Gerard Caris or Measurable Infinity

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Confronted for the first time with the work of Gerard Caris, the question is immediately raised of the meaning of his geometrical art. What, exactly, is this work about? Such intricacies can only be brought to light through an art critic's description and analysis. Such descriptions, however, often do nothing more than point out the geometrical-serial character of the work, which seems to emanate from certain regular shapes which provide the basis for exploring the possibility of combinations of these geometric patterns. It is, in this respect, vaguely reminiscent of Arabic decorations, or of nineteenth-century, predominantly Anglo-Saxon publications about complex, decorative geometric patterns which were designed and studied by artists of the "Arts and Crafts" movement.[1] These writings were based on the Classical idea that universal beauty derived from the relationship between size and number, according to the laws of harmony. Aesthetics was the science of this universal beauty. Such universal harmony is by definition, however, purely formal and decorative and consequently without content. Does it make sense, therefore, to delve into the content and meaning of work of this sort? In Caris's case, moreover, we are dealing with contemporary work. An art critic's description would therefore attempt to place this work in its own twentieth-century context and describe it as Constructivism, Minimal Art, Conceptual Art, or neogeometry with which it displays only the most general and superficial similarities. Caris's works have a spatially constructive effect and are made of cool and shining materials, such as stainless steel, chrome, polystyrene or polyester, plexi-glass, and steel wire and tubes. As in the work of Minimal artists such as Donald Judd and Sol LeWitt, one recognizes also in Caris's work connections with geometrical-modular elements. In both cases the physical execution of the work has nothing to do with the creative process, which is completely determined by the concept which precedes it: "The idea becomes a machine that makes the art itself."[2]

Such a description can hardly be called a thorough analysis of Caris's work, but rather a classification and allotment of his oeuvre to a place in a modern tradition of works of a similar nature, on the basis of outward resemblances only: description of style as a Linnaean classification.

A critical description which limits itself to such general qualifications of style, such as geometric, constructive, or serial, does not teach us much more about this work and its meaning. Such commentary quickly deteriorates into the blurred arguments that are so typical of dissertations on movements like Minimal and Conceptual art. Characteristic of this general discourse is its domination by pseudo-scientific terminology in which concepts such as construction, structure, space, module, experiment, theory, and basic research continually crop up. However, the descriptive value of these terms with regard to the work of art being examined can seldom be defined exactly. The terms have, for the most part, only a metaphorical meaning. They merely wish to point out to the viewer an objective-scientific character which is clearly recognizable in the work. It is for this reason that writings about this type of art often come across as empty rhetoric, due to the complicated nomenclature and scientific terminology. This is already apparent in one of the earliest writings in this field, the Realistic Manifesto by Naum Gabo and Antoine Pevsner. They present Constructivism as a laboratory for basic research, which should consist of "investigations" into form, colour, material, and spatial relations, on an abstract basis, without an explanatory function referring to a concrete or other reality.[3] Here one never comes across a definition of the problems posed in this research. One is also left in the dark with regard to "investigation". And because it is unclear what problems are posed by this research, it is also impossible to pin down the solution to these problems. As a result of this basic research, therefore, the work of art is considered to be the solution to a formal problem, the component parts of which are indeterminable. The success of the work of art, i. e. to what degree it has succeeded in solving the formal problem posed, can apparently only be judged on the basis of pure aesthetic intuition. The solution offered for certain problems of form, therefore, has absolutely no logically compelling character. In other words, one can not track down the logic of the development of this sort of research, or which limitations might hinder its progress or even make the solution impossible.

Artistic research, therefore, as opposed to scientific research, seems to function in unlimited freedom. What is called method in critical jargon is ultimately pure intuition. The commentary on this sort of work also operates in complete freedom, not letting itself be tied down to terminological exactitude, nor employing any criteria of logical argumentation.

Hence the Minimal artist Sol LeWitt states that the artistic intuition of his art has absolutely no basis in any theory: "This art is not theoretical or illustrative of theories. It is intuitive, involved in all kinds of mental processes and it is purposeless.[4] It can therefore not even be said what this sort of art is an intuition of. It is founded on indefinable mental processes and the work of art itself cannot be interpreted as being anything other than "mentally interesting to the spectator". This sort of work is not abstract simply because it has no reference to reality as an image or figurative referent. It is abstract in a much more radical sense, in the second degree, as it were. Modern geometrical art, from whatever direction, does not permit any definition to be given to the determinants of the so-called problem of form which is posed. One can therefore not say what this work is about, i. e. to which concrete reality it refers. Worse still, one can not even say what is being stated on an abstract level about reality, in the form, for

example, of a theoretical explanatory model such as is common in physics. A critical description is also lacking of given elements which, in one way or another, could be articulated.

Especially in the case of Minimal Art, description quickly runs aground due to the lack of such elements, whose complex structure could be put into words. Characteristic of this movement, as is well known, are the simple geometric forms such as the cube, sphere, and pyramid, which call for only the most elementary articulation and arrangement. Now then, it is one of the theses of perceptual aesthetics that the eye has an aversion to forms in which it perceives no order, in other words, chaos. On the other hand, it is also true that the eye is not arrested by shapes which are only and self-evidently orderly. On the contrary, what does fascinate us is looking at forms which are complex and at the same time orderly in nature. Here this order is somewhat hidden in a complexity which is at first difficult to unravel, but while contemplating it, the order emerges as the secret law which governs this complexity, of which it is also the solution.

The static, solid character of simple geometric forms in a given space leads to boredom and this is a reproach which is often heard from critics on Minimal Art. Gerard Caris, in a lecture at the Parsons School of Design in 1981, also articulated this thought: "While those static aspects provide a stable background for physical orientation, they do not allow for much variation in the field of vision. Externally monotonous and internally predictable, the strict adherence to square or nearly square conditions men's spatial perception and narrows his mental scope... Prolonged exposure and keeping in line with uniform visual fields causes boredom."

