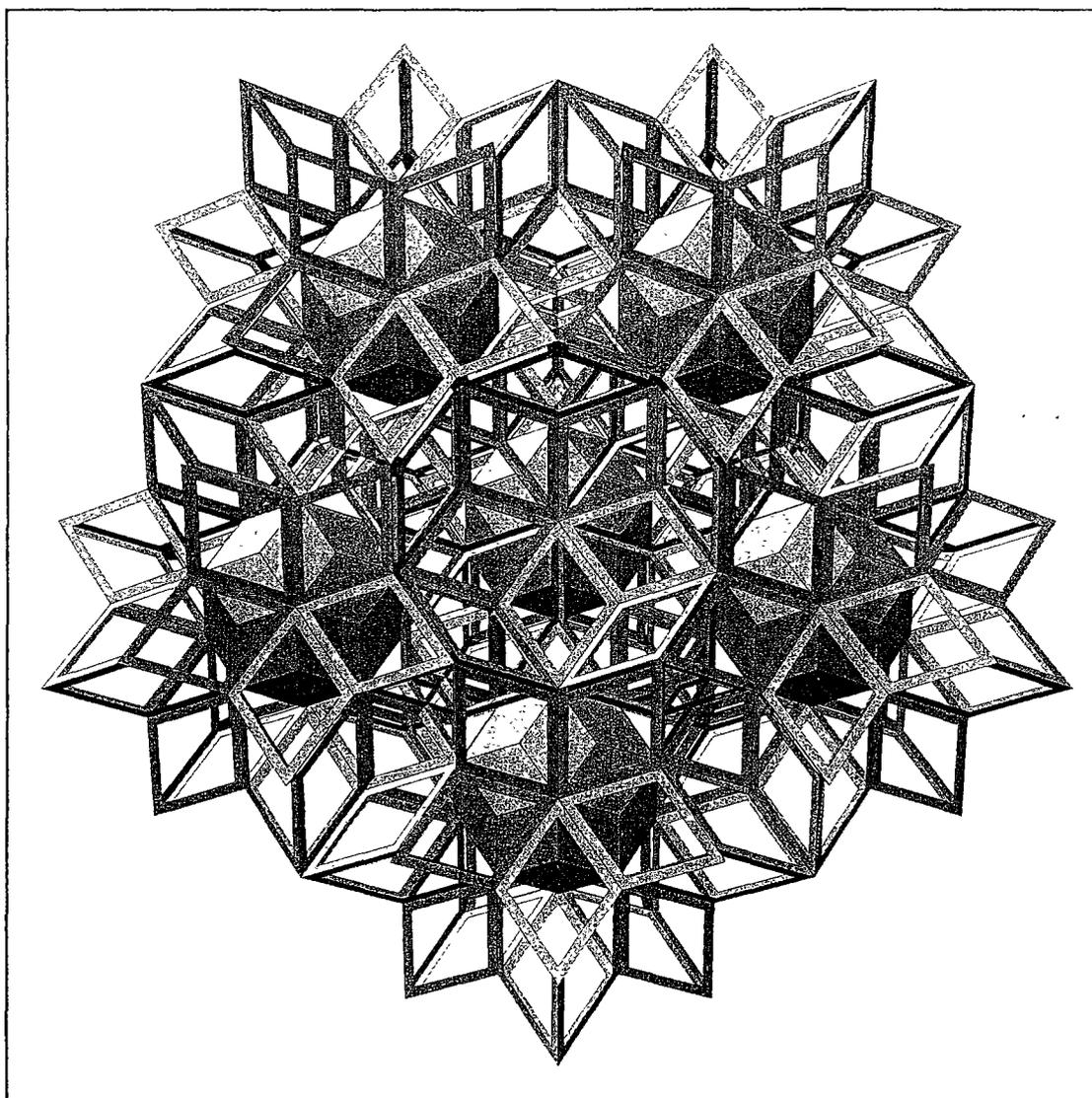


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SYMMETRY AS KEY-NOTION IN THE INTERRELATIONSHIP BETWEEN SCIENCE AND CONSTRUCTIVIST ART

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“12. *Symmetry and repetition.* The new architecture has suppressed symmetry’s monotonous repetition as well as rigid equality which results from division into two halves or the use of the mirror image. It employs neither repetition in time, street walls, nor standardized parts. A block of houses is as much a whole as a single house. The laws governing single houses apply also to both blocks of houses and the city as a whole. In place of symmetry, the new architecture proposes *a balanced relationship of unequal parts*; that is to say parts, because of functional characteristics, differ in position, size, proportion and situation. The equivalence of these parts is gained through an equilibrium of inequality rather than of equality. In addition, the new architecture has granted equal value to the ‘front’, ‘back’, ‘right’, and possibly also to the ‘above’ and ‘below’.” (Theo van Doesburg, *Towards Plastic Architecture*, Paris 1924)¹

As architecture, painting and sculpture always include a compositioning within a restricted area (like a building-site, the format of the canvas), which is nothing else than a balancing of elements each with its own particular visual “force”, this balancing of forces made symmetry the key-notion both in abstract art and in architecture. This paper will focus on art and discuss that the ideas as exemplified by van Doesburg are not merely coincidental or a result of merely studying composition-possibilities. This can be stated, because many abstract working artists have always been interested in cross-references to scientific knowledge. Obviously under influence of the culture of which they are a part and the *Zeitgeist* they lived in or still live in. Contrasts, rhythms, complementarity of form and colour, their interrelationships and (visual) counterbalancing are the tools. Compositioning as such is nothing else than a sensitive

balancing around the situation of absolute symmetry. This feature of art becomes clear in this century in the emergence and further development of the art that one in general knows as “constructivist art”. It is interesting to re-study the analogies and interrelationships between this art and the development of scientific knowledge in direct relation to historic events in society. As the complete material on this subject concerns an immense amount of information, I do hope it can be understood that in this paper only some examples can be presented. It still will become clear, however, how the tension between symmetry and *asymmetrical* symmetry are key-notions in the search for order and structure in the phenomena of reality. For further reading a small selection of literature is suggested at the end of this paper. As this seems to be appropriate this paper starts with a more or less extensive survey of some aspects of the pioneer-period of constructivism, than unfortunately only a very few aspects of later developments can be discussed in relation to the limitations of length and density of this paper. Finally, some contemporary artists will be discussed briefly.

THE PIONEER-PERIOD

This period concerns the birth of constructivist art. It emerged between approximately 1910 and 1922 as result of simultaneous interests and efforts by several artists in different groups and different countries in Europe. Constructivism in art is slightly different from constructivism in science or constructivism in psychology. Constructivism in science means constructivism in mathematics, which is considered the equivalent of intuitionism founded by the Dutch mathematician L. E. J. Brouwer. Brouwer considered mathematics to be inseparably linked to the thinking of the individual. The mathematical activity is considered to consist of constructions and activities in the mind of the mathematician and as such is opposed to the formalistic opinion that mathematics is merely a formal manipulation of symbols. Brouwer and followers considered mathematics to be absolutely autonomous. Other constructivist mathematicians were Bishop, Beeson and Stolzenberg. The constructivist aspect of Euclidian geometry often refers to “straightedge and compass constructions” (see Greenberg 1994, p. 49). This obviously is in its *Zeitgeist* quite well interrelated to constructivism in early abstract art. Especially Russian constructivism has made its mark on history, although one should also recall the Dutch *De Stijl*, Polish groups *Blok* and *AR*, Hungarian *MA*, Balkan *Zenith*, the *Hannover Abstracts*, and many others in Belgium, Italy, Czechoslovakia, Yugoslavia and elsewhere. It is worthwhile to have a look at some of the books in the proposed list of literature.

