

SYMMETRY AS A DEVELOPMENTAL PRINCIPLE IN NATURE AND ART

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QUESTION 1

Since 1970, using the methods of trial and error, supposition and refutation, I have attempted to establish formal results for my sculptural thinking and work on the foundation of nature observations.

what is
symmetry?

Using sculptural experiments with variable form-color pictorial signs, I arrived, via perception of movements and configurations, at a procedure for constructing forms exclusively by means of reflections ("symmetrizations") and distortions or deformations, ("asymmetrizations"). These results were surprising, and attracted a great deal of attention. A method for changing forms was discovered by means of sensory concepts (perception, experience) in two and three dimensions. This method allowed derived configurations to originate which resembled previous and intermediate forms, despite the variety of structural designations. I thus intuitively and spontaneously arrived at the following assumption (a provisional truth), which is of outstanding theoretical and practical usefulness: the symmetrical structures of spatial and temporal order in nature may reflect an important factor for evolutionary changes in nature. The hypothesis, deriving from the will to knowledge, that symmetrization and asymmetrization are the architects of evolution in the realm of natural events presented itself as downright compelling in view of quotidian understanding and especially biological background knowledge.

Creative symmetrization can be defined as an evolutionary process which forms regulatorily derived, structurally new entities. Here, symmetrical and/or asymmetrical refraction leads to the emergence of newly structured and differentiable mirror-image/polar equalities, synthetically combined into a network. Here, compared with the old, disrupted symmetrical totality of events, the new form of symmetry can obtain a selectional advantage from the symmetrization (which is often linked with asymmetrization).

The following pictorial examples from my book *Symmetrie als Entwicklungsprinzip in Natur und Kunst* [Symmetry as a Developmental Principle in Nature and Art] (Hahn, 1989) illustrate how, as desired, form-related, not form-identical, but derived forms can be developed from a two- and three-dimensionally structured *Urform* (original form, basal form, protoform) via intermediate forms (bridging forms). In the midline-orientated sensory constructions, which unfold in the course of time, special, unique, and surprising things appear — spontaneously, conspicuously, and unexpectedly — through self-reflections.



Figure 1: *Mirror Worlds*: in the upper picture, two "cephalopods" in a painting of mine (80 cm x 120 cm; acryl on canvas). Although differing in expression, the two "extraterrestrial beings" are enantiomorphic/mirror-images in structure. The pure, unbroken colors/lights of the double unplanned plastic suggestions (associations) are arranged complementarily, analogous to color-negative/color-positive slides. On the semantics of the picture as an entirety, which attempts to present a holistic reality (including dreams, fantasies, utopias): In view of the existence and the properties of antiparticles, there is speculation that matter and antimatter could exist side by side, shielded off from each other by a protective layer. Even the stars of our own galaxy could be antistars. In antiworld, creatures consisting of antimatter (antielectrons, antiprotons, antineutrons, etc.) could exist: creatures (exoforms) that are to us as pictures to their mirror-images, or positive film to negative film. In a hypothesis on the symmetry of the universe, A. D. Sakharov, using the model of a pulsating universe, viewed the inhabitants of the "reflected" world of antimatter (antiuniverse) as mirror-image doubles of the physical reality of the first world (universe) (for further details, see pp. 52 and 94 ff.). The lower picture: According to C. N. Yang, the mirror-image symmetrization which transforms all matter into antimatter could be defined as "the true reflection process" (picture after Yang; for further details, see p. 122). Figures 2 and 3 show that the sensory constructions of my painting were developed by means of creative symmetrization, i.e. they were derived from a "basal form", and, as a derived entirety of events, belong to a "family" of art organisms.

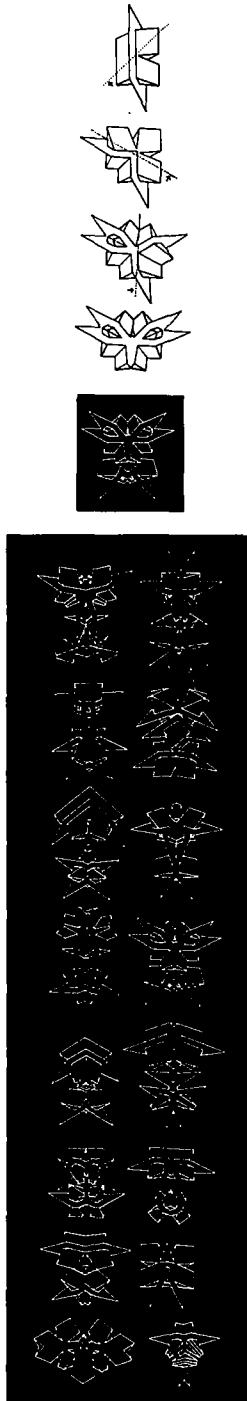


Figure 2: "Cat" of symmetrical origin. The top drawing presents the original form (basal form, set of basal points) from which I developed the unified tension-filled biomorphic configuration in the bottom picture. A cat-like head is created selectively by means of three reflections (mirror-image symmetrizations; cf. the arrows: position of the mirror symmetrizations). In the white drawing, the head is placed on a "substructure" that is also derived from the original form, and associates the arms, legs, and genitals (cf. Figs. 1 and 3).

