles and three at the sides, which have a common center of unity. Fig. 2, the *hexagon*, so common in crystallization, has twice as many points of unity; fig. 3 has many more points than fig. 2, each projecting line being a point of unity for other lines, while the figures of the animalcules, 4 and 5, which are but examples of countless millions of amazingly minute skeletons of animals out of which whole mountains are sometimes built, have an unlimited number of points of unity, the circle itself being a figure which is defined as being composed of an infinite number of straight lines, which are equidistant from the same center. Fig. 6 has a general center of unity for a variety of fibres which

Fig. 6. Fig. 7. Leaves.

Fig. 8. Echinus Shell.

Fig. 9. Star Fish.

Fig. 10. Flowers.

branch out from each side. Fig. 7 has several centers of unity which meet at a general center. Fig. 8, a shell of Echinus, forms a little dome-shaped animal with a great variety of lines of forms which have their center of unity at the apex. Fig. 9 presents a few of the radiating lines of the *asterias*, which has a flower-like center. Fig. 10 shows how the leaves and other parts of flowers affectionately meet at a center of unity. When the cactus blossoms it is said to have an array of five hundred stamens which encircle the pistil as its center of unity.

2. *Leaves* and other natural *forms* not only have centers of unity in themselves, but their very contour is apt to give a portion of some other beautiful outline with centers outside of themselves, as seen in fig. 11. While the fibre 1, 3, forms the general center for the other parts of the leaf, its graceful outline 1, 2, 3, or 1, 10, 3, describes the *line of beauty* which consists of a part of two *ellipses*, or rather of two *ovals*, which latter have two unequal centers of unity instead of two equal centers like the ellipse. I have dotted out the ovals, arcs of which are included in a single side of the leaf. Fig. 12, consisting of leaves of the castor-oil plant, presents one general center, seven sub-centers, and a large num-

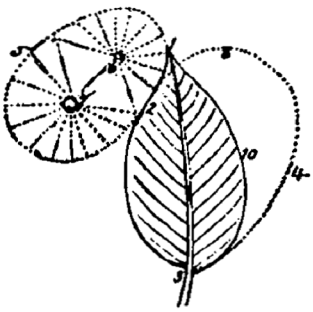


Fig. 11.

Fig. 12. Ricinus Communis.

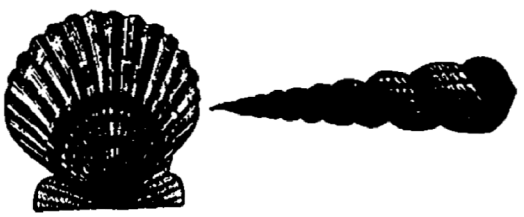


Fig. 13. Scollop Shell. Fig. 14. Spiral Sea-Shell.

ber of still smaller centers of unity and many outlines. Fig. 13

has a general point for a system of both radiating and concentric lines. Fig. 14 has the *line of grace* which winds around a general center of unity, and has also the unity of parallel lines, etc. Figures 15, 16, 17 and 18, illustrate various styles of unity in foliage and tree growth, and are taken from Ruskin's "Elements of Drawing." The methods of unity in the combinations of leaves, branches and trees are beyond all computation, and I simply give a few examples to get the reader to notice a great truth which all nature proclaims. "The number of systems," says Ruskin, "is incalculable, and even to represent anything like a representative number of types, I should have to give several hundreds of figures."

Fig. 15. Fig. 16. Fig. 17. Fig. 18.

Fig. 19. Daisies, Grasses, etc.

Fig. 20. Trees at Mount Vernon.

3. Notice how many varieties of unity are presented in a simple *cluster of leaves*, grasses and flowers, as in fig. 19. Not only have these objects many styles of unity when taken singly, but in spite of all their seeming lawlessness they have a general harmonic unity of direction, growing, like trees as a general law,

in a vertical direction, and hence more or less parallel to each other.

4. I will now present a whole world of unities within unities in a beautiful *tree cluster* which grows by the tomb of Washington at Mount Vernon. (Fig. 20.) Here the trunks of the trees may be seen as the centers of unity for the branches, the branches as centers for still smaller branches, and these for kingdoms of foliage growing less and less in size until we reach a single leaf, which after all is a miniature realm of itself, having organizations within organizations.

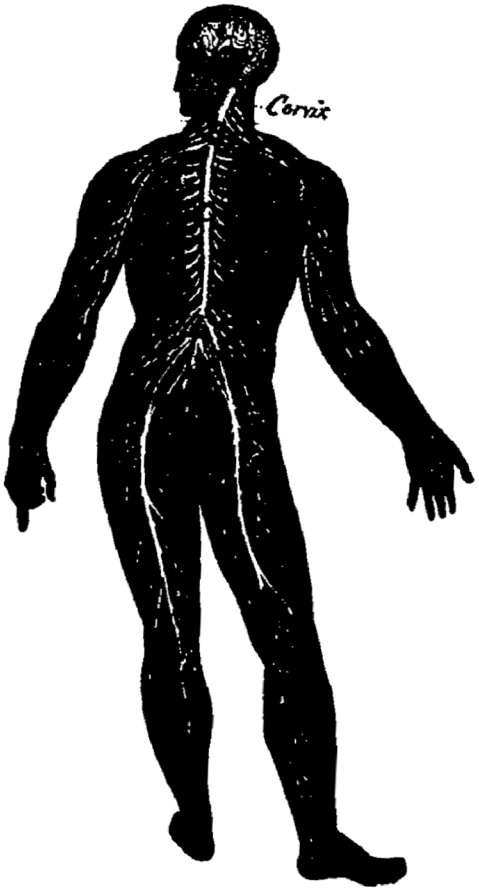


Fig. 21. The Nervous System.

5. The *human system* contains thousands of centers of unity, among the most important of which are the brain and spinal column as the general center of the nervous system (fig. 21), and the heart as the general center of the vascular system.

6. *Crystallizations* have their innumerable centers of unity.

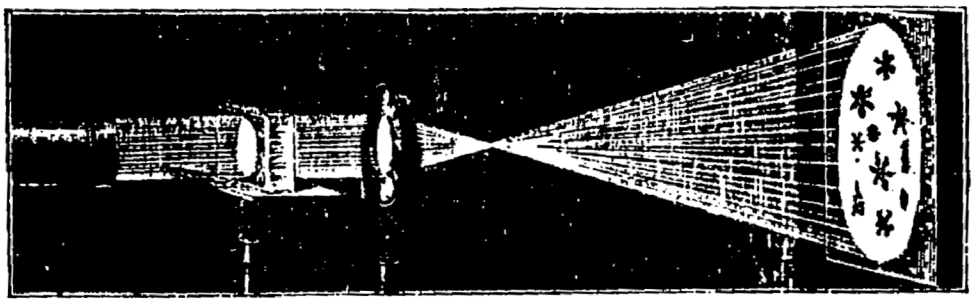


Fig. 22. Dissection by sunlight of a block of ice and its crystalline structure shown.

Fig. 22 shows some of the elegant crystalline forms of a block of ice as dissected by the solar rays in an experiment made by

Mr. Tyndall. Snow abounds in the most elegant crystals, generally hexagonal, or at least arranged in six projections, which are just 60 degrees apart, as is the case with ice. But crystalline forms are too numerous to even hint at.

