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A Manual for Design Education at the College Level

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A MANUEL FOR DESIGN EDUCATION AT THE COLLEGE LEVEL

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INTRODUCTION

TO

A MANUAL FOR DESIGN EDUCATION

The purpose of this thesis is to examine and explore the creativity, techniques, the philosophy and the principles of the broad area called design, as it is applicable to training of students in junior and senior college with emphasis on teacher education.

Education in design is directed toward a multipurpose service to mankind. It is aimed at all levels of learning and at both specific and general education. Its goal is to elevate the taste in all usage of form, line and color; to lead thought into the philosophical implications of design; to train specialists and leaders in the field, and to give to every educated individual some understanding of basic design principles through which they may express themselves.

It is the conviction of the writer that the two-fold approach —the creative and the technical—must be the basis for such level of training. Though such technical approach may not be necessary in the lower levels of education, it is imperative that the teacher understand these principles. The tendency in art education to swing from one extreme to another, from pure emotional release in art expression to the limitations of cold principles has dwarfed the growth of students for some time. The middle-of-the-road approach,

the tempering of emotion with principle, and the firing of principle with creative drive, is the narrow road to a true art form. This cannot always be done simultaneously, either by artists themselves or by students. Sometimes the emotional pot must boil, and then from the resultant overflow, combined with a background of study and understanding of principles comes the refined, the ordered expression of the dynamic idea. The great works of art through all history have had these twofold factors forged into one idea.

It must be admitted that there are exceptional individuals, so in tune with the dynamic forces of the universe that they intuitively design with strength and power, without really knowing why intellectually. In a degree, many have some of this ability. In its lesser gradation it is what is called natural good taste. But only those gifted intuitively, in respect to design, can continue strong in their field without knowing why.

Man lives in a world of color, form, line, and texture, and only the very smallest per cent is trained or gifted to use or enjoy them. The misuse in architecture, clothing, city planning, interiors, overshadow in this country at least the struggle for beauty and order. Sameness, repetition, ugliness, confusion, and disorder choke man's capacity to express harmony, interest, grandeur, and individuality. Is not the correction of this condition imperative? Is it not necessary in education for life that <u>all</u> be exposed to the science of beauty and

order that is called design? Must only part of those who have the opportunity of education be trained for this particular part of life in which they are participating during all their waking hours?

Ernest Mundt covers this subject thoroughly when he says:

> Art must be understood to be more than "glamorized" illustration which is still all it means in the minds of very many people. . . Art must embrace more even then any particular meaning given it by people who practise poetry or music, weaving, photography, or cooking. Art, to bring all these various arts together, ought to be seen as that ingredient in all of man's accomplishments which satisfies his soul . . . Even when we select from this inclusive idea of art only the visual aspects, for the purposes of this study, one can see how intimately art relates to man's daily surroundings and to his work. Beauty ought to be found not only in nature: games, movies, and hobbies should be more than informative or sensational. And above work leisure raises the plane of insight and reflection where our experience with fellow men, nature, and God is transformed into works of fine art that reveal the height to which the human spirit is invited to ascend. This interpretation of art as one facet of all human activity is broad enough to include all the approaches we have indicated above. Also this interpretation has the advantage of making art, which is now seen to be vital for the health of society, an important issue for everyone instead of appealing only to people with so-called artistic interests or ability.[1]

This thesis will discuss the subject of the creative philosophy and explore the technical aspects of design. The question of why this is important is discussed in this introduction. The great unfoldment of this day with its discovery of momentous cosmic forces from macroism to microism, will surely lead to understanding of the order in art and

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1. Ernest Mundt, A Primer of Visual Art (New York: Pelligrini and Cudahy, 1952), pp. 3-4.

in music; the relation of man to man, and ultimately of man and the universe--to God.

DESIGN DEFINED

Design as applied to the arts is the great unifying principle of cohesion. It is the director of order with dynamic interest and variation. Research as to its properties is incomplete. What is known is found through analysis and intuition as well as in making comparisons with the relative coordinating factors in nature, the sciences and philosophy. The forces of cause and effect, action and reaction, interplay, tensions, solutions as found in the counterpoint of music, the reactions of chemicals, the effects of the powerful cohesion of protons and neutrons, and in every phase of the universe in which such action takes place, can be related in some degree to design. In the chapter on philosophy of design which follows, these comparisons will be shown. Art is not something apart from life. It is a part of the whole design of the universe. The physicist and the designer are seeking the same goal, but few of them have realized it.

The history of design as used in art is described by Ralph Pearson as:

> Ordinarily when we say "design" we think of applied design—familiar patterns in wallpaper or textiles. But the Moderns have stretched the meaning of the word far beyond these narrow limits. To them it means organization of all the elements of the picture into visual harmonies—into a visual symphony, if you like—and the reorganization of subject to fit the demands of that organization. Design in this sense, as related to

> pictures and sculptures, is a rediscovery of our time. Cezanne and Van Gogh were the pioneer explorers; they rediscovered and added to a function of man that has existed through all of human history. Primitives of the Stone Age unconsciously designed their pictographs. The early Mediterranean cultures knew and practiced design. The Egyptian, the Chinese, the Greeks of the early and the Golden Age were masters of design. Then after the Roman decadence into naturalism and the complete fade-out of the Dark Ages in Europe, came the resurrection with the early Byzantines and the great Rennaissance of the Middle Ages where design reached a climax of richness and complexity. Then again the decline into naturalism and now the developing rebirth.
>
> Since the great Armory Exhibition in New York in 1913 our rebirth has been in full swing as its revitalization of the art of the picture has penetrated further and further into the consciousness of artists and public. Design, more than any of the changing attitudes toward subject, has been the home of the birth, the source of the new experiences offered by pictures, the rich vein of ore from which we are again mining the values of the spirit covered by the word "aesthetic." Design is the least common denominator of all the arts. It is the element which, more than any other, unifies the arts of all times and places where it has been known and used.[1]

In considering Mr. Pearson's last three lines, it must be clearly understood that the change has taken place in the field of design. It is no longer relegated to the field of applied design only. That is only one of its functions. It encompasses the whole field of man's endeavor in which he constructs, builds, manufactures, creates, or modifies nature. It is sadly true that most of that which is made has little to do with design principles—but that does not mean that it shouldn't. Nor does it mean that any work of "art" can be justified

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1. Ralph M. Pearson, The New Art Education (New York: Harper and Brothers, 1941) pp. 5-7.

as such without its being designed.

The relationship of the principles of design to the underlying relationships in nature are well described by the sculptor, Alexander Archipenko, who says:

> Knowledge of creativeness and its application reveals the most extraordinary facts of its power and infinity. One of these facts is that the laws of geometry, mathematics, balance, resistance, symmetry, etc., are not human inventions, but that they are and will be part of Nature. Their causes are multiple, and often unexplainable. All these laws were used spontaneously and instinctively by insects and animals long before human beings understood them and started to apply them for their purposes. . .if we look at the exterior and cross-section of a certain spiral shell from the bottom of the sea, we find that a billion years ago this shell was built exactly according to the same technical law as the round stairway of the seventeenth century, on the outside of the walls of Italian palaces. Architects did not imitate the structure of the shell, but were forced inevitably to use the same constructive law on which the shell was built. . . The abstract law of universal creativeness also constitutes art materially and spiritually. If those laws are learned and understood, one may use them for the development of our creativeness. Animals cannot develop their creativeness, while human beings can. Such superiority is due to their consciousness which operates in creative problems resolved before their nascence in animals, but which can only be resolved through learning and practicing by human beings.[1]

As Einstein[2] has inferred that there is a cosmic order, so Archipenko relates art to that cosmic order by stating, "The philosophy of art cannot be separated from the philosophy of creativeness,

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1. Alexander Archipenko, Philosophy of Art (extractions from a book being written, copyright 1953) from Fernando Puma, 7 Arts (New York: Doubleday and Company, 1953) p. 129.

2. Lincoln Barnett, The Universe and Dr. Einstein (New York: New American Library, 1950) p. 53.

because art cannot exist independently of the cosmical creativeness reflected by man and animals."[1]

Henry N. Rasmussen defines unity in a manner that this writer would call the results of design. Rasmussen says:

> There seem to be two different means of balance in nature one an equilibrium attained through the offsetting influences of contrasts, and the other a cohesive balance gained by the repetition of things alike. . . It seems that no real unity is possible without some degree of both these principles, the like and the unlike.[2]

A parallel may be drawn here between what Rasmussen says and what the writer of this paper has said of individuals, their likenesses hold them together and their individuality keeps them from being a mass. Whatever dogma would offset the balance between the relative likeness and unlikeness of society in favor of likeness is trying to dominate; and whenever the preservation of individuality, without reference to social cohesion takes place, government cannot be equally useful for all.

The philosopher and the physicist explore the mental and physical universe to find universal law. The artist designer symbolizes in his work the infinite possibilities of interacting factors being brought into perfect coordination through principles of design—these

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1. Archipenko, op. cit., p. 128.

2. Henry N. Rasmussen, Art Structure (New York: McGraw-Hill, 1950) p. 13.

same principles which are derived from the universe. The designer uses form, line, color, space, texture, content, contrast, tensions, interactions all working simultaneously independently and cohesively. Here is a principle from which the ideals of designed social living and international relations can find a parallel ideal—the ultimate harmony and unity of the universe proven not in the scientific laboratory but in the studio of design; where creativity, principle and technique, the triumverate of art, are proving through integration that harmony is possible. A Beethoven Symphony proves it possible, as does a Leger composition, a Gropius construction, a prehistoric drawing in a cave in Spain.

This thesis is particularly concerned with expanding the horizon of art teachers to some degree by showing the relations of design to science, to man and the universe; the effects of universal law, in the degree understood, on man and man's expression of it through design symbolism—a circle of interacting factors. The paper will deal with creativity in teaching. It will explore the principles of design as they are affected by the laws of physics—factors which the teacher of art should comprehend. Through this understanding the teacher will more fully understand what he or she is doing, even though the principles involved are beyond the intellectual comprehension of those being taught.

For authority the author has chosen the writings of the following writers, artists, and physicists for help:

Alexander Archipenko	Ukranian-American sculptor-cubist
Arthur Eddington	British Physicist
Albert Einstein	American Physicist
James Jeans	British Physicist
Ernest Mundt	Director, California School of Fine Arts
Amedee Ozenfant	French-American Purist Painter
Ralph M. Pearson	Art Educator and Author
Henry N. Rasmussen	Art Educator and Author
Edmund W. Sinnott	Director of Sheffield Scientific School, Yale University
J. W. N. Sullivan	Author
Janet K. Smith	Art Educator and Author

The Harvard Report on General Education

The author's own observations are the result of study with Archipenko, Ozenfant and Walter Reese, of fifteen years as a non-objective and abstract painter, as well as study in the fields of metaphysics, physics and the physics philosophers.

A chapter on a philosophy of design and its relation to the contemporary world will follow, then the chapter on design education, followed by the analysis of basic design principles.

A PHILOSOPHY OF THE DEVELOPMENT OF CREATIVITY

Creativity is the modus operandi of individuality. That man is individual cannot be disproved. He may be warped, dominated, degraded, inhibited, frustrated, but he still is different from any other human being. It is on this core of difference that rehabilitation can be built. It is there that his self-respect can be regained, through self-expression. Throughout all the gradations of humanhood, the ability to express individuality strengthens the stability of that individual. But, this expression must be done through the moderating channels of a principle, such as principles in art and music, or it will have no lasting benefit on either the individual or upon his contribution to society. The law of supply and demand, cause and effect as seen operating between what an individual is and what he can give to society and society give to him can never be brought into activity until the individual finds himself. Creativity is therefore seen, not as a privilege of the obviously talented, but a necessity of basic progress for the human race.

Individuality is vastly different from personality. Personality is acquired, the result of environment; but individuality is the innate nature of a man or woman, the degree of difference that sets him or her apart, irrespective of personality development. Psychology, physiology, and theology cannot define conclusively where or what is the source of

this capacity to be different. It is a phenomena of all nature; this grouping of likes with variation--no two grains of sand, no two fingerprints, no two minds alike.

Variation and difference are valueless unless expressed, and then according to principle. It must be admitted that the principles of music, design, or physics are only partially comprehended; that they will never be fully comprehended until such time as an ultimate understanding of the design of life itself is reached. They cannot be fully comprehended until the principle governing all other principles is discovered; when that which relates science and art, with man and the universe, is discerned. Einstein is now working on a Unified Field theory that unites the theories of gravity and atomic energy, which moves in the ultimate direction of discovery of the design of life. Lincoln Barnett says of this theory:

> . . .in its vast cosmic picture, when fully revealed, the abyss between macrocosmos and microcosmos--the very big and the very little--will be bridged, and the whole complexity of the universe will resolve into a homogeneous fabric in which matter and energy are indistinguishable and all forms of motion from the slow wheeling of the galaxies to the wild flight of electrons become simply changes in the structure and concentration of the primordial field.[1]

The question would then arise, "What has this to do with man and society?" Einstein himself shows a parallel between science and ethics

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1. Lincoln Barnett, The Universe and Dr. Einstein (New York: New American Library, 1950) p. 16.

when he shows how ethics are arrived at in much the same manner as scientific axioms. He says:

> Scientific statements of facts and relations, indeed, cannot produce ethical directives. However, ethical directives can be made rational and coherent by logical thinking and empirical knowledge. If we can agree on some fundamental ethical propositions, then other ethical propositions can be derived from them, provided that the original premises are stated with sufficient precision. Such ethical premises play a similar role in ethics, to that played by axioms in mathematics. . . It is the privilege of man's moral genius, impersonated by inspired individuals, to advance ethical axioms which are so comprehensive and so well grounded in the vast mass of their individual emotional experiences. Ethical axioms are found and tested not very differently from the axioms of science. Truth is what stands the test of experience.[1]

In the chapters on design principles it will be seen how man has imposed on design symbols his feelings in relation to the laws of the universe. He has felt these laws long before he understood them. Man certainly reacted to and transposed into his art the effects of gravitation long before he arrived at any concept of gravity. The relationship between science and art is much more obvious than between science and man. In some respects art is the intermediary between the two. It is the place where the creativity of man is combined with the principles of design, which are derived from man's reaction to the principles of the universe. As man reacted to the factor of gravity in his art before he understood it, may not man now be reacting in art to things that the physicist has yet to prove?