In order to examine whether the hypothesis that symmetrization and asymmetrization might prove to be true as a principle of formation and construction in nature, or whether it does not agree with reality, I began, parallel to practical sculptural work, an intensive study of the literature on problems of symmetry and evolution.

A study of the literature revealed that hitherto there had not been any general evolutionary theory of symmetry. Thus the task was to conceive of the symmetry phenomenon directly as a heuristic principle which could serve to permit a number of new insights into the laws that govern nature and culture.

Figure 3: Symmetrization-based derivations from the original form of Figure 2. All 16 of the developmentally related symmetristic figures are bilaterally symmetrical; in addition, some of them are lateral mirror-images. The condition of order in these "bilateralities" (like that in Figs. 1 and 2) was developed via bifurcations of an evolutionary nature through processes of repetition and metamorphosis, symmetry/asymmetry refraction and symmetrogenesis, "polarity and augmentation" (Goethe). I interpret the entirety of events (*Geschehnissganze*) generated by the process of transitional viewing, with pin-pointed artistic selection, as "interior portraits". With focal seeing, the key pictures that are developed biocommunicatively via positive semantization processes have an evocative effect (in part archetype-like "cephalopods"), and show a proportional key repertoire with a completely new perspective: multiperspectivity, vanishing lines, vanishing-point centers of focus. The "cephalopod" in the lower left of the group of figures was the initial drawing for the picture shown in Figure 1.

In the 20th century heretofore, symmetries were mainly interpreted, and often defamed, as "quiescence, stasis, invariability", and as "rigidity, pedantry, boredom, death". In order to free themselves from the "millenia-old burden" of the allegedly "static, rigid symmetry" (M. Seuphor), modern artists and sculptors discovered the possibilities of equilibrium in the asymmetrical. P. Mondrian was thoroughly in error when he wrote, in 1924: "Symmetry characterizes things as separated; therefore, a universal formation of the universal must reject symmetry". W. Baumeister was of the opinion that symmetry "no longer meets the requirements" of the arts today. Without recognizing that symmetry is a fundamental principle, modern art took the path that led to abstraction. M.

Duchamp was one of the few to rebel against the lack of symmetry in the form world of the avant-garde: "The entire century was based on asymmetry and deformation — the "bottle-dryer" [as ready-made, W.H.] rehabilitated symmetry" (Hahn, 1989, pp. 27 ff.).

Figure 4: Four configurations, derived by distortion, surround the initial figure in the middle, i.e. the basal form here is also the entirety of events of Figures 1—3. Such distortions (asymmetrizations), which accompany the symmetrizations, are of great importance for the pictorial development and dynamic concept of symmetry in my new *ars evolutoria* ("evolutionism"). On the right: a bilateral figure, derived by means of symmetrizations from the distorted basal form on the right (see Fig. 5).

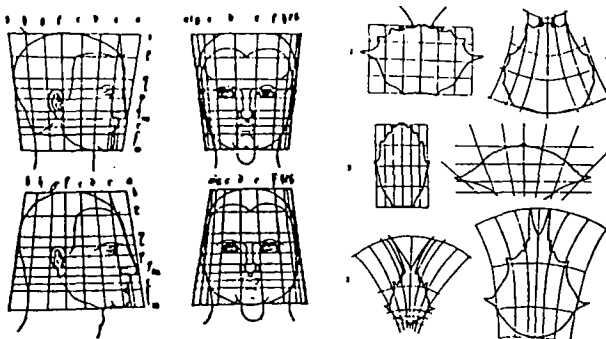
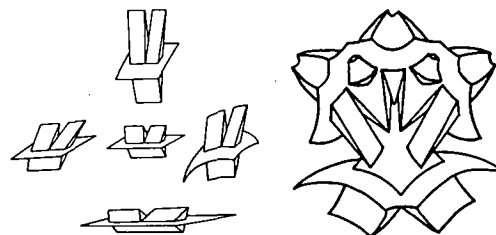


Figure 5: Transformations: The artist and student of forms Albrecht Dürer was the first to develop form variants corresponding to the deformation of a co-ordinate system. On the left: head constructions from Dürer's book on the theory of proportion. The English researcher D'Arcy Wentworth Thompson applied the same method to the comparison of forms between related animals and plants with striking variations in form, in order to detect the deviations of very peculiar species from a median type of formation. The figures on the right, with crab transformations, are taken from Thompson's book *On Growth and Form*. Today, such transformational asymmetrization experiments are joined with the concept of allometry (allomorphosis). In ontogeny and/or phylogeny, positive allometries were developed (accelerated, augmented "growth") and/or negative allometries (delayed "growth" in individual sections of the form). The transformation method is now considered to be a scientific method for developing, or revising, phylogenetic series (for further details, see pp. 45 ff. and 258).