When one hears of constructivism for the first time it may seem that there would be a clear understanding about its definition. Like with so many *Zeitgeist*-related directions, schools or groups in art this is not the case. But, then again, the same occurs in science, philosophy or in politics. One is only reminded of the very different interpretations on humanism in philosophy or the differences in definitions of socialism in the several decades of the 20th century. When one studies the available information one finds quite easily that constructivism is a notion more or less related to a specific concept of art, philosophy and science, but still without a clear definition. Art historian and scholar on constructivism Patricia Railing discusses the difficulties around the concept of constructivism even during its years of emergence in Russia². The Russian artist/architect/designer/theorist El Lissitzky³ lists two groups considering themselves constructivists: the *Obmohku*⁴ and the *Unovis*⁵. But, there were also the brothers Naum Gabo and Antoine Pevsner, who published *The Realistic Manifesto* in 1915, which can be considered to also have set the line of thinking on constructivism. Or take Alexei Gan, Rodchenko and Tatlin, and not to forget the Hungarian artist/designer/theorist and important educator Moholy-Nagy. He first made himself quite well-known in Hungary, before becoming one of the major professors at the *Bauhaus* in Germany. The *Bauhaus*, which makes up theories for a multi-disciplinary approach towards an improvement of our everyday environment and all the products in it, still sets the tone for all contemporary industrial design. Escaping fascism Moholy-Nagy moved to the USA where he first held influential courses on art and photography in New York before becoming one of the founding professors of *The New Bauhaus* at Chicago, which later was renamed the ITT School of Design that still exists today. Besides, as mentioned above, there were many more simultaneous developments all through Europe in the 1920's and early 1930's⁶. An important general characteristic was to try to visualize the cosmic powers of nature. The powers which scientific knowledge and theories showed the public to exist "under" or "behind" the visible reality of our existence. To be able to show this, the artists believed in trying to show clear "constructions" as a kind of reconstructions of the motions of nature. As such, many opted for clear and "honest" visualizations with the aim to approach the problem in a kind of scientific sense. The result was that sculptors like Tatlin or Gabo wished to discard colour for its illusionary properties and preferred to use the properties of the material – like unpainted wood, steel or glass. Symmetry was not studied as most important feature by these artists, although a kind of symmetry can be found in some paintings like by Malevitch, Kliun or Gontcharova. The purest symmetry was used by Rodchenko in a very nihilistic sense when he painted his highly idealistic pure monochrome paintings in 1921 (one in red, one in yellow, one in blue), declaring this the end of painting. This bold semi-political

statement is quite typical for his *Zeitgeist* as painting was understood by many Bolshevik artists as academic, elitist and the metaphor for the bourgeoisie. It is somehow ironic and typical for human history that first in the 1960's and also currently one can find quite so many artists painting only monochromes, believing that more than the monochrome surface would be too much, too. It is needless to say that Rodchenko's statement was very wrong. Painting was and is not finished. Just like today the existence of the computer has not "finished" painting, sculpture or architecture.

The emergence of simultaneous interests of artists, architects and theorists in constructivism was not an opportunist response to incentives from the international art market as one could expect in today's world. In the 1920's or 1930's there still was virtually no art market! The inspiration to take up constructivism came first from their commitment to contribute as artists to the improvement of our knowledge on reality – with the desire to be as important as scientists in this matter. The big impulses came however from politics and economics. These led artists to take up their responsibility to try to help improve society as it is by improving all design⁷. This was on one hand the result of the political changes in Europe: the communist revolution in Russia, the need for an international non-elitist society for all "working-class" people after the slaughter of the World War I (of which the elite of the nobility and bourgeoisie were considered guilty, sacrificing working-class people by the thousands for their political games). On the other hand, lots of excitement and inspiration to accomplish this new mission for artists came from modern science, especially from theoretical physics and astronomy. Although most artists will not have actually studied Poincaré, Minkowski, Bohr or Einstein, they picked up general ideas on space/time and translated their understanding into artistic concepts of a fourth dimension. Exceptions were some of the pioneers of constructivist art, like I would like to mention Michael Matjushin and Kazimir Malevitch who actually did study scientific knowledge. Especially 19th century knowledge as published by the American Hinton, translated into Russian around 1910. To Matjushin and Malevitch also the ideas of projective geometry became well-known through the theories of Lobachevsky. El Lissitzky has referred in one of his lectures to the space/time curvature of Einstein. Around 1919 El Lissitzky did change his suprematist linear motion as simulated in his paintings into compositions that clearly simulate a motion that is curved – often curling back into itself. Let us not forget that the highly influential and gifted painter/theorist/teacher Wassily Kandinsky first followed courses in physics and engineering before starting to paint. He has tried all his life to make clear the importance of connecting art and science into a new synthesis. This, in my opinion, explains why he worked out an artistic translation and application of his ideas on the importance of the point, the line and the plane exemplifying motion

and dynamics as similar to theories in the modern physics of his days. Around the turn of the 19th and the 20th centuries, in philosophy and in science one of the hot debates was our fascination for *geometry*⁸. Other *Zeitgeist*-related subjects were keen interests in the *idea*, in the *sensation* and in *construction*. In relation to the sensation for instance the influence on our physical well-being of certain colours in our environment were explored. Obviously, these subjects did not come out of the blue at the start of the 20th century, but are logical results from discussions in the 19th century. Although it would take too long a detour to explain the relationships, or to prove what I say here, it should be sufficient for now to know that the debate on *a free will* from the beginning of the 19th century and later discussions on the object versus the subject led to ideas on a basic structure of nature as a whole⁹, to ideas on continuity, progress and the notions of space and time, finally leading to think about the construction of reality. Also, in the 19th century new theories on colour¹⁰ and light, but also discoveries like the principles of the conservation of energy, the discoveries of electromagnetism and of X-rays clearly influenced the interests of scientists, philosophers but also of artists around the turn of the 19th and the 20th centuries. As evidence of how subjects can be *Zeitgeist*-related, I would only like to mention that Maxwell's electromagnetism and new ideas on the properties of light, space and time obviously inspired scientists like Minkowski or Einstein, or a mystic like Ouspensky, but coincided with the emerged interest in the occult. In occultism mystical theories are discussed between our selves and the universe, on the connection between everything through superstructures or supervised by higher beings. Serious interests in knowledge from ancient and oriental cultures became natural (a kind of late 19th century "New Age", as we would call it today). Anthroposophy as initiated by Madame Blavatsky and later developed by Rudolf Steiner into a cultivated philosophy is its offspring. In a different way in this occult interest there were analogous interests in electromagnetism, light and space/time as in science. Like the reflection of cosmic energies inside our bodies. Artists tried to combine both approaches. To find the structure of nature, to resemble the construction of reality, they tried to search for the universal. To find the universal, they had serious interest in certain aspects of folk art¹¹ and in other cultures. Proof of this can be found with artists like Malevitch or Kandinsky who clearly knew about for instance Hindu or Islamic art¹². Besides, literature on Hindu or Hebrew philosophies, but also for instance the scientific ideas on space and time by the earlier mentioned American Hinton were translated into Russian before or around 1910. Obviously, the publications on new discoveries and theories in astronomy or on X-rays were sources of information to the artists¹³. An artist like Malevitch was fascinated by the evidence that we as humans on our little planet Earth are part of the universal motions and developed his famous