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1. Albert Einstein, Out of My Later Years (New York: The Philosophical Library, 1950) pp. 114-115.

A true philosophy of art cannot be pursued without deeper understanding of man, of the universe, as well as of art. For students to attempt to find themselves in art without some comprehension of what is being revealed in the world of science, dwarfs their progress from the start. No one who is teaching art should be lacking in inquisitiveness as to what is being constantly discovered. It is realized that the individual artist or art teacher cannot also be a scientist, but if he is inquisitive enough he will make use of the ever available material coming from the physicist-philosophers and those who are interpreting for them. This will expand his horizon, and validate his creativity. Einstein says, "All religions, arts and sciences are branches of the same tree. All these aspirations are directed toward ennobling man's life, lifting it from the sphere of mere physical existence and leading the individual toward freedom."[1]

Looking at the subject of the relationship of man, science, and art the following excerpts from Barnett's book, The Universe and Dr. Einstein, show the relationship of science to man, and, from the deductions made before, to art:

> . . .the Greek philosopher Democritus wrote: "Sweet and bitter, cold and warm as well as all the colors, all these things exist but in opinion and not in reality; what really exists are unchangeable particles, atoms and their motions in empty space.

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1. Ibid., p. 117.

> Galileo also was aware of the purely subjective character of sense qualities like color, taste, smell, and sound and pointed out that "they can no more be ascribed to the external objects than can the tickling or pain caused sometimes by touching such objects."
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> "I am able to prove," wrote the German mathematician Libnitz, "that not only light, color and the like but motion, shape, and extension, too, are mere apparent qualities."
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> Thus gradually philosophers and scientists arrived at the atartling conclusion that since every object is simply the sum of its qualities, and since qualities exist only in the mind, the whole objective universe of matter and energy, atoms and stars, does not exist except as a construction of the consciousness, an edifice of conventional symbols shaped by the senses of man.[1]

This last statement by Mr. Barnett is particularly important in relationship to design: "an edifice of conventional symbols shaped by the senses of man." The chapters on design in this thesis reiterate the idea that design principle is based on the transposition of the extrovert world on introvert feeling. If it is proven that the extrovert world is a "construction of consciousness" then no transposition is necessary, and design becomes relatively as much a reality as what is considered the outside world, as much affected by cosmic principle.

Mr. Barnett carries this idea farther by saying:

> Einstein carried this train of logic to its ultimate limits by showing that even space and time are forms of intuition, which can no more be divorced from consciousness than can our

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1. Barnett, op. cit., p. 20-21.

> concepts of color, shape or size. Space has no objective reality, except as an order or arrangement of the objects we perceive in it, and time has no independent existence apart from the order of events by which we measure it.[1]

This brings back the subject of the beginning of this chapter—individual man. It is individual man in whose consciousness the qualities of objects exist. Since the scientist says, as was quoted above, "that every object is simply the sum of its qualities" and that "space has no objective reality, except as an order or arrangement of the object 'man' . . . perceives in it, and time has no independent existence apart from the order of events by which 'man' . . . measures it."

Edmund W. Sinnott, Dean of Yale's Sheffield Scientific School, in discussing the relationship of man to science says:

> Let us face the fact that what the world must have is a fuller cultivation of those qualities which are best termed spiritual . . . for on their strength depends our own survival. The good old days of billiard-ball atoms, Euclidian geometry, and the indestructability of matter are now gone . . . Matter in the old sense has ceased to be. The universe in which our fathers felt so comfortably at home has vanished. . . great things are in the air, exciting new ideas in the sciences which may still modify our understanding of the universe. This is no day to be dogmatic or complacent, for almost anything can happen now. The idealist who follows the ancient highway of the spirit toward reality has gained a more respectful audience than was his half a century ago . . . Belief in something constant and unchangeable, call it by whatever name we will, is a necessity not only for religion but equally for the sciences and the arts and forms a common meeting ground and starting point for men who

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1. Ibid., p. 22.

travel on the highway of the mind and those who use the spirit. . . . Man, not matter, is the chief problem of the world today.[1]

The statements of these men are startling, yet they are the leaders in thought along scientific lines today, the most respected thinkers of the times. They are turning to man and his consciousness to find reality. In relation to such thinking, the place of the artist becomes much more important for he works directly from consciousness. The traditional artist drew what he knew and saw of his outside world. The modernist, through his various schools of philosophy, paints, draws and sculpts the world, from the standpoint of his own being. It is significant that the modern movement in art with this important approach to "reality" began in the latter part of the nineteenth century, and that while great thinkers in all ages have been dealing with the subjective, it is only recently that the pragmatic school of scientific thinking has given way to such statements as Dean Sinnott's and Dr. Einstein's. Einstein says, "I cannot believe that God plays dice with the world." Barnett says of him,[1] "He repudiates the positivist doctrine that science can only report and correlate the results of observation. He believes in a universe of order and harmony. And he believes that questing man may yet attain of knowledge of physical reality."

J. W. N. Sullivan more closely relates the work of the physicist to art when he says:

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1. Einstein, op. cit., p. 115.

> . . . both Eddington and Jeans arrive at very much the same conclusion, namely that the ultimate nature of the universe is mental. We have seen that Jeans has been led to this conclusion by the impossibility of conceiving anything save pure thought to which the modern mathematical description of the universe could apply. Eddington reaches his conclusion by reflecting that the only direct knowledge we possess is knowledge of mental states. All other knowledge, such as our knowledge of the material universe, is inferred knowledge, often the products of a long and complicated chain of inference. The fact that science is confined to a knowledge of structure is obviously of great "humanistic" importance, for it means that the problem of the nature of reality is not prejudged. We are no longer required to believe that our response to beauty, or the mystic's sense of communion with God, have no objective counterpart. It is perfectly possible that they are, what they have so often been taken to be, clues to the nature of reality. Thus our various religious aspirations, our perception of beauty, may not be in the essentially illusory phenomena they were supposed to be.[1]

The scientist works in many ways as the artist does; he seeks to break through the wall of the unknown and uses intuition and creativity to find a possible solution to the answer he seeks. Intellect can fail him. Logic and research can reach their limit, but with his intuitive capacity the scientist finds ideas which he later can prove by mathematical and logical procedure. In the same manner the cubists Braque, Leger and Picasso in the early years of this century sought a new kind of expression, which they found intuitively, in the manner usually attributed to artists. Now that very cubism is the basis for the design of motor cars, skyscrapers,

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1. J. W. N. Sullivan, The Limitations of Science (New York: The New American Library, Incorporated, 1933) pp. 142-145.

and jet engines. It is important that a new profession has developed in the last 25 years that is almost reversing the process. Industrial design has been developed. Now designers like Henry Dreyfuss,[1] who are artists and not engineers are designing jet airplanes for the army. Of course, they work in collaboration with engineers, but the principles of design are being found so fundamental that the designing begins with the artist, not the artist decorating what the engineer developed!

The designer does find order in the universe of design, and if it is proven that the objective is only real as it exists in the subjective, may it not be surmised that the designer is finding reality as he balances form, line, and color with creative artistry. It is the conviction of the writer that this is so and that the day is not too distant when the scientist and the artist will work side by side for the good of all mankind! Individual man collectively working through the difference that is his identity, to prove the Principle of his individual and collective being.

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1. Henry Dreyfuss, Personal Interview, 1953.

ART EDUCATION FOR INDIVIDUALS

The field of education has taken some leadership in the trend from teaching groups to the teaching of individuals in groups. This trend has been accented by the division in the world between the philosophy of statism, or state supremacy over the individual; and the ideal of the democratic nations of the importance of the individual above the state. But much effort and understanding of man as an individual must be made. It is said that at the time of the dedication of the Palomar telescope in California that one of the men who helped develop it said, in substance, that more is known about atomic energy than is known about the mind that conceived it. In other words man knows more about the power in the atom than he knows about the mind that must control it--a most alarming situation, considering the power of the atom.

Teaching individuals must be done with consideration of the creative ability of students. The training of self-expression should start with the earliest learning and be continued through all education. This will bring up the question, "Does self-expression have to be taught?" The answer is the crux of the whole question of creativity. It is "Yes!" It must be taught because, as was said before, <u>only as self-expression is done according to a principle does it become an art form</u>.

The Harvard Report on General Education discusses this subject of education in relationship to self-expression as:

> We must be on our guard so as not to confuse individuality with subjectivity. In a natural reaction against the concept of verisimilitude in the arts, the teacher today urges the pupil to pour out his soul on the canvas as spontaneously as possible. Yet aesthetic work is not self-expression but self-transcendency, as when an actor projects himself into a role. The cult of self-expression in the arts is partly the result of a reaction against Puritanism which has overreached itself. Doubtless all learning must be absorbed into the tissue of individual experience, since man is a living being growing from within out. Yet work in the arts is significant in the measure that it has submitted to discipline. It is not a case of an alien force imposing arbitrary restriction. The discipline comes from the very nature of the materials used by the artist, such as color, space, clay and sound; and it comes from the structure of the object which is revealed. The word imagination, tends to mislead our mind, suggesting as it does mere inventiveness. In fact, the imagination discloses to the mind a realm of ideal possibility and value. The artist does not create this realm; he discovers it and upon entering it, obeys the rules of the realm.[1]

Self-expression without principle, whether learned or intrinsic, is suitable only for psychological research into the emotional status of the individual; it has not been transformed into an art expression. Art is a combination of both. This is the reason that in every period of artistic revival there is much work done in the name of art that does not live; it lacks the basic ingredients of self-expression with creativity and principle.

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1. The Harvard Committee, General Education in a Free Society, (Cambridge: Harvard University Press, 1945) p. 128.

It may be also asked, "Is education necessary for the nutriment of individuality through self-expression or must it be carried through through principle to an art form?" Self-expression alone is of course valuable and in many cases of great therapeutic value, but it is surely not an ultimate. It never lifts the individual into such coordinated living as does self-expression modified by discipline of principle. Such training that does demand adherence to form is the great builder of individual nature. It fills the gap in academic education caused by the training of the intellect alone and it does so by training the emotions in relationship to principles.

Training in art that is not paralleled with the drawing out of creativity (the expression of individual nature) is a stifling, limiting and narrow procedure. In a chapter "To be Creative" Alexander Archipenko says,

> In speaking of art it should be amplified that there is a difference between the study of technicality and learning how to be creative. Technical training is offered in all schools of art, creativeness is ignored. A student without guidance will not likely be able to achieve self-education, unless his hereditary psycho-physiological organization already contains all the necessary elements constituting his creativeness. Rarely has a student clear understanding that the optical imitation of nature has nothing to do with the development of his creativeness.[1]

The writer, during the time that she studied with Archipenko experienced the greatest impetus to creativity of seven years of art training. Technique and form were not neglected but were brought

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1. Alexander Archipenko, Philosophy of Art, from Fernaldo Puma, 7 Arts (Garden City: Doubleday and Company, 1953) p. 130.

together to strengthen the student's progress. Unless this latter is done the creativity may be such an overflowing emergence that the student loses control. It does seem that in the very last few years many art schools have turned from the tight control of pure technique to pure creativity. It is hoped that the swing to the center of the road will not be too far hence.

The development of creativity in older students is in itself a creative capacity. It is an art. It can only be practiced by one who is himself creative. The principle of this art is in an understanding of human nature. It may be gained through the study of psychology, but it must be accompanied with compassion for and interest in the individual student's development. Young children are naturally creative but as they grow older their developed self-consciousness inhibits creative activity. As a director leads an orchestra, so the artist-teacher leads, inspires, coaxes, and builds the self-confidence of his students. The teacher needs to know when to push the student into the exploration of his own being. The writer well remembers the time Mr. Archipenko tapped her on the shoulder and said, "Now paint what you really want to." It was a moment of change in the whole course of artistic pursuit, and the direction has been the same since. It was a challenge to break away from any preconceptions of what one ought to be painting. It turned away from obvious "realism" to that realm of individuality that is so intensely important both in art and

other forms of education where creativity is possible.

One of the most important essentials to creative teaching is the establishment of rapport. The student needs to feel such confidence in the teacher that he can overcome any fear he may have that self-expression is the same as self-exposure. This problem that is present in most students must be handled wisely and carefully by the teacher. It is the greatest stumbling block to self-expression. If the teacher does not realize this, there will be many students that he will never be able to help with any degree of success. The student must be led to feel that in creating, his strength and not his weaknesses will be exposed; for though every one has weaknesses, only few have the intuitive strength to work through them into creating something of value. The desire to cover up, to retreat from reality is corrected to some extent as the person finds that his individuality is worth expressing; that no one else can possibly express just what he has to express. As his ability in creativity grows and develops, according to the specific design principle involved, he becomes established through the self-confidence gained in completing an expression that has artistic value.

Art students are also groups and the teacher has group problems to work with. An atmosphere of individual freedom and mutual respect must be developed among those learning. Each will in some degree influence the others; the individual student, the group, and the

artist-teacher becoming a co-ordinating organ for group and individual growth. When each student realizes his own value he will be more willing to recognize the value of the expression of his fellow students. Poorly adjusted students improve remarkably in such a working climate, even the braggart, the extreme egotist is tempered by working in a class of this kind. In some degree he is forced to be honest with himself and this is the moderating factor.

Care must be taken to see that the student's creating is sincere and not just affectation. The more talented student, who lacks drive of accomplishment, if not prodded will drift in his ability; whereas if he is enabled to see the heights his ability could go, he will be motivated into working commensurate with his talent. All students must realize that each of them will approach each problem in a different manner, and that while they may learn from each other they must not be overinfluenced by each other. They should judge their own work only as to its sincerity as a true self-expression and to the degree in which they have worked according to the principle involved. Group experience is valuable for individual growth through the stimulation of artistic activity and atmosphere, but at the same time the effect of the group must be as individuals together, rather than as a homogeneous body. Students must be conscious that though they are using the same principles, they themselves are all different. This understanding prevents the situation in which one more talented and forceful student might dominate the work of other students.