It can be demonstrated that — in contrast to the Renaissance — art and science in the modern period no longer constitute Siamese twins. Abandoning the field of natural reality, painters invented an artificial reality that no longer had connection with the phenomena of nature. Likewise, they discarded symmetry and perspective, a process that had begun with P. Cézanne. With him, the father of classical modernism, which defamed the products of nature as "deception", there began the process of forcible dissolution of form in visible objects, a process which can be interpreted as "antirational". The pictorial composition of cubism, for instance, became more and more lacking in perspective and focal points. The art philosophy

of Cézannism and cubism, with its increasing destruction of symmetry and perspective, took as its erroneous point of departure an "a priori knowledge" (D.-H. Kahnweiler) of geometrical figures: spheres, cones, cylinders, upon which — according to Cézanne — everything in nature should be "modelled"; colors would order themselves "as great noumena, corporeal ideas, beings of pure reason, as they please", according to Cézanne, the disciple of Kant.

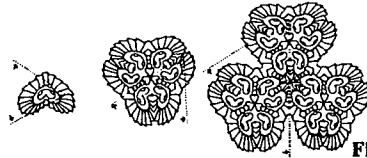


Figure 6: Radially symmetric derivations from a three-dimensional form by means of two mirrors. Upper left: basal form of the three entireties of events. Arrows and lines show the positions of the mirror surfaces. The three derivations with triadic radial symmetry were developed from the basal form with two mirrors, whose reflective surfaces formed an angle of $60^\circ (= 180^\circ/3)$. By increasing the double mirror angle ($180^\circ/2 = 90^\circ$), or decreasing it ($180^\circ/4 = 45^\circ$, $180^\circ/5 = 36^\circ$, ...; generally $180^\circ/n$), dissymmetrical, tetradic, pentadic, etc. "radiata" can be generated (see also Figs. 7-10).

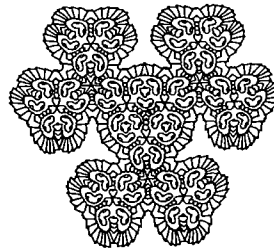


Figure 7: Derivations from the bilateral form of Figure 4 by means of two mirrors, where one mirror remained unchanged, while the other was shifted by a constant angle of 45° . The three illustrations (symmetrization phases) are also intended to indicate that I also use my experiments in evolutionary form development for films: I pointed a motion-picture camera at the variable double mirror while it was gliding selectively over *ars-evolutoria* painting. To accompany this film painting, I developed a *musica evolutoria*: two comparable form-creating processes in my art (see pp. 261 ff. and Fig. 18).

My discovery of a new view of symmetry as a developmental principle produced in me an encyclopedic sense of joyous discovery. Looking above and beyond the boundaries of various disciplines, I was able to demonstrate that symmetry is a fascinating phenomenon which, consciously or unconsciously, provides perennial stimulation and challenge. I recognized that today, after a long pause, it has become possible to readapt art to the sciences, and vice versa, by means of an evolutionary concept of symmetry. In view of the artistic evidence, I had collected data on symmetrization/asymmetrization of those form-creating master builders with the aid of whom the artist no longer works according to nature, but rather in the same manner as nature itself — we can state that the new art *ars evolutoria* (see below) can function as an example for the sciences. The obsolescence of classical modernism, including its theory and philosophy of art, is also revealed by its inability to keep pace with the development of theories in the natural sciences, e.g. the scientific and cultural significance of the theory of evolution, doubtless one of

the most important single theory in modern science. The "displaced [verrückt] reference system of modern painting", in which "the concepts of the sensory world are no longer valid" (W. Haftmann), has hitherto not been able even to approximate the "unity of the world" (W. Heisenberg). The "displacements" of modernism have not been able to illuminate the "meaning of existence" for enlightened and scientifically educated 20th-century man (see Hahn, 1989, pp. 246 ff.).

QUESTION 2

I concentrated on the phenomenon of symmetry, a phenomenon which could hardly be more manifold. Here, an object of knowledge was taken up which promised to overcome the fragmentation of science into individual disciplines, and of thinking and action into specializations that had become mutually unintelligible. Symmetry, if viewed as evolutionary instead of non-dynamic, appeared to me as being the Ariadne's thread that can show us the way out of the labyrinthine realms of science, out of the old and the new unclearness of our world. The concepts of symmetrization-/asymmetrization could indeed be a royal road leading to a new unity of science.