paintings of geometric shapes “flying” past us as planets. This was the start of his *Suprematism*. The discovery of X-rays was exhibited to a large public, showing how it enables us to look through our bodies, showing the bones in one’s hand or leg. To the kind of artists discussed here, this proved that matter does not exist indeed! It inspired artists from Cubism or Futurism to discard of painting solid shapes and instead opted for intersecting planes and shapes that give the impression to be virtually transparent. Cubism and Futurism both also tried to translate their understanding of space/time¹⁴. These ideas and the scientific interests in light stimulated artists like Moholy-Nagy and later the American pioneer of photography Quigley to explore photography into a new medium for abstract art by using only light directly to shape forms. Moholy-Nagy also experimented with light itself in his sculptural installations. In the translation of all these sources of inspiration or analogous, *Zeitgeist*-related subjects, these artists used no exact or pure symmetry (even Malevitch’s famous “Black Square” is not perfectly symmetrical), but the kind of dynamic equilibrium of unequal parts of which van Doesburg speaks in the quote at the start of this paper.

The notion of constructivism, therefore, is from the start no mere painter’s idea of a certain kind of composition, but a clear example of the connection between artistic explorations and scientific knowledge in a certain cultural and political climate that by its characteristics has sparked the desire to make this connection work. Anyway from the artists’ point of view – not so many scientists have ever really been interested in art, especially in thinking and writing artists, although this seems to slowly change now. The different aspects of the *Zeitgeist*, therefore, must always be taken into account when one tries to understand any development in history. Constructivism, as it also has been used by later generations of artists is based on the assumption that the world around us is constructed on some kind of logic, consisting of elementary particles or basic units or cells and governed by laws by which their construction and interaction is defined. To the early generations of constructivists our image of the world, like exemplified in artworks, should therefore also be constructed out of basic units and be based upon a certain logic. A related idea was to present works of art to the observer in which the system or structure or construction method can easily be retraced. Purity and honesty of form, colour, and material were considered important to find the universal in combination with the individual – exemplified in the personal interpretation of every different artist – and thus to present the essence of reality (with obvious relations to for instance Hüsserl’s phenomenology). Visual illusions and complexity were also considered decorative, elitist, bourgeois and simply *wrong*. As was said before in this paper, the artists of constructivism obviously hoped to become as fundamentally important to the ideas and knowledge on reality as the scientist. The direct link as seen

by these first generations of constructive artists between art – applied design or industrial design – architecture – urban design and everything in between¹⁵ basically has formed the accepted fundamental notion all through the 20th century concerning all design of any object or product or environment that have shaped our societies¹⁶.

In modern psychology constructivism is a general theoretical position which proposes that perception and perceptual experience are, according to Gregory, constructed out of “*volatile fragmentary scraps of information, for a part caught by the senses, for another part from memories-banks - that are itself constructions from bits and pieces out of the past.*”¹⁷ In this psychology the perceptual experience is not understood as merely a response to a stimulus, but as a construction of hypothesized cognitive and affective operations. In sociology social constructivism is the family name for all theoretical approaches that emphasize the social character of the human construction of meaning. Social constructionism is introduced by K. J. Gergen for a theoretical-scientific approach of psychology and its field of enquiry stating that the phenomena studied by psychology are in fact historical and social constructions. More recently, constructivism has been taken up by psychotherapy and is considered to be part of the postmodernist approach. This approach in modern constructivist or constructionist psychotherapy is based on the assumption that nobody makes his or her image of reality based on objective observation, but as a construction of subjective “realities”¹⁸.

AFTER WORLD WAR II

The idealistic search of the early constructive artists for a complete renovation of society by desiring a new world, a new man and (opted by some) a new order was taken over by the national-socialists in their particular understanding. Even worse, the fascist propaganda-machine used the knowledge on media-communication which was developed by constructivist artists: strong symbols in clear designed graphics and dynamic photography. It is somewhat ironic, that the Nazis not only choose to copy from the constructivists the effective use of black and red for their propaganda and emblems, but even used a typical constructivist layout and typography for posters of the exhibition of *Entartete Kunst*. In the late 1940's and in the 1950's one can find in general that the artists retreated in their studios, focussing on painting and sculpture in a more classical sense. This was not only the result of the public mistrust for any art that in appearance or statement was associated by them to the new order of dictatorial fascism, but of course was also stimulated by a slowly emerging art market. As in that market as a logical result in the post-war traumata no geometric art, but more personal

and emotional tachistic or expressionistic art became successful and ruling, many postwar constructivist artists had a hard life in merely surviving. This was the same on both sides of what later became known as the Iron Curtain. Similar to science, psychology and sociology (or linguistics), the constructivist artists from the 1950's and into the 1960's researched the notion of structure and structuralism. This development can be explained as a further result from the interests in these fields earlier in the 20th century as was explained. It is interesting to further explain the growing interest in a strict ordering of elements by referring to Quantum mechanics, especially to Quantum Field Theory and a general interest in the notions of "fields" or "nets" as metaphors to explain all interactions and interconnections of events. But also to structural chemistry¹⁹, which led for instance to the development of the DNA-structural model by Crick and Watson in 1956. Interests that became emphasized by new ideas, like by the theory in linguistics by the notorious Noam Chomsky. Chomsky stated that the structure of a language is more essential than its phonetics, revolting against Roman Jakobson's emphasis on phonetics²⁰. In the 1960's Claude Lévy-Strauss followed in cultural anthropology with his structural anthropology, emphasizing the overall or underlying structure of a culture. In that period we can find in constructivist art many links to the *Zeitgeist*-related interest in structure, like in structuralism in art. To this generation of artists the American artist Charles Biederman was a prime source, especially with his book *Art as the Evolution of Visual Knowledge* from 1948. Biederman's own main sources or influences on his ideas were the artists Courbet, Monet, Cézanne, the philosopher Whitehead and the semiotician Korzybski. He focussed on the development through human history of the visualization, the interest to translate natural light and the structure of nature at a deeper level into artworks with the aim to understand reality better. As the notion "evolution" already indicates, he believes strongly in the general progress of knowledge and of mankind itself. He emphasizes the coloured relief as the new medium, being between painting and sculpture. The interest in structure is exemplified in art for example in the artists' magazine "Structure"²¹ with regular contributions by the artists Joost Baljeu, Kenneth and Mary Martin, Anthony Hill, Richard Paul Lohse, Charles Biederman, Peter Lowe and Jean Gorin. Another example is the academic publication "The Structurist"²². The interest of these artists in the notion of space/time was especially discussed in relation to the notion of "growth" and illustrated by following van Doesburg's idea of a repetition of certain units or cells. This interest in simulating motion quite naturally inspired artists to use actual motion in their sculptures. As such, kinetic art became known²³. Examples are the French artist Nicolas Schöffer, the Russian late 1950's group *Dvezhenye* (movement) initiated by the artist Lev Nussberg and including Francisco Infante, the Spanish group *Equipo57* of Angel Duarte or the American and probably best known-kinetic artist George Rickey. A

different, but still familiar direction in constructive art was born just before the war in Switzerland: *konkrete Kunst* (concrete art). It can be seen as the furthered version of van Doesburg's *Concrete Manifesto* from 1931. "Concrete" would be a work of art that does not refer to any natural object then to itself. The main artists were Max Bill and Richard Paul Lohse. Others were Camille Graeser, Hans Hinterreiter and Verena Loewensberg. Their concept is still being followed by many artists in Europe, although most have not studied the ideas and works of Lohse enough. The modular and serial structures in Lohse's highly coloured paintings are much more complex as in general concrete artists seem to have noticed. His works are so fascinating as he includes both rational and intuitive properties.