That which was announced in the pre-war Constructivism of Gabo and Pevsner as basic research of complex spatial structures would, in Minimal Art, result in simple, closed geometric forms whose most important characteristic is their rigid nature as compact volumes in space. Despite the radical rejection by these Minimal artists of thorough analyses and interpretations of their work, one may ascertain th at art critics' descriptions of their work does not often limit itself to physical elements such as colour, materials, and size. The search for meaning in this art and the impossibility of articulating a meaning in this elementary form often entices the critic to mere aesthetic contemplation, which naturally slides into a pseudo-religious mystique of emptiness. The commentary is further riddled with metaphorical connotations which, just as flowery, uncontrolled rhetoric, flourish on the very thin layer of humus composed of these elementary forms. The minimal forms and volumes become the object of a contemplative meditation which is the antithesis of scientific research. In other words, these treatises then seem to be a desperate attempt to approach, though only approximately, the sense and meaning of these works.

A critic who is enmeshed in a discourse such as this 0'ill have difficulty appreciating the work of Gerard Caris, which is rooted in an entirely different artistic context. He would therefore categorize Caris's work as formal abstract art which is based solely on aesthetic intuition, and would fail to recognize the clear statement of a problem for which a solution is being sought: it therefore has more to do with content

than with pure form. Thinking about a work of art as a thing with content was already problematical in the writings of Kant. He made a distinction between *freie Schönheit* (intrinsic or self-contained beauty) and *bloss anhängende Schönheit* (dependent or relative beauty). With this last concept he meant that the content or the subject of the work of art is not of an essential nature, but rather an added element. The actual artistic element would be situated exclusively in the form. According to Kant, only in the case of intrinsic beauty con the judgement of taste be pure, i. e. aesthetic and unconstrained (*reines Wohlgefallen*). According to later formalistic art history and its investigation of style, art was also to be found in perceivable forms - the purely visible.

Authors such as Riegl and Wölfflin, for example, thought that the subject or content made no essential contribution to the artistic nature of the art work. The form ensured the autonomy of the artistic phenomenon; the work of art had therefore to be dissociated from any content or description of a non-artistic nature. The logic of this theoretical paradigm also led to the phenomenon of abstract art.[6]

This late nineteenth-century formalism, however, which is also the basis of the critical appreciation and theoretical justification of the twentieth-century avant-garde, was itself the offshoot of a much richer literature, in which the content and meaning of the work of art posed the central problem for critical description and interpretation. Only in the last years has attention been drawn to the range of these (often still) unknown aesthetic treatises and literature of art theory, which display this preoccupation with the meaning of art.[7] It is at present impossible to get an overall picture of the complex theories in these eighteenth- and nineteenth-century writings, in which, besides science, art is also seen as an instrument for gaining knowledge and truth about reality. The earliest of these writings dates from around the middle of .the eighteenth century. The heart of these aesthetic theories is based on the principle of an analogous explanattion of reality, which harks back to the age-old analogous thinking of ancient philosophers and thinkers such as the Pythagorians, Platonics, neo-Platonics, gnostics, and cabbalists, and which took on its most fantastic forms in the alchemy of the Middle Ages. In the eighteenth century we see a general tendency arising to develop anew a sort of logic from analogous thinking, whereby it was purified of its wildest and most fantastic excesses, to which it had fallen victim in the Middle Ages. The nineteenth-century author George Field states in his book *The Analogy of Logic* (1850): "Hitherto analogy has been consigned to imagination, employed in the construction of symbols, rhetorical and poetical allusion, or common illustrations by example, and excluded from strict ratiocination and science."[8] Field maintains then, that opposed to inductive scientific thinking which draws general conclusions about the systematic nature of things by observing particular examples, there exists also an analogous way of thinking in which one departs from universal laws in order to draw conclusions about individual cases. The idea was that the whole creation was governed by laws which determined the farm of things and accounted for the comparable forms (analogies) between natural phenomena of a most diverse nature, and could shed some light on the essential character of these things. Nature was a network of corresponding forms, in which the things

revealed their true nature. "All knowledge is relational. . . the order of these relations is pure logic and hence the whole system of truth…is analogical."[9] Analogous logic was therefore based on the idea that the universe was governed by basic universal structures, which could be recognized to be in endless metamorphosis on anorganic, plant, animal, and human levels, and which ultimately provided insights into the spiritual nature of existence and the psyche of man. In other words, the world was seen as an immense network of correlations in which a profound, ultimate meaning lay hidden.

One of the most important writings in which this analogous thinking is recognizable is Goethe's *Versuch die Metamorphose der Pflanzen zu erklären*[10] In this treatise Goethe endeavors to trace, through the multiform nature of the plant world, the basically abstract structure of the transcendental primordial plant.[11] The great adventure of philosophy, science, and art was the discovery of the ultimate meaning of the world and human existence. The importance of this analogous thinking is evident not only in the many studies of the phenomenon of synaesthesia, in which one attempts to track down the profound correspondences between forms, sounds, and colours. New sciences such as pathognomy and physiognomy, in which one tried to draw conclusions about the character of an individual from his facial expressions, testify to the belief that was attached to the logic of analogy.[12] Analogous thought also forms the theoretical basis of many works of art and aesthetic writings, from Philipp Otto Runge to Paul Klee and Wassily Kandinsky. The theories of Kandinsky are actually close to the origin of abstract art. [13]

The basic principles of this analogous thought are rather easy to identify in pronouncements by artists such as Gauguin, Delaunay, Le Corbusier, Baumeister, Wols, Mondriaan, Malevitch, and many others, although, in the twentieth century, they were no longer supported by an explicit aesthetic theory, but were only identifiable in their writings and aphorisms as residual elements of this theory.[14]

This enormous ambition, to develop a logical analogy which attempted to explain, in scientific as well as artistic terms, the total context of the universe - microcosm and macrocosm, world and existence - came to an end in the nineteenth century. This whole line of thinking was then absorbed into new esoteric and spiritualistic movements such as theosophy and anthroposophy, in which it often went into hiding in the form of occultism. The theories of abstract art of Malevitch, Kandinsky, and Mondriaan stijl reflect this analogous thinking about forms, lines, and colours as the expression of a deeper spiritual content.

A more scientific version of a theory, which attempts to explain the expression of forms, lines, and colours as the basic structures of art, is found in the writings of the nineteenth-century Gestalt psychology. The most recent application of Gestalt psychology in the formal analysis of art is found in the writings of Rudolf Arnheim.[15]

In this long art-historical digression I have only wished to show that contemporary formalistic art criticism still bears traces of this old complex theory of the analogy of forms which was directed at knowledge and truth about life and reality, and to which both science and art could contribute. The of ten wavering nature of formalistic

commentary in contemporary art criticism is, however, no longer supported by such an elaborate theory of logical analogy, for which reason it of ten degenerates into empty rhetoric full of profound contemplations which vegetate on the work of art and wonder unchecked until they become too rarefied for comprehension.