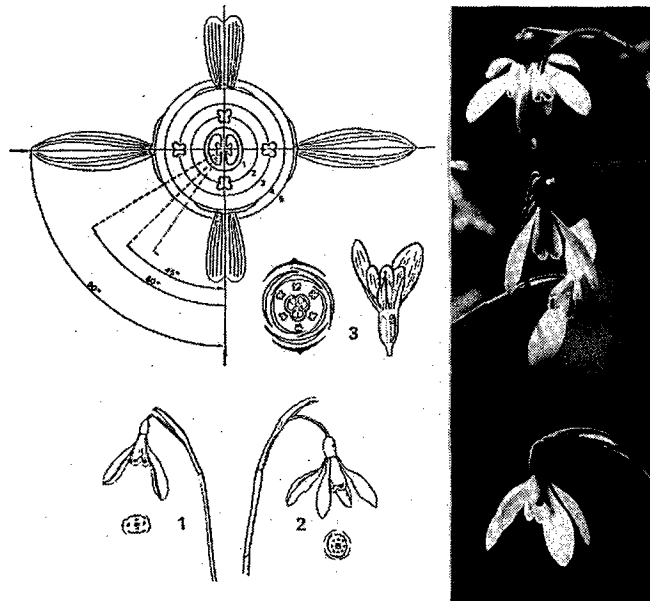
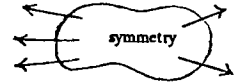


Figure 8: Outline of the blossom of a disymmetrical mutant of a snowdrop flower (*Galanthus nivalis*). Symmetrizing it with a double mirror at an angle of 90° (cf. Fig. 6) produces the disymmetrical blossom and its diagram. The "normal" triadic diagram (picture 3) of the "normal form" of a snowdrop blossom results from symmetrization at an angle of 60° ($180^\circ/3$). By symmetrizing at an angle of 45° ($180^\circ/4$), we obtain the tetradic mutant (with diagram: see picture 2 and photograph). For further details of many other blossom mutations based on the laws of symmetrization (*Linaria*, iris with photographs), see pp. 40 ff., 75 ff., and color tables pp. 293 ff., *ibid.* the color photograph of the snowdrop double blossom (upper right in the picture).

I discussed the points of contact between form-developing processes in nature and art that provide a theory of form, its development and its transformations. Emphasis was placed on the idea of symmetry at the beginnings of a dynamic, organic theory of form: Goethe, de Candolle, Darwin, and others. Plant teratology proved to be a treasure trove for *a posteriori* symmetrizations and asymmetrizations that can be observed today. It was ascertained that living nature behaves like an artist who does not permit himself to be restricted to the merely useful: the "mutation-selection theory" was surmounted (Hahn, 1989, pp. 75 ff.)

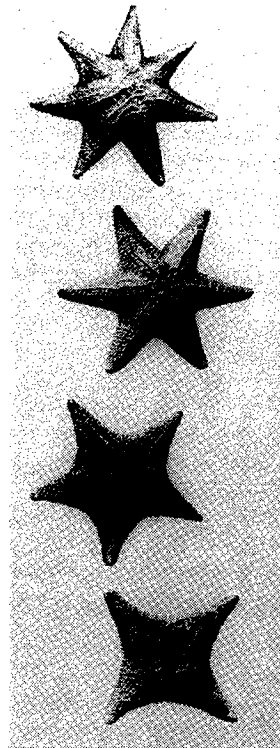


Figure 9: Genotypic variation in a sea star (*Oreaster reticulatus*), which can have four, five, six, or seven arms (according to De Beer). Comparable with the change in symmetry found in species of flowering plants, sea-star species are often found with a number of arms other than five (for further details, see pp. 30, 43, 80, and 117).

The collection of new and increasingly precise data on perception and knowledge in regard to the postulated reality of symmetry led to a further development of an "evolutionary theory of symmetry" as described in Part 3 of my book: "evolutionism/ars-evolutoria — theory of light/color and form, morphogenesis, morpho-mutability, and morpho-evolution as causal form theory" (Hahn, 1989, pp. 83-291). My purpose was to present for discussion the facts and problems of an evolutionary concept of symmetry in its applicability to many fields of non-living and living nature, to the liberal arts and natural sciences, and to society. It is my desire to stimulate a discussion of the evolutionary theory of symmetry that would transcend the boundaries of individual disciplines.

The knowledge gained through the interaction of discoveries, new evidence (often experimental), and theoretical concepts was concentrated on the paramount importance of symmetry for understanding evolutionary events in nature and art. In many areas, this knowledge produced convincing arguments, e.g. the conviction that inter- and trans-disciplinarity in symmetry research leads to a recovery of scientific perceptual abilities which are hindered by individual disciplinary developments, by atomization into individual fields.

