

from:  
Laszlo Moholy-Nagy, "Vision in Motion"  
Paul Theobald, Chicago, 1947.

## **introduction**

To state the case is almost too simple:

The industrial revolution opened up a new dimension—the dimension of a new science and a new technology which could be used for the realization of all-embracing relationships. Contemporary man threw himself into the experience of these new relationships. But saturated with old ideologies, he approached the new dimension with obsolete practices and failed to translate his newly gained experience into emotional language and cultural reality. The result has been and still is misery and conflict, brutality and anguish, unemployment and war.

Emotionally most people live within the old dimensions of anachronistic fixations, tribal prejudices. They are immune against any suggestion for a better use of their resources because in our verbalistic society all such arguments can be answered by counterarguments for the preservation of the status quo. What is needed is a rediscovery of the elements of existence, work, recreation, and a fearless demonstration of their fundamentals relative to our time without paralogy. We have to free the elements of existence from historic accretions, from the turgid symbolism of past association, so that their function and effectiveness will be unimpaired.

Theoretically, man is the sum total of his psychophysical, intellectual, and emotional potentialities. His reasoning power parallels the emotional forces. What he knows, he could also feel if he would train himself in both spheres. In fact, this is his historic struggle, to arrive at an integrated life in which he would function to the fullest of his capacities through a synthesis of the intellectual and the emotional,



through the coordination of penetrative thinking and profound feeling. To reach this goal—to feel what we know and know what we feel—is one of the tasks of our generation.

To achieve this integrated state there is need for a well-balanced social organization and an appropriate education; an education for personal growth and not a mere training in skills for the purpose of profit; a social organization in which everyone is utilized to his highest capacity.

In the training of the human intellect there is an official standard, comprising logical thought categories, the set mechanism of syllogism and rhetoric. But there is also a need for correlated perceptive and emotional education. This is not even yet acknowledged. At present the nonintellectual development of the individual is entirely his private affair, confined to a hit-or-miss approach. The consequence is emotional illiteracy, which means to be without compass, without assurance of feeling, in a complex, immensely extended world.

Generally, the mechanism of feeling is set in motion by a network of sensations both from within and without. The mechanics of inner stimuli is as yet unexplored, although psychoanalysis attempted revolutionary explanations about the subconscious, its traumas, repressions, regressions, and wish-fulfillments. If not sublimated or released, such psychic maelstroms become the foci of conflicts.

More is known about emotional activation from without, starting with simple sensory experiences, which serve as basic material for the externalization—that is the expression—of emotional life. Expression on a high level produces art which is the most effective agent for emotional articulation. It is a sociopsychologically dangerous mistake to allow art to be classified as remote—a luxury—a nonessential.

One of the functions of the artist in society is to put layer upon layer, stone upon stone, in the organization of emotions; to record feelings with his particular means, to give structure and refinement as well as direction to the inner life of his contemporaries. It is the artist's duty today to penetrate yet-unseen ranges of the biological functions, to search the new dimensions of the industrial society and to translate the new findings into emotional orientation. The artist unconsciously disentangles the most essential strands of existence from the contorted and chaotic complexities of actuality, and weaves them into an emotional fabric of compelling validity, characteristic of himself as well as of his epoch. This ability of selection is an outstanding gift based upon intuitive power and insight, upon judgment and knowledge, and upon inner responsibility to fundamental biological and social laws which provoke a reinterpretation in every civilization. This intuitive power is present in other creative workers, too, in philosophers, poets, scientists, technologists. They pursue the same hopes, seek the same meanings, and—although the content of their work appears to be different—the trends of their approach and the background of their activity are identical. They all must draw from the same source, which is life in a certain society, in a certain civilization. This basic identity is the common denominator, the desire



today to find and investigate the fundamentals in every field so that they can become constructive parts of a new civilization.

The problem of our generation is to bring the intellectual and emotional, the social and technological components into balanced play; to learn to see and feel them in relationship.

Without this interrelatedness there remains only the disjunctive technical skill of handling human affairs, a rigidity stifling biological and social impulses; a memorized, not a lived life. •

### **vision in motion**

*vision in motion*

is simultaneous grasp. Simultaneous grasp is creative performance—seeing, feeling and thinking in relationship and not as a series of isolated phenomena. It instantaneously integrates and transmutes single elements into a coherent whole. This is valid for physical vision as well as for the abstract.

*vision in motion*

is a synonym for simultaneity and space-time; a means to comprehend the new dimension.

*vision in motion*

is seeing while moving.

*vision in motion*

is seeing moving objects either in reality or in forms of visual representation as in cubism and futurism. In the latter case the spectator, stimulated by the specific means of rendering, recreates mentally and emotionally the original motion.

*vision in motion*

also signifies planning, the projective dynamics of our visionary faculties.

• "The head is not more native to the heart." (*Hamlet*)



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### **the function of art**

Art is the most complex, vitalizing, and civilizing of human actions. Thus it is of biological necessity. Art sensitizes man to the best that is immanent in him through an intensified expression involving many layers of experience. Out of them art forms a unified manifestation, like dreams which are composed of the most diverse source material subconsciously crystallized. It tries to produce a balance of the social, intellectual and emotional existence; a synthesis of attitudes and opinions, fears and hopes.

Art has two faces, the biological and the social, the one toward the individual and the other toward the group. By expressing fundamental validities and common problems, art can produce a feeling of coherence. This is its social function which leads to a cultural synthesis as well as to a continuation of human civilization.●

Today, lacking the patterning and refinement of emotional impulses through the arts, uncontrolled, inarticulate and brutally destructive ways of release have become commonplace. Unused energies, subconscious frustrations, create the psychopathic borderline cases of neurosis. Art as expression of the individual can be a remedy by sublimation of aggressive impulses. Art educates the receptive faculties and it revitalizes the creative abilities. In this way art is rehabilitation therapy through which confidence in one's creative power can be restored.