This all goes to prove how difficult it is to describe the work of Gerard Caris in the terminology of an art critic who attempts to interpret phenomena such as Constructivism, and Minimal or Conceptual Art. Furthermore, if the description of his work is inadequate, then the sense and meaning elude us. One is then able to recognize only the decorative play of geometric patterns.

This digression is also within the framework of the general problem of the adequate description of works of art and the possibility of talking about art in a comprehensible way. In other words, is it possible in Caris's case to describe his work as being something more than structured, constructive, or serial? Can it be more than the enumeration of the materials and techniques with which it was realized? Can we penetrate to the work's message, to its content? If it is a question of content and meaning, then another question is immediately raised, that of the referential character of this work. About which reality is Caris's work speaking? What is his subject, his frame of reference?

One could raise the point that his work is abstract and that the question of content is therefore irrelevant. Indeed, his work is not figurative: it does not refer to a concrete reality which is visually recognizable. But this does not mean that his work is not about something. A philosophical or mathematical discourse also has a frame of reference, which is apparent due to the fact that, emanating from a number of propositions, it becomes a composite whole of propositions in which something is maintained in relationship to something of which this is asserted. In this sense, Caris's work, in spite of its abstract character, can indeed have content and meaning.

This frame of reference, the content of his work, can only be brought to light by an iconographic analysis. One must then assert that it is far removed from the frame of reference of twentieth-century Constructivist tendencies and also has nothing to do with the analogous thought of nineteenth-century aesthetics, as briefly explained above. The physiognomical treatises of Lavater, Goethe's doctrine of metamorphosis, or Klee's *Unendliche Naturgeschichte* (Neverending Natural History) were aimed at discovering universal laws in the phenomena of living nature. The teachings of eighteenth-century natural history and nineteenth-century natural science were their common frame of reference. Their objective was a qualitative description of the universe which was supposed to reveal its deepest spiritual dimension: the unity of micro and macrocosm. This kind of universal natural history was enmeshed in a paradigmatic struggle with the quantitative and inductive science of modern physics, which had been developing since the eighteenth century.[16] "The Napoleonic years saw the steady abandonment of analogy in the life sciences which began to take on the character of the physical. Empiricism and rigorous modes of interpreting experimental results brought a positivistic tone to biological science. The harmony once believed to exist between life and the energies of matter was disrupted."[17]

The iconography of Caris's work must be situated in the earliest philosophical research of Antiquity concerning the essence of reality, in the cosmological thinking of Pythagoras and Plato. This thought about the nature of the world and reality was directed especially at the order of the universe, at the cosmos. Cosmos signifies order and beauty and is the opposite of chaos. The order and beauty of the universe are, according to these thinkers of Antiquity, based on relationships of size and their internal harmony.

From the One, the monad, came the numerical series of numbers. The One was also the transcendental Good and Beautiful. The numbers were connected to the greater ordering of reality: the dual nature of the number two was an expression of masculine and feminine duality, the number four described the directions of the wind, the four elements of water, earth, fire, and air, the four seasons, the four temperaments, etc. The fascination that arithmetic and geometry held for these thinkers is apparent from the way in which Plato, without any empirical knowledge, described the qualitative difference between the indivisible building blocks of the four elements, the atoms, as a quantitative difference: "There are therefore four kinds or atoms, each atom of fire is a tetrahedron, each atom of air an octahedron, each atom of water an icosahedron, each atom of earth a cube. The fifth regular polyhedron, the dodecahedron, was used by the deity for the whole (cosmos), arraying it with signs." [18]

The thinkers of Antiquity considered the measurable nature of things to be tied up with their essentiality, their specific qualities, or why they are as they are. The essential nature of 011 things expressed itself in measure and number. Only primordial matter was unformed, dead quantitative weight. Aristotle also distinguished between form and raw material. His hylomorphism is the basis of his ontology. Matter is only recognizable because of its measurable form. All specimens of a similar kind are subjected to the same formal law, and thanks to their essential differences from other sorts or species, they may be defined by the similarity of their characteristics. The origin of the essential nature of a thing is the *causa formalis*. A thing becomes recognizable (*forma intelligibilis*) because it is true to its nature, has an identity and is not indefinite. Knowing the nature of things, therefore, means investigating their relationships of size and number. The physical appearance is only an outer layer of an abstract formula which the thing only makes to fit its essential nature, a measurable form.

The fact that the frame of reference of Caris's work must be situated in this thinking from Antiquity about the nature of things and mathematics does not mean that the artist first made a thorough study of the ontology of Antiquity and the role that mathematics played in it. The central idea which is fundamental to his art displays, however, a curious similarity to this way of thinking in Antiquity. It is the idea that qualitative aspects are connected to the numerical series of figures, to geometric shapes, i. e. that numbers or geometric shapes cannot be reduced to mere quantitative relationships. Modern mathematics considers numbers and geometrical figures to be neutral, however. This insight dawned on Caris when he discovered that certain regularities are in play which govern, for example, the possible combinations of certain

geometric figures. It seemed, in fact, that such geometric figures were qualitatively different from others, in that they cannot so easily be combined into continuous patterns. The pentagon is one such unmanageable figure.

The fact that, from Antiquity until the Renaissance, qualitative and not merely quantitative differences were attributed to geometric figures, is already apparent from the symbolic value attributed to the numbers 3, 4, 7, and 10, in mythology, fairy tales, as well as religious rites. They were meant to have a sacred or mystic meaning. In Johann Keplers astronomical calculations, aesthetic-qualitative proportions play an important role in the explanation of the orbiting of the planets. One of the proportions to which the mathematicians of the Renaissance attached great value was that of the Golden Section, in which the relationship between the numbers 3, 5, and 8, the so-called series of Fibonacci, approach the value of 0.618. This means that the number 3 is in the same proportion to the number 5, just as 5 in its turn to the number 8. Lengths which are in the proportion of 1 to 0.618 fulfil the requirements of the Golden Section. [19] This relationship is based on the following equation: the smaller length a and the greater length b are to each other as b is to (a + b) or a: b = b: (a + b). Therefore, if the longer and shorter lengths are given, one con, through further division, produce an infinite series of lengths which are in the proportion of the Golden Section.