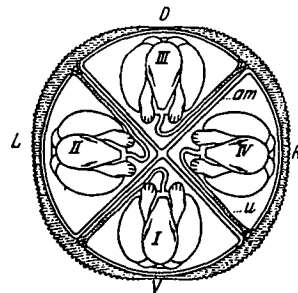
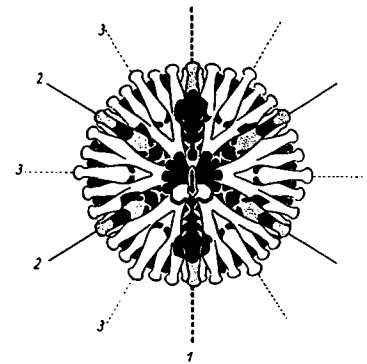


Figure 10: Cross section through the amniotic sac of the nine-banded armadillo, or peba (*Dasypus novemcinctus*) with four identical embryos. It is genetically determined that this phylogenically original species of armadillo always has four monovular offsprings of the same sex (pp. 35 ff.).

Figure 11: Symmetry levels in a sea anemone. Axis 1 = axis of bilateral construction; axes 2 and 3 are subordinate mirror levels which also appear analogously in arsevolutoria pictures (after Portmann; for further details see pp. 30 and 71).



Transdisciplinarity involves the development of an overarching paradigm encompassing a number of scholarly disciplines. The theory of symmetrization and asymmetrization as a theory of form, formation, and form-variation/mutation ("evolutionism") illustrates a transdisciplinary framework. The components of this theory (modern painting, art theory, evolutionary biology, natural philosophy, psychology, geometry, physics, chemistry, cosmology, music, etc.) are not only linked internally and closely interwoven through integration by the theme "symmetry"; but, in addition, the disciplines (monodisciplinary fields) are subsumed in the transdisciplinary concept "symmetry" under a supradisciplinary paradigm. A possible superintegration as the ideal of a unified science would be attained if all science could be reduced to a general theory of form.

Here are only some of the results and aspects of my transdisciplinary consideration of symmetry (Hahn, 1989):

- Evolution of a form is unthinkable without total disdain for, and renunciation of, form. Dissolution of form in the sense of a transformation of totalities via symmetrization/asymmetrization is in the service of a morpho-evolution (pp. 83 ff.).
- Cell division in uni- and multi-cellular animal and plant organisms can be interpreted as mirror-image symmetrization. Likewise, in meiosis and DNA doubling I recognized symmetrizing formational processes. M. Eigen has postulated a mirror-image symmetry in the structure of the "proto-gene" (cf. pp. 98 ff. and 111 ff.).
- The demonstration that changes of dimension and proportionality in ontogenesis and phylogenesis are primarily based on symmetrizations linked with asymmetrizations (pp. 99 ff.).
- Light proves to be a causal factor in symmetroclastic and symmetrogenic morphogenesis and morpho-mutability (see *Fucus serratus* as an example; pp. 104 ff., 109 ff., and 127 ff.).
- The hypothesis of the inherently symmetrical and potentially bisexual "proto-proto-proto...cell". Sexuality as a mechanism for triggering form-giving symmetrization (pp. 112 ff. and 126 ff.). Love as an act of symmetry (p. 110).

- Model concepts on symmetrization. Evolution from unicellular to multicellular organisms via morphologically "primitive" diplocells, tetrad and octet forms (pp. 122 ff. and 129 ff.).
- Demonstration that the master builders' symmetrization/asymmetrization are the foundations for perception of objects and orders as well as discernment behavior, cultural evolution (pp. 133 ff.).
- Discovery of double-mirror sight as binocular double stereoscopic vision that can be used to develop a symmetrization theory of perception via a plethora of controllable reproducible experiments with forms and colors (pp. 142 ff.).
- Mirror-image symmetry as a law of form and composition, and the "principle of precision" in Gestalt psychology (pp. 158 ff.).
- Symmetrizations as the basis of cogitation and memory (pp. 228 ff.).
- Experiments indicating that white visible light has a symmetrical structure (pp. 191 ff.).
- Refutation of the dogmatism of "absolute and blind chance" (J. Monod). Order in chaos (pp. 231 ff.).
- Ethicization via social symmetrization (pp. 233 ff.).
- Evolutionism as the third basic direction in philosophy, being neither materialism nor idealism (pp. 243 ff.).
- Evolutionism as a unification of ambivalences: "great realism"- "great abstraction" (pp. 238 ff.).
- Symmetry as a developmental principle in music. Foundation of a *musica evolutoria* (pp. 261 ff.).
- The light—matter/antimatter—energy primary model of evolution as a key figure in clarifying evolutionary processes, providing access to a "graphic atomic dynamics". Protomorphology and protomorphogeny which deny that the universe began from nothing, and postulate the dissolvable multi-unity of the infinitely small in dynamic geometry: "proto-proto-proto...symmetrization" center, "proto-proto-proto...geometry", "proto-proto-proto...three-dimensionality", "proto-proto-proto...mathematicity", etc. (pp. 264 ff. and 272 ff.).