### **the "professional" artist**

The best representatives of the arts whether in music, poetry, sculpture, or painting, even in their single works, always express the spiritual state of the age. Today a painting or a sonata is a tightly woven fabric of which the historic warp may often disappear under the richly textured modern yarns of the weft. Nevertheless, the soundness of the weave is dependent on both. The contemporary artist organizes his work within this given historical and cultural framework, but he derives his subject matter from his social and spiritual interests. These are expressed in different periods with different means and themes, such as a still-life, a portrait, a landscape, or an

● "Culture" and "civilization" are used in this book as synonyms, though in German, for instance, a differentiation is made between the two: "civilization" is the term for the technological and "culture" for the humanistic sphere.



abstraction, all possessing a sensory directness as well as freedom, order, and harmony which are among the organic qualities of art. On the other hand the intensity of the artist's work is dependent upon the uniqueness of his purpose and his ability of transference. Thus the professional artist's solutions are dependent upon the existing body of knowledge in addition to the sociobiological components. But if he wishes to stir his audience and appeal to their senses, he has to create powerful new relationships. He can do so either by developing tendencies or by opposing them. The gradual elimination of the still existing feudal residues, that is, obsolete economic theories, obsolete patterns of individual behavior, obsolete sexual and family relationships is not an automatic matter.

It is unimaginable that, along with the economists, philosophers and politicians who advance suggestions for social changes, the most intuitive and responsive people in a society, namely, the artists, have no say. Tyranny and dictatorship, manifestos and decrees will not recast the mentality of the people. The unconscious but direct influence of art represents a better means of persuasion for conditioning people to a new society either by its projective or satiric-destructive means.

The true artist is the grindstone of the senses; he sharpens eyes, mind, and feeling; he interprets ideas and concepts through his own media. In the midst of vast social controversies he cannot escape that task. He has to take sides and proclaim his stand; indeed the artist has a formative ideological function, otherwise his work would be only an exercise of skill in composition. Hitler was aware of this. He propagandized trash, he tried to destroy modern art, science, and philosophy as the greatest sources of opposition to his vicious system of oppression. He banned the contemporary, the "degenerate" art, as he called it, from the galleries and museums, burned books, and forbade the teaching of Einstein's theories.

He sensed that the content of art is basically not different from the content of our other utterances. The only difference is that art is produced mainly by subconscious organization of the means implicit in the cultural and social setting of the period. To be sure, there are numerous opportunities for expression and research in all fields but among them only a few which are positively related and favored by the dynamic forces of the age. In intuitively choosing certain esthetic or technical problems, the most sensitive and advanced artist is a tool for the recording of the time-expressive contents. That is, form and structure denote definite spiritual trends. The work of the artist corresponds to the creative problems in other fields, complementing them in the structure of civilization of that particular period.

Art may press for the sociobiological solution of problems just as energetically as the social revolutionaries do through political action. The so-called "unpolitical" approach of art is a fallacy. Politics, freed from graft, party connotations, or more transitory tactics, is mankind's method of realizing ideas for the welfare of the community. Such a "weltanschauung" is transformed by the arts into emotional form, and becomes retroactive in the realm of the conscious existence. This suggests that not only the conscious but also the subconscious mind absorbs social ideas which are



then expressed in the specific media of the arts.\* Otherwise any problem could be successfully solved only through intellectual or verbal discourse. The difficulty lies in mass participation. The masses are filled with a petit bourgeois ideology, the masculine superman ideal promoted by papers and radios, books and films—by the unofficial education which the people have been taught to enjoy in spite of lip service to casual revolutionary political ideas. Once their sensitivity is killed, they are unable to receive the message of art whether contemporary or old.

The success theory of the profit economy pays a high premium to the anti-artist. Artists are considered effeminate who do not have the stamina to participate in competition. This is not only untrue, as are most clichés, but tragic since at present art is perhaps the only field where convention does not completely suppress sentiment and where the omnipotence of thought and the independence of emotion are kept relatively intact. To follow the divining rod of intuition and expressive desire may often act as a psychological lifesaver especially in periods of hidden and open suppression of independent thought. The phrase that “the artist represents the consciousness and memory of his time” is a good characterization of his function. No society can exist without expressing its ideas, and no culture and no ethics can survive without participation of the artist who cannot be bribed.

Art represents the uncensored statement of its author; this is one of its most positive characteristics. No one but the painter, the author, the composer is the sole master of his performance. The simpler his medium and the less investment it involves, the easier it is to avoid possible censorship and to preserve the ways of genuinely free expression.

Through his sensitivity the artist becomes the seismograph of events and movements pertaining to the future. He interprets the yet hazy path of coming developments by grasping the dynamics of the present and by freeing himself from momentary motivations and transitory influences but without evaluating their trends. He is interested only in the recording and communicating of his vision. This is what materializes in his art. He cannot misuse such a situation. To be a “fulltime” worker, a “professional,” involves a moral responsibility. This is why the secured existence of the uncompromising and incorruptible artist is so important to society. If he does not have adequate tools and materials, he cannot produce his best. His records cannot be fluid

\* Alfred Korzybski, the leader of the general semanticists, states that if a “translation is made into the language of lower centers—namely into ‘intuition,’ ‘feeling,’ ‘visualizations’—the higher abstractions gain the character of experience. By re-translating our higher order, verbal abstractions of relations and order into simplified but direct manifestations which can be visualized and felt, modern art affords immediate sub-cortical experience of essential structure.” (Quoted by Oliver Bloodstein in “General Semantics and Modern Art,” in “etc.” Vol. 1, No. 1, 1943)

This suggests the intertwined nature of human experiences and their expression. I question only the biological justification of discriminating between “higher” and “lower” orders of experiences. Biologically seen, they are of equal order and without their balanced, interpenetrated performance no satisfactory life exists.



and direct if he cannot consecrate his life to constant work in his craft, if he has to fight for minimum subsistence.

The silly myth that the genius has to "suffer" is the sly excuse of a society which does not care for its productive members unless their work promises immediate technological or economic applications with calculable profit.