These relationships of size have also been established in nature. According to Kepler, the relationship between the time required for one orbit of Earth and Venus was 8: 13.

This relationship was recognized in leaves and flowers, as well as in the branches of a tree, climbing in a series from large at the bottom to small at the top. Also the joints of starfish, the Cochlea snail, the bodies of insects, and even that of man correspond to the Golden Section.[20]

This established relationship is also found in art. The attempt has been made to unravel the secret of beauty via rational explanations. Beauty is supposedly based on a principle of unity in diversity: the relationship between smaller and larger compositional elements should be the same as that of both of them to the whole of the work of art. The diversity is therefore based on the same ratio.

One finds them in Egyptian architecture and ornamentation, in Greek and Roman temples, in Arabic decoration, in the Gothic cathedrals, and in Raffael's *Sistine Madonna*. Not only Leonardo da Vinci and Albrecht Dürer, but also modern artists such as Johannes Itten of the Bauhaus and Mario Merz remain fascinated by it, and this list is certainly not complete.

This does not prove, however, that the Golden Section is an aesthetic law. In perceptual psychology test persons have been asked to decide which proportions they found aesthetically pleasing.The Golden Section was usually among their choices, but successful experiments to repudiate this have also been carried out.[21] Much here is unclear. For example, one must take into account optical illusions: the same length, seen in a vertical position, appears to be 7 % longer than when seen in the horizontal position.

There also existed in the persons tested a predilection for proportions such as 2: 3 or 1 : 2. The Golden Section as a rule and law of beauty and harmony is therefore, scientifically speaking, not so self-evident.

It seems that the proportion of the Golden Section is especially preferred by the persons being tested when it enables them to track down equivalents in a complex geometric pattern. Complex figures are seen to be symmetrical if two or more forms are incorporated into the total composition (so that together they become a farm of a higher order), or if they crop up as separate lengths in other groups of forms.[22]

The regularity of complex geometric figures can be observed by the uneducated viewer only up to a certain point. He con no longer perceive the information from even more complex figures.23 In order to track down the nature of this regularity one must appeal for help from mathematical analysis. The problem, however, is that the average viewer does not have the mathematical background at his command to make the calculations necessary to transform complex geometric groups. With complex farms such as those of Escher and Caris, the viewer then undergoes on aesthetic experience, i. e. he does perceive the order within the complexity, but the principle which governs this order eludes him, which produces the effect of vertigo. An analysis con help the viewer to trace the rule of symmetry which dominates the whole structure. Without this analysis, he may well see a similarity between elements and the way they are joined in the structure, but not the low governing the similarity. One recognizes this geometric regularity immediately in simple geometric farms, for example in the case of the square, the rhombus, the circle, and the triangle. For this reason, these farms were used in schematic drawings of irregular natural farms, from the time of Villard de Honnecourt to contemporary textbooks of drawing, which still employ this method. In the case of more complex farms, therefore, one has as a viewer an inkling of a higher, mysterious order which is not immediately discernible, even though it is palpably present. It is this tension, that of on unsolved hidden secret, which ploys a role in complex ornamental patterns, such as in the work of Escher.[24] Here appears the idea of the unfathomable and the infinite, and the insufficiency of human powers of comprehension.

Even for the mathematician who is capable of determining the rule of symmetry which is the basis of such complex patterns by analyzing the systematic nature of the figure, this mysterious element continues to be a baffling presence, albeit on a higher plane. He is also not able to picture the entire visual field of the complex figure. From the multiplicity of visual impressions evoked by the various ports of the composition, his attention con be held only by one certain configuration at a time. Formal relations in the figure which also form other configurations disappear for this reason into the background, against which he sees the profile of the one figure. He can therefore, at any given moment, only retain a limited amount of the information presented: certain lines, angles, points of intersection. Hence a complex pattern has a dynamic character, because it reveals itself in different configurations which, through continuous transformations and metamorphoses, change into ever new aspects. Such patterns, therefore, retain

their mysterious aesthetic effect even for the mathematician.[25] The various configurations from the optical field which is the figure itself acquire in each case a certain meaning in each separate configuration and many meanings in their transformation into yet other configurations. It is impossible, however, to gather all the configurations into an integrated meaning of the total visual field. This is all the more baffling for the mathematically experienced viewer who understands that this continually elusory nature of the total picture is in contradistinction to the fact that the figure is based only on a very limited number of rules of symmetry, each of which is reducible. If we call these rules of symmetry, from which the complex figure is generated, the semantic matrix, it means that this is capable of generating a number of configurations as meanings, which are related to each other on the basis of a number of deductions and transformations, but which cannot be integrated in a single reading. The discovery of one configuration leads simultaneously to the loss of the previous one. The viewer remains fascinated by the figure, because the only possibility of tracking down the semantic matrix involves the continuous joining of the figure in ever new readings of other configurations.

In an earlier publication I described the same phenomenon with regard to the iconography of figurative representations in art.[26] Even though we can point out the iconographic elements in a representation - identify figures, explain themes, trace allegories - we are nevertheless unable to state, with such an exhaustive explanation of the iconography and the subject of the painting, that the total meaning of the work of art is merely the sum of these individual parts. The most gripping part of an image is, in fact, that between these iconographic elements which are actually of an unambiguous nature, certain semantic and formal relationships become visible, often producing a complex network of connotations. These relationships are of a contextual as well as a formal nature, but both are semantic. An iconographic figure can be associated with another in a contextual way in the same representation, but it may also give rise to recollections from a wider artistic or historical context. The Bible contains good examples of this: Isaac carries the wood for the sacrifice to be made by his father Abraham, Christ carries the cross on which he will sacrifice himself. Figures may also display similarities in composition or colour in a formal sense, these being then directives by which the viewer is led to recognize complex semantic relationships between the figures. These relationships are therefore of both a contextual as well as a formal nature. They form configurations which one would call types in figurative art. In this way originate connections of complex connotations in an image. Connections of semantic elements lying on the same axis are called in semantics isotopes, i. e. they are elements of meaning lying on the same topical plane. It is these isotopes which form the layers of meaning in an image, semantic networks or *réseaux* on which the image may be read. In this respect, those iconographic figures are especially interesting which can be read on more than one isotopic or connotative circuit and are therefore a kind of "shifter", through which the reading of a painting shifts from one plane to another. The same thing then occurs as when observing complex geometrical patterns. The "shifters" lead the viewer over

and over again from one isotopic plane to the other, from one reading to another. The most important characteristic of this is that the total meaning of the work cannot be comprehended in one reading. The semantic matrix continually generates metaphorical transformations between the various isotopic levels and can therefore not be expressed in one definitive reading. It remains the hidden kernel of meaning which always eludes one upon "reading" a painting.[27] It is recognizable, but, as the generating principle, cannot be exhaustively described.[28]