These magazines, groups and ways of working went well into the 1960's. In general they all led to an interest in searching an even more objective, a more logical or rational and more "scientific" approach to art. As we will see, it led to another and more strict use of symmetry. The moment constructive art almost came to a dead end.

ULTIMATE OBJECTIVITY

The 1960's and early 1970's focussed even more on the search for the optimum of objectivity. There should be no illusion whatsoever and no mimetic effects. The eye should see what the eye sees. This semi-scientific study by artists of perception led to simultaneous interests in Optical Art, Minimalism and Systems Art. Symmetry became essential once more. This should be understood as to be quite natural as the search for the ultimate objectivity in art is the equivalent to the search for the absolute balance between equal pictorial parts in an artwork. As such, one can draw a line between these artistic efforts and democratic ideas in the politics of the 1960's (the ideal that everybody is the same and has the same rights). These interests are exemplified by a group like the French/German group *GRAV*²⁴, including artists like François Morellet, Vera Molnár, Julio Le Parc, Klaus Staudt. In France, England and the USA important incentives for "Optical Art" came from Michael Kidner, Bridget Riley, Richard Anuskiewicz, Victor Vasarely. By its sheer popularity and the highly commercial successful applications in fashion also known as "Op-Art". The art that became the metaphor for the hippie-cult and, without the intention of the artists, became very fashionable. In Germany, Italy, Belgium and the Netherlands similar initiatives for the pure objective came from groups like *Zero* and *Nul*, including artists like Macke, Piene, Ücker, Fontana, Manzoni, Peeters, Schoonhoven, Armando, Dekkers, Leblanc and many others. Especially in this art pure symmetry (absolute mirror symmetry) became

the prime tool to represent absolute zero-subjective art. In sculpture one should not forget the Buckminster Fuller-pupil Kenneth Snelson with his magnificent constructions that exemplify a clear connection between art and engineering. Also, in the 1960's the first artistic experiments to find structure with aid of the computer were explored, like by Frieder Nake, Herbert W. Franke, Georg Nees, Gottfried Jäger, Vera Molnár, Peter Struycken, Ernest Edmonds, Manfred Mohr.

AMERICA'S EMPHASIS

For a long time, almost quite parallel to the existence of the Cold War, American absolute objectivism in Minimal Art ruled the international geometrical art. This art advocated absolute objectivism in great sizes of paintings and sculpture. Pure symmetry, repetition of form and size, exemplifying the material in its "own" right, using colour only in a "functional" way (as emphasis of the shape, not as something with its own meaning) should get rid of any emotional content. It was a clear artistic analogy to the architectural concept of pre-fabricated building and to Functionalism in architecture. Within American art history it was the natural response of a younger generation of artists to the large and emotional paintings of the American expressionists (Pollock, Kline, Motherwell, Rothko, De Kooning, Frankenthaler), a logical follow-up after Colour-Field painting (Leon Polk Smith and later Elsworth Kelly) and a rational protest to the success of their contemporaries in Pop-Art (Warhol, Rauschenberg, Rosenquist, etc.). Representatives were Donald Judd, Richard Serra, Frank Stella, Sol Lewitt, Carl André and Agnes Martin. Seen in a larger context and not only in the American context, the link to early Russian constructivism is evident in this art (just compare some of André's wooden sculptures to Rodchenko's), although the Americans miss a lot of the substantial contents the Russians did have. The success and the impact on the European artists by these Americans can only be explained as part of the general glorification of the USA as major world power of democracy and because of the fast growing art market in the USA at that time. The pure symmetry of the compositions can be understood as the desire for ultimate democracy of the political movements in the 1960's. Also analogies can be found in scientific ideas around that time. Ideas like David Bohm's Implicate Order and interests by many in oriental thought reflect the search for an order connecting everything at a deeper level, making everything of similar importance, making everybody the same. Only after the Cold War ended in the late 1980's, several of the Minimal Art artists (like Judd) admitted they had been inspired by early European (Russian) artists. Symmetry was to become the metaphor of this pure American emphasis.

FROM CHAOS TO COMPLEXITY INTO THE FUTURE

Analogous again to the developments in science and to the general interest in society, at the end of the 1970's and into the 1980's sincere constructivist artists became doubtful about the "reductionist" approach and opened up for instance to the implications of the concepts of Chaos Theory and even to the less general popular (less romantic sounding) Theory of Complexity in the late 1980's. Artists like Frank Stella, not necessarily pure constructivists anyway, understood these great changes in understanding reality through his own artistic development. Stella's highly rational black paintings of the 1960's, which brought him fame, have changed dramatically into reliefs that became proceedingly more complex during the 1980's. To some they may seem only "expressionistic chaotic" or even "baroque", but when one studies his progress through the years it becomes evident how his art has grown towards complexity in a most logical way from pure geometric to almost only organic shapes.

Michael Kidner (Figure 1) in England had been reading scientific books for a long time – out of a personal interest in knowledge on the process of reality and to search for a better understanding of what he was looking for as an artist. He is one of those exceptional artists who rather focusses on a neverending artistic research for structure and complex order. Kidner is especially interested in units that are interrelated like life-cells, each with their own individual behaviour and still related in shape and purpose. He combines a highly rational approach with intuitive experiments with unusual combinations of materials. For instance, he makes a circle out of a thin fiberglass rod and attaches broad elastic bands differing in widths at certain rationally decided intervals on spots along this circle, crossing the circle in a diagonal and symmetrical fashion. The result is often quite surprising, even to himself as well. The different tensions in the material, caused by the battle between the different widths of the elastic with the resistance of the fiberglass circle, make the perfect and symmetrical shaped flat circle jump into a three-dimensional and more complex shape – a kind of *Möbius* strip. The change from flat and perfect circle into its three-dimensional shape can be understood as a quick process of actual breaking of symmetry. Currently Kidner is exploring the artistic implications of Boolean nets using a kind of Penrose-tiling structure.