*"We must have now sciences at the places where formerly intuition directed us." (Frank Lloyd Wright)*

*Among the artists in the 19th century there are Philip Otto Runge in Germany, Delacroix in France, who had the reputation of being competent color research workers. They applied science to their art. But there is a reciprocity, too. Seurat, for example, with his pointillist art, intuitively anticipated the science of color photography.*

*Sometimes a whole chain of successive influences can be traced from science—to technology—to art—and back again to science. Examples can be found in the research of photographic speed exposures such as that of Muybridge, Thomas Eakins, and the industrial motion studies of Taylor and Gilbreth which were transferred into art by the futurists around 1912. This in turn influenced scientific studies resulting in the stroboscopic photodiagrams of Harold Edgerton, MIT.*

*Rodin, the sculptor, was fascinated by light problems in the time of Helmholtz' investigation of optics. As a result, Rodin introduced a new type of chisel-cut to achieve transparent shadows, in contrast to the heavy shadows of the renaissance sculptures.*

*At present it would be a great help for the painter to know more about scientific optics so that he would be able to make controlled light paintings without the use of pigment, with only polarized stresses of material; or by gratings (almost invisible lines engraved into a transparent surface) and lit from behind so that prismatic light effects could be produced at will for colored light compositions.*

*The new artist working with plastics inevitably has to take up scientific studies or else wait decades until the knowledge about plastics becomes a commonplace.*

### art and science

The task of the professional artist is not only to vitalize people but also to continue and synthesize spiritual traits. For this, besides the unconscious elements, he must have conscious source material, sound scientific outlook though not necessarily a method. But most people educated in the liberal arts, and frightened by badly-taught mathematics and physics, have an awed respect for science in any of its possible interpretations. Because of this fear, they are suspicious of an art which uses elements reminiscent of geometrical shapes, synthetic materials, and optical instruments.

In popular short-cut theories there is the problem of "chaotic nature" versus "organized machine;" sober science versus mystical religion; social planning against free enterprise. This is oversimplification. The eyes of the artist record cows and dynamos, trees and skyscrapers equally well. They represent visual raw material for him. And this is the real issue. The actual aim is sociobiological synthesis. This cannot be achieved without "laboratory experimentation," though this is another objection to contemporary art, voiced often by the layman. But without experimentation there can be no discoveries and without discoveries no regeneration. Although the "research work" of the artist is rarely as "systematic" as that of the scientist they both may deal with the whole of life, in terms of relationships, not of details. In fact, the artist today does so more consistently than the scientist, because with each of his works he faces the problem of the interrelated whole while only a few theoretical scientists are allowed this "luxury" of a total vision. The main difference between the problems of artist and those of scientist is the difference in the form of their materialization and grasp. Plastic art is expressed with means largely comprehensible by sensory experiences on a non-verbal level. Even if, as in old paintings, the creative impetus is screened by the logical presentation of a describable theme, it is not the landscape or still-life that results in art, but the creative act by which the subject matter is transmuted into visual form. On the other hand, a scientific discourse is stated in rational intellectual terms even if the impulse to it comes from subconscious regions of the intuition. On the basis of sentimental education, many still believe that the emotional depth of the artist will be endangered by the attempt to organize his elements consciously. But the artist ought not to be afraid of conscious traits in his work, as the conscious approach will be translated by him into terms affecting the senses. The conscious problems of research are on a rather modest scale anyhow, overshadowed by the intuitive forces and the subconscious mechanism of expression. In every art work there remains a great number of components which cannot be verbalized, only approached intuitively. Even product designs executed with a largely



conscious approach generally answer more questions than their producers originally expected they could. The reason is that so far product designs have shown the most obvious integration of intuition and science, form and function. Their analysis can sometimes be helpful in giving more effective information; it may stimulate new techniques in the subconscious transubstantiation of such information. Analysis can eliminate also the repetition of overused elements and create an inner security for new solutions.

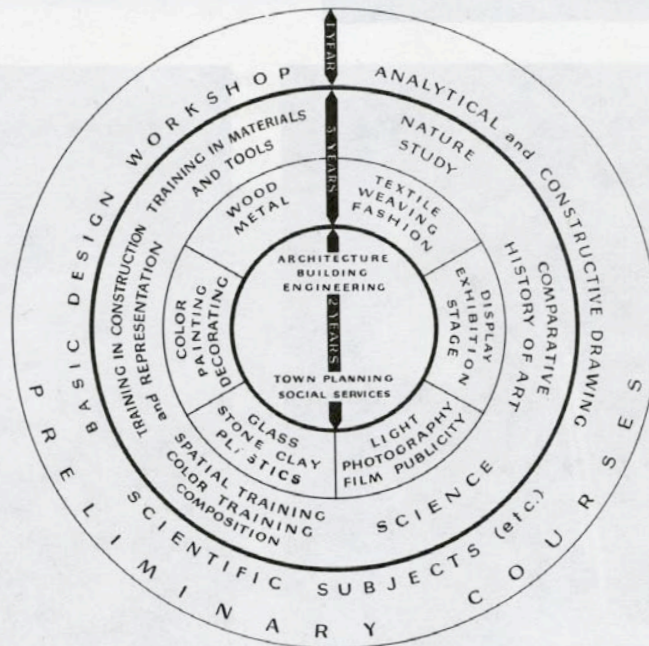


from:  
 Richard Kostelanetz (ed.), "Moholy-Nagy, an anthology"  
 Praeger, New York, 1970.



We know that art itself cannot be taught, only the way to it. We have in the past given the function of art a formal importance, which segregates it from our daily existence, whereas art is always present where healthy and unaffected people live. Our task is, therefore, to contrive a new system of education which, along with a specialized training in science and technique leads to a thorough awareness of fundamental human needs and a universal outlook. Thus, our concern is to develop a new type of designer, able to face all kinds of requirements, not because he is a prodigy but because he has the right method of approach. We wish to make him conscious of his own creative power, not afraid of new facts, working independently of recipes.

Upon this premise we have built our program.



65. First program announcement, The New Bauhaus, Chicago, Fall, 1937.



# EDUCATIONAL PROGRAM

**AIMS** The New Bauhaus requires first of all students of talent: the training is for creative designers for hand and machine made products; also for exposition, stage, display, commercial arts, typography and photography; for sculptors, painters, and architects.

**ORGANIZATION** The education of the student is carried on in theoretical and practical courses and in the workshops of the school. The school year is divided into two semesters, the first extending from the end of September to the middle of February and the second from the middle of February until the end of June. Each student must spend two semesters (a school year) in the preliminary courses and at least six semesters (three school years) in a special workshop. After the successful completion of this training he will obtain his Bauhaus diploma and he may, by continuing four semesters (two years) in the architectural department receive the architect's degree.