The aesthetic character or effect of a work is, after all, not dependent upon its being more or less complex. A higher degree of complexity does not necessarily increase the puzzlingly intriguing or fascinating character of the figure.[29] The isotopic networks and interweavings must be generated by the same matrix, so that, through their transformations, they may be reduced to the simplicity of the matrix. A typical example in this respect is the often semantic *horror vacui* of amateur painters who attempt to enrich their work and make it more profound by loading it with extremely complex symbolic content. Such semantic complexity is, however, not the result of a semantic matrix which generates the connotative wealth of the work via laws of transformation. It consists only of an unstructured conglomeration of iconographic elements.

What makes the structure of meaning in an art work surprising and fascinating is something which remains unpredictable. It is in large measure dependent upon the way in which it refers to a larger socio-cultural context, to the values and conflicts of values in a certain society or period of history. It is, for this very reason, more difficult to be captivated by Gerard Caris's structures if one approaches them via the context of recent Constructivist currents and their commentary. The meaning and especially the sense of his oeuvre will, however, become much more intriguing when viewed against the background of a mathematical train of thought in which the qualitative character of numbers and relationships of size occupy the center of importance. We recognize this mathematical way of thinking not only in the traditions of Antiquity and the Renaissance, but also in a number of problems posed by science today.[30]

In interpreting Caris's work it is therefore important to determine the frame of reference in which it belongs. We may pin down this frame of reference in a type of form which occurs throughout Caris's entire oeuvre and which determines the rules of articulation and transformation in nearly all his representations: the figure of the pentagon. The artist did not choose this figure, however, due to any prior knowledge of ancient geometry. The choice of this figure and its derivatives was purely intuitive. I refer to the earliest work in which the pentagon appears (Fig. 1). What fascinated Caris in this form was the fact that it could be divided by five diagonals of equal lengths which then produced a pentagram, the center of which was itself a pentagon (Fig. 2). These diagonals intersect each other in the proportions of the Golden Section. Why exactly is the pentagon such an interesting figure? To begin with, it is more complex than geometric figures such as the circle, the square, and the triangle. The number of

angles of these simple figures displays a certain ratio. Their number is not arbitrary. With a triangle, the number of angles is limited to the minimum necessary to fill a plane. With the square, their number is in proportion to the number of directions. And finally, with the circle, the change in angle is minimal.[31]

The triangle, the circle, and the square are basic shapes because they are three irreducible forms of simplicity. All three display a minimal number of irregularities which make them capable of defining the form of a plane. All other regular polygons are indeed more complex, but their greater complexity cannot be used visually to realize regularities other than those in the plane.[32] This is especially true of the pentagon. As the first of the series of complex polygons, it was credited with a special symbolic meaning in Antiquity and the Renaissance. The three simple geometric figures (triangle, square, and circle) were associated with the measurable - science and culture. The pentagon, on the other hand, referred to something which could not be reduced to the internal ratio of the plane. The number 5 represented that which rose above the ratio. There are numerous testimonies to the qualitative meaning attached to the pentagon in the mathematics of Antiquity and the Renaissance. Five was the sign of the fifth unfathomable element, the ether, the *quinto essentia*.[33] A special significance was attached to the pentagon, especially because of its capability, when divided diagonally, to produce the pentagram in the proportions of the Golden Section. The pentagon already appeared as a secret symbol used by the Pythagorians, the alchemists of the Middle Ages, and later by Goethe in *Faust*, as well as by the Freemasons. Leonardo da Vinci and, before him, Villard de Honnecourt drew the human figure in this shape.[34] The mysterious nature of the pentagon also becomes apparent if one attempts to fill in a plane with one (or more than one) type of polygon, yielding a completely linked-up pattern. This appears only to be successful with three types of polygons: the triangle, the square, and the hexagon. In the case of twenty-two other polygons, one must change over to partially regular divisions, for example with combinations of triangles, squares, hexagons, octagons, and dodecagons. In the case of three polygons, it is not even possible using partially regular divisions to create a joined-up pattern in the plane. This is true in the case of the pentagon, the heptagon, and the decagon.[35] For this reason as well the pentagon seems to be a special form.

The idea that a regular form will not yield to becoming a unified pattern is contrary to our feeling that every regular form, precisely because of its regular nature, must be combinable with other regular forms. The strange thing is that this is possible with, for example, irregular pentagons.[36] One can, however, fill a space with regular pentagons in combination with other figures such as the fivepointed star and the rhombus. We find such a pattern in the work of Dürer.[37] Owen Jones records in his *Grammar of Ornament* (1856) that, among the Arabic geometrical patterns, there exists only one example of quinary symmetry (Fig. 3).

It was Roger Penrose who, in a mathematical study of decorative geometric patterns, re-discovered the connection with the mathematical thinking of Antiquity

and the Renaissance.[38] In his wake followed many publications of research in the fields of mathematics, physics, and chemistry about structures with quinary symmetry. It was also ascertained that decorative patterns could be made which display no uniformness, i. e. that they no longer display the same basic structure or periodicity when translated or shifted. A good example is found in *Some New Oxford Books on Mathematics 1977-78* (Fig. 4). Such patterns were thoroughly studied after Penrose's first publication.[39]

Here Caris's artistic experiments with decorative patterns based on the pentagon meet up with the interest of scientists in similar phenomena and the mathematical problems they pose. Suddenly, via this scientific research into quinary symmetry, his work appears to have found its place in a very up-to-date and captivating frame of reference. For this reason, Gerard Caris's work has, until now, drawn the attention al most exclusively of scientists, as witnessed by their comments on his work. This does not mean that his work is mathematical or scientific, but that the artistic problems posed by his work and which form the very basis of it, display affinities with the way in which various scientific disciplines make discoveries with regard to quinary symmetry, for which there is no immediate explanation.