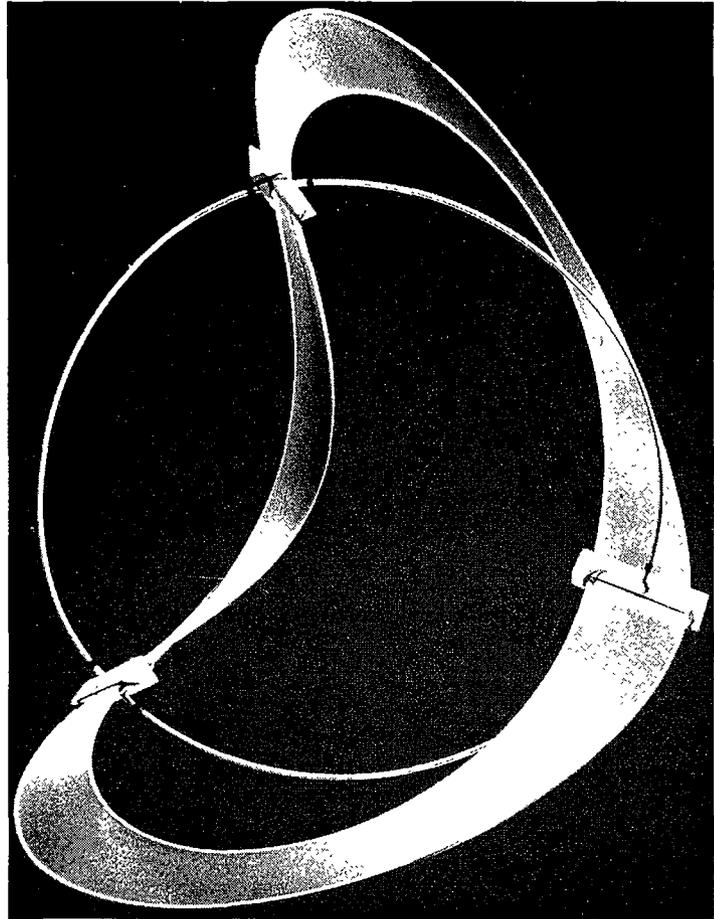


Figure 1: Michael Kidner (1989) Circle and Oval in Countertension, 114x70x50 cm, fibre glass and nylon stocking

American painter James Juschyck (Figure 2), who can be considered to further the artistic colorist research of Josef Albers, works on the breaking of symmetrical compositions by a delicate range of colours and perspective projection methods. At a closer look one starts to see how intelligent the breaking of symmetry is accomplished in very little differences between two cubes. The cubes look to be in exact mirror-symmetry to each other, but evidently are not. The sensitive choice of colour-hues makes the pleasure and sensibility of looking at these pictures and give them a meditative functioning. This is not without reason. Juschyck is also a sincere student of Zen-philosophy and aims to translate his meditation experiences into painting. Symmetry and breaking of symmetry also play important roles in modern Zen (as can

be found in the Japanese culture) in relation to our position and direct interrelationship to nature. This connects this approach as such clearly to the modern science's interest in a process "on the edge of chaos", emphasizing continuous change.

Figure 2: James Juszczyk

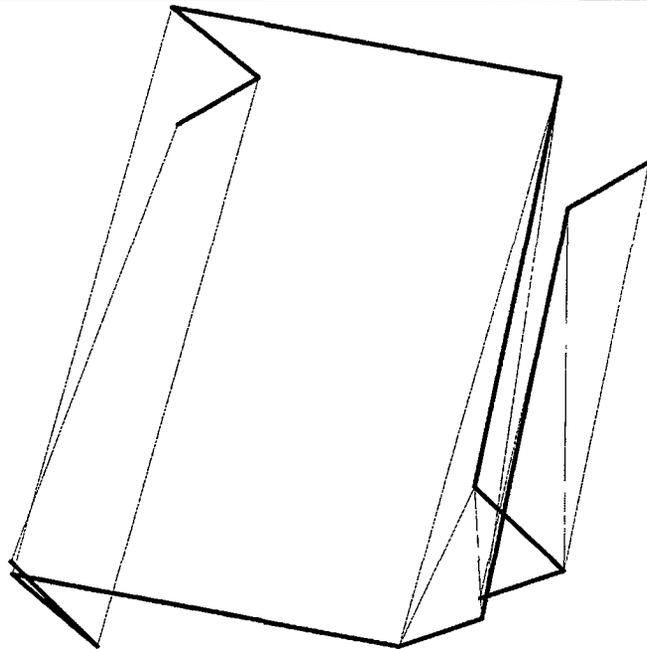
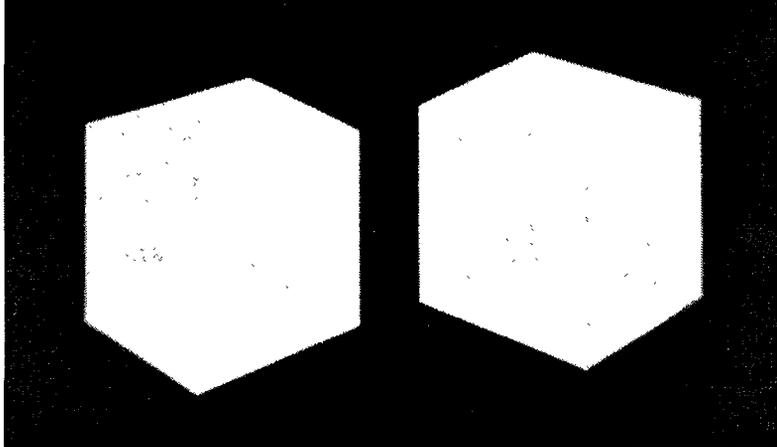


Figure 3: Manfred Mohr

Manfred Mohr (Figure 3), born in Germany and living in the USA, has been mentioned before. He is one of the very few artists using a computer while knowing how to programme the software he needs to develop his paintings. He is especially fascinated by exploring the hypercube and distorting it through a certain sequence of actions in time. Earlier works showed parts of the hypercube growing and interlocking like a complex crystal. Mohr's further interest is the abstract observation of studying a multi-dimensional motion projected – or flattened – onto a two-dimensional plane. His recent works have become so complex that one cannot “read” the picture anymore in the sense of still recognizing the turning and swirling motions of the hypercube. His fascinating new compositions show very complex simulations of a dynamic equilibrium in complex space/time. Although highly abstract artworks in only black/whites, it is not so strange to consider that they are translations of abstract explorations of space/time as contemporary scientific diagrams explaining highly complex theories on space/time are similar visualizations using black lines connecting and disconnecting at certain points (compare the Feynman-diagrams).

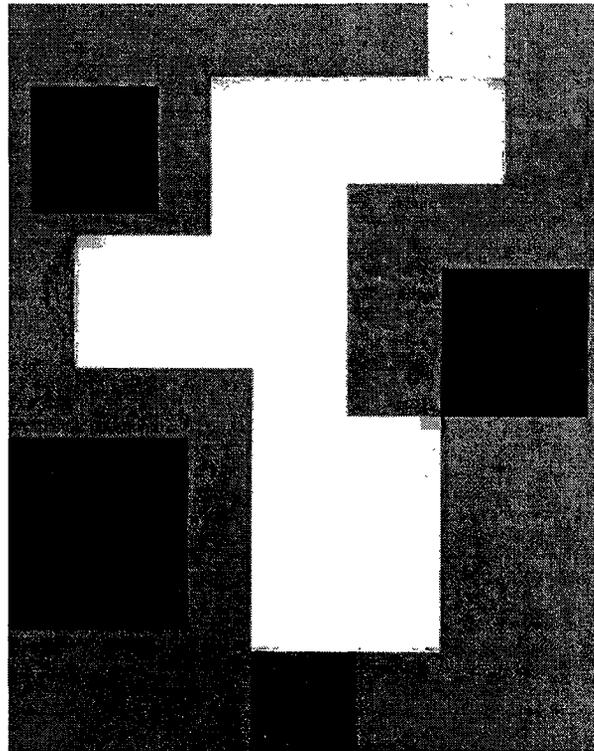


Figure 4: Rodney Carswell (1995) Cut (figured in green), RC95 46, oil, wax, canvas, wood, 72x58x4 in.