**PRELIMINARY COURSE** The preliminary curriculum offers a test of the student's abilities. It helps shorten the road to self-experience. It embodies briefly the essential components of the training given in the specialized workshops of the new bauhaus. It gives him ample opportunity to make a careful choice of his own field of specialization later.

The preliminary curriculum is divided into three parts:

- (A) The basic design shopwork (tools, machines, building musical instruments).
- (B) Analytical and constructive drawing, modeling, photography.
- (C) Scientific subjects.

## THE OBLIGATORY PRELIMINARY COURSE

In the basic workshop the student learns the constructive handling of materials: wood, plywood, paper, plastics, rubber, cork, leather, textiles, metal, glass, clay, plasticine, plaster, and stone;

- (a) their tactile values;
- (b) structure;
- (c) texture;
- (d) surface effect and the use of their values
- (e) in plane,
- (f) in volume,
- (g) and in space. Henceforth the student becomes (1) volume- (2) space- and (3) kinetic-conscious.
- (h) In order to develop his auditory sense, he experiments with sound and builds musical instruments.
- (i) He learns: the subjective and objective qualities, the scientific testing of materials;
- (j) existence of the fourth dimension (time).
- (k) As he experiments he builds, with small motors or other devices, toys, moving sculptures, spatial constructions, etc.
- (l) and develops his sense for proportion, and penetrates this work with the different
- (m) visual representation. He sketches by hand and with photo apparatus as well in black and white and in color and he works in clay. Standard nature forms will be analyzed and this analytical method leads the student to the
- (n) elementary forms, later to the construction of these forms in relationship to each other
- (o) with the aim of free composition.

(A)  
*Basic Design Shopwork*

(B)  
*Drawing, Modeling, Photography*

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(C)  
*Scientific Subjects*

The following scientific courses complement shopwork and drawing:

- |                             |   |                   |
|-----------------------------|---|-------------------|
| 1. Geometry                 | } | Physical Sciences |
| 2. Physics                  |   |                   |
| 3. Chemistry                |   |                   |
| 4. Mathematics              |   |                   |
| 5. Biology                  | } | Life Sciences     |
| 6. Physiology               |   |                   |
| 7. Anatomy                  |   |                   |
| 8. Intellectual Integration |   |                   |

In addition to these, the curriculum includes *Supplementary* brief surveys of

- (a) Biotechnique—the system of conscious inventions (e.g. Edison)
- (b) Psychotechnique (ability testing)
- (c) Music
- (d) Guest lectures on other subjects;
- (e) Lettering, writing (construction of letters, and printing types);
- (f) Light (as an instrument of visual notes, using light as a new medium of expression); photography, film;
- (g) Visits to factories, newly constructed buildings, museums, exhibitions, theatres, etc.
- (h) Exhibitions (some assembled by the students, some by the faculty or others).



from:  
Richard Kostelanetz (ed.), "Moholy-Nagy, an anthology"  
Praeger, New York, 1970.

### A New Humanism *Herbert Read*

Based on lectures which he gave at the Bauhaus between 1923 and 1928, [*The New Vision* by] Professor Moholy-Nagy was originally published in Germany several years ago. The present excellent translation by Miss Daphne Hoffmann appeared a year or two ago in New York, but no English publisher has yet had sufficient

From *The Architectural Review*, LXXVIII (October, 1935).

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enterprise to issue an edition here. Since, however, the esteemed author has now taken up his residence among us, it is desirable that his book should become better known. For it is an extremely important book—one of the very few statements which are essential for an understanding of the modern movement in architecture and the plastic arts generally. It is a study of the basic relationships which subsist between man as a sensitive animal and the materials he uses in construction. More than once Professor Moholy-Nagy uses the word "biological," and it expresses the originality of his approach to these problems. The individual is for him not an abstraction, but an organism with five senses, all crying for development, and art will only be secure if it is a function of the whole organism. The present system of production destroys this wholeness by creating a monster with a specialized calling, a man with perhaps one beautiful muscle on an otherwise wretched body. The general health suffers. There is no integrity in the individual, and therefore no wholeness in art. For health, for beauty, we need the whole man, harmoniously developed. Here in the attitude of Moholy-Nagy we see the idealism, the almost moral fervor, with which Gropius inspired the whole Bauhaus movement. It is the most wrongful distortion of the facts to make out of this movement, the most fertile movement of modern times, a heartless and inhuman functionalism. Gropius, Moholy-Nagy, Breuer—these men are the prophets of a new humanism.

Germany has rejected this new humanism, and though the label "cultural bolshevism" is only justified if bolshevism implies a constructive and not a destructive movement, there is nevertheless no doubt that the program of the modern movement in art and architecture requires social changes inconsistent with the present structure of industry. It is merely childish to imagine that one can change the plastic features of our environment without at the same time changing the underlying structure. The disease is constitutional, and of long standing. Moholy-Nagy suggests that the injuries worked by a technical civilization can be combated on two fronts:

1. By the purposive observation and the rational safeguarding of the organic, biologically conditioned functions (science, education, politics).
2. By means of the *constructive* carrying forward of our over-scientific culture—since there is no turning backward.

Partial solutions cannot be commended; partial rebellion is only evidence of the monstrous pressure, a symptom. "Only the person who understands himself, and co-operates with others in a far-reaching program of common action, can make his efforts count.



Material motives may well provide the occasion for an uprising, for revolution, but they are never the deciding cause." This makes the moral basis of the Bauhaus attitude clear enough: *L'esprit d'abord!* "The revolutionist will always remain conscious that the class struggle is, in the last analysis, not about capital, nor the means of production, but it actually concerns the right of the individual to a satisfying occupation, work that meets the inner needs, a normal way of life and a real release of human powers."

The problem is primarily educational, and this is strictly a book about educational methods. But the outward conditions for the realization of the necessary reforms must be guaranteed. "At this point the educational problem merges into the political, and is perceptible as such in so far as man goes into actual life and must make his adjustment to the existing order." It was necessary to make so much very clear—necessary and courageous.

For the task of education we need:

1. Actual life examples of strong-minded people, leading others onward;
2. An integration of intellectual achievements in politics, science, art, in all the realms of human activity;
3. Centers of practical education.