The results of my investigations thus overcome disciplinary limitations and embarrassments: the dynamic concept of symmetry and the method of interdisciplinary parallelizing make possible to attain an overarching pervasion of the "key theme" symmetry in the fields of art, the humanities, and the natural and

social sciences, a comprehensive integration and unification of the reality of art and the laws pertaining to it, together with the reality of nature and the laws governing it. This new direction in art: *ars evolutoria* or *evolutionism*, originally called "harmonic art" or "symmetrism", is, owing to its direct provision of experience, outstandingly suitable for making us aware of the fascination of symmetry as an evolutionary construction principle in nature and culture.

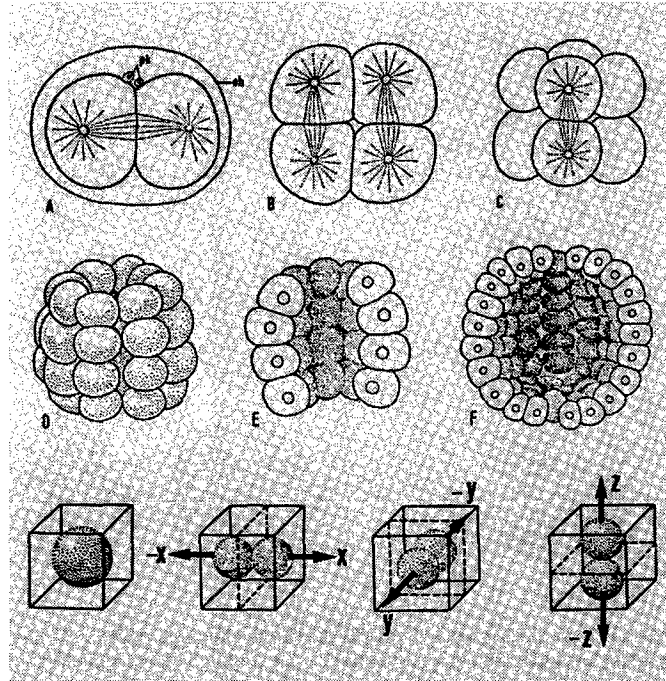


Figure 12: Cleavage with radial symmetry in a sea cucumber (*Synapta digitata*; after Siewing). In many multicellular organisms with bilateral symmetry, the first cleavage level runs congruent to the symmetry level that divides the basic structure of the organism into two halves: first symmetrization to the diploid stage at A; this is equivalent to the equatorial level of the cell-division spindle during mitosis. The four-cell stage (B; tetrad form) and eight-cell stage (C; octet form) are attained by two additional symmetrizations vertical to each other. Below: case model for symmetrization of an initial cell that extends to the entire dipolar co-ordinate system. Dashes indicate symmetrization levels (for further details see pp. 116, 321).

Moreover, *ars evolutoria* is based on Goethe, who appraised art as a "true mediatrix", as the "most worthy interpretress" of natural reality (concept of style). The art style evolutionism, which is directed towards the "unity of entirety", contains, as an integrative perspective, aspects of the following fundamental stylistic directions: realism (cogitation), surrealism (emotion), expressionism (sensibility), and constructivism (intuition) — all reflections of basic human psychosomatic structures — in an overall synthesis ("reanimation of modernism"; see Hahn, 1989, pp. 244 ff. and 251 ff.).

QUESTION 3

The style *ars evolutoria*, with the variants "neo-cubism", "neo-baroque/neo-mannerism", as well as "atomism" ("pointillistic evolutionism"), provides a possibility for presenting and elucidating additional comprehensive connections that previously could not be expressed in art.