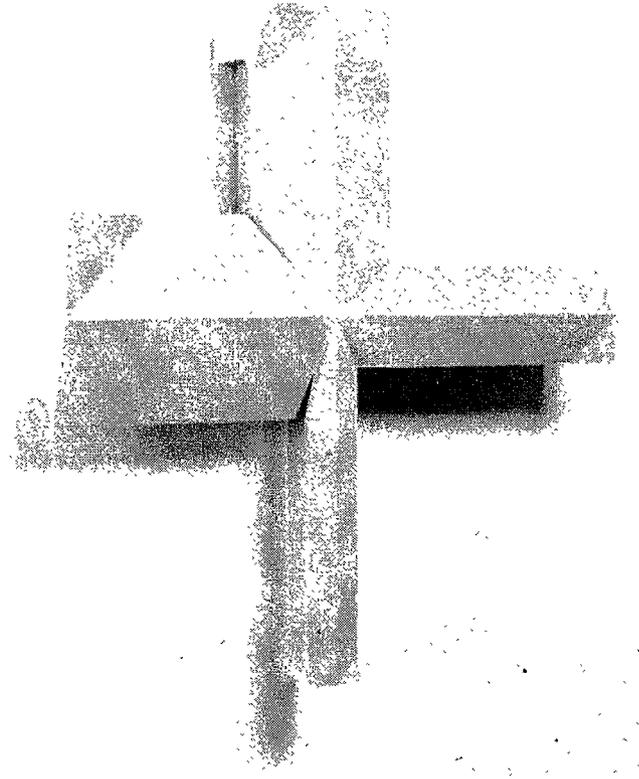


Figure 5: Richard Rezac (1996) Untitled, RR96 14, painted wood, 39½x36¼x8½ in.

Two other contemporary American artists, Rodney Carswell (Figure 4) and Richard Rezac (Figure 5) exemplify in their art a dynamic equilibrium in different ways. Carswell makes shaped canvasses, or paintings with some geometrical shapes cut-out. Although painting is virtually a two-dimensional technique, Carswell manages a multi-layered dimensionality by the simple act of cutting out a shape. The vision of the observer as a result jumps from a square plane of the canvas to the shape of the canvas itself and further to the cut-out square. Rezac is mainly a sculptor. This can definitely be observed as only when one sees all sides of his wall-works one will notice the very three-dimensional properties of these pure shapes. Like in Juszczuk's paintings also in Rezac's works a breaking of symmetry is accomplished by sometimes minor differences on the left, right, top or bottom of a composition. Carswell and Rezac fit with their choice of form and colours very well into the tradition that was started by American Minimalism (especially Robert Mangold's use of shaped canvasses and exploring the cross-composition), but they belong more to our times as they have included a higher level of complexity and dynamics.

The Belgian painter Jean-Pierre Maury (Figure 6) since the 1960's has been developing combinations of the same elements into abstract and geometrical paintings following a gradual process towards higher levels of complexity. His structured paintings are often in only one or two colours and present a complex interaction of optical effects using form, distortion of form, direction and simulation of motion. The overall impression of his works show a position "on the edge of chaos", but then at the "order"-side of this edge. His paintings clearly reflect a dynamic equilibrium under pressure of change. They often balance between a more symmetrical state and an a-symmetrical state.

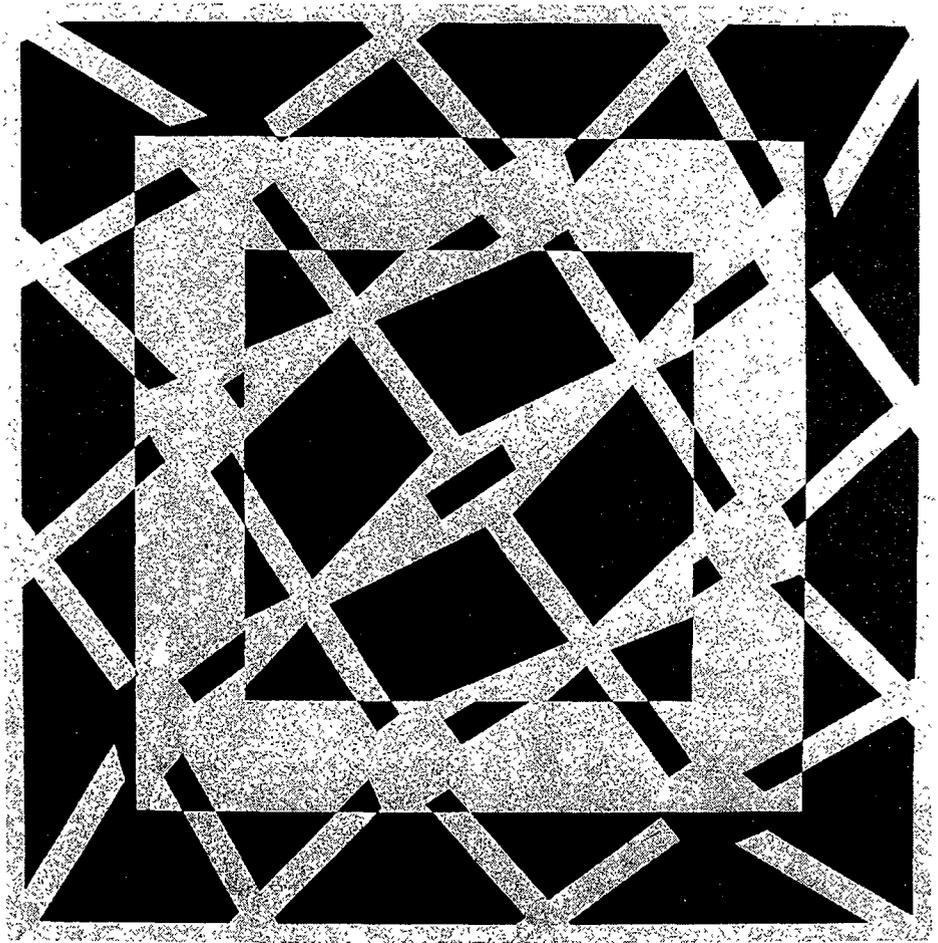


Figure 6: Jean-Pierre Maury

An interesting analogy to Maury's art can be found in the mobiles of the American artist Tim Prentice (Figure 7). Prentice develops a kind of sculptural curtains containing many square or rectangular forms that are suspended individually to a flexible grid-construction. The result is that with the slightest draft or change of air the in principle pure symmetry of the composition dances away into every variety of symmetry-breaking. Photographic reproductions of Prentice's art show remarkable resemblances to Maury's form-field paintings. Although both have a different concept in their art they also both seem to reflect the theories of self-organization by contemporary scientist Ilya Prigogine. From experience I know that at least Maury is informed on Prigogine's ideas²⁵.