All those needs the Bauhaus was providing, but its activities converged on the provision of practical education. Manual training was the key to the development of individual wholeness. But the manual training was directed to the requirements of the processes of production in our technical age, and in that way differentiated itself from the reactionary arts and crafts movement, which was right in spirit but wrong in method. Clarity, conciseness and precision were the qualities to be attained—the fusion of these into a single meaning. Such was the aim of the Bauhaus training and experiment, and "out of the welter of rejection and approval, of demand and intuition the principle implicit throughout our technical age slowly crystallized: *not the single piece of work, nor the individual highest attainment, shall be emphasized, but the creation of the commonly usable type, the development of the 'standard.'*" To attain this goal, scattered individual efforts proved insufficient; the Bauhaus was the co-operative solution.

The policy of the Bauhaus in general has been described by Professor Gropius himself in his recently published book,\* reviewed in the August number of this magazine. The Bauhaus education, which is the subject of Moholy-Nagy's book, is only, of course, part of the complete curriculum. But it was a very important part,

\* *The New Architecture and the Bauhaus.*

providing that basic sensory training which is the foundation of the new biological or humanistic attitude. The subject is divided into three stages: Material, Volume (sculpture), and Space (architecture), and these stages are progressive. It is perhaps unnecessary to remark that the author has the most lively awareness of the various developments of modern art, for he himself has made a vital contribution to them, and as painter, typographer, photographer, stage-designer and architect is one of the most creative intelligences of our time.

The author's treatment of the subject which more particularly concerns the readers of this journal may perhaps be best indicated by a few of his forceful aphorisms:

Architecture will be brought to its fullest realization only when the deepest knowledge of human life as a total phenomenon in the biological whole is available. One of its most important components is the ordering of man in space, making space comprehensible, and taking architecture as arrangement of universal space.

The root of architecture lies in the mastery of the problem of space, the practical development lies in the problem of construction.

Building material is only an auxiliary, insofar as it can be used as carrier of space-creating and space-dividing relationships. The principal means of creation is always the space alone, from whose laws the treatment has to proceed in all respects.



from:

Laszlo Moholy-Nagy, "The New Vision",  
4th, revised edition, Wittenborn, Schulz, Inc., New York, 1947.

**Biotechnics as a method of creative activity.** The natural scientist, Raoul Francé, devoted himself to an intensive study of this problem. He calls his method of research and its results "biotechnics."

The essential part of his teaching is expressed in the following quotations:\* "Every process in nature has its necessary form. These processes always result in functional forms. They follow the law of the shortest distance between points: cooling occurs only on surfaces exposed to cooling, pressure only on points of pressure, tension on lines of tension; motion creates for itself forms of movement — for each energy there is a form of energy."

"All technical forms can be deduced from forms in nature. The laws of least resistance and of economy of effort make it inevitable that similar activities shall always lead to similar forms. So man can master the powers of nature in another and quite different way from what he has done hitherto."

"If he but applied all the principles that the organism has adopted in its striving toward useful ends, he will find there enough employment for all his capital, strength, and talent for centuries to come. Every bush, every tree, can instruct him, advise him, and show him inventions, apparatuses, technical appliances without number."

As to the possibilities of using nature as a constructional model for appliances, we have statements by Galileo. Even in the earliest periods of cultural history, we find objects recognizable as the result of understanding prototypes in nature in regard to their functional value (not to be confused with a merely *ornamental* exploitation of natural forms).

But still it has more often happened that man, probing into the problem of rightly sensing and recognizing the unique properties of material (medium) + tool (machine) + function has, without studying prototypes in nature, hit upon correct solutions, later found to be in agreement with natural forms with similar functions. Such coincidences are valuable as laboratory data, but they should not lead to the assumption that a well functioning construction always has analogies.

The usefulness of biotechnics lies in a more conscious approach to inventions which are generally believed to be the results only of intuition. Fortunately, Edison's work proved that inventions can be greatly aided by the analytical method of science.





**Gyorgy Kepes**

**the new landscape**

**in art and science**

**Paul Theobald and Co.**



from:

Gyorgy Kepes (ed.), "The New Landscape in Art and Science",  
Paul Theobald, Chicago, 1956.

PREFACE This book is meant to be looked at more than read. It is a picture book, arranged to bring attention to a newly emerged aspect of nature, hitherto invisible but now revealed by science and technology. The "text" of the book is not its message. Primarily, a body of material is presented, rather than scientific information or esthetic theory. The material is organized to help the reader to *see*, with the hope that he will grasp significant connections for himself.

To develop more highly our ability to see does have the consequence of intensifying our intellectual grasp of reality, for there is an intimate connection between the ontogenic development of seeing and thinking. Vision is by no means an automatic function of our physiological apparatus. There is much evidence that vision is itself a mode of thinking. When we see, we interpret the world around us and orient ourselves in it. Sharpening our awareness, heightening our sensibility, disciplining our vision, will increase our power to understand the world, appreciate its richness and cope with its problems.

Although suggestive rather than definitive and tentative rather than conclusive, this book has an admittedly ambitious purpose. The customary modes of presentation are inadequate to realize this purpose; and an attempt is made here to develop a new form of communication.

Principles that C. S. Peirce asked of logic were a guide: ". . . to trust rather to the multitude and variety of its arguments than to the conclusiveness of any one. Its reasoning should not form a chain which is no stronger than its weakest link, but a cable whose fibers may be ever so slender, provided they are sufficiently numerous and intimately connected."\*

The method—for which preparing this book has served as a kind of laboratory experiment—fuses visual images and verbal communication in a common structure. The visual images—the pictures brought together here—are the content. The verbal statements—comments and documents—are illustrations. They do not constitute a connected, systematic account. The quotations touch the subject from one angle, the comments from another, with the visual images forming the basis of the interrelated structure that alone tells a connected story.

Thus, the visual and verbal statements neither parallel one another in exact correspondence nor follow one another in a strict casual chain. They complement one another in an interwoven sequence. The structure builds, then, as the observer proceeds from one experience to another, and finally a new aspect of perception is outlined. Scientific and artistic insight fuse, creating by their interplay a basic type of experience—neither science nor art, but a comprehension that has both the character of information and the quality of poetic vision.

My personal needs as a painter and teacher to see the world as a whole have been a motivation for making this book. As a painter, I need visual values that can bring into common focus the rich world of the unaided senses recorded in our artistic heritage and the new vistas of nature which have hardly yet reached our sensibilities. As a teacher, I need tools of communication in which rational analysis through intellectual concepts and emotional delight through perception of nature's configurations are fitting complementaries.