7. *Forces* of all kinds in nature, when unrestricted, move according to absolute laws of unity. Gravitation makes it impossible for any object to exist without a tendency toward some more powerful object, all objects on a planet, for instance, tending toward its center, and all planets tending toward their parent suns, their tendency, however, being balanced by their centrifugal or projectile motion. In fact the unities of form already given result from some principle of unity in *force*, as will be seen hereafter. Fig. 23 shows some of the billions of lines of force which encircle a *magnet* as their center, shown by iron filings on card-board above a magnet, as well as some of the straight lines which pass through the bar itself as a polarizing center. Figs. 24, 25, 26, 27, 28, show nodal lines of vibrating circular or polygonal plates according to Chladni and Savart. These plates are sprinkled with dry sand, and may

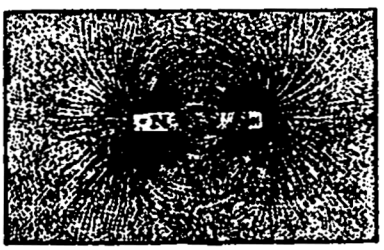


Fig. 23. Magnetic Centers of Unity.

Fig. 24. Triangle. Fig. 25. Circle. Fig. 26. Octagon. Fig. 27. Circle. Fig. 28. Hexagon.

be vibrated by a violin bow under different circumstances, under all of which they develop some principle of unity as signified by the forms of the sand, and show how wonderfully nature's freest operations are developed according to law.

8. All *vibrations*, all *undulations*, all *motions of falling* or *projected bodies*, move according to some mathematical law of unity, such as the curve of the parabola, the circle, the oval, or generally some other section of a cone.

9. *Verse* and *musical composition* have a unity in the length of steps, called rhythm; *melody* demands some ruling tone,

called the key note, around which the other notes cluster as their element of unity ; *logic* lays down its central idea or proposition, and either reasons from external points toward this center (a posteriori), or from this center toward external points (a priori), and all true art must crystallize its esthetic jewels upon some thread of unity.

10. All *light* emanates in untold millions of rays from some center of unity, such as the sun, a gas burner, etc.

11. All *colors* combine in a wonderful unity to form white light, and even when separated by a prism or by a rainbow, they blend so perfectly as seemingly to constitute a single band of hues.

12. *Gravitation* binds the whole physical universe into oneness of law and oneness of existence, and is everlastingly bringing all objects toward some central point by its infinite chains of power. *Cohesion*, dealing with atoms, binds solids into a firm unity of mass, and rolls up fluids into little spheres, each of which has its center of infinite points. Gravitation, however, binds all atoms and all masses of atoms into one family, first chiseling out all worlds into beautiful globular shapes and then tying them together. By its means the sun becomes a center of unity for 137 planets, moons and asteroids,* as well as for comets, which are so numerous as to be estimated by millions. The following remark by Guillemin will show that the sun, mere point as it is compared with the universe, has after all a vast reach into space : "Whereas the radius of Neptune's orbit is equal to 30 times the mean distance from the sun to the earth, the aphelion of the comet of 1844, whose period is 100,000 years, is lost in extra planetary space at a distance 4000 times as great."

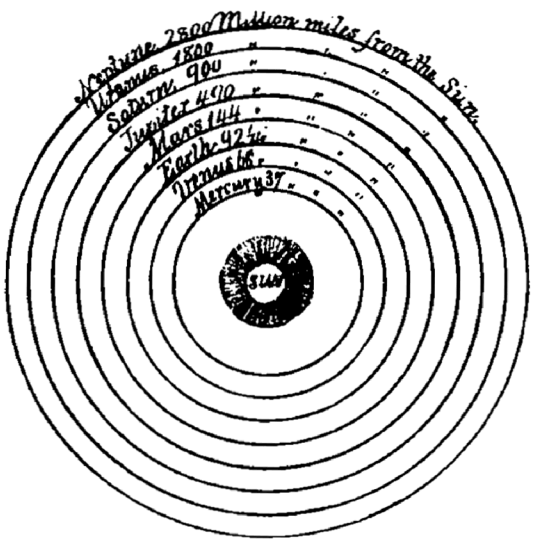


Fig. 29. The Solar Family.

* This includes the two moons of Mars lately discovered; but new asteroids are being looked up yearly, and the above estimate will prove too small.

13. The star *Alcyone*, in the Pleiades, is supposed by many astronomers to be the mightier sun which forms the center of unity for our own sun and a great number of other solar systems.

14. To show that the universe follows this law of unity in the large as well as small, I will give a few star clusters, sometimes called nebulæ, as seen by Sir John Herschel. I would first remark that our own solar system is situated in the vast cluster called the Milky Way, which William Herschel, aided by his telescope, estimates as composed of 18,000,000 stars. If Alcyone is the center around which move our own and many other solar systems, it is reasonable to suppose that the Milky

Fig. 31.

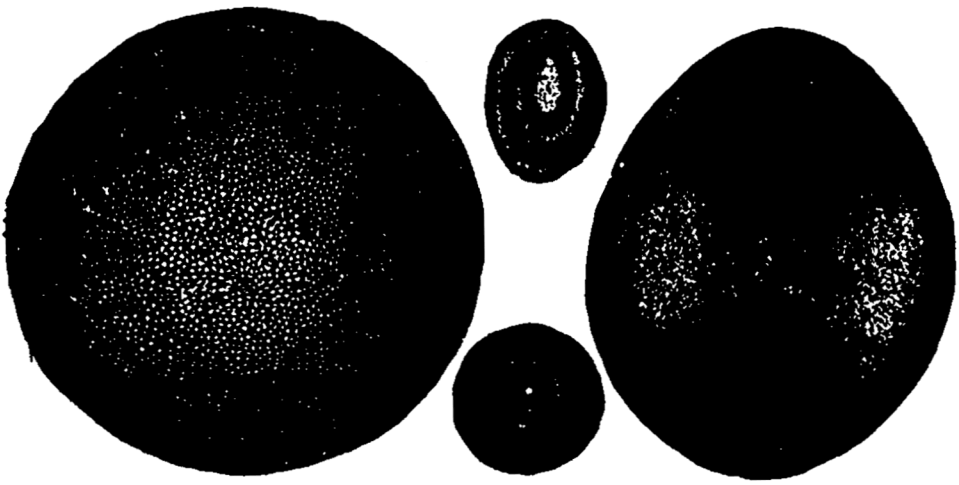


Fig. 30. Fig. 33. Fig. 32.

Way itself has some vast center around which Alcyone and all the other stars of this immense cluster make their almost infinite circuit. Otherwise how could they be held in a mass separate from the rest of the universe? But all stars seem to be situated in some cluster, and held there by a law of unity with the other stars. These clusters are counted by thousands. In the Constellation Virgo is what seems to the naked eye to be a small star called ω (omega) Centauri, but when viewed through a large telescope proves to be a magnificent globular cluster of thousands of stars, represented by fig. 30. These globular clusters are very common. Fig. 31 simply gives the central portion of a spiral nebula in the lower jaw of Leo, the whole of which is supposed to contain millions of stars. There must have been

a center of amazing power around which inconceivably vast whirlwinds of force swept this array of stellar systems. Fig. 32 is an oval nebula in the constellation Vulpecula, the brightest part of which resembles a dumb-bell. Fig. 33 is a nebula in Gemini near the bright star Castor, with rings and a star in the center.