The last but most important thing that the artist-teacher must watch with extreme care is that his teaching leads, inspires, and instructs in principles, but that he does not dominate or limit the work of those he is teaching. This is the hardest thing to do, to teach outside of one's own immediate philosophy of art, to be open to new concepts of form, line, and color, and to be able to judge objectively in relation to the student and his needs and not in relationship to the teacher himself. He does not own his students; he is only entrusted with their artistic growth for a period and it is a solemn charge, requiring skill, artistry, love, and unselfishness. Though the student's successes glorify the teacher, the teaching can never be for such purpose, or it will wither the growth of mutual interaction between teacher and student.

The subject of creativity has been discussed in relationship to principle, but the actual study of the principles of design will be discussed in the following chapters.

PART II

THE ELEMENTS OF DESIGN

The basic components of design are line, form, space, color, and texture. These elements are all interdependent. To understand their relationships the intrinsic nature of each of them must be explored, its nature as an independent contributor and also as part of the whole. It is concerned principally with the forces of nature and the way in which they influence man, who in turn creates design symbols in which these natural forces are implied. It is similar to the use of language in which the printed symbol "fire" stimulates an idea. Different design symbols give different effects. These must be understood by the artist as the composer comprehends composition.

There are four basic rules for design that have application to most of the factors involved. They are:

1. The counterbalancing force of one element of design to another shall be neither so small nor so great that the identity of either is lost.

2. The distance separating related objects in design must be less than the width or length of the forms on a straight line at the point of the shortest distance between them.

3. The sum total of the qualities of each entity in design effects the sum total of all other entities used, form, line, color,

contrast, tensions, textures, and spaces.

4. The relative sizes of related lines or forms should be in the range of the first distinct difference from equal identity to the point where one is neither so large or so small that they lose relative value.

The following chapters deal with the application of these rules to form, line, color, and texture.

LINE

Interest in design is produced by the development of compliments. Lines create spaces. Both the lines and the spaces that they create are elements of design which can be respectively complimentary to each other without being alike. If they are alike they create the opposite of interest, which is monotony. In the following material on line the various means by which judgment in interesting proportion can be developed are discussed. There appear certain basic areas in which the differences between chaos and order, between interest and monotony are definable. These are the principles of design. These principles are very simple. Also they are very important. There are individuals who do not need to know them to design successfully because they know them intuitively; but it is the conviction of this writer that <u>they should be understood by all who are going to teach design</u>.

<u>Proportion as used in line</u>. Proportion is the most important factor in the study of line. Its proper use is the basis for making interesting order out of chaos. Chaos is disturbing because it takes the eye more time to define it. The eye can not move with a feeling of restful balance and counterbalance as it can when viewing a well designed object. Order alone does not make design. Design must be interesting, be based on a principle, and must be an expression of creative artistry. Proportion is the key to the success or failure of a design to meet the above requirement. One fulfillment is not enough. All three must be accomplished.

The most important single law of design is the one dealing with proportion of line. It can be applied to almost every other component. It will be called in this thesis "the first law." To explain it, the following illustrations and descriptions will be made:

1. Two equal lines, equally spaced within an area are each saying the same thing in the non-verbal language of design. They have developed no relationship of proportion between themselves but sameness. There are times in design when repetition is valuable for strength and the tying of things together, but it is not the basis upon which interest is built.

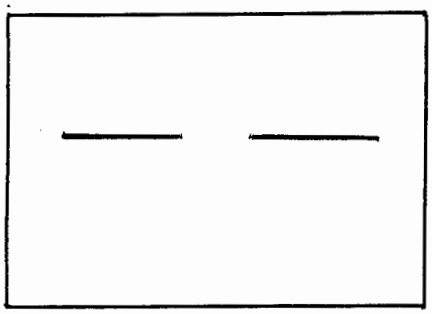


Figure 1.

2. By contrast, two lines of unequal length can set up varying sets of relationships. If this relationship is to be strong; by the process of both lines contributing to each other with respect to their length, there must not be an overdominance of one line to the other. In comparison with music, if a held note is held too long, the accent note following has no significance and the sense of rhythm is lost. This is the other extreme of a musical situation in which the length of notes is the same over and over. Then any sense of its being music is lost and it becomes just noise.

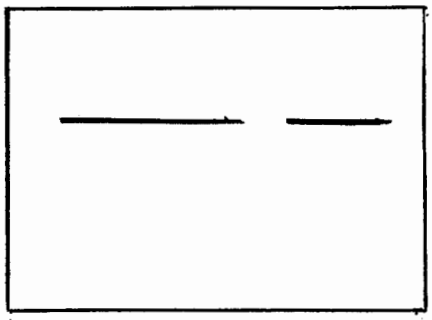
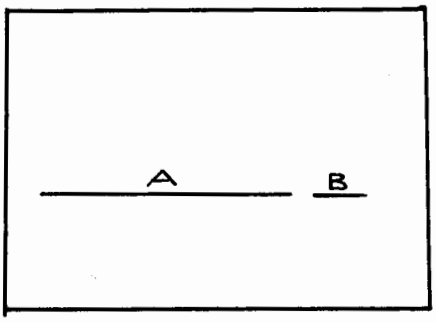


Figure 2.



In Figure 3, line a overbalances line b to such an extent that line b loses its identity. This also is a rule that has exceptions where overdominance is a need.

Figure 3.

In Figure 4, lines a and b are so nearly alike that their relationship can not be clearly defined. If a difference is not clear to the eye it becomes confusing.

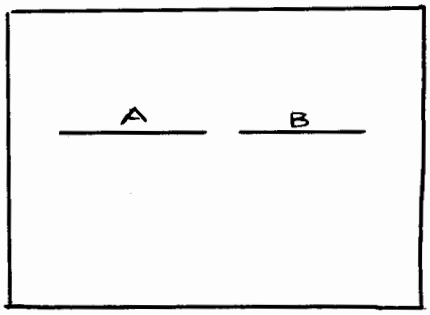


Figure 4.

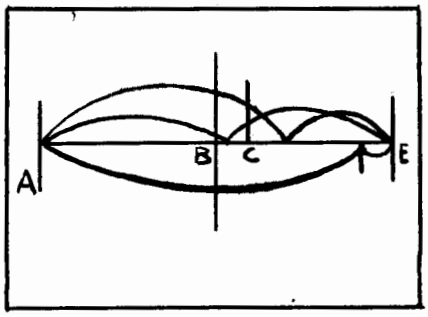


Figure 5.

But in Figure 5, the area of strong relationship is shown as neither overdominance of one or likeness of both. This is the first rule of design that the counterbalance of one line to another be neither so great nor so small nor so nearly alike that confusion is made. To find a point on the line A-E that meets the requirements of this rule, and suitably breaks this line in two, the areas that are not right must be found. Point b is the center; therefore any area too close to it, defined by the area between b and d would suggest repetition, because the eye can not quickly

define the difference. Area d to e is so small in reference to area a to d that it has no significance. But area c to d contains the place in which a suitable break of the line a to e can be made for a strong harmonious relationship between the two segments. The blue line shows overdominance, the green line similarity and the red line one of many possibilities of correct divisions of the line a to e.

These simple relationships are not only the most important consideration in reference to line but also to straight line forms and their relationships to each other. This will be discussed under the subject of form.

It is difficult to divide the study of line and space. A line defines a space. These same principles discussed above apply not only to the line as such but the space that it creates. When used in a given space a line has four qualities that must be considered. A line starts, it stops, it has direction and it modulates. In Figure 6, the line starts at point a and stops at point b. The dotted lines show how it hypothetically divides the area. Point a is so close to the top of the area that area c is too small to function. Also the area g overdominates area f so that it loses its importance. By contrast in Figure 7, line a-b is setting up a relationship of areas that are important in the proportion that they

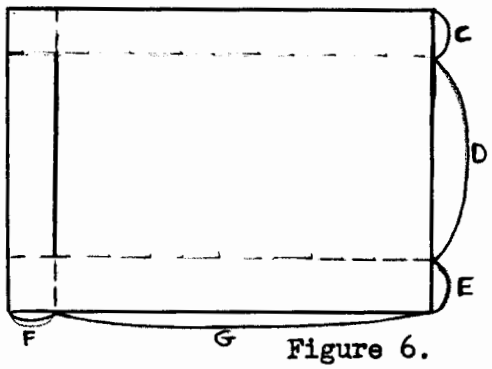


Figure 6.

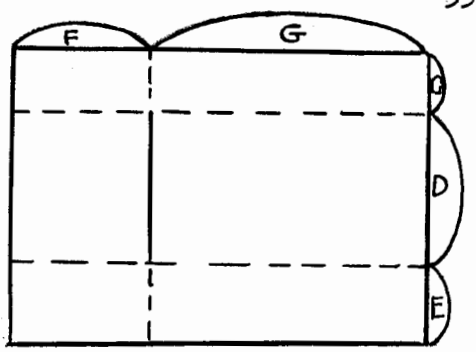


Figure 7.

have to each other. Area c is not so small but what it has force in relationship to d and e. The same is true of the areas f and g. None of the six areas created by the one line are the same. From this is seen that not only line but space must be designed. Nothing can be just added whether intuitively or intellectually that does not have a justifiable reason for being there.

The subject of line in space has been discussed but the question cannot be left until the significance of the forces of nature on man and his resultant attachment of significant on certain symbols be analyzed.

The Forces of Nature As Imposed On Line. The effects of the force of gravity on man has imposed on him a set of sensations which he generally feels in relationship to line. Even though the effect of gravity on a line as it is drawn on a paper is insignificant, and has no relationship to the actual placing of the line, man does relate to it what he feels as a three-dimensional being in a three-dimensional world. It is not within the scope of this paper to discuss the philosophical and scientific question of the nature of the universe. It can only summarize the obvious effects and point out that with the revolutions in concept, design, freed from the present limited sense of nature's forces, may be changed as well.

A vertical line has significance that other lines do not. It is a symbol of resistance to gravity. It stands alone by the very fact that it has no area but its narrow width to be affected by that force. Actually the line is governed by the direction of the paper it is drawn on and its only strength is that that it gains as a symbol of strength. Would this be true if men were in the habit of holding a page upside down to read or view it? How much the response to symbols is wholly a matter of education, psychology has not yet decided.

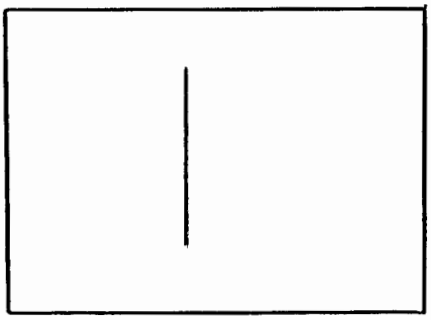


Figure 8.

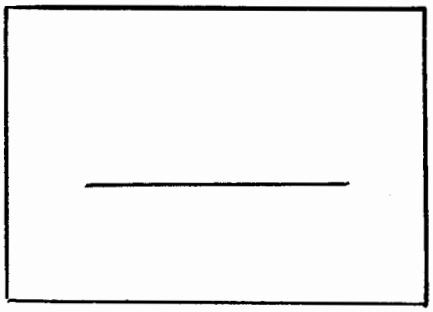


Figure 9.

Figure 9 deals with a horizontal line. It suggests the feeling of repose, of being at complete rest because the equal force of gravity on all its parts leaves it immovable. It gives no suggestion of resistance to the force upon it.

Also related to the feelings instigated by the vertical and horizontal are the areas between them. An angle line takes on the characteristics of the plane it most closely resembles. But because of the strength of the gravitational influence, any degree off straight up takes on the pull of the horizontal. This is partially due to the fact that the educated eye resolves things to rest and completion.

In Figure 10 the angle line a-b though at equal angles from lines c-b and b-d takes on more of the quality of the b-d line because the force of gravity is greater than any force inherent in the line itself. But should line f-g be added the total of its vertical force counteracts the gravitational force and line a-b is at rest. Here again though there is no stress and strain involved in the lines used as drawn on the paper. Sensation of action or rest can be suggested because of man's transposing of feeling to symbols. Just as the symbols of the printed page stimulate thought and feeling so do the elements of art. They stimulate, transpose, and they communicate.

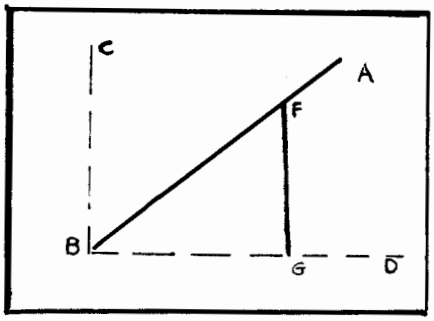


Figure 10.

Amedee Ozenfant has listed and defined what he calls the "Constants" as these:

> All forms can be grouped into four sensations. The two primary elements are verticality and its contrary horizontality: the other two related to them are obliqueness and the curve."

Of obliqueness, or the degree of angle, he says:

> If a man falls, in thought we fall with him, and when he reaches the ground we ourselves are at rest; this participation, imposed on us by the tropism of form, is the basis of a universal language of feeling.[1]

Mr. Ozenfant further points out that curved lines also take on the varying qualities of obliqueness as they are related to being more

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1. Amedee Ozenfant, Foundations of Modern Art (New York: Dover Publications, Incorporated, 1952) p. 259.

horizontal or vertical as in figures 13 and 14.[1]

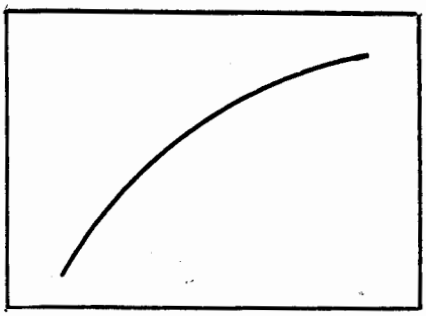

Figure 11.