Of the limitations of my presentation I am acutely aware. This is frankly a book of allusions and not conclusions. Neither the text nor the visual material claims rigorous precision. Scientific records are presented without exact data and works of art without pretense of scholarly erudition. As its title implies, the book is a landscape. Or, more correctly, it is the first sketch of a new landscape which seems to me rich in promise, a landscape I am moved by and have confidence in.

\*"Some Consequences of Four Incapacities," in: *Collected Papers of Charles Sanders Peirce* (C. Hartshorne and P. Weiss, eds.), Cambridge, Mass., 1934.



## INTRODUCTION

*A child rolls her hoop in a vast, lonely nightmare landscape, racing toward the shadow where an unknown terror awaits . . .* This now familiar image in modern art distills for the spectator the pervasive emotional disaster of the twentieth century—the sense of being lost in an alien, menacing world.

In times of self-confidence, man was able to domesticate the world and gradually bring it into his human scale. Forests and mountains were once fearsome places; inhabited by wild beasts and demons, they were given a wide berth by the prudent. Later they became part of the familiar, friendly world, peaceful refuges in times of stress. Challenged, the world of nature gave up some secrets of its form and structure and lost its alien and terrifying aspect, if not all its dangers. Man explored his environment with his senses and learned about its form and textures; work and reflection revealed in nature, innate order and susceptibility to human organizing, bringing him a feeling of confidence and power. Sense experiences brought intimacy with nature, awareness of its patterns and the ability to enjoy the natural world. Out of the sensible richness of his environment, man built himself an image, a picture of nature as the great mother—the universal source of life and strength—and of the natural world as a garden—a refuge from stress and the living source of a full human life. He sensed form-patterns in nature the sun, the moon, a face, an ear of wheat, the shadow of a tree, and used them to break down his isolation within himself. Stored in memory, recreated in imagination, they built a feeling of being connected with the physical environment and with other human beings.

The sun that warms us, the flowers that please our senses of sight and smell, become clearly apprehended only when we attach significance to them. When we have made *symbols* of them, so that they can evoke emotional response as well as stimulate us by their palpable reality, we can use them to understand both our surroundings and the world at large, individually in our personal images, socially in images we share with men of our time and condition.

It is not with tools only that we domesticate our world. Sensed forms, images and symbols are as essential to us as palpable reality in exploring nature for human ends. Distilled from our experience and made our permanent possessions, they provide a nexus between man and man and between man and nature. We make a map of our experience patterns, an inner model of the outer world, and we use this to organize our lives. Our natural "environment"—whatever impinges on us from outside—becomes our human "landscape"—a segment of nature fathomed by us and made our home.

When unprecedented aspects of nature confront us, our world-model inherited from the past becomes strained; the new territory does not belong to it. Disoriented, we become confused and shocked. We may even create monsters, using old, outworn images and symbols in an inverted, negative way. Manipulating them, amplifying them, we invent new Minotaurs and new mazes, until we find new meanings and



symbols growing from the new world. We are denied the pleasures of experiencing the sensed form-patterns of this new world until we have traced the paths by which this poetry of form can become meaningful.

That is our situation today. *The strength of oak, the ferocity of the tiger, the swiftness of the eagle* are expressions which are out of place in the new world of form revealed to us by modern science. They belong to the old world of sense experiences; they are in scale with it, interrelate some parts of it. Rapid expansion of knowledge and technical development have swept us into a world beyond our grasp; and the face of nature is alien once again. Like the forest and mountains of medieval times, our new environment harbors strange menacing beasts: invisible viruses, atoms, mesons, protons, cosmic rays, supersonic waves. We have been cast out of the smaller, friendlier world in which we moved with the confidence born of knowledge. We try to cope with the exploded scale of things without the standards which would enable us to evaluate them.

To convert this new environment into a human landscape, we need more than a rational grasp of nature. We need to map the world's new configurations with our senses, dispose our own activities and movements in conformity with its rhythms and discover in it potentialities for a richer, more orderly and secure human life. The sensed, the emotional, are of vital importance in transforming its chaos into order. The new world has its own dimensions of light, color, space, forms, textures, rhythms of sound and movement—a wealth of qualities and sensations to be apprehended and experienced. If we relate experience to experience, image to image, we can bring our environment into focus and become aware of the new order on the sensed and emotional levels rather than on the rational level alone. Reoriented, we shall then be in a position to cope with the new world of forms.

Science appears to be the most confident and vigorous unifying force today. It has produced a new foundation for our material existence, but, as we all know, has not yet solved our human problems. So far, our recently acquired knowledge, with all its precision and power, has brought us as much ugliness, discomfort and danger as it has sanity and order. Science is only one component of the understanding that we need for a well-balanced attainment of human ends. In our chaotic and directionless world, it gives us two-edged weapons—powerful tools and ideas with which we may either create or destroy.

Step by step, science has been giving us this vast and constantly expanding armory. Through bold scientific generalization and precise observation, phenomena which once seemed unconnected have been put into a unified order. Knowledge gained thereby has given the additional resources of nuclear energy, new materials, new techniques and new means of transportation and communication. We now possess machines that can react and, after a fashion, think. We have developed electronic brains and nervous systems, just as the nineteenth century developed mechanical



muscles. Precise and flexible control of machinery and appliances is now possible without human intervention, as instruments connected by complicated electrical circuits carry out the appropriate thought-processes. The widespread applications of these, from automatic doors to radar and electronic computers, suggest that men will need progressively less of their physical and nervous energy for routine tasks and will be left freer for more creative work.

Classical geometry and Newtonian physics, though they are majestic achievements of human intellect, are only approximate descriptions of physical reality. They sum up what can be learned in scale with the unaided senses. Modern physics and non-Euclidian geometry describe reality with far more subtlety and power. Interrelationships are now seen to be far more complex than we ever imagined before modern instruments allowed us to push back the limits of the very far, the very big, the very small. Behind our technical refinement is the refinement of our capacity for observing relationships in nature.