15. But have we reached the ultimate of the law of unity in these thousands of star clusters, each of which is almost a universe in itself in its immensity? Is there no omnipotent, ubiquitous bond of unity which binds even these clusters of solar systems into one almighty center which "we call God and know no more? (Derzhavin.) If not, then all analogies fail and all attempt to arrive at universal law is a mockery, for we see that the principle of unity is absolutely universal, whether we progress toward telescopic or microscopic infinities.

16. But the unity of the material universe is not all. The common supposition that spirit is wholly unlike matter, in other words is *immaterial*, is quite superficial; for if there were no bonds of unity between the two, spirit could never act upon matter nor matter upon spirit. The teaching of such absurdities drives logical minds to the denial of all spirit, and the advocacy of materialism and atheism. It should be understood that the very same laws rule in the spiritual and intellectual phases of being as in the material; in other words, *unity of principle rules in every department of the universe and binds the whole in one.* Mankind intuitively understand this, and constantly express it in their language, using such expressions as "*heat of passion*" and "*heat of fire;*" "the *light of knowledge*," as well as the light of the sun; "*harmony of colors and sounds*," as well as *harmony of feeling.* A person is spoken of as having a "*cool, reasoning style*" *of mind*, while another is said to have a "*warm and loving heart.*" The eyes are talked of as "*flashing fire*," as, for instance, a New York paper speaks of Verdi, the composer of Trovatore, as having "fiery, flashing eyes." Words are said to *burn*, the heart to "*boil with indignation*," and so on. In the chapter on Chromo-Mentalism, it will be shown that mind and body work after precisely the same laws; that the eye can flash real fire, only it is of a higher grade than ordinary fire; that the process of reasoning is attended with blue emanations

from the front brain, which may be seen by certain persons, and as the blue is the cold principle in colors, we see that it is literally exact to speak of a "cool, reasoning mind;" that the impulsive and loving processes are attended with red emanations, and as red is the principle of heat among colors, we are absolutely correct when we speak of the "warmth of love" or the "heat of passion," and are not using figurative words; that when we say the "heart boils with indignation," we are literally correct, as heat of the spiritual forces causes a hot condition of the heart which sends the blood into a boiling motion, and that there is a chemical affinity ruling in the psychological and etherial forces just as absolute as that which works in physiological and ordinary material conditions, will be abundantly shown hereafter. Unity, then, being thus ubiquitous in all realms of matter and force, we may be guided by the following rule:—

All things in their basic principles resemble all other things, and we are safe in judging of the unknown by the known, of the invisible by the visible, and of the whole by a part.

Great and important as is this law, and giving us as it does a key to the mysteries of things, we come now to another law which is equally important and without which all harmonious unity itself is impossible.

IV. Diversity.

Diversity is a universal law of nature, and exemplifies freedom, life, individuality, infinity, etc.

In other words, nature consists of infinite unity differentiated into infinite diversity. The reader will now please review all the engravings which illustrate unity, and see how absolutely they also illustrate diversity, otherwise they would have been a perverted style of unity quite contrary to all free natural development. In the triangle, fig. 1, we see lines moving in three directions; in fig. 2, lines moving in six directions; in fig. 3, the diversity is far greater; in fig. 4, we have the circle which, geometrically speaking, consists of an infinite number of straight lines, and we have also diversity in the size of the dots; in fig. 5, we have a variety of circles and arcs of circles; in figs. 2 and 5, we have also a diversity caused by light and shade; in the

illustrations following, diversities of form, of size, of direction, and of color. In all foliage the outline and color of the leaf and the size and direction of the fibres and texture are a constant source of diversity. Trees afford a remarkable diversity of direction, size and color of their branches and sub-branches, and leaves, bark, flowers, fruit, etc., as well as in the light and shade of their different parts. In short, the earth and man—the land, and sea, and sky—are rich and delightful in their infinitude of forms, and sounds, and colors, and motions, while the world of literature and spiritual power is richer than even the outward world.

V. Harmony.

Harmony consists in the equal balance of Unity and Diversity, and this harmony is increased in exquisiteness in proportion to the number of these parts of Unity and Diversity

1. In other words, organization and individual freedom must be combined. In fig. 1, we have three points of general unity, and three lines moving in diverse directions, to constitute the triangle. In fig. 2, we have twice as many points of unity balanced by twice as many points of diversity, consequently the hexagon is more beautiful than the triangle. On the same principle fig. 3 is more beautiful than fig. 2, and figures 4 and 5 than fig. 3, although fig. 3 is more spirited than these last mentioned.

2. Colors must combine this variety of tints, hues and shades on the law of unity to please. If we should see a daub of various colors on an object without any unity of law in their arrangement, taste would be offended, for it would be diversity

Fig. 34. Diversity without Unity.

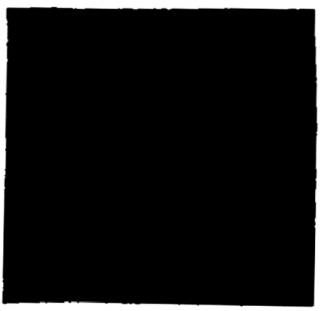


Fig. 35. Unity without Diversity.

Fig. 36. Unity and Diversity combined.

run wild. If we should see only one color everywhere and always, it would be insupportable from its unvaried unity (see fig. 35); or if we should see light and shade mingled in a lawless manner on the plan of mere diversity, as in fig. 34, it would be equally distressing. The one would be well represented in a treeless, barren desert, or by a condition of absolute darkness, the other by a mass of ruins, or debris, while both would be a violation of the regular development of nature. It is a relief to turn from these to fig. 36, where freedom and law combined delight every eye.

3. *Chiaroscuro*, or the fine balance of light and shade, constitutes a most effective feature in art. Joshua Reynolds made a rule that one-third of a picture should be in shadow and two-thirds in light, but this would interfere with our rule, which requires, on the average, an equal distribution of opposite principles, such as light and shade. If light or shade predominates too much, the diversity is not sufficient to balance the unity, and the objects portrayed are less distinct and spirited than they should be. Take, for instance, fig. 37, in which an etching from Rubens is given, and although the features and expression are brought out by a master hand, yet the effect as a whole is much less brilliant than the head of the "Astronomer," fig. 38, presumably Galileo, which I copy from the London Art Journal, or rather which the potent beams of the sun have copied for me as they have also engraved the Rubens. In this way I get a fac-simile of both. It will be seen that the light and shadow are very finely distributed in the "Astronomer," the greatest light being on the face where nature has placed it; and the shadow being on the hair and beard where nature has also placed it, while the dark back ground brings out the light of the whole head by contrast. Diversity

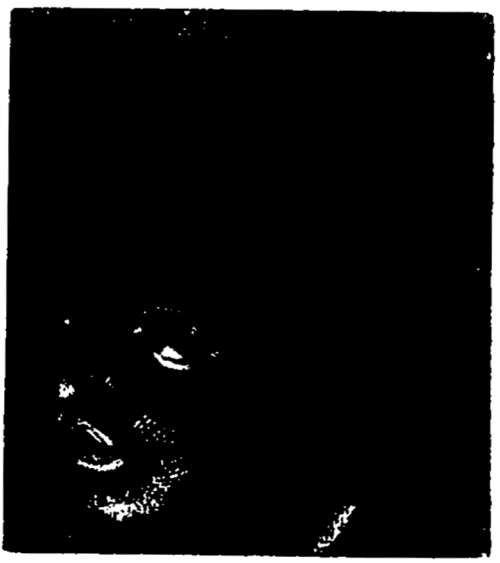


Fig. 37. An Etching of Rubens.