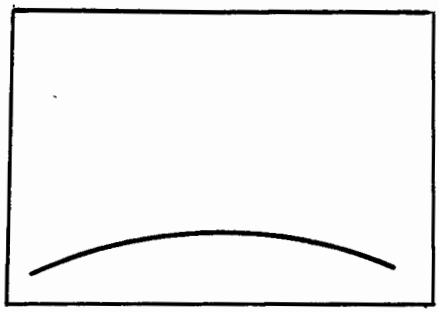

Figure 12.

Direction of line. Line direction is also affected by the transposition of force to symbols. Combinations of lines, symbolizing forces can be analyzed as follows:

Design demands self-completeness within its area. Then no lines can or should carry the eye out of that area. For example, line A-B is moving out of the area because downward forces are greater than the upward ones giving direction to the line A-B downward, and out of the area. In Figure 14 there is a sense of repose because the triangle suggested counteracts the downward force and strength is built against it. It is one of the few ways in design that two strong directional lines alone can be used.

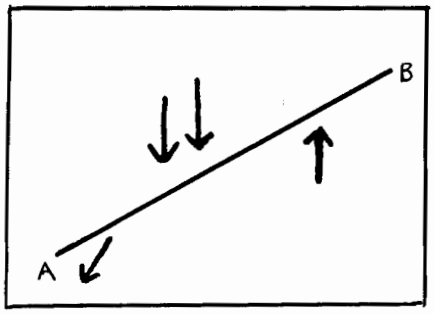

Figure 13.

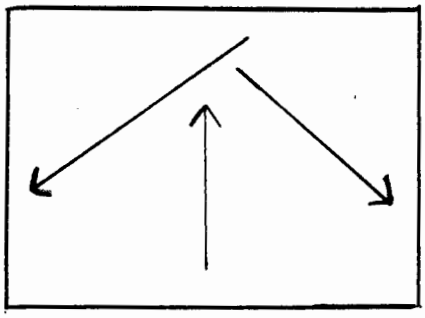

Figure 14.

1. Ibid., p. 260.

In Figure 15 the forces of the triangles formed (red arrows) plus the pull of the lines as affected by the angles, sets up a counterbalancing movement that starts a circular movement that preserves the self-containment feature needed for good design.

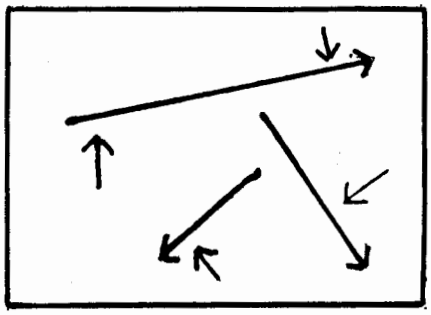

Figure 15.

Repetition of line. Line used in relationship to itself has strong design value. There are times when only the use of the parallel will be dramatic enough to hold a design together. Textures can be achieved with the use of closely related parallel lines. But a rhythmic beat of broken space can still add interest, while giving either strength or texture.

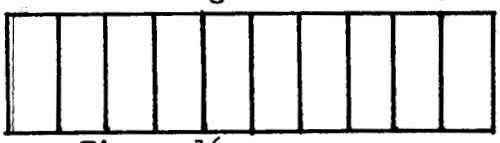

Figure 16.

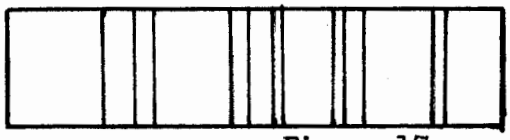

Figure 17.

These simple relationships are not only applicable to line but also to straight line forms and their relationships to each other. This will be discussed next in the chapter on form.

TWO-DIMENSIONAL FORM

Form defines the objects in design that have dimension. This chapter will deal with those of two dimensions. They have peculiarities that are entirely different from three-dimensional form. They are limited in man's comprehension by the fact that though they represent third dimension they have only the qualities of length and breadth with which to do it. They also are used in two dimension as a decorative form. The kinds of form will be separated for analysis.

Geometric-oblong. Geometric form has many of the characteristics applicable to the study of line. The rules of proportion are just as true to an oblong as to a straight line and are in a degree as effective with all other geometric forms except a circle. Because a circle has no straight sides it is in a category of its own.

An oblong, when used in a given space, sets up a series of vibrations of space modulation. This is true whether used in two or three dimensions, because when used in the second dimension it is symbolical of the third. The "first rule" as applied to line also applies in the use of the oblong. In Figure 18 it is shown that by placing one oblong within another, nine new oblong forms are hypothetically created. These can be individually different or repetitious depending upon how well the "first law" was applied. In Figure 19 on the next page this law

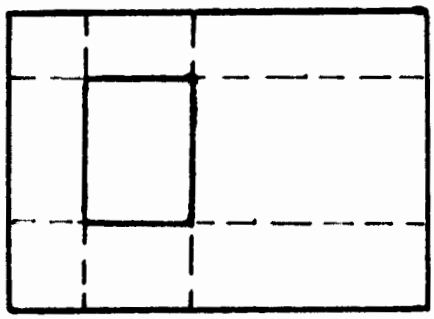

Figure 18.

has not been used. Six forms are created that say the same thing. They have equal lengths and widths. Also there are two other forms the same. Compare this with Figure 18 in which each form sets up a modulating reaction to every other form. There form vibration is set up. None are so small as to be unmeaningful or so dominant as to ignore its other relations.

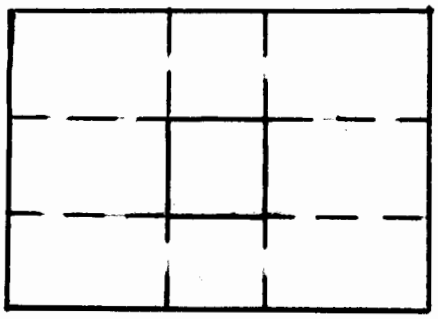

Figure 19.

As soon as two forms are used within a given area they set up a relationship with each other as well as with the combined hypothetical forms that both create. There are many ways in which such relationships can be effected.

1. Any two objects within a given space have some relationship because they are contained within the same area. This is a very weak relationship.

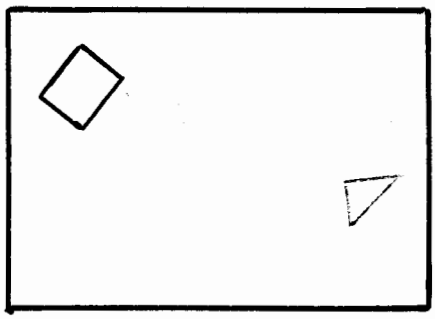

Figure 20.

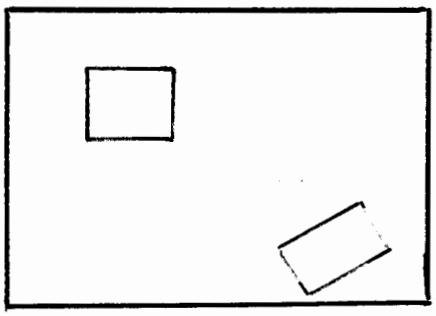

Figure 21.

2. Any two objects of the same shape have a stronger connection because the eye relates similar things. They combine this connection with the one in Figure 20 of being contained in the same area.

3. Parallel lines strengthen relationships even though they are at some distance from each other. This similarity also combines the properties of being contained in the same area and of similar shape due to the fact that to have parallel sides they would have some similarity in shape.

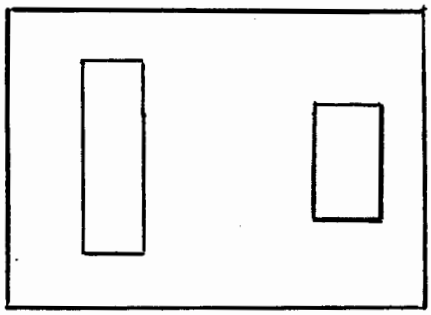

Figure 22.

4. The strongest relationships, the ones that contribute most to the creation of secure design are in the relationships of two forms, in which the distance that separates them is less than the width or length of the forms on a straight line at the shortest distance between them,--the "second rule" in Design.

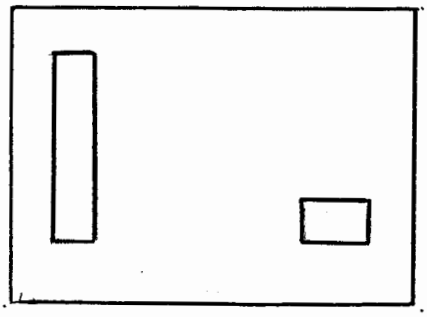

Figure 23.

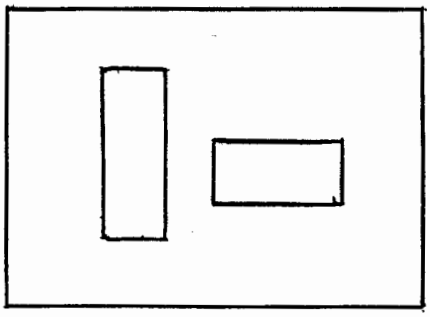

Figure 24.

In Figure 23 the figures are too far apart to be of much relationship to each other. In Figure 24 the two forms are placed in close relationship, directly affecting each other. They are utilizing the three principles of relationship as well. Their first relationship is to each other while in Figure 23 the forms are related first to the space and thereby to each other.

There is a correlation here, in the relations of forms to each other, with what is known of magnetism. As man relates the forces of gravity to symbols, so he relates the effects of magnetism and attraction to form. Stewart says, "The force between two magnets at distances much larger than the lengths of the magnets varies inversely as the fourth power of the distance—a very rapid decrease in force as the distance increases."[1] The analogy between this law of magnetism and the "second law" of design is that in both forms the strength of pull between the bodies begins losing power after they are farther apart than the length or width of the bodies concerned at the point of closest relationship.

Oblong forms set at angles. If oblong forms are at angles with each other they set up hypothetical vibrations that are symbolically dynamic in effect upon each other. To be strong the points at which the hypothetical lines cross the form lines must set up harmonious proportions as in the "first law." These hypothetical lines make breaks in the lines forming the shape of the object, and move at right angles to them. Upon entering an oblong or square area the eye moves at right angles in defining the nature of the area. Unless this is done according to the law of proportion weakness is manifested even though the hypothetical lines are not obvious. To the sensitive individual,

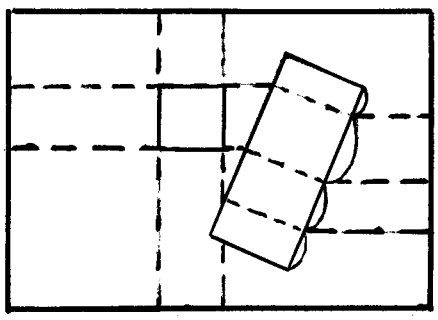

Figure 25.

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1. Oscar M. Stewart, Physics (New York: Ginn and Company, 1939) p. 374.

one who "speaks and understands" the language of form, these hypothetical lines are very much in evidence. This is one of the underlying principles, that, though intuitively done by some, are natural influences moving through that intuition.

Overlapping of form. In considering the problems of overlapping it depends upon what the artist wishes to do. If the need is for repose and resolved order, the overlapping must be done so that a sense of accordance between the two is achieved. In Figure 26, the form a has the largest part of its area within the limits of b. The points at which the two forms intercept each other create upon them a sound proportional relationship. Not only are the forms at rest with each other, but their relation is at the same time interesting and balanced.

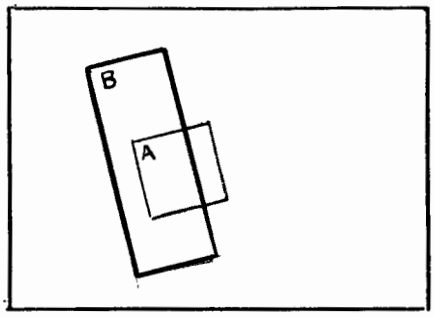

Figure 26.

If it is a matter of movement or of directing attention to a point, an unresolved coaptation may be used. In Figure 27, form a is moving out from form b or moving into it. It is not at a point of repose, even though from the standpoint of design proportion it is sound. In some forms of design strong movement is needed and this is one means of achieving it. An example of this can be found in the designing of motor cars in which the appearance of streamlining can be accentuated by such suggestion of moving form.

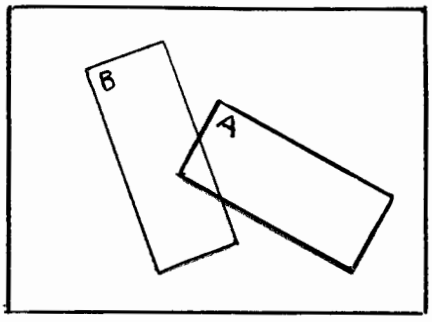

Figure 27.

Relationship of size. Variation can be achieved whether the objects are similar or not. A design in which all the objects are of the same size lacks movement. The eye moves from small things to large ones or from large through stages to small objects. Repetitiousness of form lacks this movement that is attainable by variation. In Figure 28, there is only the repetition of the same object in space. It is like polka dots, and become a form of textured effect. In Figure 29, there is variation in size; therefore, variation in the space around them. The movement from one form to another, according to both their placement in relation to each other, and the relation of size to each other, is comparable in music to a theme and variation in which variations are made on one tune. There are two sets of movement taking place.

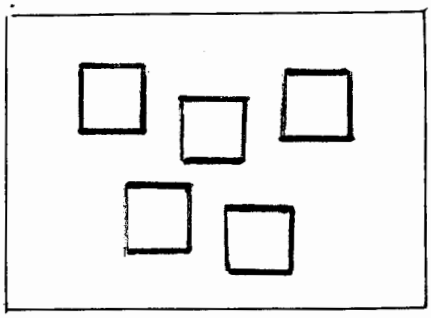

Figure 28.