Where our age falls short is in the harmonizing of our outer and our inner wealth. We lack the depth of feeling and the range of sensibility needed to retain the riches that science and technique have brought within our grasp. The images and symbols which can truly domesticate the newly revealed aspects of nature will be developed only if we use all our faculties to the full—assimilate with the scientist's brain, the poet's heart, the painter's eyes. It is an integrated vision that we need; but our awareness and understanding of the world and its realities are divided into the rational—the knowledge frozen in words and quantities—and the emotional—the knowledge vested in sensory images and feelings. Artists and poets on the one hand, scientists and engineers on the other, appear to live in two different worlds. Their common language, their common symbols, do not exist.

To develop a vision which brings the inner and outer worlds together, we need common roots once more. We are like Antaeus of old, whose strength, ebbing whenever he lost contact with the Earth, his mother, became renewed each time he touched the ground. Spun out of our heads, science and art remain anemic and without root, and need strengthening contact with nature once again. The natural world remains the common basis for all of us, even though it is changed beyond recognition from the world of nature known to our fathers. It still starts for us where we come in contact with it—through our senses. Science has opened up resources for new sights and sounds, new tastes and textures. If we are to understand the new landscape, we need to touch it with our senses and build the images that will make it ours. For this we must remake our vision.



from:  
Gyorgy Kepes (ed.), "The New Landscape in Art and Science",  
Paul Theobald, Chicago, 1956.

# V

THING  
STRUCTURE  
PATTERN  
PROCESS

By deepest instinct, we reject chaos and try to order our experience. We seize upon means to bring coherence into the welter of signals furnished by nature as though our life depended on it—as it does.

The basic instrument that we use to make our experience intelligible is our body itself. With it, we articulate the constant stream of impressions on our senses, differentiating the world into discrete entities and unifying it into an interrelated whole. Our body defines axes of reference: position, size, direction, density. Through repeated comparisons, we build the realm of *things*, of objects which have their separate existences in a space framed by these axes. We fill the world with stones, mountains, leaves, trees, men and animals. These, even if they move, do not lose their fixed identities. We still see them as things and our self as the central thing—the subject—that observes, measures and understands all the others.

Thing-seeing is a highly developed mode of perception. There are other modes—prior, more rudimentary. Primitives and children do not make an extremely sharp distinction between subject and object. Subject and object, perception and feeling, concept and action tend to fuse. Orientation is reached not so much by classifying the world into gauged things as by linking its movements into action-relations.

Here it is purpose that shapes the meaning of the phenomenon, purpose rooted in human impulses, needs and feelings. To children and primitives the significance of objects is their potential for practical use, fantasy or play. The older our children grow, the more they see static characteristics like size, shape, color and substance rather than the dynamic relation between subject and object. Thing-seeing displaces dynamic relation seeing.

Although it enables us to order our surroundings on the gross level of familiar experience, thing-seeing is too limited to help us discriminate on the extended scale of space and time, on the levels of the very large, the very small, the very fast, the very slow. The world measurable by our own bodies has been succeeded by a world with many unfamiliar configurations unrelated to our bodies. To bring coherence into this wider manifold of experience, we need new axes of reference, a new common denominator of the extended scale revealed by science and the gross scale of our unaided senses.

We may be guided by the new nature to structure as a common denominator. Structure brings together all the levels of experience that we know. But the structures that we find in nature are not independent, isolated "things." They emerge from and disappear into other structures, both in space and in time. Molecules of water vapor become first a snowflake and then a raindrop. The fertilized egg develops into a child whose form, in turn, grows into that of a man. The patterns of structure are also patterns of action!



Although we see it as an entity—unified, distinct from its surroundings—a pattern in nature is a temporary boundary that both separates and connects the past and the future of the processes that trace it. Patterns are the meeting-points of actions. Noun and verb must be seen as one: process in pattern, *pattern in process*.

It would seem that to perceive the expanded world we need to return to our prior mode of perception, and, as children do, see interactions rather than things. It is possible for us to reorient ourselves and do this, for we perceive as we mobilize ourselves to perceive. It is intellectual growth that causes the maturing child's awareness of a stone to change—his concept altering both his percept and his remembered image of the stone. Our own further growth can enable us to see the stone as a pattern generated by interacting complex forces, and not the physical stone only but our percept of it, image of it and intellectual concept of it. This is not seeing interactions in a primitive anthropocentric way. In pattern-seeing, we do not refer everything to our narrow subjective life; we trace the interplay of processes in the world. We do not give up objective nature, but, where we formerly saw only things, we are now mobilized to see action patterns.

A visual pattern, the first perceptual contact with the world outside our bodies, is an organization by outline, the creation of a figure against a background. Sir Charles Sherrington remarks, in *Man on His Nature*:

"Visual contour dominates visual space. Perceptually a contour is a line. When we hear that Nature has no such thing as a line, vision answers that all contours are lines. That every contact of fields of light or color is sharpened and stressed into a line—a psychological line. "Contrast" develops a line at every contact between abruptly distinguishable areas. If the mind did not deal in "lines" an outline drawing could hardly be the magical thing it can be. Simple outline diagrams, serving to illustrate clearly by the thousands. The mind dealt in "lines"? The so-called rivalry of contours is a master key to "meaning" in visual perception. As far as the mind thinks spatially its thinking largely accepts "lines" and manufactures them."\*

The creation of a figure against a background is an interaction of complex processes—of physical processes in the outside world with the perceptual processes of the observer. It takes time for the pattern to emerge, time enough for the organism to receive a succession of images, a series of constellations of sensory excitations. The visual world is constantly recreated in a sequence of images—contour graphs in which space and time are indistinct—the higher structure of the figure central in awareness detaching it from the lower structure of the background. As our eyes range over the perceptual field, one part after another of the field becomes "figural", and there is a constant shift of "figure" and "ground" to one part after another. Each figural part appears defined and delimited from the remainder of the field, its

\* Sir Charles Sherrington, *Man on His Nature*, A Doubleday Anchor book, New York, 1953.



characteristic shape standing out as if contoured.

We may regard any configuration in nature—a physical object, a sensation, a thought—as the contour which marks the intersection of interpenetrating forces. We may find traces of force-interplay on one level alone, as in the physical pattern generated by physical events or the patterns of abstract thought generated by the interaction of the perceptual with the perceptual. There may be traces of interaction on intercepting levels, as in the perceptual pattern created by the interaction of physical with perceptual events.