The optical effect of the types of patterns designed by Caris and based on the pentagon is the that the figure continually fades away to form the background to other geometric shapes with which it is combined to form a unified plane. Because the various geometric forms change from being the foreground to being the background, the plane acquires a pulsating effect which produces a feeling of disorientation. The result is that a pattern based on quinary symmetry seems continuously to expand from its plane into an illusionary three-dimensional space.Through his plane-filling combinations of pentagons and other figures and their parallel, cyclical and alternating connections, Caris continuously evokes such three-dimensional forms, e. g. the dodecahedron (Fig. 5). The optical disfigurement which is a characteristic of the dodecahedron causes an irregular rhombic shape in combination with a pentagon to be seen as a segment of the dodecahedron. This perceptive uncertainty between the pentagon and the rhombus as planes and the threedimensionality of the dodecahedron is to be seen in Caris's numerous relief structures (Figs. 6-13). The concave spaces can just as well be seen as convex forms. In this way Caris succeeds in transmitting a complex feeling of space to the viewer and so evokes, just as Escher, another space.

In spite of years of experimenting with the pentagon and its three-dimensional form, the dodecahedron, Caris experiences daily the secret, intractable nature of this figure. If one turns a dodecahedron on its axis, it remains difficult to recognize optically the regularity of its form. With every turning one can see first four, then six planes (Figs. 14a and 14b). Such revolutions produce optical illusions again and again, which give the impression that one is dealing with an irregular body. When dealing with simple bodies such as the cu be or the pyramid, such optical illusions are much more easily recognizable as views of a regular form.

It is no wonder, therefore, that Kepler associated the figure of the dodecahedron with the earth as a heavenly body in its relation to the universe. *"Dodekaedron vero relinquitur corpori celesti, habens eundem planorum numerum quem zodiacus celestis signorum."* (" For the heavenly body [i. e. the earth] there remains [in this series of planets] in fact the dodecahedron, which has just as many planes as the zodiac.")[40]

The way in which the earth in its relation to the cosmos is symbolized by the dodecahedron, while the binary, ternary, and quaternary symmetry of the other regular bodies symbolizes science and culture here below, points to the fact that Kepler felt the transition from the earthly to cosmic space to be a qualitative leap from science to the mystery of a cosmos on a higher level.

The topicality of Caris's art is made especially apparent by recent discoveries in the field of crystal structures. The symmetry of crystals is based on numbers which are composed of the factors 2 and 3, for example the triangle, the square, and the hexagon. Quinary symmetry does not occur in the case of crystals. If one now takes a look at Caris's combinations of icosahedrons or dodecahedrons, then they seem to mock the laws of crystallography (Figs.15-28). They give the impression of a symmetrical order, which is in fact not regular. The amazing thing now is that chemists have also discovered crystals with quinary symmetry, in the alloys of certain metals such as aluminium and manganese. It was the Israeli scientist Dany Shechtman who made this discovery in 1982. They are the so-called pseudo-crystals.[41] It seems as though one is dealing here with a qualitative leap from the molecular level to a higher level with quinary symmetry of a somewhat looser structure. The French matter expert J.-M. Dubois of the *Centre National de la Recherche Scientifique*, in Nancy, France, recently received the first patent for a synthetic material composed of aluminium, copper, and iron, the characteristics of which are similar to teflon.[42] As in Caris's experiments, the arrangement here of these pseudo-crystals is not arbitrary, but also not regular.

Modern science doubts more and more the existence of an absolute systematic ordering of the universe and its matter. Contemporary research in the field of artificial intelligence has directed its attention to the qualitative aspects of human intelligence and its consciousness. Scientists such as the Belgian Nobel Prize winner Ilya Prigogine were also fascinated by a form of knowledge which deviates from scientific logic and which manifests itself in artistic thinking and design.

One can, as a lay scientist, be fascinated by the work of Caris. One will only be able to get beneath the surface of it, however, if one makes the effort to immerse oneself to some extent in the puzzling aspects of mathematical and other scientific knowledge, just as the study of harmony and counterpoint con contribute to a deeper understanding of the music of Bach. This means of course that concepts such as aesthetics and artistic intuition must once again be taken seriously, i. e. that one must, just as in Antiquity and in the eighteenth and nineteenth centuries, acquire knowledge and understanding of art and that artistic intuition is no longer tossed off as open-ended, subjective fantasy. In this sense, art as well as science are two of the many forms of human *Wirklichkeitsbewältigung* (coming to terms with realilty).

Caris's work, which finds its inspiration in size and numbers, is easily connected with both the earliest and the most recent thinking over the cosmos as a recognizable order and ornament, to a cosmology in which nature, the world, and man recognize their principles of order and essentiality. The craving expressed in his work is not so much for the practical reality of applied science, as for an insight into the truth, behind which the ultimate mystery is hiding - knowledge which is at the same time the fulfillment of life. His work is connected to the acceptance of contemporary science of the unpredictability of reality, now that it is confronted with the limitations of the positivistic paradigm, with qualitative barriers in the continuity of the measurable.

Gerard Caris's artistic intuition also creates practical possibilities for alternative designs in our environment. Simple forms such as cubes, prisms, and pyramids are often used in architecture. Other more complex forms, such as those used by Caris, are still shunned by architects and designers. I refer here to Caris's designs: Model E-House, 1983 (Figs. 29a and b and 30), Model D-House, 1985 (Figs. 31 and 32) and model Q-House, 1991 (Fig. 33). Our first experience of space as children comes from the discovery of simple symmetries such as the cube, in which the principle of the four orientations is enclosed. And yet other forms, which would enable us to experience a richer, more complex perception of space, are rarely used in the designs of our daily environment. Authors such as P. Pearce, just as Caris, plead for a richer unfolding of our feeling for space through better designs.[43] The artist says, "Before birth you live in the round womb of your mother. But al most before you're born the square begins to take over."