is thus developed; but what is the principle of unity? The sameness of general tone throughout the picture, or so far as there is diversity of light and shade, such a gradation from one to the other as not to interfere with the oneness of effect. Swinging to the other extreme of too little shadow, as in fig. 39, we find the law of diversity lacking equally with the Rubens, fig. 37, and the same indistinctness of detail as in that picture. Both utility and beauty then require a balance of light and shade. Fig. 40 is a fac-simile of one of the ruder sketches of the brilliant artist Gustave Doré, showing the frightened Sancho Panza lying on the ground. The blackest shadow is made to fade suddenly into absolute light without the gradations which nature adopts, and the little patches of ground at the lower part of the engraving seem to stand out like islands by themselves, without any relationship to the ground on which he lies. Compare this

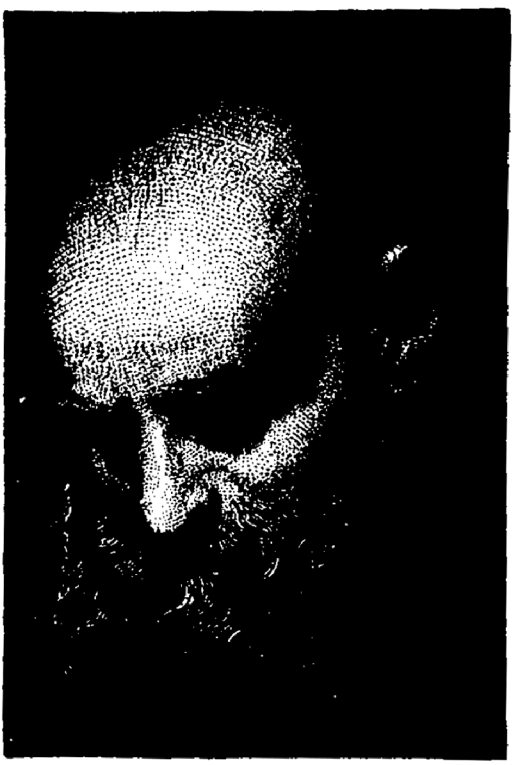


Fig. 38. The Astronomer. (Galileo.)

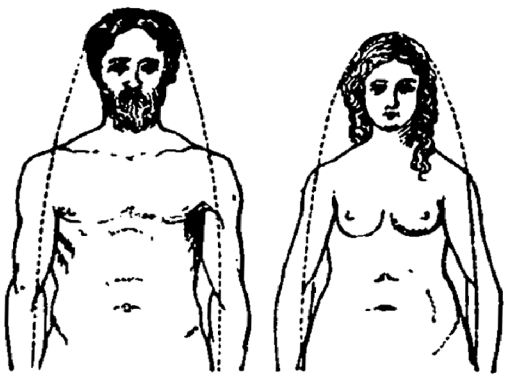


Fig. 39 Deficiency of Shade.

Fig. 40. Unity lacking.

to the engraving of the tomb of Plautus Lucanus, fig. 41, which has an effective display of light and shade. Every stone and piece of soil or other object stands out distinctly, and while

there is a fine diversity and gradation, there is also a general unity of spirit and tone throughout. In this picture it will be seen that the sun, though slightly in front of the bridge, must be nearly perpendicular, as the light does not pass under the arches. In fig. 42, however, the sun must be behind the bridge and near the horizon, judging by the distance that its rays are able to penetrate beneath it over the water, and by the dark shadows which it casts.

Fig. 41. Tomb of Plautus Lucanus.

Fig. 42.

4. But we shall hereafter see some great and distinctive methods by which light and shade and other principles are combined to constitute real harmony, which is the *golden mean* made up of the two extremes, rather than the golden mean between extremes. In all things that harmony which is the foundation of beauty, life, health, happiness and power, comes from the union of the two extremes of power, and these extremes generally find their type, if not their exact character, in unity and diversity. Some of these combinations are as follows :—

Light and *shade*, which are exactly balanced in nature, the nights and days having the same average length the world over.

Positive and *negative forces*, which must ever be combined equally to make smooth and perfect action.

Heat and *cold*, which are balanced in the temperate zones and over the world taken as a whole, but being blended one-sidedly in the torrid and frigid zones they cause more or less distress and interference with nature's harmonious processes.

Life and physical harmony are impossible without a balance of these two principles of heat and cold, heat being the principle of diversity and outward expansion, and cold the principle of unity, organization and crystallization, but either one being destructive if alone.

Sweetness and *acidity*, as combined in strawberries, peaches, apples, lemonade, etc., or *sweetness* and *bitterness*, as combined in coffee, tea and many other substances, set into motion that harmonious flow of forces through the organs of taste which lead us to call them luscious or delicious. They delight the physical taste. Unity and diversity, as combined equally, especially on the law of Gradation or Contrast, which I shall now proceed to explain, reach a more spiritual part of our nature and delight the esthetic taste, as in the beautiful or sublime. It is plain, then, that when we reach basic principles they apply to every department of the universe, including both matter and mind.

VI. Gradation or Progression.

1. There are two great leading and distinctive methods of combining unity and diversity for the production of harmony, common through universal nature and of course through all correct human art, which should be a mirror of nature, namely, Gradation, whose characteristics are exquisiteness, progression, beauty, femininity, typical of the love principle, and Contrast, whose characteristics are spiritedness, decision, power, picturesqueness, sublimity and masculinity, typical of justice.

2. *Gradation consists in delicate degrees of progression from one quality or condition to another*, and nature's progressions, when unrestricted, are ever toward superiority of some kind. Thus in Æolian tones there are crescendos progressing toward superior power, and diminuendos progressing toward superior sweetness; in all leaves, fibres, branches, trees, flowers, etc., there are endless progressions toward superior size and power in one direction, and superior fineness and delicacy in the other, see figs. 4, 8, 9, 10, 11, 12, 13, 14, 16, 19, 20, 21, etc. In a sunset sky, the gradation is toward superior brilliancy as we move from east to west, and toward superior softness of color as we move from west to east; in the rainbow or solar spectrum, we

have another beautiful example of gradation or blending of colors, the progression being toward superior fineness, coolness and penetrating power, as we move from the red through orange, yellow, green, blue, indigo and violet, and toward superior warmth and animation as we move in the opposite direction. Examples of this gradation of colors may be seen in all of the colored plates of this work. I will give a few divisions of nature's infinity of gradations.

3. *Gradation of Size.* I have just mentioned a number of gradations of size as in the fibres, branches and leaves of plants, etc. The gradation of human limbs and features is especially beautiful. Trees abound in many styles of gradation. Fig. 43 shows the ordinary round-topped tree, such as the beech, the maple, etc., in which there is a progression in direction of

Fig. 43. Round topped-tree. Fig. 44. Oblong headed tree. Fig. 45. Spiry-topped tree.

the outline and progression in size. Fig. 44 is an oblong-headed tree, like the poplar, which has too little diversity in its progression toward a point at the top, and consequently its appearance is rather stiff. Fig. 45 is a spiry-topped tree, and includes in its class, cedars, firs, larches, etc. It is more attractive than the poplar, from its greater diversity of angles and forms, both angular and curved, and presents sharp contrasts of direction as well as its gradations. Fig. 46 is the spire in decorated Gothic of the Cathedral, corner of Fifty-first Street and Fifth Avenue, New York. It has a beautiful and gradual progression from top to bottom, that makes it far more graceful than the spire in fig. 47, which at a point a little above the roof widens so abruptly as to

Fig. 46.