This gradation must be kept within bounds for if the transition is too great, some of the carrying quality from one form to another will be lost as in Figure 30 on the next page. Here again the "first law" of design is used; that variation that is strong but not too strong, that clarity between objects, and their coordinate relationship, contribute mutually to the other.

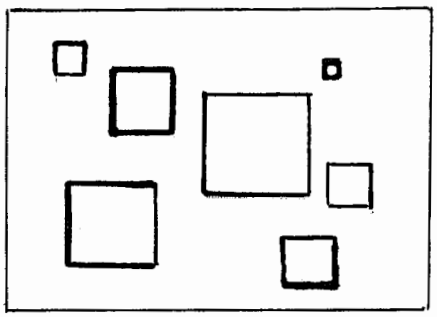

Figure 29.

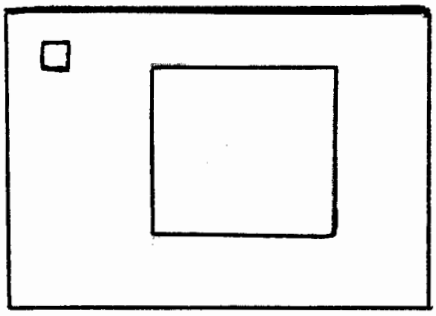

Figure 30.

In this figure, the object a is far more related to the outside area than it is to object b. Therefore, b has little or no notability. Surely it has little influence on a, and a has no relationship to b because of its closer relationship to the area by which they are confined.

Collective relations of forms. The relationship of the forms collectively, to the space, involves an understanding of the history of design and its transition from a perfect balance concept to the offset balance idea. Design, at some periods in history, and in the one preceding the modern movement, has been limited to the balance of equal content. Modern design is based on the belief that the sum total of the variation of form, line, color, tonal variation, texture, and direction be resolved into an overall sense of balance and order. This is a much more difficult procedure. In the older formal balance as long as the two sides were equal the respective sides themselves had little cause to be controlled. A sense of unity was obtained by exact repetition in reverse. For example in Figure 31, both sides are the same. Neither side alone accomplishes anything. It is only by the process of repetition that it has strength. This does not mean that everything done in this manner is wrong. Some forms of artistry and industrial design such

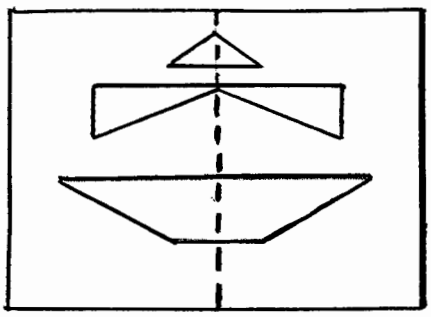

Figure 31.

as pottery and vehicles require a duplication but each part is within itself handsomely proportioned.

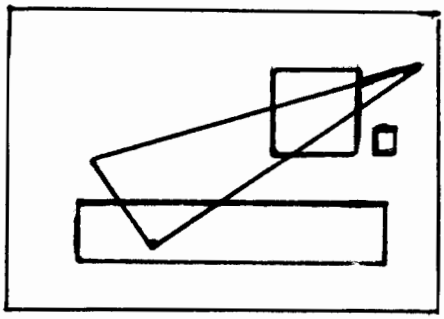

Figure 32.

In Figure 32 off-balance is carried too far and nothing but overweight is achieved. Here is another place in which feelings are imposed on symbols. A form drawn on paper gives the impression of having weight. The combination of suggested weights should be equal. It can be compared to children on a teeter-totter. Not only the weight of the object but the distance it is from the focal point of the design is important. If the children are of equal weight they sit at equal lengths from the support to their board.

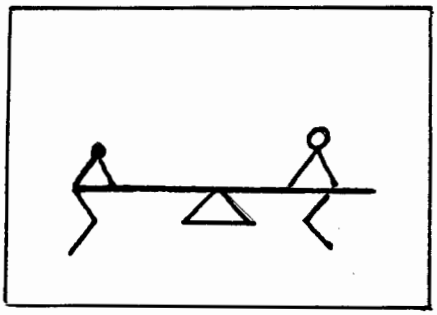

Figure 33.

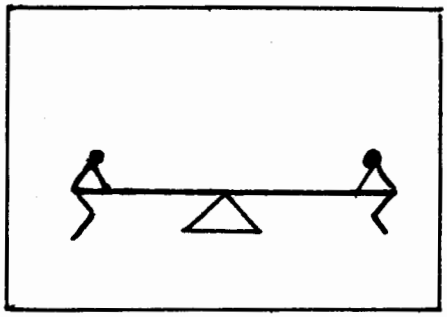

Figure 34.

But if they are of unequal weight, the lightest of the two must be at a distance from the center enough greater than the distance of the heaviest child, to compensate for the first one's lack of pounds. So it is with forms. It does not matter if they are not the same shape, color or texture, but the total effect must balance. Color density, and the roughness or smoothness of texture add to the feeling of

weight. These will be taken up subsequently. In Figure 35 the total area of the forms a, b, and c equals the area of the form d. This is accomplished not only by the area but by the placement of the line f-g. If a triangle other than an equilateral one had been introduced, the force of the direction of line would have had to have been considered. This will be discussed under the subject of triangles.

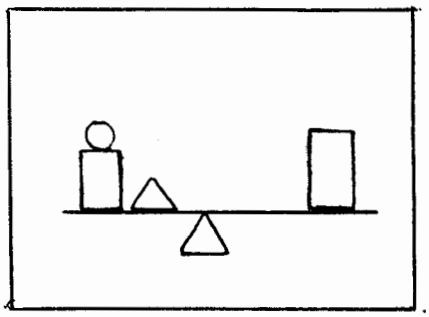

Figure 35.

The physical force that is a parallel to the effects of balance in design is that of torques and levers. The following material of Stewart's should be understood.

> Whenever a force tends to produce a rotation there is a torque. . . .In producing rotation about an axis, we learn from experience that a force increases in effectiveness when we apply it farther from the axis. When two torques acting on a body are equal and opposite in direction they are in equilibrium—there is no tendency to produce rotation. The first condition of equilibrium is that the vector sum of all the forces acting on a body must be zero. The second condition of equilibrium is that the sum of the torques about any axis in the body must be zero.

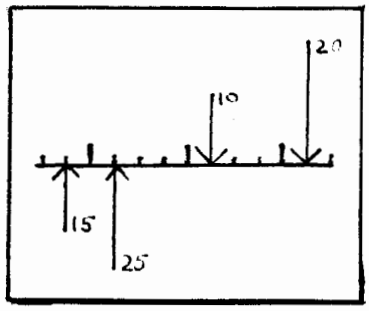

Figure 36.

To solve the problem in Figure 36 it will be seen that:

20 x 5	=	+ 100
10 x 1	=	+ 10
15 x 4	=	- 60
Sum	=	+ 50

So an added torque of -50 is needed in order to produce equilibrium. Since the force needed is 25 pounds and must be upward it would need to be at a distance 2 from the left of the axis.[1]

---

1. Oscar M. Stewart, Physics (New York: Ginn and Company, 1939) p. 72.

Squares. A square has properties that belong to it alone. Like the circle and the equilateral triangle it is self-contained. It gives a sense of completion that the oblong does not. It is resolved to its final state. Its four equal sides resisting gravity and its four right angles resisting change give it a symbolical nature of absoluteness. It is, though, a finite absolution because it begins and ends. It sets up no pattern of motion of itself.

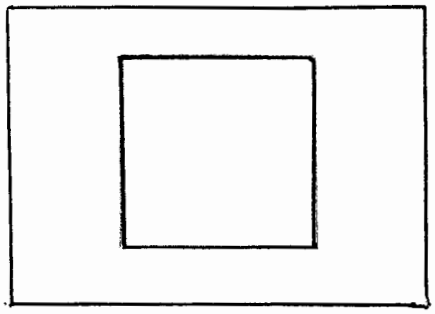

Figure 37.

The square when used with other squares and in relationship to oblong space adheres to the same principles as the oblong. It is affected by the basic law of the "first law" as other forms break into it or it is imposed on them. Its relationship in position to the basic space is also controlled by the "first law."

The self-containment of the square is in some degree a magnetic factor because unresolved oblong forms being used with it have a tendency to seek their own resolution to basic form in the square. In this case it would be the square. This will be discussed in more detail later on the subject of resolution.

Because of the above-named qualities of a square it is very difficult to use it correctly in design without knowing the basic nature of it in comparison with others and what it will do to other forms.

The circle. The circle is the most dynamic of all geometric form. Its power comes from the fact that it neither begins nor ends. It is a symbol of infinity. Like the square it is unalterable. There is only one kind of circle or square in the second or third dimension. Except for the equilateral triangle all other forms in the second dimension are changeable. This unchangeable characteristic contributes to the force of the circle. It can never be parallel to any form, nor can it be influenced by them when used in its entirety. Parts of the circle suggest the whole and though not as strong have much the same effect on other forms. It is particularly interesting to note with regard to the matter of circles that Lincoln Barnett says, "In the Einstein universe there are no straight lines; there are only great circles."[1]

The division of space made by a circle sets up a motion that never stops and affects everything within its scope as its self-motivating vibration evolves into infinity. The impression that a circle gives of escaping its boundary into larger and larger circles is shown in the effect caused by a rock in water setting out pulsating waves of expansion. It also may be compared to man's reaction to centrifugal force as shown in Figure 38.

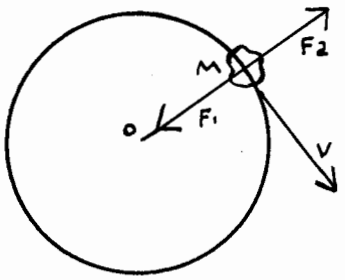

Figure 38.
M - the string
F^2 - the force on the string
F^1 - force of string on rock
If the string breaks, the force V separates it into a larger arc.[2]

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1. Barnett, op. cit., p. 104.
2. Stewart, op. cit., p. 84.

The circle when used with another geometric form tends to break away from the limitations of the lesser form. By lesser is meant a form that is not resolved to its elementary form. If the circle is used with an equilateral triangle or with a square the effect is not so great, the only greater force of the circle being that it has no beginning or end. Figure 40 shows how a circle acts against unresolved form, and Figure 39 shows it with a square.

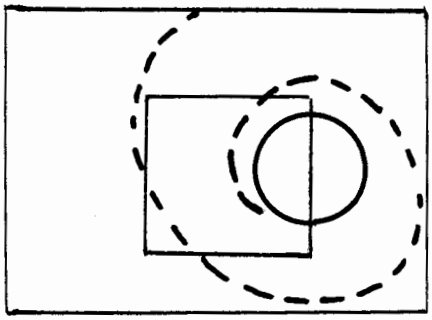

Figure 39

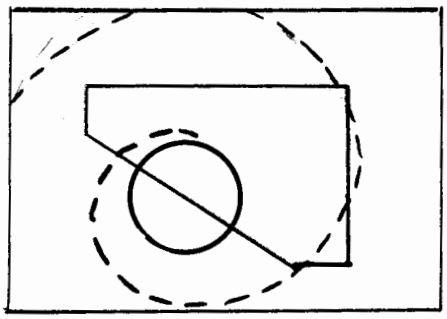

Figure 40

When considering the circle with other forms it must be remembered that every force has an equal counter force, as used in a jet engine. The very force that goes out also comes in. The circle in a design can draw things into it. If a design is weak a circle within it does not affect it as much as in a weak one, where there is no resistance built against it. Again there is a relationship to what Einstein says of the gravitational field.

> It should not be thought that Einstein's theory of gravitation is only a formal mathematical scheme. For it rests on assumptions of deep cosmic significance. And the most remarkable of these assumptions is that the universe is not a rigid and immutable edifice where independent matter is housed in independent space and time: it is on the contrary an amorphous continuum, without any fixed architecture, plastic and variable, constantly subject to change and distortion. Wherever there is matter and motion, the continuum is disturbed. Just as a fish swimming in the sea agitates

> the water around it, so a star, a comet or a galaxy distorts the geometry of the space-time through which it moves.[1]

Though this theory cannot actually be applied to design as such, an analogy can be made. A form alone is different when it is used with another form. The same form takes on a different feeling as it is used with a variety of other forms. The reason for this is that it reacts differently in each different situation. Also the effect on the space around a form is changed as the form charges or quiets the atmosphere. For example, the space around a composition made up entirely of squares is different from one made up entirely of triangles. The space around a combination of forms is still different.

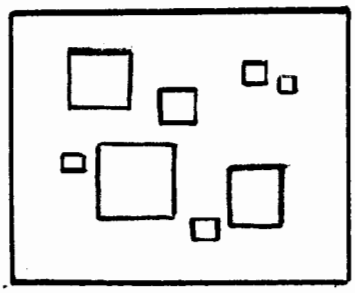

Figure 41

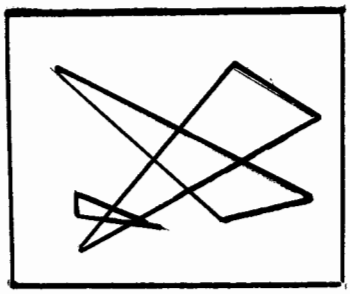

Figure 42

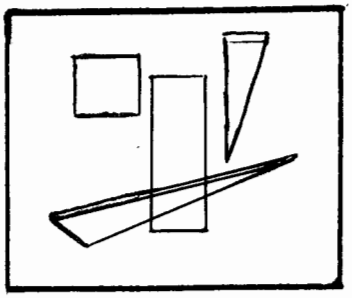

Figure 43

What man does and creates and feels in design is in most ways related to cosmic action and reaction, much of which is just beginning to be understood. Since the law of gravity has so much to do with effect on design it might be speculated as to what will happen to it as the understanding of that force is unfolded.

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1. Barnett, op. cit., p. 92.

At the present time scientists believe the universe to be limited, yet such a symbol as the circle is symbolical of a concept of infinity. It is said that the late James Jeans said that all scientific research is subjective. If so then the sensitive artisan moving creatively among principles he discovers is also a scientist.