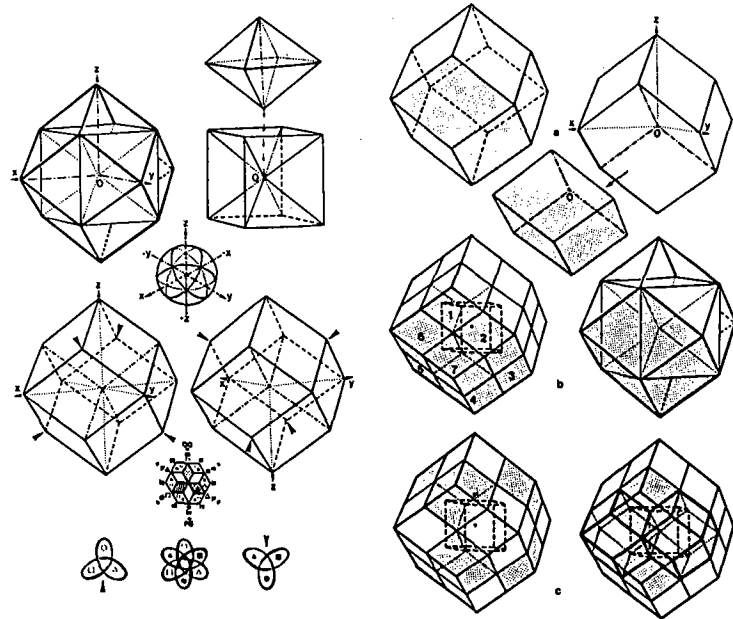
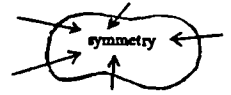


Figure 13: What was before the big bang? Two pictures from the large number of illustrations on the protoform theory of my evolutionism. Approximation to the infinitely dense singularity at the beginning of the universe, as postulated by physicists. Protoform pattern with a fundamental honeycomb structure: rhombic dodecahedron with rhombic hexahedra, concave cubes and rhombic dodecahedron, double pyramids, triquetra vibration, color/light circle of *ars evolutoria*, etc. (For further details see pp. 264 ff.).

On the one hand, I use the expressions *ars evolutoria* and *evolutionism* synonymously as stylistic concepts, but in addition, I achieve an actualization and extension of the 19th-century term "evolutionism" in regard to a philosophy of nature and culture. In my pictorial work, and also in my book, the scientific attitude and the artistic vision are not antithetical. Since the search for unity in nature on an evolutionary basis requires transdisciplinary points of view and hypotheses in order to obtain knowledge of the symmetry/asymmetry phenomenon, and since there are many points of contact with the Renaissance, especially with the researchers and artists Leonardo da Vinci and Albrecht Dürer, the purpose of my art and my book is to found a Neo-Renaissance as a "belligerent movement".

This new concept for a new style and a new epoch: "Neo-Renaissance" as a constant challenge to cultural reflection, thus designates a new beginning for a comprehensive and evolutionary knowledge of the world obtained by a union

between science and art. In view of the linking and interaction of the two, my book places critical emphasis on the art and cultural history of modernism: it is a plea for a positive, culture-forming attitude towards art. I hope to establish and encourage a dialog between institutions, disciplines, and persons involved in cultural activities of the present who so far have carefully avoided taking one another seriously.

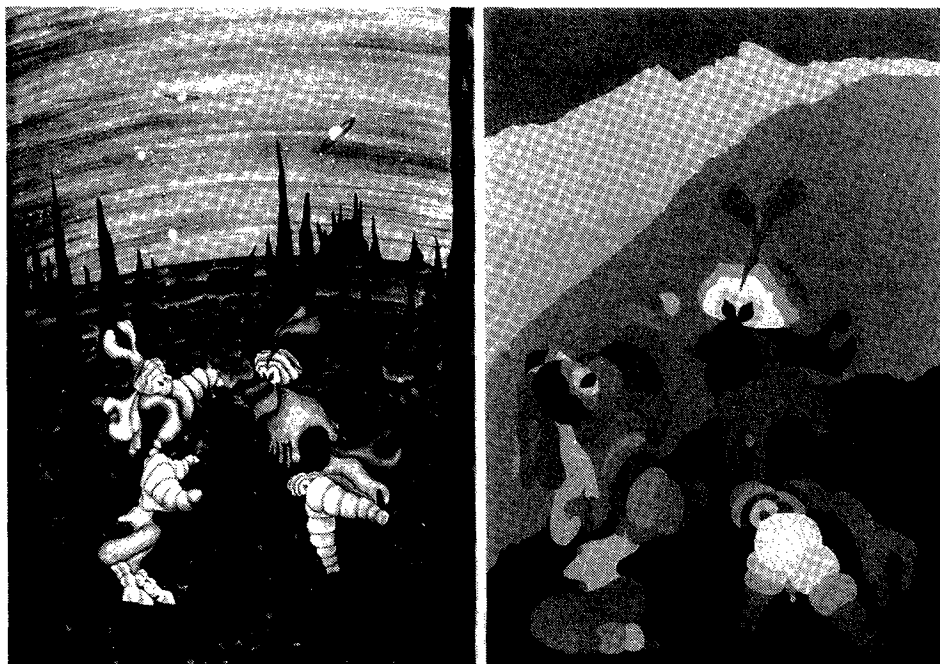


Figure 14: Two variants of *ars evolutoria* as "neo-baroque—neo-mannerism". Changes brought about by "trasmutazione di forme" (Leonardo) permit communication between the two bilateral organisms (cf. Hahn, 1989, Fig. 21, study, lower right). Movements, social "life together", are associated, resulting in a "secularization" of *ars-evolutoria* painting (popularity). (For further details see p. 255).