Fig. 47.

make a contrast rather than a gradation. Such a spire may be called picturesque, but it is not graceful.

4. *Gradation of Direction*, is simply *curvature*, and curves are among the leading features of beauty in forms. I have given in figures 48, 49 and 50 three leading curves in natural forms and motions. Fig. 48 shows the beautiful curves of the parabola, such as are described by fountains, cataracts and all missiles thrown upward outside of a perpendicular line. Fig. 49 gives what the famous old English artist Hogarth called the *line of beauty*, and moves in two directions like the meandering of a stream or the form of undulations (see fig. 51). It may be seen in the forms of many grasses, leaves, flowers, shells, streams, etc., and is given in figures 6, 7, 11, 12, 13, 15, 16, 19, 20, 21, 37, 38, 39, 51, etc. Fig. 50 is called the *line of grace*, named also by Hogarth, and is a spiral. It is seen in the climbing of vines as they encircle a tree, in many sea-shells (see fig. 14), in curls of hair, etc. It is perhaps the most beautiful of all simple continuous lines, and, as will be seen hereafter (chapter III.), is the most common form in the universe. It not only has a leading center for the whole form, but is composed, geometrically speaking, of an infinite number of circles as points of both unity and diversity. Undulations not only progress in size but in delicacy of form as they advance. The fern branch, fig. 52, has not only gradation of size as a whole, but of each branch and part of a branch, and has also many gradations of direction. Fig. 53 consists of gradations of gradations, which are formed by superposing compound sounds on simple sounds and causing their vibrations to be recorded in lamp-black by a graphic instrument

Fig. 48. Curves of the Parabola. Fig. 49. The Line of Beauty. Fig. 50. The line of Grace.

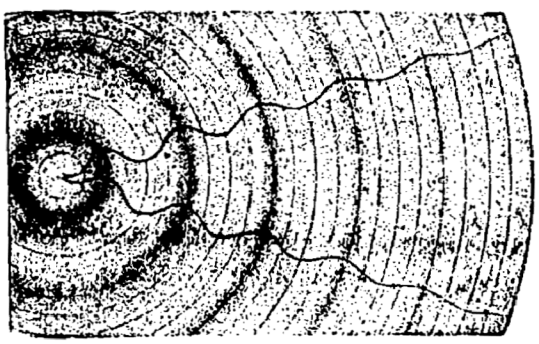


Fig. 51. Undulations.

Fig. 52. A Fern.

Fig. 53. Vibrations of compound sounds.

Fig. 54. Combination of two parallel vibratory movements.

devised by Savart. Fig. 54 has gradations of size and direction, and was written in lamp-black by a combination of tuning forks. Fig. 55 is an example of progressive rings of colored light, which were produced by electricity, as seen and drawn by an artist and quoted by Dr. Jerome Kidder of New York, in his pamphlet on Electro-Allotropo-Physiology :—"Placing the sponge of an electrical machine to my left eye, and making the current strong, I saw stars in about four seconds. Rings vibrating came from the ends, growing weaker as they approached the center, where they died out entirely. This was very beautiful. It commenced with yellow at the first ring, at about the fourth or fifth ring they became red, and disappeared in a faint blue." It will be noticed that these waves of light progress in size, in thickness, in color, and in direction of outline according to the line of beauty, and have a general unity as a whole, as well as a special unity of breadth, of parallelism and of a common center, while the features of diversity are equally marked.

Fig. 55.

5. *Gradations in the Human Form.* The human form being the highest development of the external universe should have the highest manifestations of harmonic features. It may be remarked, first, that the contour of a mature and graceful countenance, as well as of the top head, is on the plan of the oval, while the unripe period of infancy and early childhood approaches the circle. The Romans advocated the circle as the highest form of beauty, while the more cultured taste of the Greeks preferred the ellipse, the oval and other sections of a cone. The circle is the stiffest of curves, in fact is a curve of limitation, while the oval may have a great variety of curved forms all of which have their centers of unity. Fig. 56 is an ovoid, or egg-shaped form, which has its center of gravity at G,

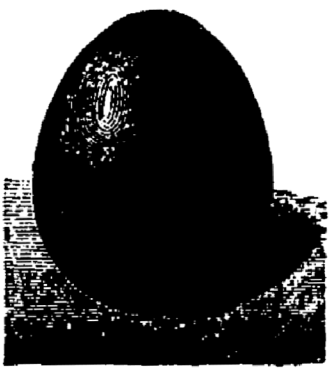


Fig. 56. An Ovoid.

within, but its general center of form around a line which should extend through the center of the whole ovoid longitudinally. I will now present some faces as illustrations of the principle.

Fig. 57. Emma. Fig. 58. Katie.

Figs. 57 and 58 are a copy from life of two sisters, who at the same age had a good deal of resemblance to each other. Emma is 18 months old and has fine round features. Katie is 6 years old and her features have become much more oval, the curve of the chin being more delicate and yet more marked as

Fig. 59. The Infant. Fig. 60. The French Market Girl.

Fig. 61. Childhood and Youth. Fig. 62. Maturity: Genevieve.

compared with that of the cheek, while the hair contrasts more distinctly in color and prominence with the face. Figures 59 and 60 present subjects still younger and still older than those of Emma and Katie, the infant which I have copied from the London Art Journal having a face so nearly circular that its chin almost disappears; while the French market girl, having reached early womanhood, has a fine oval face and more distinct features of every kind. In fig. 61, the same principle is well illustrated in the three faces presented, which lengthen out as their age progresses, while womanhood, as represented by Genevieve in fig. 62, presents a still greater variety of gradations as seen in the curves of her form as well as greater contrasts. The line of beauty will be seen on her cheeks, top hair, shoulders and bust, and the lines of grace in her lower hair, although the artist has not given her a very superior expression of countenance.

6. *Gradations of Light and Shade* so beautifully exemplified in sky and hill and valley and lake, and in most of the manifestations of nature, must be imitated as far as possible in art. In most of the foregoing pictures these gradations are easily seen, especially in that of the Astronomer, fig.38, in which the light fades into shadow as we pass from the forehead to the temples, or into still deeper shadow on passing to the eyes, which are overhung by his prominent and intellectual brow. This latter, in fact, may be called a contrast of light and shade, although it is graded

off so as to be quite refined in comparison with the rude masses of light and shadow in fig. 40, which are almost lacking in gradation.

7. We have already seen that *Gradation of Colors* appears in those that blend as in the rainbow, and that this gradation, although so diversified in its hues, has the property of binding a mass of colors into oneness or unity of effect, hence its beauty.

8. In the *Motions and Forces* of Nature, gradation seems to be a universal law, extending to gravitation, chemical affinity, etc. All projected or falling bodies, all movements of suns, planets, moons and comets forever progress either with increasing or retarded velocities and momentum.