Confronted with Caris's work, the problem posed itself of describing his work in such a way as to drive home the meaning and sense of his oeuvre. The poverty of the critical description of modern geometrical art, such as manifests itself in the commentary on phenomena like Constructivism and Minimal Art, causes one often to seek refuge in an intuitive and vague "empathetic" approach to these phenomena, which, because of their pseudo-scientific jargon, often serve to veil the meaning instead of clarifying it. The reason for this is usually that, by doing so, one hopes to point out the mysterious nature of the art work. On the contrary, it seems to me that two principles must be applied when talking about art: 1) that one CAN talk about art but 2) that certain limitations are set. The task of commentary consists of making those limitations visible, precisely through its description. I hope to have succeeded somewhat in showing, via Caris's example of quinary symmetry, how this at first glance cool, calculating work leads us to this boundary, behind which the mystery occasionally deigns to reveal itself. Here this discourse comes to an end in a paradox: measurable infinity.

Notes and References

1. D. R. HAY, *The Science of Beauty* (1856); *An Essay on Ornamental Design* (1844); O. JONES, *Grammar of Ornament* (1856); see also D. BRETT, "The Aesthetic Science: George Field and the Science of Beauty", in *Art History*, 9, 1986, pp. 336-350; C. DRESSER, "On the Relation of Science and Ornamental Art", in *Prodeedings of the Royal Institutions of Great Britain*, Vol. 2, 1854-1858, pp. 350-352.

2. S. LEWITT, *'60-'80 attitudes/concepts/images* (exhibition catalogue), Amsterdam, 1982, p. 155.
3. C. LODDER, *Russian Constructivism*, Yale University Press, New Haven-London, 1983, pp. 7-40.
4. 4 See Note 2.
5. I refer here to the explanation of perceptual psychology for the characteristic nature of visually unique forms by F. BOSELIE, "De Dodekaëder. Volmaakt veelzijdig voegzaam lichaam" in *Gerard Caris en de Viifhoek* (Dutch/German museum series) published by F. VAN DER Blij and W. KOTTE, Museum Hed. Kunst (Museum of Contemporary Art), Utrecht, 1988, pp. 58-61. As, up until now, Caris's oeuvre has attracted the attention mainly of mathematicians and chemists, I refer repeatedly to their comments on his work when it concerns aspects which are more at home in a scientific context than in art theory or criticism. My intention is especially to describe the latter. For the sake of clarity, the comments of scientists have been quoted directly in my text, as far as this was possible.
6. J. VANBERGEN, *Voorstelling en Betekenis. Theorie van de kunsthistorische interpretatie*, University Press Leuven-Van Gorcum, Assen Maastricht, 1986. p. 17.
7. K. LANKHEIT, "Die Frühromantik und die Grundlagen der gegenstandlosen Malerei", in *Neue Heidelberger Jahrbücher*, N.F., 1951, pp. 55-90; W. HOFMANN, "Beitrag zu einer morphologisehen Kunsttheorie der Gegenwart", in *Alte und Neue Kunst. Wiener Kunstwissensehaftliche Blätter*, 1953, pp. 63-80; L. LOHMANN-SIEMER, "Der Universale Formbegriff in der Physiognomik des 18. Jahrhunderts. Ein Beitrag zur Geschichte der gegenwärtigen Kunsttheorie ", in *Jahrbuch der Hamburger Kunstsammlungen*, 9, 1964, pp. 44-73. AII these studies bring much to light concerning this rich tradition.
8. G. FIELD, *The Logic of Analogy and the Logic of Analogy or the Third Organon*, published by D. BOGUE, 1850, pp. 233 and 222.
9. Quoted by D. BRETT, op. cit., p. 341.
10. J. W. von GOETHE, *Die Metamorphose der Pflanzen*. With explanatory and concluding remarks by D. KUHN, Weinheim, 1984.
11. See the recent studies by C. LICHTENSTERN, *Die Wirkungsgeschichte der Metamorphosenlehre Goethes. Von Philipp Otto Runge bis Joseph Beuys. Metamorphose in der Kunst des 19. und 20. Jahrhunderts*, 1, (VCH *Acta Humaniora*), Weinheim, 1990.
12. M. COWLING, *The Artist as Anthropologist. The Representation of Type and Character in Victorian Art,* Cambridge University Press.
13. W. KANDINSKY, *Über das Geistige in der Kunst*, (München 1912), Bentele, Bern, 1952; "*Punkt, Linie zu Fläche*, Beitrag zur Analyse der malerischen Elemente", *Bauhausbuch*, 9, München, 1926; S. RINGBOM, *The Sounding Cosmos. A Study in*

the Spiritualism of Kandinsky and the Genesis of Abstract Painting, (Acta Academiae Aboensis, 1 er. A., *Humaniora*, 38, 2), Aboe, 1970. This author demonstrates that Kandinsky's belief in the inherently expressive value of pure elements of form harks back to this analogous thinking, as witnessed by his views on synaesthesia. See also Klee's theoretical writings which he wrote while teaching at the Bauhaus: P. KLEE, *Das Bildnerisehe Denken. Schriften zur Form- und Gestaltungsanalyse*, 1, published by J. SPILLER, Basel-Stuttgart, 1965; Especially the second part: (*Unendliche Naturgesehichte. Prinzipielle Ordnung der bildnerisehen Mittel, verbunden mit Naturstudium und Konstruktive Kompositionswege*, 2, published by J. SPILLER, Basel-Stuttgart, 1970,) testifies to how strongly his theory is rooted in analogous thinking. W. HAFTMANN, *Paul Klee's Wege bildnerischen Denkens* (1950), München, 1957, pp. 126-133. This author demonstrates to what extent Goethe's writings on natural science were a source of inspiration for P. Klee.