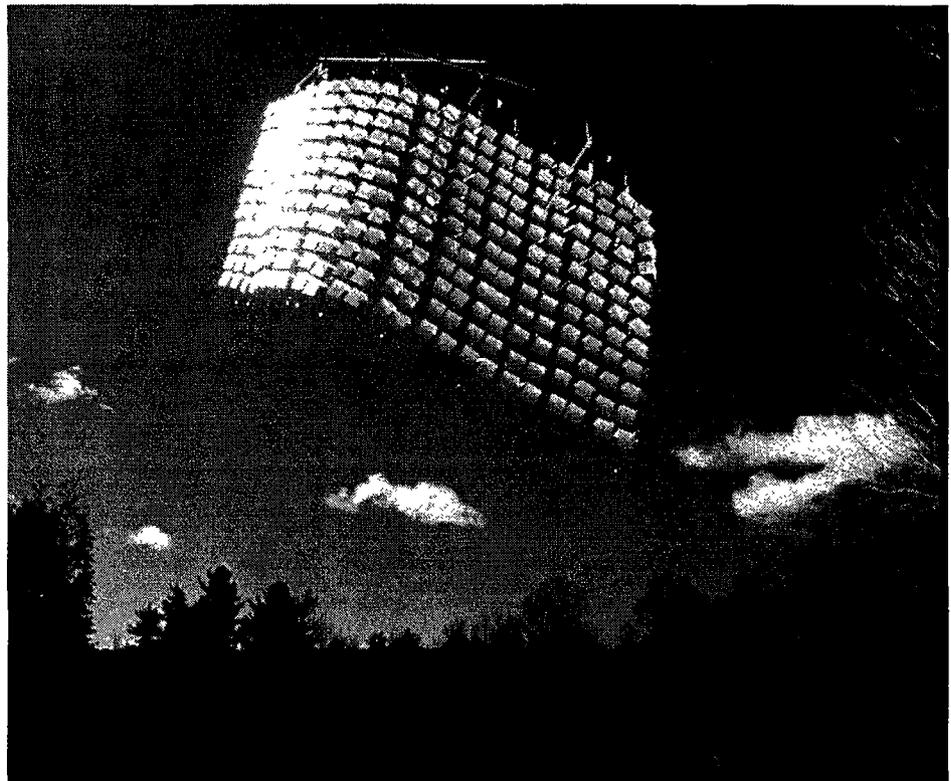


Figure 7: Tim Prentice

The German painter Michael Bette (Figure 8) paints a different complexity. He offers us an intertwining and highly pulsating complex structure on basis of geometrical, sometimes almost amorphous (certainly organic) shapes and unusual colour-

combinations, making the “reading” of a system impossible. His paintings are still based on a certain personal language of shapes and rules for the choice of colours. His art-language has been developed through the years towards more complexity. Maybe a comparison can be made to how Stella also developed his art to a state of almost complete chaotic complexity. Bette’s art presents us with a possible interpretation of (coloured) Quantum Fields. His compositions are virtually chaotic on the edge of becoming ordered. One might say, that Bette approaches the moment of pure order (or of symmetry) from the opposite side as Maury or Prentice do.



Figure 8: Michael Bette (August 1995), acryl/moleskin, 170x140 cm

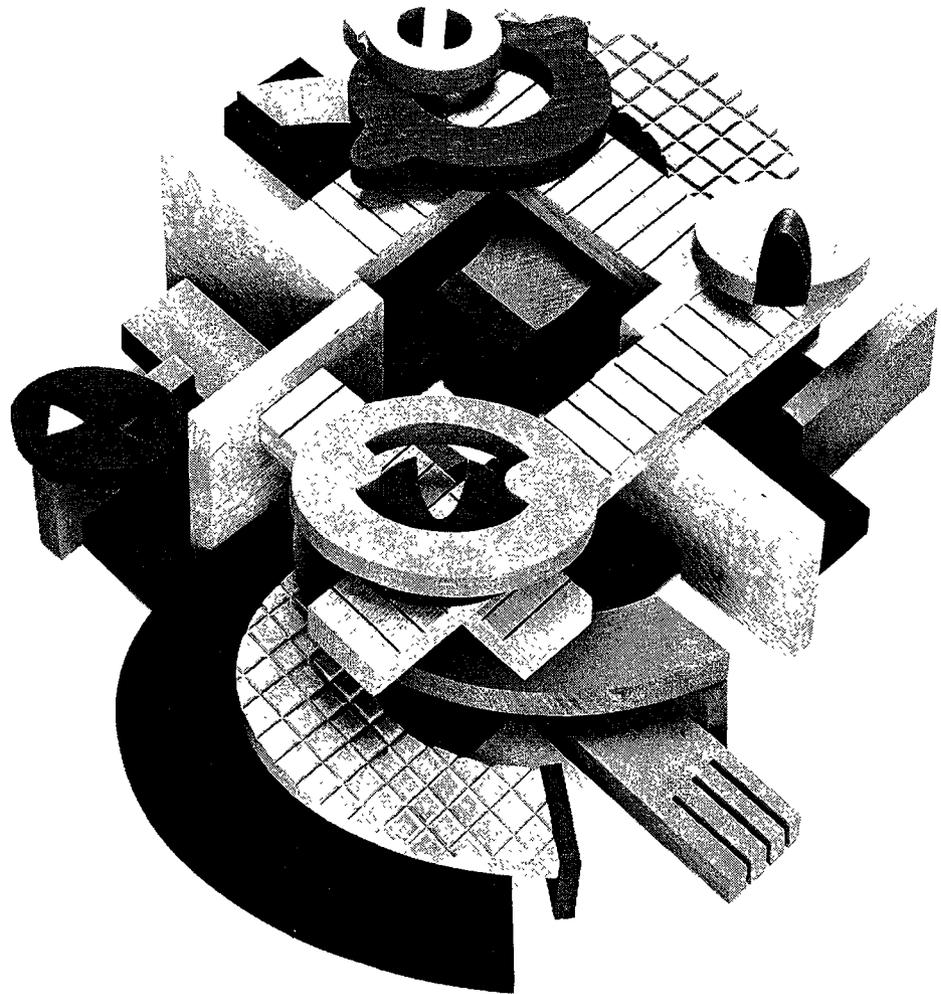


Figure 9: John Okulick (1996) Outer Walls, printed wood, 45x43½x8 in

Again different, but still maybe comparable, one can draw an analogy between the paintings by Bette to the reliefs of American artist John Okulick (Figure 9). Okulick's reliefs maybe show resemblances to certain early 1980's wall-works by Stella, but they are not similar which one can find after serious comparison. They are a kind of assemblages of rectangular and circular shapes in compositions that simulate strong motions returning into themselves. Said otherwise: a combination of centripetal and centrifugal motions. An extra visual quality is reached as Okulick distorts the shapes by a clever use of perspective-projection creating the impression that one perceives them

from a different angle. His wall-works seem to virtually go through the wall by optically tilting backwards. The use of perspective obviously means that also the notion of direction as such is involved in his compositions, exemplified by the juxtaposing of rectangular shapes. This effect is emphasized by his use of linear structures on some of these shapes. His use of large shapes in combination with smaller shapes, like large parts of circles and small ellipsoid shapes enhance the complexity of motions simulated. Small circular shapes simulate small or concentrated rotations, large parts of circles show parts of larger rotations. On top of these properties he applies colour, too. Not purely functional colour to contrast the different shapes, but colour as colour, meaning that it forms an extra element in the whole composition.