9. *Rhetorical* and *Musical Gradations* consist of those climaxes or passages of increasing power or sweetness which move on step by step until they culminate. In music, there are various dynamical, melodic and climacteric gradations such as crescendos, diminuendos, curves of the voice, upward or downward movements of the voice, etc., all of which, when on the law of gradation, are beautiful. In rhetoric it is often said that climaxes are beautiful, but that it is impossible to tell the reason. It is very easy to see the reason when we remember that a climax is simply a progression or gradation of ideas in harmony with nature's universal law of beauty. Fine rhetoricians are ever apt to arrange the clauses of their sentences in an increasing gradation, and when this is attended with increasing importance of ideas, it becomes doubly effective. I will give only a single passage from Burke:

> There is one thing
> and one thing only,
> which defies all mutation:
> that which existed before the world,
> and will survive the fabric of the world itself,
> I mean JUSTICE, etc.

10. *Miscellaneous Gradations.* I have given my last paragraphs partly to show that a unity of law exists in the world of intellect and language as well as in external nature itself. The same law of gradation could be traced all through refined social life, through government, through religion and through every department of nature, mind, and art.

VII. CONTRAST.

Harmonic Contrast combines Unity and Diversity in bold degrees or in distinct masses.

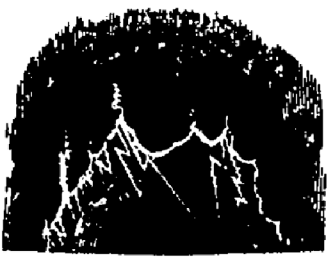


Fig. 63.

1. *Contrast of Direction* consists of straight lines and acute *angles*, just as gradation of direction consists of curvature. These right lines and bold angles are generally attended with power, sublimity, spiritedness, or picturesqueness, as is the case with flashes of lightning (see fig. 63), or great cliffs, or storm-tossed billows, or lofty cataracts. In fig. 64 the bold angles of the cliffs, the dash of billows, the lowering clouds and the lightning's track all betoken great power, are especially sublime, and are manifestations of contrast. The contrast of light and shade which the artist has represented adds to the spiritedness of the scene.

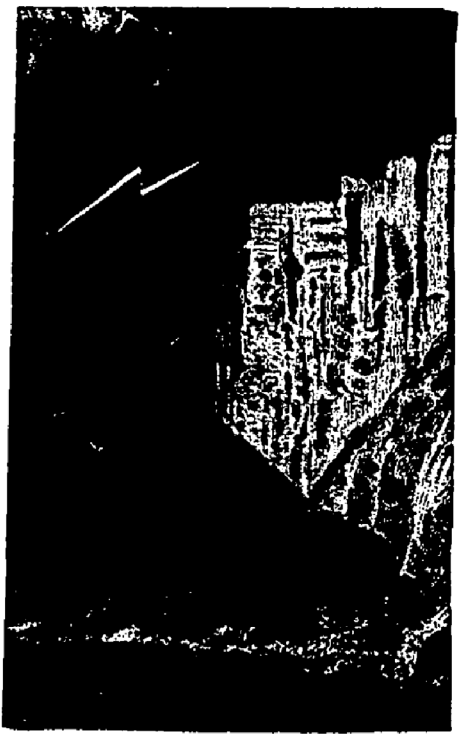


Fig 64. Beachy Head.

2. We shall see the distinction between *gradation* and *contrast* all the better by means of fig. 65, in which the graceful predominates everywhere from the curvature and other gradations that rule, including the bridge with its vases, the winding drive and walk, the arched pavilion, the flowing foliage, and flowers, the placid water picturing surrounding objects on its bosom, the easy slope of the land, the swan and the spirit of the scene generally which soothes and delights the mind.

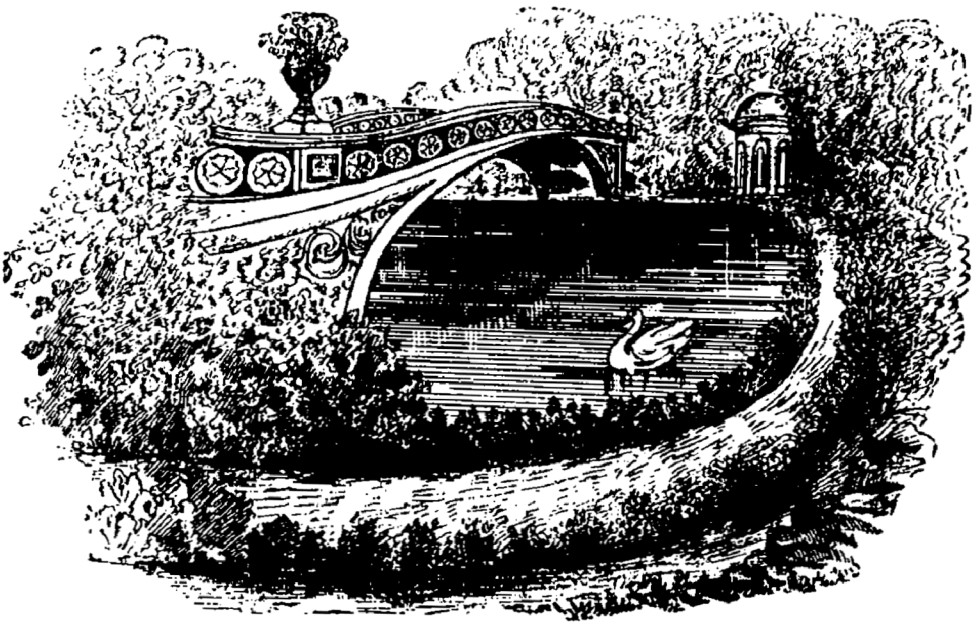


Fig. 65. Gradation, or the Beautiful in Landscape.*

Fig. 66. The sublime in Water.

Figure 66 presents some elements of the beautiful in the curved form and sparkling effect of the waters of Niagara Falls, a part of which appear, but the loftiness, vastness, power, and the terrific contrasts and whirling motions of such mighty currents are especially sublime.

3. *Light and Shadow* appear in countless beautiful and startling manifestations, in the sky especially, as well as on water, and over the mountains and valleys. Gradation of light and color in the sky, represented in fig. 67, is apt to be the most delicate where no clouds are, the light of course being most brilliant where the sun is, and having a progression

* This pretty piece of landscape was drawn for me by a young artist, Miss May Kidder, daughter of Mrs. M. A. Kidder, the well known poetess.