14. A typical pronouncement is, for example, that of the pointer Jean BAZAINE, in his *Notizien zur Malerei*, Frankfurt a. M., 1959, p. 46, quoted by J. LOHMANN-SIEMER, op. cit., p. 50: "Real sensitiveness exists only when the pointer discovers that the movements of trees and the surface of the water are related to each other, only when, after the world had gradually pulled itself together and become condensed in this way, in the middle of this immense number of phenomena, he sees the essential signs stand out, which ore his own truth and at the same time the truth of the whole." See also S. LOEVGREN, *The Genesis of Modernism. Seurat, Gouguin, Van Gogh and French Symbolism in the 1880s*, Revised Edition, Hackert Art Books, New York. 1983.
15. R. ARNHEIM, *Art and Visual Perception. A Psychology of the Creative Eye*, London, 1972.
16. Goethe's critism in the *Farbenlehre* of the modern colour theory of the physicist J. Newton is typical in this respect.
17. P. C. RITTERSBUSCH, *Overtures to Biology: The Speculations of 18th-Century Naturalists*, 1964; quoted by D. Brett, op. cit. p. 342.
18. Quoted by W. KOTTE, "Plato en Caris geven elkaar de vijf" in F. VAN DER BLIJ and W. KOTTE, op. cito p. 17.
19. P. HUYBERS, *De gulden snede en het werk van Caris* (exhibition catalogue), Technische Hogeschool, Eindhoven, 1980, p. 6.
20. For more examples see P. HUYBERS, op. cit., pp. 11-18.
21. M. SCHUSTER, *Psychologie der bildenden Kunst. Eine Einfühlung*, Roland Asanger Verlag, Heidelberg, 1990, pp. 120-121. This work is the most recent *status quaestionis* on this complex problem and offers an extensive bibliography.
22. Ibid., p. 122.

23. Examples of such simple and complex figures are to be found in P. HUYBERS, op. cit., p. 25, Figs. 1,2, and 3.
24. With regard to this, see G. CARIS, "Een onderzoek naar de samenhang en betekenis van Eschers werk", in *Bonnefans*, 7. 2. 91, Maastricht.
25. My views differ in this respect from that of authors such as A. V. SHUBNIKOV and V. A. KOPTSIK, *Symmetry in Science and Art*, Plenum Press, New York, 1974, p. 7: "The aesthetic effects resulting from symmetry (or other law of composition) of an object in our opinion lies in the psychic process associated with the discovery of its laws." The solution of the puzzle of complexity through the discovery of the regularity of the figure should, at the same time, solve the mysterious nature of the figure and mean the end of the aesthetic experience.
26. J. VAN BERGEN, op. cit., pp. 39-76 and pp. 128-154.
27. For examples of this phenomenon I refer the reader to a number of works by Poussin, Magritte, and others, which were analyzed in this way; Ibid., pp. 47-54 and pp. 147-154.
28. It is obvious that not every work of art displays such an immanent and complex structure. Its aesthetic meaning can also be determined by the position the work occupies on the macro-level of artistic tradition. In this way, M. Duchamp's "ready-mades" generate a complex meaning on the macro-level of the tradition itself by the way in which they destroy this and bring to light in a disconcerting way the limited paradigm of art as mimicry, by radicalizing the dialectic reality vs. representation. An interpretation, therefore, cannot and should not limit itself to the so-called immanent or autonomous-aesthetic character of an individual work of art.
29. This is also true of perception. "The visual structure which arises, for example, by putting together a number of geometric bodies, must be surprising. The surprising part must not be caused, however, by bodies being put together in an incomprehensible, complex manner. Whenever a large number of new angles and lengths are introduced in the design of a set-up - angles and lengths which are not borrowed from the farm of the objects being put together - then a complex attention-grabbing something is admittedly produced, which, however, remains visually formless because it has no visual limitations." F. BOSELIE, op. cit., p. 70.
30. With regard to the problem of the complexity and order of an aesthetic structure, it seems appropriate at this point to examine the explanations of works of art by Gestalt psychology, such as those given by R. Arnheim (see note 15). The Gestalt-psychology aesthetic more or less defends the position that the aesthetic experience is based on perceptual structures which order the complexity of the representation according to simple geometric figures, thus lending it a certain simplicity and harmony. R. Arnheim also constructs abstract geometric patterns which, applied to a transparency, are then laid over a mostly figurative representation, supposedly revealing in this way its compositional scheme. The problem is, however, that this

usually gives rise to a very static-formalistic interpretation of the work of art. The author con also not prove that a representation is indeed articulated, according to such perceptual structures. Analyses of this sort sound clichéd: the structure of the work seems thereby to be pre-determined. Which formal elements in a given work are expressive, however, is dependent upon extremely variable factors, including the type, and the wider artistic and socio-cultural context. However, the most important objection to Gestaltpsychology explanations is that its analysis of form and composition is nowhere connected to an interpretation as regards the inconographical content. A Gestalt-psychology interpretation which attempts to reveal the geometrical harmony and symmetry of an art work ultimately harks back to the idea that structure and order are in themselves aesthetic. This interpretation has its roots in a nineteenth-century *Einfühlungstheorie*, such as that of Th. Lipps, who fits in with the analogous thinking of Romanticism. O. SCHUSTER, op. cit., pp. 123-124, criticizes Arnheim's views: "As the laws of symmetry are nothing other than the structural laws of the construction of matter and therefore also of organisms, it can naturally be debated whether or not there exists an isomorphy between the laws of symmetry of one's own formation (in works of art, for example) and the laws of symmetry of the nervous substratum. An isomorphy of this sort contrasts with Arnheim: 'In the case of a work of art, the value and also the main attraction of the structural theme is derived from humanity, whose types of order it makes evident...What is ultimately required is that this order imparts a realistic, true, and profound view of life.'" O. Schuster's criticism of the Gestaltpsychology aesthetic is, ultimately, that the theory of the *Einfühlung* and the empathetic experiencing of forms in the art work has, until now, never been grounded on anything and therefore remains purely speculative.

31. F. BOSELIE op. cit., p. 62.
32. Ibid.
33. W. KOTTE, op. cit., pp. 20-23.
34. P. HUYBERS, op. cit., pp. 1-9.
35. Ibid., p. 24.
36. F. VAN DER BLIJ, *Strukturen in het werk van Gerard Caris*, in F. VAN DER BLIJ and W. KOTTE, op. cit., pp. 32-36.
37. Ibid., p. 39, Fig. 28.
38. R. PENROSE, *The Role of Aesthetics in Pure and Applied Science* 1974.
39. F. VAN DER BLIJ, op. cit., pp. 38-39. I have based this whole passage mainly on his description of the problem of filling in a plane decoratively.
40. Quoted in a translation of P. Huybers, op. cit., p. 41.
41. F. W: SARIS, "Hoe weten die atomen dat?", in F. VAN DER BLIJ en W. KOTTE, op. cit., p. 55.

42. "Kwasi-kristallijne materialen vinden proctisehe toepassingen", in *De Standaard,* 2-3 February 1991, p. 7.
43. P. PEARCE, *Structure in Nature is a Strategy for Design*, M.I.T. Press, London, 1978.

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