When the wind traces its impact on the sand into waves and drifts, the sand pattern is not only a passive record of the wind's activity; it is an active "contour" which both separates and connects the force of the wind and the resistance of the sand. It is not wind, nor is it sand; it is something new. In the same way, a crystal growth is not a fixed form that emerges from nowhere; it is a space-time boundary of energies in organization. The pattern of a branching tree is the trace of growth. And so are all the other graceful figures of equilibrium: a raindrop, falling through the air or splashing on a surface; the form of a bone; the fabric of a plant; the year-rings of a tree trunk or of a fish scale; the hills and valleys of the ocean bed; the geological stratification of a mountain; the shock wave in bullet-pierced air; the webs of spiders and of cosmic ray showers; the tree-like pattern of an electrical discharge.

A pattern may be a continuous linear path, like handwriting or the vapor trails of aircraft; a three-dimensional path, like the centrifugal motion of a potter's wheel restrained by the potter's hand; a discontinuous path, like footprints on snow, or puffs of smoke. The factor of time can predominate, or the factor of space. Patterns can be primary events: cells, crystals, bubbles or animal bodies. They can be mere secondary effects: shadows, the color patterns of sunsets, mirror images or perspective transformations. They can be generated from within, as in growth, or built from without and joined mechanically, as in coral deposits. Like volcanoes, they can be alive and durable, or, like fossils and seashells, the mere memories of live figures. They can reach their unique configuration through a forming process, like perceived images created through the excitation of brain cells; or they can gain separate and distinct existence as the boundary of other events, like snowdrifts. When we perceive, our perception structure is itself a force diagram of interacting systems—of optical stimulus and our sensory apparatus, of optical image and our store of memory images, of our immediate experience and our inner picture of ourselves or of the world.

Leading us away from the system of fixed *things*, and toward the system of spatio-temporal patterns, the newly revealed visible world brings us to the threshold of a new vision. We cannot relate its seen patterns to our familiar experiences of things that we know and touch and smell. The path of a cosmic ray, the growth of a crystal, the stroboscopic record of a raindrop are meaningful only as interrelations. We are compelled to interpret them as intersections of events.

These new idioms of vision bring us to new awareness also in our daily life. The sensed aspect of the world now includes both whence and whither. As we perceive things, whether we scan optical data with our eyes or fold our hands about a jade, we shall be aware of the process of perception itself, attaching importance to the emergence of our feeling of unity or harmony rather than to the quality of the feeling alone. Instead of thing-conscious we shall be process-conscious.

What we learn today through the new contributions of science has always been a part of man's esthetic wisdom. To the beholder of a work of art, awareness of the process of making and awareness of the esthetic pattern have always been one.

First, a single act of self-inquiry will show the impossibility of distinctly conceiving the one without some involution of the other; either time expressed in space, in the form of the mathematical line, or space within time, as in the circle. But to form the first conception of a real thing, we state both as one in the idea, duration. The formula is:  $A = B + B = A = A = A$ , or the oneness of space and time, is the predicate of all real being.

S. T. Coleridge  
*Formation of a more comprehensive  
theory of life.*  
*Selected Poetry and Prose of Coleridge*  
Random House Inc., New York

Always follow the natural paths of creation, the growth of forms and their functions. That is the best way to learn. Perhaps you may through nature arrive at the point where you can create on your own. Then one day you yourself will be a part of nature; you will be able to create as she does.

Paul Klee  
Quoted by W. Haftmann  
*Paul Klee*  
Munich 1950



Whether we look into the Far Eastern art of the Japanese painter Sesshu or into the Occidental art of Picasso, Rembrandt, Frans Hals or the Greek vase painters, our participation in the work of art echoes the artist's making of it. In calligraphy, whether in the brush-drawn characters of a Chinese master or the chancery script of Vicentino, the esthetic impact on us is strongest when the line and the movement that generated the line are in perfect correspondence.

We, too, are strongest and happiest when we are ourselves. When we let our emotional or intellectual processes move along natural paths, the directness of expression that we achieve is a greatly valued human gesture. We all enjoy watching children because we sense in them more freedom than in ourselves. We have a similar feeling when we follow the path of the wind in sand or the playful metamorphosis of clouds in the upper air.

Most of the visual patterns of our man-created landscape lack such congruence between process and pattern. Our cities, our houses, our objects for use, our printed images, our clothing, our facial gestures do not evoke the sense of inevitability which is inherent in the trace of a primary natural event. Confusion, feeding our perceptual life, has dulled our sensibilities. Not only are the concrete forms and patterns we see misleading, but the visual habits of our culture lead us to accept this confused world. In our civilization there is a serious blindness to the logic of the processes of the sensible world. It is not accidental that, lacking healthful nourishment of our senses and trained to a limited way of seeing, we have created a world around us and within us that robs us of power to see.

Gaining the ability to read the relation between process and pattern can lead to better tools for resolving conflicts in many areas of our intellectual life. In the past, without previous preparation of the visual background, the conceptual had no substance to make it coagulate. Today, there is a crisis in science which stems partly from our habit of making images in terms of isolated things. Establishing a new perceptual background for conceptual thinking may lead toward resolution of this crisis.

Man could not have ordered his world within the scale of his senses without breaking it up into separate things, freezing its movement and chopping up its continuity. Dividing and subdividing natural processes, we devised ever more precise means of delimitation—our sense tools first, later all the intricate means of algebraic and geometrical abstraction in combination with instruments. Measure became the means of separating; and separating by measuring appeared to be the key to interpreting nature. Today, however, interpretation has reached an impasse. Within today's extended scale, images of things and the words for images of things—formerly adequate for the uses to which they were put—are too clumsy for the uses to which we now try to put them. The more precise the measurement, the more difficult the act of isolation—because measure and measured interact. The act of measurement alters what is being measured. For example, the light energy that we direct upon our subjects displaces it and changes its weight.

Although we have learned to express connection only in limited language, it has become obvious that not only what separates is important but what connects. The connections are not fixed. They are patterns and processes of nature's dynamics and, as such, undergoing constant *transformation*. Men and mountains can be brought into common expression in terms of inches and ounces, but this connection is static and dead. The deeper connections are the dynamic organization of the successive patterns. They clarify relations of order, continuity and direction in the emergence, growth and disappearance of nature's forms.