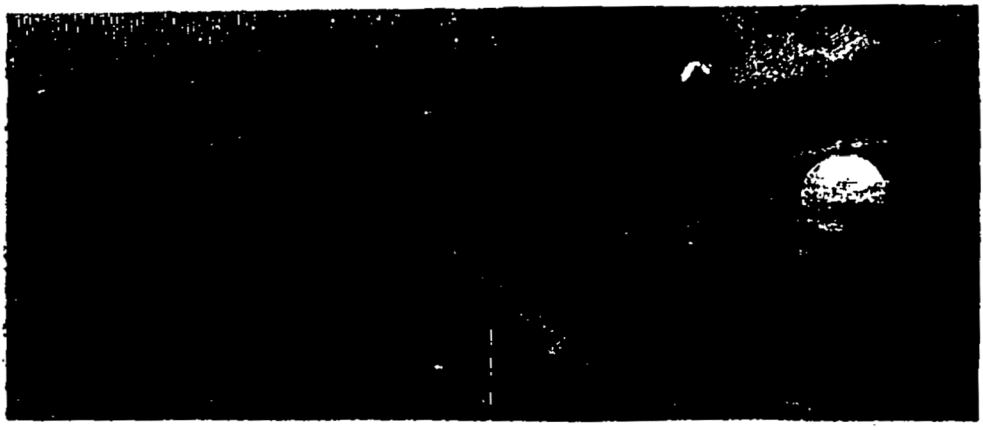


Fig. 67. Gradation in Sky Scenery. Fig. 68. Contrast in Sky Scenery.

toward shadow as we recede from the sun. In a sunset sky, or a sunrise scene, there are often millions of degrees of tint from the point where the sun is all the way over to the opposite side of the sky, when it is not cloudy ; but in case of clouds, magnificent contrasts of light, shade and color are apt to appear with their more exciting effects. The clouds and light of a tempest often manifest brilliant contrasts, something as in fig. 68. Fig. 69 shows a scene in which contrast and diversity are almost entirely lacking, so that the land can scarcely be distinguished from the water, and the whole effect is feeble. In fig. 70 contrasts of various kinds appear and give a brilliant effect. There is a con-

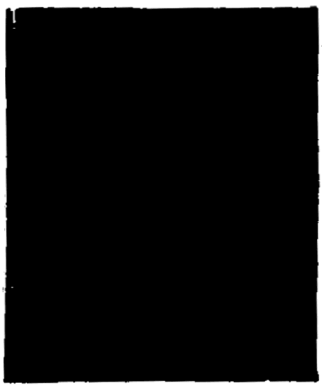


Fig. 69. A Night Scene.

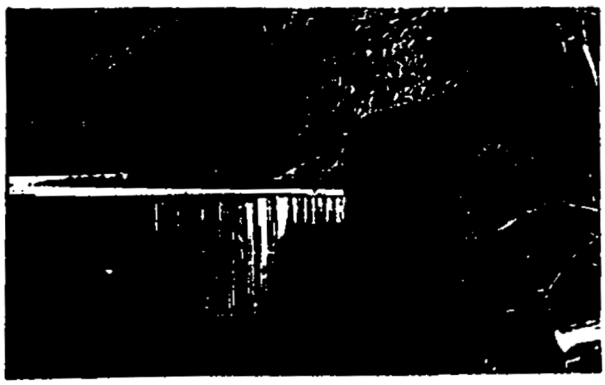


Fig. 70. Stony Point on the Hudson.

trast of *size* and direction in the rocks and bold scenery as placed side by side with the placid sheet of water ; and there is the contrast of the deep shadow in which these rocks are placed with the brilliant light that flashes over the water, and this light is toned

down by a gradation of shading which gives refinement. The contrast of luminous branches on the shadowy rocks should also be noticed.

4. The *contrast of Masculinity with Femininity is* one of nature's great strokes of harmony, being an admirable method of employing diversity in the sexes to bind them together in unity of spirit. It is really a contrast of gradation of style as predominating in woman with contrast of style as ruling in man. In fig. 71, I have presented the beautiful queen of Delhi, in contrast with the manly head of the Emperor of Germany in fig. 72. The queen's forehead, eyebrows, cheeks, chin, mouth, neck and shoulders are all graceful with gradation; her hair progresses from *lines of beauty* above to *lines of grace* below; her drapery and jewelry are arranged on the flowing and curved style of gradation, while all very strong contrasts both of color or form are avoided. The Emperor with his firm shoulders and neck, his massive forehead and eyebrows, his bold features approaching angularity, his beard and mustache contrasting in form and color with his face, his angular ornaments with their bright colors placed in contrast with the dark color of his coat, give him an appearance of dignity and power. Nothing is more effective in a social circle than a manly man by the side of a womanly woman, the man setting off by his size and ruder power the delicacy and grace of the woman, while the woman enhances the majesty of the man by her more petite and yielding form. The true woman naturally desires in man masculine force of character, and the true man naturally loves in woman feminine refinement and gentleness. By *feminine* I do not mean *effeminate*, and by gentleness I do not mean lacking in firmness of principle. When such natures form a matrimonial union their harmony, both physical and spiritual, will be far greater than two natures which are too much alike, or rather which do not contrast properly. By *contrast* I do not mean *contrariness*, or *opposition*, but distinctly marked diversity in unity; for natures that are almost totally opposite cannot harmonize any better than those which are almost wholly alike.

Fig. 73 presents the face of our eminent ornithologist Audubon, certainly one of the most feminine of masculine faces, from the delicacy of his chin and mouth and the fine curves of

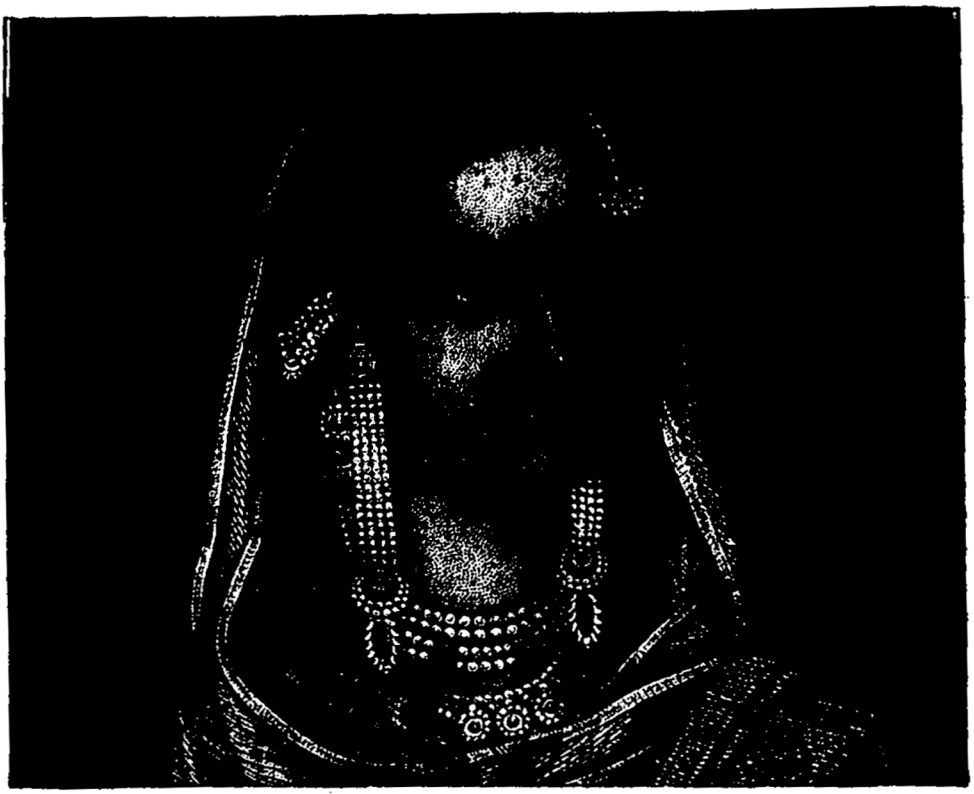
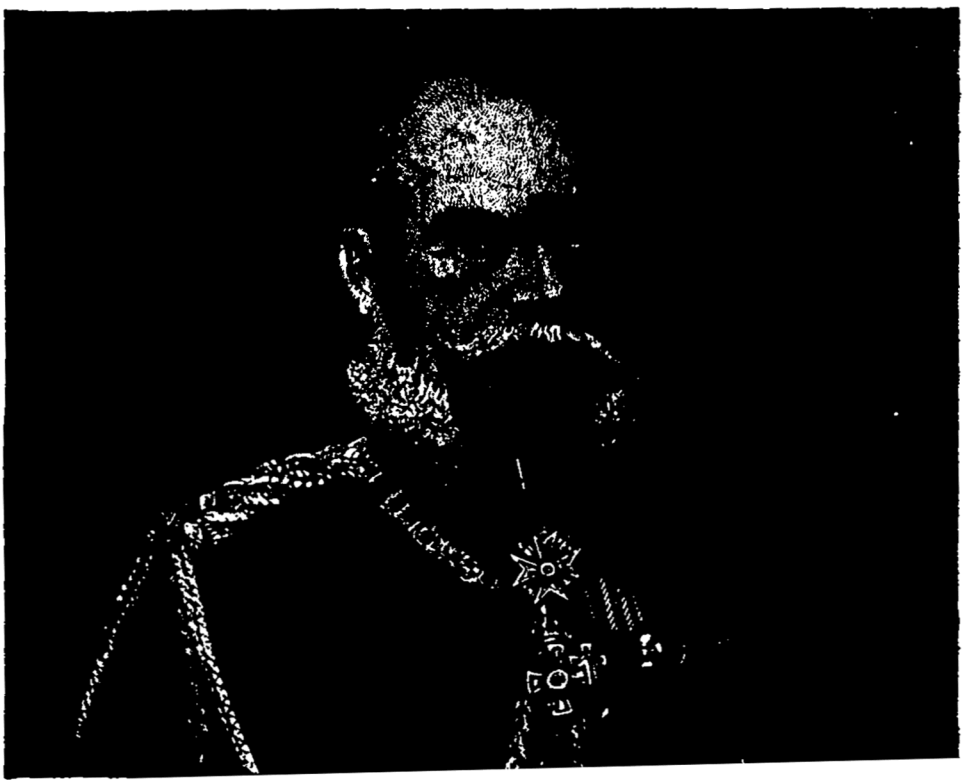