Triangles. Triangles have different characteristics than the other geometric forms. They adhere to the law of line only as other forms overlap them, as they overlap other forms, or as other forms are parallel to one side of them. Each kind of triangle has individual properties so each has to be analyzed separately.

Equilateral triangles have some of the properties of squares and circles in that they are complete, are resolved to their elementary condition and have the greatest strength of their kind. The fact that all three lines and angles are equal to each other gives the equilateral triangle its strength—strength against interference and against the force of gravity. The direction set up by the sides, and with consideration of the fact that all three are pulling at a constant force, a circular motion is suggested. An example of this is the Fourth of July pin-wheel.

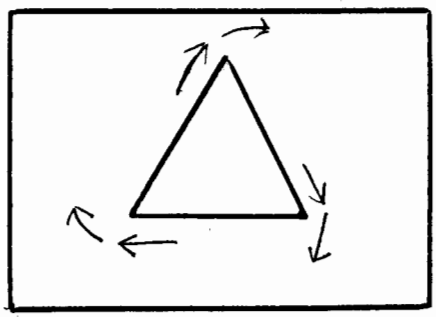

Figure 44.

Isosceles triangles, those with two sides and two angles equal, have strength against gravity when the two equal angles and unequal side are used at the base. When this is not done, and the angle rests on one of its equal sides it lacks the anti-gravical force that it has the other way; the longer side taking the most force. Its line movement is counter-acted by the base with a neutralizing effect.

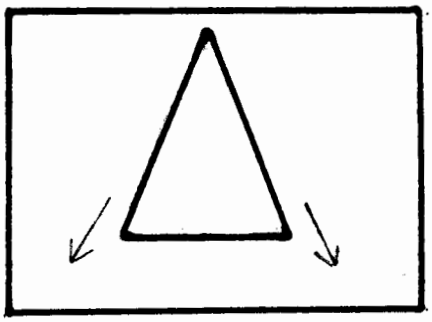

Figure 45.

The obtuse angle is related to the isosceles, when it has two equal angles as well as the one that is larger than a ninety-degree angle. Out of it can be made two right angles which also give it the characteristics of right angles. When it does not have two equal angles it is related to the scalene triangle and has far different characteristics.

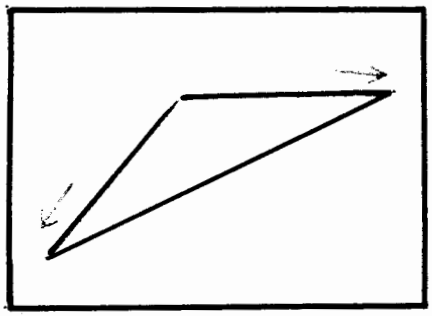

Figure 46.

Right triangles, those with one ninety degree angle have little movement to them. The solidarity of the 90°, a symbol of solidarity and strength, counteracts the movement of the other angles.

Scalene triangles are the most dynamic, because they have the most movement to them, and have the least restraining force. They are

triangles with no equal sides and no equal angles. The triangle points in the direction of its longest line, combined with the force of direction of the second longest line and the effect of the shortest. It is also affected by the angle in which it lies in relationship to the force of gravity. It is these combined forces that give angles their force of line and direction, and the factor that must be considered in design.

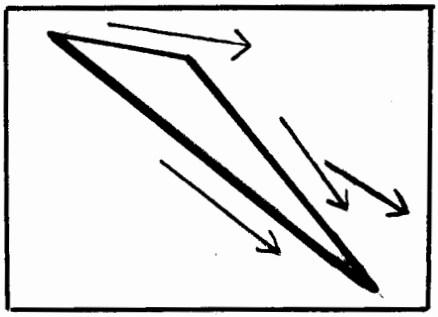

Figure 47.

Since most design is in some way related to oblong form the reaction of angles to such form must be considered. The obtuse and scalene triangle are much stronger counter forces to oblongs than other triangles. The reason for this is that they have no relevance to the oblong except as one of their sides might be placed parallel to the sides of the oblong. Right angles, used even with no parallel to the oblong, have a strong relationship because both forms have a right angle. Because the form that relates them is one of the strongest in the symbolism of design, their cognation is quickly felt. The obtuse, the scalene and the equilateral do not have this relationship. The equilateral has more relationship than the scalene because it is one of non-moving forms, as is the oblong. Its circular motion would not be applicable in this situation.

By showing the angle direction in the following drawings, it will be seen why some angles have more direction than others.

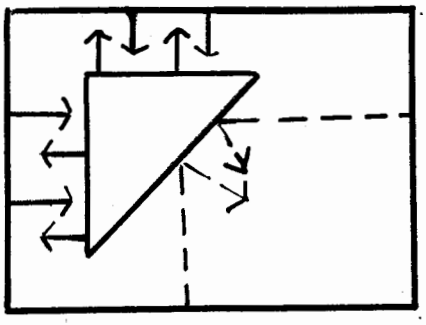

Figure 48

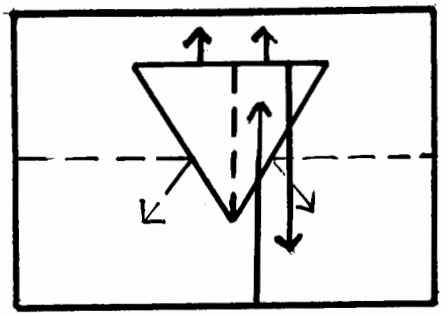

Figure 49

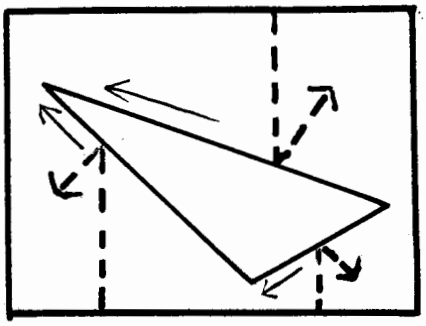

Figure 50

Free Form. Free form is probably the most poorly used of the types of form. It has been believed that free means unrestricted. Throughout all human experience it is found that real freedom comes when strong structure and a sound principle are used to develop that freedom. In the use of non-geometric form without principle, whether it be traditional, primitive or contemporary, a weak ornamental effect is all that is gained.

In Figure 51, there is no semblance of its being designed according to principle. It has no relationship of basic sizes, no balance and counterbalance. It has just grown without reason.

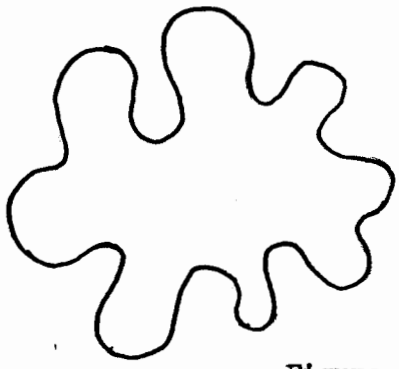

Figure 51.

Traditional form is usually based on exact repetition as its structural basis. This structure was used in both its functional and ornamental capacity. For example the Sheraton leg[1], the Hepplewhite chairback in figure 53, or the Italian seat[2] in Figure 54.

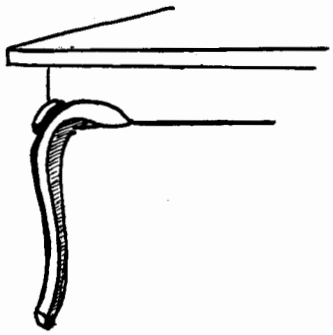

Figure 52

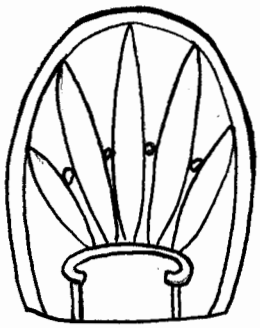

Figure 53

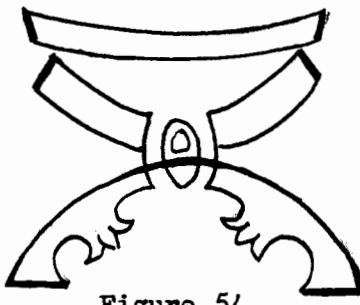

Figure 54

These examples are well designed on each side, but the coordinating factor is the use of repetition.

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1. Joseph Aronson, The Encyclopedia of Furniture (New York: Crown Publishing Company, 1938) p. 67.

2. Ibid., p. 62.

Primitive design, has been done almost always from the standpoint of intuitive feeling. It is true though that the design is much stronger in message and appeal as it uses the bases of design principle, even if the individual painter was not conscious of the rules he was using. In the next two figures are shown two examples of Indian design. Number 55 is strictly ornamental but Figure 56 has dynamic feeling due to its offset balance. It is taken from the Painted Rocks State Park in Yakima County, Washington.

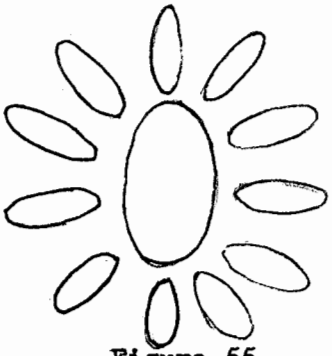

Figure 55

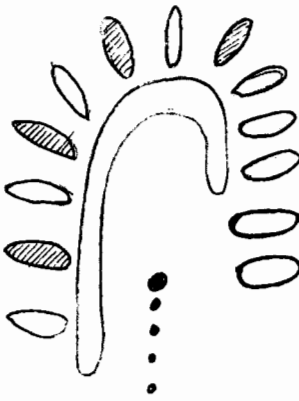

Figure 56

Derived form is taken from an object in nature and used as the form of ornamentation or object, such as the Georgian use of the lion's claw holding a ball used as the foot of a chair table or sideboard or as the Tudor Rose used in repetition.

Free form as used contemporarily may have structure. It must have it to be either functionally or artistically strong. A free form may be created in the following manner.

Its structure must be designed through the use of:

a. Variation in line direction.

b. Strong proportion according to the first principle.

c. Off set balance of large areas.

d. Relative size of areas.

Figure 57 shows how this is done.

a. Each line is a different length. They are broken up according to the "first law."

b. Breaking up of overall space in relationship to the area in which the free form is to be contained.

c. Balance of relative size of major areas A and B.

d. Balance of line direction which will later effect the free form.

e. Freedom from parallel lines—or a dominance of such.

f. Analysis for beauty and grace, according to individual experience.

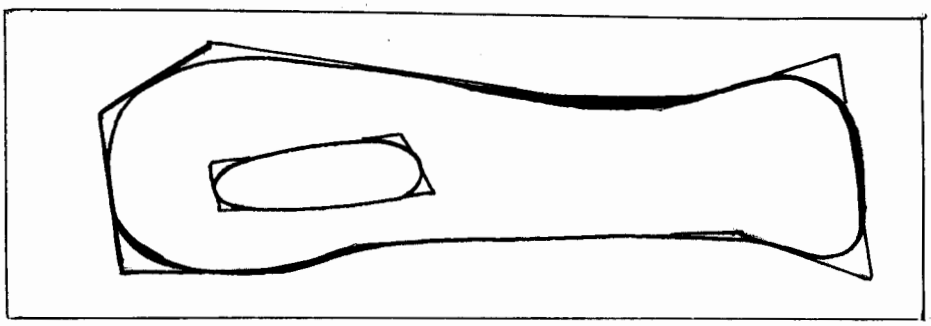

Figure 57.

Only when forms are built, are they based on principle and have structure. After much practice the mechanical procedure can be discarded for the individual is then trained in both structure and drawing to a point where he can work freely. It is comparable to the process of learning to draw in perspective. A student needs the lines to vanishing points, the horizon line, et cetera, to help him see what

happens as he sees in the third dimension. Likewise a student of form needs to know the structure of form. It is not just a wiggly line.

Free form is the most challenging of all the kinds of form. It is the easiest in which to be deceived and the most difficult to use. In the section on resolution of form which follows, this problem will be explained.

When used together with other free forms the following considerations should be made:

1. There should be a variety of kind of free form.
2. Variation in size.
3. Dominant lines of each form should be drawn to see if they are counterbalanced as in Figure 58.

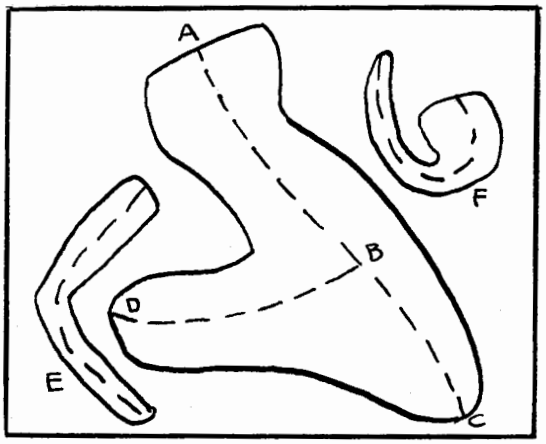

Figure 58.

4. They be spaced so that the general spacing be in accordance with the "First Law."
5. The second law is applicable in the relation of one shape to another by using the dominant line of the form. In Figure 58 line abc is more dominant than line bd, but bd is more directly affecting form f, so it would be the bd length that would be used to judge if the shapes were within range for effective relationship with each other.

Resolution of form. There are many examples in biology, chemistry, hydraulics, and psychology of a tendency in nature of things to return to their primal or elementary state or position. It is the author's belief that various kinds of form symbolize a tendency to resolve to their most stable and unmovable form.

There are three forms that do not suggest the need to resolve. They are first the circle and then the square and equilateral triangle. The circle, as has been said before, represents immovable infinity. The square and triangle represent limited immovability. All other two-dimensional form resolve to these three. When an unresolved form is used with a resolved one the former seems to be attracted to the latter. The unresolved form is an alteration of the basic form. By the power of the change that has been made upon it, it cannot return to its former state, but there is still the drive to do so. It must again be pointed out that this is another situation in which activities in nature are impressed on symbols. It is the same relationship which the sound "ouch"--written, spoken, or felt--has to itself.