In addition, my work is intended to lead to a new understanding and consensus between competing world views, and between the cultural and natural sciences. On the basis of the universality of the form-creating and form-changing evolutionary factors: symmetrization/asymmetrization, and in agreement with the evolutionary theory of knowledge, perspectives also emerge for a new and progressive philosophical direction, with the goal of "social symmetrization", i.e. ethicization by means of growing knowledge (Hahn, 1989, pp. 221 ff. and 233 ff.). The Neo-Renaissance is convinced that man and society are capable of further education and development in the direction of perfection. It advocates the surmounting of the "fragmentation of our world view" (R. Riedl) by building a bridge between nature and mind.

Thus it is important "to have unrolled the phenomena of symmetries in their full breadth to a monumental work; whether in quanta, atoms, and crystals, or in corporeal forms, senses, and brains, or in the forms of all the artifacts that have

originated from human activity. Only then we will become aware of our potentialities: the concert of relations that joins the inorganic and the organic, our sensibilities, our thoughts, and our deeds; that which reciprocally unites nature and culture in the human psyche." (Riedl; see Hahn, 1989, p. 5).

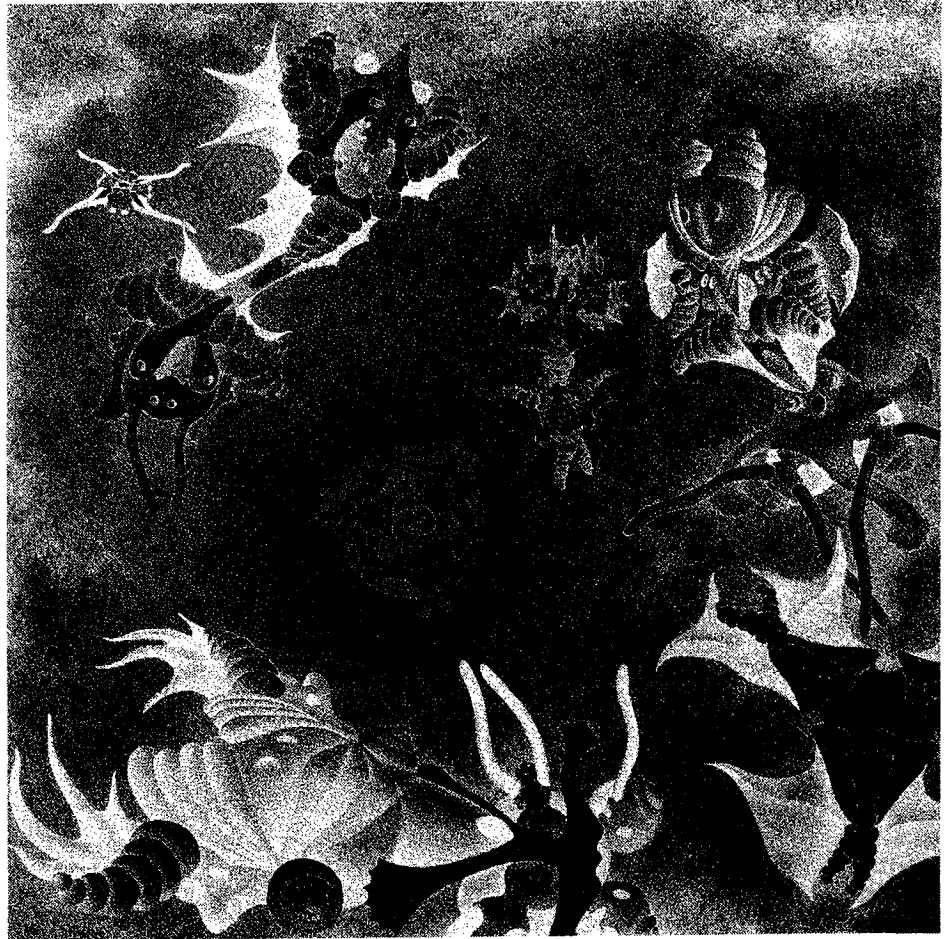


Figure 15: This stylistic variant of an "atomism" or "pointillism" in *ars evolutoria* was founded with the picture *Conditions of Existence after the Big Bang* (ink, 25 cm x 25 cm). The inspiration for the picture came from my protoform theory. (For further details on the syntax and semantics of the picture see pp. 284 ff.).

REFERENCE

- Hahn, W. (1989) *Symmetrie als Entwicklungsprinzip in Natur und Kunst*, [Symmetry as a Developmental Principle in Nature and Art, in German] Königstein im Taunus: Langewiesche, 320 pp.