Fig. 71. Zenat Mahal-Begum, Queen of Delhi, drawn by a native artist, on ivory. Illustrating Gradation.



his cheeks and eyebrows. His forehead alone seems to have the masculine prominence of outline. To make this femininity the more extreme in style he wears his hair long and laid carefully in curls over his forehead, his collar and drapery flowing and his face wholly without beard, which is certainly a mistaken conception of what is appropriate in manhood. This same mistake is made by many priests, who shave their faces closely and wear those flowing gowns which simply make them resemble women of a large and coarse type. The uncomfortable and heat-producing wigs with long and curled hair which are still worn by barristers in England, are a very unmasculine and very absurd ornament. But the subject of dress will be considered hereafter. The contrasts of the masculine and feminine form are shown in fig. 39.

Fig. 73. Audubon.

5. *Contrasts caused by Reflection.* Nature is not satisfied with filling all things with her fine effects and harmonies which inhere in the objects themselves, but has turned every lake and river and sea into a burnished surface of quicksilver to mirror forth in softer light her real objects, thus making shadows contrast with their substances, as seen in fig. 74, also in fig. 65.

Fig. 74. Contrasts caused by Reflection.

6. *Contrasts in Typography.* I will throw out just a hint as to how different styles of lettering and penmanship may be combined to produce an effective contrast, and also gradation. In fig. 70, the upper and lower words have gradation as their ruling feature, while the middle word has those firm straight lines and sharp angles which make contrast, and so taking them all together is a pretty contrast of gradation and contrast. The grad-

ual swelling and diminishing of the shaded line in the capitals is a gradation of size, while the light and shaded strokes which come near each other form a contrast of size. The word *eminent* has different contrasts, both horizontal and perpendicular, but the shaded ground work of the word should be extended to the other two words or omitted altogether to have perfect unity of effect; but I have chosen them from their applicability in other respects.

Fig. 75

11. *Contrast in Music.* *Rhythmical* contrast consists of sudden changes from short to long or long to short tones; *dynamical,* in sudden bursts of tone after soft and gentle movements, the use of rests, etc.; *melodic,* in sudden transitions from high to low or low to high notes, and in straightforward and angular movements of the voice rather than in fanciful curvatures and warblings.

12. *Contrast of Ideas and length of clauses* may be seen in the following antitheses of Mirabeau:

"Be firm.....not obstinate;
Courageous.....not turbulent;
Free.....not undisciplined;
Prompt.....not precipitate."

13. A *Gradation of Contrasts in Language* may be seen in the following extract from Chateaubriand, in which each of the three leading steps of gradation from less to more important ideas has a contrast of a smaller with a larger object, as "insect" with "elephant," etc:—

"THERE IS A GOD!

1. { The herbs of the valley, / the cedars of the mountain, } bless him—
2. { The insect sports in his beams, / The elephant salutes him with the rising orb of day—
3. { The bird sings him in the foliage, / the thunder proclaims him in the heavens:—

Man alone has said—There is no God!"

The unity of idea in the above finds its central point in "There is a God," while the diversity consists of the seven clauses which cluster around it, as leaves cluster around a branch.

14. Crystallized or other hard forms usually have that predominance of straight lines and angles which constitutes contrast, and their effect is generally spirited, or if large, sublime, while the more soft or yielding forms of natural growth have usually a predominance of curvature on the graceful law of gradation. For examples of the first see figures 2, 3, 64, etc.; for examples of the second, see vines, leaves, human forms, etc., as in figures 11, 12, 19, 20, 60, etc.

15. *What is the principle of unity in contrasting objects?* my reader may ask. The principle of diversity is evident enough. Take the picture of Stony Point, fig. 70, which presents marked contrasts. Are the rocks so black as to be entirely separated in effect from the white appearing water near it? No, for the water is graded down with shadow so as not to be entirely white, while the rocks are softened down with light to prevent blackness. So far, then, there is unity of effect. But there is also another kind of unity, for the darkness of the rocks works in harmony with the water to develop its brilliancy, while the brilliancy of the water, on the other hand, works harmoniously with the rocks to bring out their bold and massive power the more distinctly. But these contrasts by means of which one object works to glorify its neighbor, are seen all through nature. The red of the flower makes the green of the surrounding foliage seem the more pure by comparison, while the green on the other hand sets off the red and gives it a deeper hue. The foliage harmonizes with the reddish brown of the soil; a violet flower is very apt to be associated with yellow lines or a yellow center, and various other harmonic contrasts exist in different departments of nature, developed on the principle of chemical affinity, which deals in contrasts as will be shown in chapter V.

16. *How is Contrast the type of justice?* A true philosopher will always see an interior spiritual meaning in every manifestation of nature. The earthquake, the tempest and the lightning, which so abound in sublime contrasts, are great purifying and corrective agencies of the physical world. Is not *Justice* the great purifier of the moral world? But as in nature the mountains and cliffs which have been developed by the earthquake are softened down by many yielding and beautiful gradations typical of love, so should human justice be tempered by the gentle hand of mercy.