The triangles that have an angle larger than ninety degrees have resolvant tendencies towards the right triangle; those whose angles are less than ninety degrees to the equilateral.

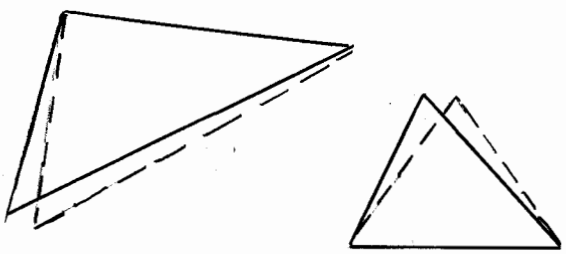

Figure 59.

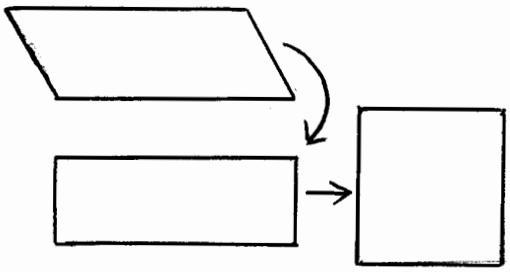

Figure 60.

The parallelogram in all its forms would resolve first to the oblong with its stronger structure. This is only an intermediary change as the oblong would change to the square of equal area, which is its closest relationship to an absolute in form.

The counter activity between these forms, the relative and the absolute form is one of strength from the resolved one acting on the weakness of the unresolved.

The free form would resolve to the circle. It has the greatest chance of doing so because of its freer nature, suggesting movability. It would resolve to a circle of the same overall area. The free form suggests that it is a variation of the circle originally and so is only a state of its form and not derived or directed to a form. When circles are used with free forms this variation factor is emphasized. Figures 61 and 62 are examples of free forms used with and without the circle.

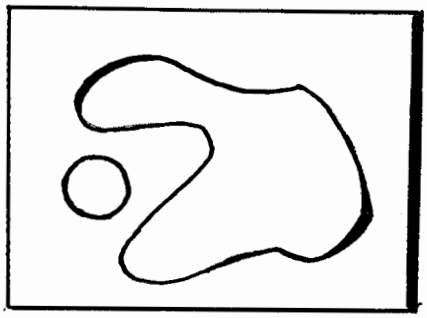

Figure 61.

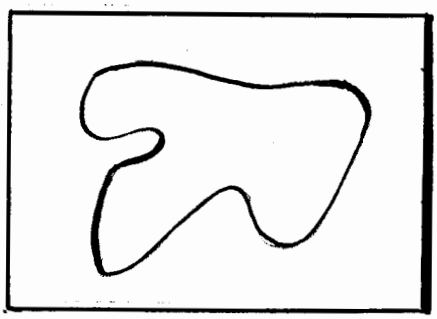

Figure 62.

In Figure 61 the free form is definitely attracted to the circle, even though it is of much smaller size. In Figure 62 the free form is undisturbed because the factor of resolvancy is not immediately suggested.

In the next chapter the subject of color will be added to those ingredients of design already explored.

COLOR

The subject of color has been explored far more than any of the other phases of design. Though more is known about the physics of color, the relationship of these findings to art has been little explored. The limitations of this thesis do not permit any deep study as it is a subject of its own and of great magnitude. Some resume may be made as color is used in design. The Committee on Colorimetry of the Optical Society of America reports on the degree of scientific progress in the following quotation:

> Color, the embellishment of all civilizations, a sign of their progress, and a clue to the migrations and influence of artistic peoples, provides pleasure for young and old, rich and poor, sophisticated and simple. Yet it poses problems that strain to the utmost the techniques of the most clever and baffle the speculations of the most profound: artists, philosophers, psychologists, histologists, physicists and chemists. . . It is noteworthy that color, which is such an intimate part of the experience of everyone, betrays the ever-tentative and ever-incomplete character of science.[1]

Henry N. Rasmussen defines color as "the reflected visual rays of the light spectrum. One or more of pigmentary primaries, red, blue, and yellow, or resulting combinations."[2] Color has hue,

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1. Committee of Colorimetry, The Science of Color (New York: Thomas A. Crowell, 1953) p. 44.

2. Henry N. Rasmussen, Art Structure (New York: Pellegrini and Cudahy) p. 10.

intensity and brightness. Hue is the place a given color has in relation to the red, blue, or yellow triad and the amount of each of the triad to make the hue desired, that is needed. Intensity is the amount of color or saturation of color used in a given area. Brightness is the amount of light that is shown through a given color; the degree it is lightened or greyed. It is the way in which light is shown with the artist's pigment.

Of light itself the Committee says, "We perceive the light and its characteristic blueness by the agencies of the eye and consciousness. If either were lacking, we would perceive neither the light nor its blueness. . . Light itself is part of our environment: the visual aspect of the physical agency, radiant energy."[1]

The discrepancies between pigment color and light color are very great. Each form of pigment reacts differently than the others. Oil paints have a high degree of opacity, while water color is very translucent. Rubber base paints react differently to oil base paints in the manner in which the colors react upon each other. Tempera, with its dull finish gives an entirely different effect than that achieved with the same color but with a shiny surface. This is caused by the amount of light reflection variation. Light is constant under governed situations. Most artists are using an imperfect medium to express something they have seen in color, but which has been modified by their own capacity to see, to observe, and their own individuality.

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1. Committee of Colorimetry, op. cit., p. 45.

The Combining of Color. Combinations of colors cause degrees of vibration, diminution, and contrast. Vibration is caused when two colors of mutual intensity are put together. The amount of interaction is determined by the degree of intensity. For example a strong blue-red combination has far more interactivity than pale blue-pink interaction. In Figure 63 it will be seen that the degree of reaction is quite different, depending upon the degree of saturation of the color used and the place they have on the color wheel. Analogous color has less reaction than complimentary colors. The vibration is the result of the mutual strength of the two colors forcing the eye to see the variation in the visual rays of the light spectrum.

Figure 63

Diminution is caused when two colors of unequal saturation are used together. For example, a strong blue and a pale yellow used side by side. The yellow color, as was seen of weaker form, starts an inter-reaction of draining from the stronger color, while the stronger color resists the encroachment. Neither color is the same used alone as it is used with the other. Diminution can also take place between two degrees of saturation of the same color. The degree

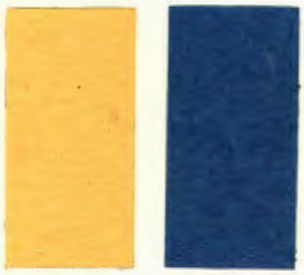

Figure 64

of variation must be quite strong to be effective.

Contrast depends more on the degree of brightness of color. A color that is reflecting a great deal of light contrasts strongly with one that absorbs light. Ralph M. Evans gives a clear example of this as used in Figures 65 to 68.[1]

Figure 65

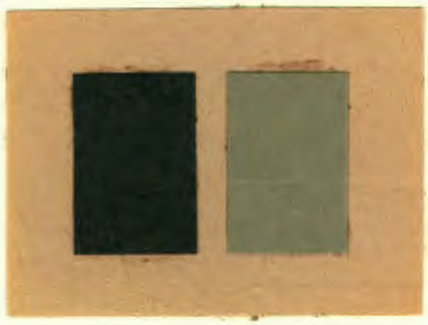

Figure 66

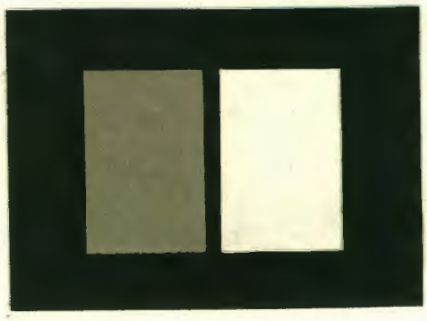

Figure 67

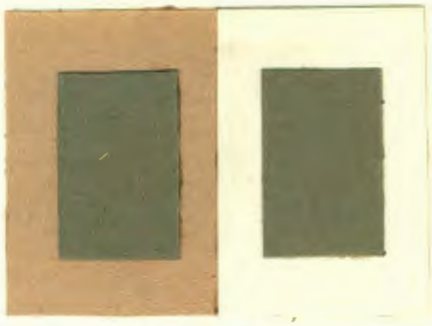

Figure 68

When the same degree of brightness is used with two different backgrounds it appears to be different itself. In Figure 68 Mr. Evans says,[2] "the two rectangular gray areas have the same reflectances (brightness constancy) although the one enclosed by the grey is seen

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1. Ralph M. Evans, An Introduction to Color (New York: John Wiley and Sons, Incorporated, 1948) p. 128.

2. Ibid., p. 45.

as the lighter of the two." This is because there is more degree of contrast involved with the gray and black than with the white. The gray is nearer to the white than it is to the black.

Figure 69[1]

Figure 70

The Committee of Colorimetry says of color and light, ". . .color is a characteristic of light and not merely a property of objects. . . color cannot be seen apart from light."[2] The figures used show that color is not red, blue, or yellow alone; it has hue and intensity, degree of saturation; it vibrates, diminishes and forms contrasts; and it is inseparable from light, both as it is seen and as man is conscious of it. Man's psychological reaction to color is another factor that must be considered, in the approach to understanding color. There is great discrepancy in terminology depending upon whether the subject is being pursued from a scientific, a psychological, or an artistic viewpoint.

Up to this time this paper has dealt with the physical properties of color as seen by man. Now it will deal with man's intuitive and

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1. Ibid., p. 164.

2. Committee of Colorimetry, op. cit., p. 44.

emotional reactions to them, how man interprets them in relationship to what he feels and knows, in relationship to art.

Ralph Wiehiser says, "Color affects you by its:[1]

1. Shape
2. Size
3. Placement
4. Recessiveness

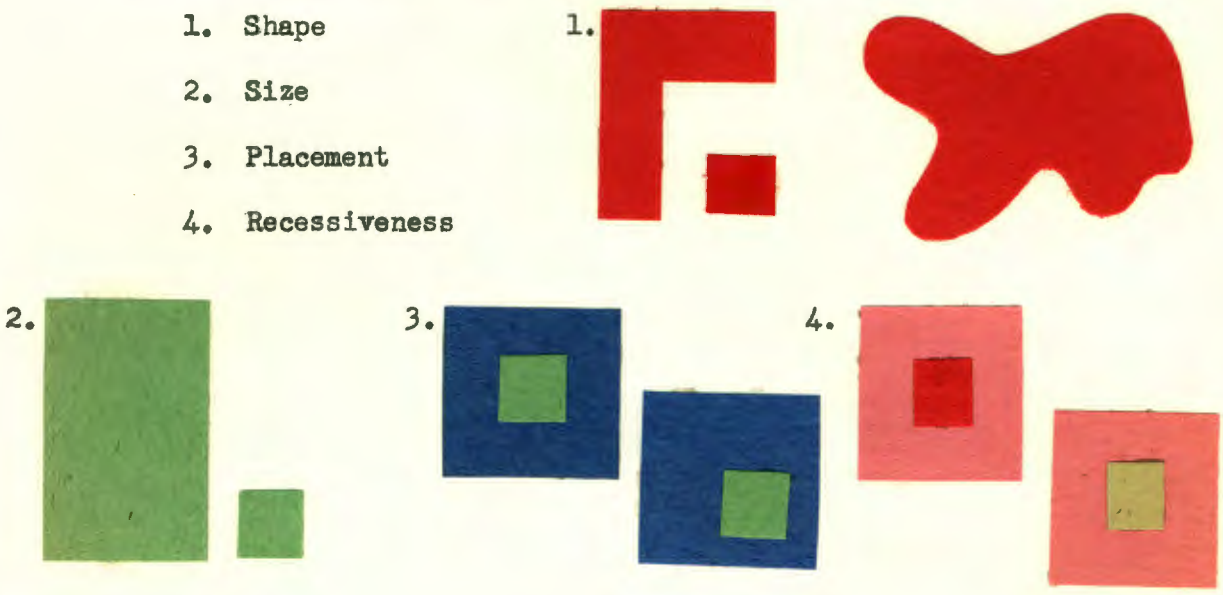

Figure 71

With reference to shape it is seen in Mr. Wiehiser's figure 1 that the kind of line that a color makes as it defines itself has an effect on the impression the consciousness receives. The color does not seem the same in the straight edged figure as in the blobish one.

The size of color is very important in design. If a very strong color such as red or chrome yellow is used in large areas the weight of the area is greater than if a less intense color is used. A design

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1. Ralph Wiehiser, Introduction to Art Activities (New York: Henry Holt, 1954) p. 117.

may be done in black and white and be in a state of great off-balance harmony, and be turned into a completely disrupted conglomeration by the poor use of color. It should be clear that each and every element of design that is being discussed is absolutely essential in its careful usage, to the completion of an arrived work of art. Color is certainly no exception.

The subject of placement is tied closely to the subject of form as it was discussed earlier. The way in which forms react upon each other is retarded or accelerated by the colors used. If the colors are ones in which there is a great deal of vibration the movement is accelerated, but if there is a quiet atmosphere between them the movement of the form is slowed down.

The subject of texture will be covered in the next section. Color is greatly affected by texture because the shadows created give the effect of degrees of saturation. The vibration is then not one of the sides of a form but taking place throughout the whole form on which the color texture is used. If two colors are used they give the effect of mixing of the two. Seurat, Van Gogh and Cezanne were the Impressionist painters who introduced the effect of light being attained by using the component parts of a color directly on the canvas in order to achieve the effect of the color without actually mixing it.

The psychological effect of color has been found to be the same

in different parts of the world and in different cultures.[1] The only difference found was that in warmer areas the reaction was stronger in degree rather than any difference in kind.

Most artists agree that colors give the following reactions[2]:

1. Pure yellow — energy
2. Red — power
3. Blue — passivity
4. Orange — as a mixture of red and yellow, combining energy and power, denotes sustained energy
5. Green — as a mixture of blue and yellow, mixing energy and passivity, denotes sustained energy
6. Violet — as a combination of red and blue, creates introspective power

These reactions to color are developed mainly through association. Would man hypothetically react to color as he does if he had never seen the yellow energizing sunshine, or the heat developing power of fire? Is the reaction to blue not an association with the calm and passive blue sky and sea? Since man lives in such a sense-perceived world and these reactions have been proven to be quite general it may be assumed that they can be considered valid. The eye sees only a small part of known light rays, so perhaps through the discoveries of science more of this world of light can be opened up for man's comprehension.

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1. Ernest Mundt, A Primer of Visual Art (New York: Pellegrini and Cudahy, 1952) p. 20.

2. Ibid.

Ernest Mundt says of these generalizations about man's reaction to color,

> These fundamental meanings become submerged when we mix the hues with black; attenuated when we add white; and neutralized when we mix them with each other. . .we rarely have occasion to use one hue alone. Just as with music, where we do not react to a single note but to the melody or chord of which this single note is a part, we react to color in the form of a composition of hues.[1]

This is the manner in which an artist can create a mood or feeling in a composition. It may be violent and tempestuous by the use of color, or it may be placid, calm, and tranquil. The warm colors seem to come forward and the cool colors appear to recede. This too may be a matter of association. The warm sun, the hot fire, actually affects man physically while the cool of sky and sea recede.

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1. Ibid., p. 21.

TEXTURE

Texture, as used in two dimensional design, is created by the handling of the medium in such a manner as to suggest third dimension. Janet K. Smith defines it as "the particular characteristic arrangement of make of the surface structure of an object or material. Refers to tactile sensation, real or imagined. It may be a purely visual illusion of texture. The surface quality of a kind of material."[1] This is possible in all two-dimensional art forms, painting, printmaking, designing. It is a process of giving the visual impression of a tactile experience. It is problematical as to whether or not an individual, who had never experienced the feeling of textures, would be able to see them, as they are meant to be seen, in a printed or painted impression. "Is the transfer from tactual to visual impression necessary to give the 'feeling' of texture from the visual stimulus?"[2]

Textures have several purposes; they enrich color, suggest third dimension to form as a means of shading, give depth through textures intrinsic dimensional quality (real or suggested) and darken areas by shadow effects. The subject of color enrichment by texture was covered in the section on color itself. It gives color depth and variation as well as modeling form.

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1. Janet K. Smith, A Manual of Design (New York: Reinhold Publishing Corporation, 1952) p. 171.

2. Ibid., p. 171.

Shading through the use of texture is achieved by lightening the technique in a given direction to achieve the form desired. Figure 72 is an example of how it may be used.

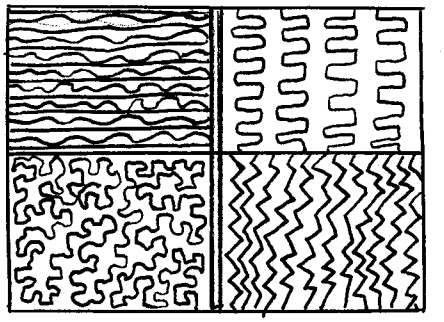

Figure 72

Any texture suggests that the surface has a certain amount of depth. Even marble, which feels very smooth, looks as if it had more than one level to its surface. What is actually done on the surface is smooth.

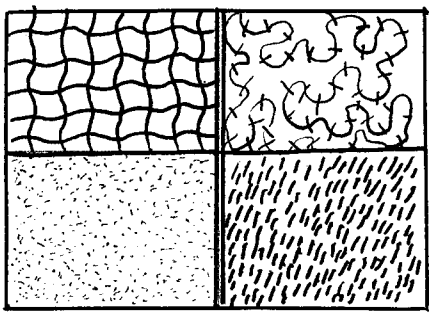

Figure 73

Another form of texture is the actual construction of the texture through pigment, introduction of foreign material such as sand, or precipitated chalk, and the use of materials themselves as a means of creating design composition.

Texture, like all the other forms of design, must be balanced with off-set relations. Dominance of texture must be counterbalanced with plain areas. The rougher or deeper texture needs the compliment of the smooth surface. In the same manner that a well-adjusted satisfying design may be ruined by the improper use of color; so the over-use of texture can through the delicate balance of form, line, space and color, throw it off enough to make the subject dissatisfying.

It is comparable to an interior in which the details of balance, composition, color harmony and spacing were beautifully balanced; but in carrying out the interior designers' instructions, the owner used prints, stripes, and dots on everything in the room. Even if the colors were completely correct, the room would be changed from one of restfulness and repose to a jangling, counteracting jumble; completely hiding the good design that had previously been done.

The degree of intensity of texture must also be balanced in order to stay away from either a monotonous sense of too much texture, too much of the same texture, or too much of the same intensity of surfacing. Intensity means the degree of roughness. An egg has a very subtile texture, whereas toweling is very obvious.

Although texture is used with other forms of design more directly than any of the others, it, like space, is independent in function. Space, which will be discussed next, is entirely dependent on the other elements of design for its existence.

SPACE

The subject of space in the study of design calls for some understanding of the theory of space in physics. The writer of this paper is convinced that man derives from the nature of the universe, basic, intuitive feelings that he has by reason of being included in the universe. These feelings are not the result of the educated sense testimony but are revealed to man as he throws off the limitations of his inherited thinking and feels his way into understanding of himself in relation to the universe. Einstein says of space, "Space has no objective reality except as an order or arrangement of the objects we perceive in it, and time has no independent existence apart from the order of events by which we measure it."[1] That space cannot be completely separated from the other elements of the universe is shown when Lincoln Barnett says of his theory:

> In our minds we tend to separate these dimensions...time and space...we have an awareness of space and awareness of time. But the separation is purely subjective; and as the Special Theory of Relativity showed, space and time separately are relative quantities which vary with individual observers. In any objective description of the universe, such as science demands, the time dimension can no more be detached from the space dimension than length can be detached from breadth and thickness in an accurate representation of a house, a tree, or Betty Grable.[2]

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1. Barnett, op. cit., p. 21.

2. Ibid., p. 76.

It may well be asked of Mr. Barnett's comparison if a tree or a house or even Betty Grable can be adequately described within the dimensions of length and breadth. Surely Miss Grable likes to think of herself as existing in time. The question can be asked, can anything be adequately described without taking into consideration the fourth dimension of time. Marcel Duchamp's painting of the Nude Descending a Staircase,[1] is a clear example of early comprehension of the time-space relationship. It was painted in 1912; Einstein's first publication of his theory of relativity was in 1905.[2] But even previous to Einstein's paper, William Busch did a cartoon, "Finale Furioso,"[3] showing the time-space effect of a conductor. Contemporary artists no longer deal with the "surface appearance" for they, like the scientists, are seeking a deeper reality.

The importance of this in relationship to the study of space in design is to see that forms cannot be defined without space, and space has no meaning without form to identify it. Then it may be assumed that neither can exist without the other. Will they be proved to be inseparable as time and space, and man's sensory separation of them be wholly subjective?

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1. Alfred H. Barr, Jr., What is Modern Painting? (New York: The Museum of Modern Art, 1952) p. 32.

2. Barnett, op. cit., p. 13.

3. Herbert Bayer, "The Way Beyond Art." (New York: Wittenborn Schultz, 1947) pp. 120-121.

The physicists admit of a great gap between what the senses see and what science proves of the universe.[1] When it is proven, and it is the opinion of the writer that it will be--that what is seen with the senses is what is known--that no amount of seeing without knowing will make anything understandable and that this gap of separation can ultimately close. For example, in the realm of modern art, the layman cannot "see" "Girl With Mirror" by Picasso.[2] He rebels at it. He hates it because he cannot understand it and because it is an affront to his so-called intellectual dignity. He sees no expression of time-space relationship, nor psychological implication. He is not developed enough to see the basic art structure. He cannot see what he does not know. There is very little difference between this analogy and one that might be made between an aborigine viewing a cyclotron--the worlds do not meet. Is the gap any greater or more formidable than the one of science and the one of the sense testimony? It would not be considered a complete impossibility to bring the average man to the point of understanding Picasso, or the aborigine to be educated to a point of comprehension that a cyclotron was not just an unnamable thing.

The limitations of the physical medium of seeing are for most beneath any comprehension of "seeing" what Einstein is discovering.

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1. Ibid., p. 123.

2. Barr, op. cit., p. 30.

It would be interesting to know what the master physicist himself "sees" with his physical eye when his "mind's eye" goes so far. Perhaps the limiting factor of not believing that such things can be seen is wholly the cause of such limitation. Plato said, "The prison house is the world of sight."[1]

Mr. Barnett says further:

> Man's inescapable impasse is that he himself is part of the world he seeks to explore; his body and proud brain are mosaics of the same elemental particles that compose the dark, drifting dust clouds of the interstellar space; he is, in the final analysis, merely an ephemeral conformation of the primordial space-time field. Standing midway between macrocosm and microcosm he finds barriers on every side, and can perhaps but marvel, as St. Paul did nineteen hundred years ago, that "the world was created by the word of God so that what is seen was made out of things which do appear.[2]

The Barnett quotation does not say from what version of the Bible he is quoting St. Paul, but the King James Version gives a different meaning that is actually more understandable in relation to the subject being discussed. It says, "Through faith we understand that the worlds were framed by the word of God, so that things which are seen were not made of things which do appear."[3] This could be interpreted to mean that the things that man sees with the eye are not made of the things (the basic motivation) of the universe which do appear, a fact that the physicist is faced with today. But this does not disprove the writer's

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1. Plato, quoted from Barnett, op. cit., p. 123.

2. Ibid., p. 127.

3. The King James Version, The Holy Bible (London: Oxford Press) Hebrews 11:3.

conviction that as the physical factor of seeing is governed by knowing, and as the limitations to sight are broken down, man will be able to comprehend visually "the things which do appear."

From the above discussion of the factors involved in thinking of the quality "space" it is seen that space can no longer be considered as the area around an object. Artists must become more and more conscious of the fuller implication of all that they are doing in relation to the discoveries of modern science. They must see the components they use in their universal implication in order to keep in step with progress.

CONCLUSION

Art is not a separate entity from life. Art is a part of life. In the not-too-distant future, design which is the principle of art, and the sciences will work together to discover the truths of existence. That thinkers in the field of design must be prepared is most necessary. They must expand their horizons beyond the limitations of their greatest interest in order to integrate their experimentation with the rest of the progressive activity of mankind. Think what a momentous surge of progress could be made today if knowledge between the sciences were to be integrated. It would cause an individual and collective resurgence amongst them that might solve many problems that each alone are struggling to solve. It is prophetic that men of the intellectual and philosophical stature of Einstein, Jeans, Eddington, and Millikan are looking beyond their own field of physics to see what value their work has in relationship to the social and economic progress of the human race.

A theory of training for art educators, for designers, industrial, architectural, and artists, and for the educated citizen, should include all the facets necessary for complete awareness of the scope of the field. The basis of this theory is that the following considerations must be included in such training:

1. That art is a contributor to the whole design of life; that without it self-expression in life would be incomplete; and that without the expression of individuality man loses his raison d'etre. In other words art is not only a contributor to life—it is imperative for life.

2. That research in design is as important in the search for finding the basic truths of the universe as it is in the realm of physics. It has too long been considered a part of the so-called unscientific fields. During the last twenty years the sciences have discovered how much they don't know. It is time that the arts gained their respected place.

3. That the relationship between what man knows of the universe and what from this knowing he imposes on design symbols must be thoroughly explored. As new concepts in physics are discovered the corresponding effect on design must be investigated.

4. That the balance and relative importance of creativity, technique, and principle, must be maintained either simultaneously or in sequence.

5. That creativity without principle is not art. That principles and techniques without the creativity of self-expression can never produce true art value.

6. That the art teacher must be an artist-teacher; that teaching is a creative process, and only one who has explored his own capacity to create can inspire it in others.

7. That the artist-teacher must be alert and aware of progress in all fields of human progress. That he may not live a life apart.

8. That the boundaries that segregate parts of art from each other are only the result of traditional belief and circumstance, and are not necessarily valid in contemporary living and expression.

9. That all art is the result of design, whether it be in the crafts, the fine arts, in commercial, architectural or other arts arising from the productivity of the age.

10. That teaching design and designed art can be one of life's most stimulating, rewarding, and expanding experiences, because the teacher not only teaches art, but integrates it with all other learning. He enables the individual student to find himself in his own self-expression and he raises the general taste in the community in which he works. That more such teachers are needed can be answered by just looking around to see the vast amount of work that needs to be done in this regard.

This thesis will end with the writing on the works of Albert Einstein by Lincoln Barnett who says:

> Ultimately the features of the universe distilled down to a few basic quantities--space, time, matter, energy, and gravitation. But in Special Relativity, Einstein demonstrated the equivalence of matter and energy, and in General Relativity he showed the indivisibility of the space-time continuum. The Unified Field

Theory now culminates and climaxes this coalescing process. For from its august perspective the entire universe is revealed as one elemental field in which each star, each atom, each wandering comet and slow-wheeling galaxy flying electron is seen to be but a ripple or tumescence in the underlying space-time unity. And so a profound simplicity supplants the surface complexity of nature. The distinctions between gravitational force and electromagnetic force, matter and energy, electric charge and field, space and time, all fade in the light of their revealed relationships and resolve into configurations of the four-dimensional continuum which is the universe. Thus all man's perceptions of the world and all his abstract intuitions of reality merge finally into one, and the deep underlying unity of the universe is laid bare. . . The urge to consolidate premises, to unify concepts, to penetrate the variety and particularity of the manifest world to the undifferentiated unity that lies beyond is not only the leaven of science; it is the loftiest passion of the human intellect. The philosopher and mystic, as well as the scientist, have always sought through their various disciplines of introspection to arrive at a knowledge of the ultimate immutable essence that undergirds the mutable illusory world. More than twenty-three hundred years ago Plato declared, "The true lover of knowledge is always striving after <u>being</u> . . . He will not rest at those multitudinous phenomena whose existence is appearance only."

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1. Barnett, <u>op. cit.</u>, pp. 121-122.

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