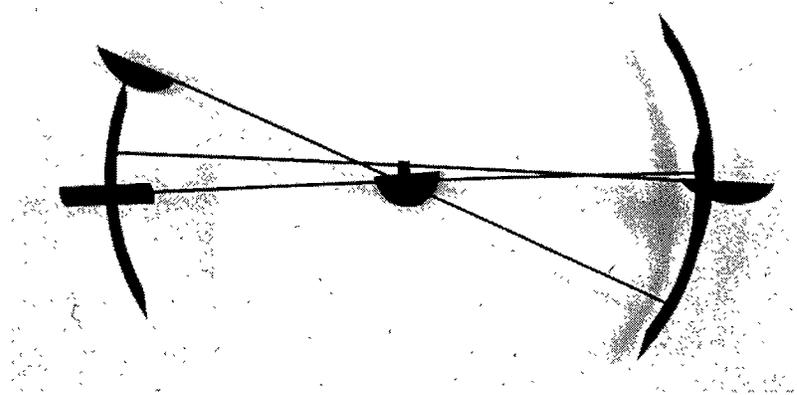


Figure 10: Pedro de Movellan (1995) Rotating Arcs, blued steel/pain/A1, 41x5½ in.

Pedro de Movellan is a young American artist who explores motion in a very different – in an actual way. His art (Figure 10) concerns wall-constructions, suspended sculptures or free standing sculptures that will not be moved by the wind as happens with Rickey's or Prentice's art, but by a kind of interaction of the observer with the sculpture. The observer touches the sculpture gently and some kind of sequence of motion starts. De Movellan uses combinations of polished wood, brass and stainless steel. This choice of material and only using the colour of the material itself relates him to the first generations of constructivist artists. The contrasts between the materials and the reflections of light on the material play important roles in our perception of the process from a state of perfect equilibrium into a state of a disturbed equilibrium into finally a state of perfect equilibrium again. The natural process from pure symmetry through a continuous changing state of breaking of symmetry towards a returning into a state of perfect symmetry can be followed quite well in his handsomely crafted sculptures.



Figure 11: Fré Ilgen (1997) *Dance on my Own*, suspended object, wood/acrylic paint/stainless steel, 52x74x75 cm

In a different way also interactive and visually maybe more related to Okulick and Bette, I would like to introduce you to my own art (Figure 11). As an artist I am exploring a better understanding of reality by the simulation of complex movements of which our reality seems to consist. This I do by making highly three-dimensional sculptures consisting of straightedge geometrical shapes and bent (organic?) stainless steel strips. The simulation of motion is enhanced by a careful use of contrasts: contrasts in length, width, in height, in colour and in direction. The colour-choice is based on a colour ordering inspired by the colourwheel of Ostwald. This means that the eyes will follow more or less unconsciously the ordering from bright yellow to orange, to red, violet, blue, blue-green, green, green-yellow back to yellow and thus create an extra movement in our vision. As colourwheels are ideal models, I am tempted to prefer colour combinations as we can see in nature itself. This implies the combination of pure colours (like primaries) with mixed colours (like a dark green or very light violet).

Furthermore I use the notion of visual memory. As the coloured parts are coloured differently on both outer ends one can never see all the colours at once. When a suspended sculpture or the observer changes position another colour becomes visible – and the earlier perceived colour disappears out of vision. Nevertheless, our visual memory fills in this gap of information and will thus also influence our perception of the sculpture. A phenomenon that seems essential to our everyday experience. Another aspect clearly visible in my art is the notion of “direction”. Along the length of the coloured parts directions are suggested. Because of the different coloured outer ends these directions seem to be virtually cut off and led back into the composition. That is why in combination to the bent stainless steel strips I refer to my compositions as “an oscillation with a direction”. As I try to understand what I am doing, why I am doing it and for what reason other people seem to respond to my art, I am involved in art-theory. This has led me to research very different fields of knowledge in history and of today, not only in art history or art theory, but also in science and philosophy. Especially in theoretical physics, astronomy, the cognitive sciences and computer-science. A research that is continuously proceeding. I am convinced that just like science and philosophy also through fine art the human being tries to understand his or her reality better. This fact makes the finding of analogies between these obviously different disciplines a logical result and no fiction.

AFTERWORD

Symmetry did not change so much in appearance in constructive art from the pioneer days of abstract art onwards till the end of the 20th century. It is always a bit disturbing to have to conclude that there is not so much real progress of human knowledge as we are grown up with to believe. In society one can see that ideas of new generations are not always “new” or a next step in this supposed progress, but quite often repetitions of earlier accomplishments. This is the same in art. It is somehow interesting to see how also in constructive art or art that by the use of geometry is often automatically associated to constructive art not so much has actually been developed along the length of the 20th century. This becomes especially evident in the purist tradition which one can find everywhere and through all generations. The preference by many artists to still keep painting monochromes or monochrome-dualities (two similar planes of contrasting colours) with the usual easy aesthetic effect is only one example. Another example is that one cannot state that either geometrical art or figurative (mimetic) art would be “the only real art”. Both are accepted as obvious means to understand our reality. The phenomenon of non-progression can quite probably be understood to be similar to the

academism in physics to still believe in the Newtonian “reductionist” and pure empirical approach. But, then again, maybe “progression” is just a fiction of our culture? Of course, progression does exist, but only more slowly like in a spiral looping slowly upwards. Anyway, the artists I discussed here seem to my opinion to better reflect the spirit and ideas on reality of our *Zeitgeist* as one can also find in science and philosophy. Van Doesburg’s remark on “a balanced relationship of unequal parts” still is feasible for contemporary art, especially for the art discussed here. The discussed artists apply this concept in their paintings and sculptures like Yin and Yang forces. To my opinion this can well be understood as so many artistic translations of the universal law of the conservation of energy. Within art history the difference to the early constructivist artists lies in the purpose, the sensibility and complexity. The artworks have no particular political statement anymore. Complexity in form and colour are not considered to be “wrong” anymore. The contemporary artists learned from the gradual developments of abstract art through the 20th century to handle the artistic means like shape, colour and composition more sensitively using much more complex schemes. Thus, also their ways of breaking symmetry happens more consciously. A breaking of symmetry, which also in the most recent ideas in science has become a major concern. In biology, for instance, a state of pure symmetry is understood as the equivalent to death. In the multi-disciplinary approach to physics, artificial intelligence and economics these new ideas are combined in a “Theory of Complexity” and its central notion is “a state on the edge of chaos”. This is the equivalent to the moment a symmetrical state is on the verge to be broken. Continuous change has become the new paradigm. This seems quite well illustrated by the art discussed in this paper. Also artists today have a better understanding of what they are doing, just like science also advanced bit by bit and knows something more about the complexity of reality and the role of symmetry/breaking of symmetry. As also science found out, the previously discussed artists all are different but still all accept the importance of continuous change in the dynamics of the compositions in their art. This art still has a further future when the artists will continue their quest with integrity and with a serious interest in the knowledge in science in their own *Zeitgeist*. As final remark to this paper I would like to state that constructivist art should not be labeled “constructivist” anymore, as our current knowledge on our perception of reality makes the concept of a construct in one’s mind not very feasible anymore. Interactions between our mind, our body and the phenomena of reality are more important than only the processes in our head. The high complexity of the art of most artists discussed here show that their concepts can not be visually analyzed so easily anymore which make them quite different from earlier constructive art (the “construct” is cannot be re-traced easily). When a new notion

should be opted for this tradition of artistic research, maybe “extensionalism” would be a better notion. The word “extension” reflects better our current understanding of our perception (the interaction).

Already our breathing process, the interactions and synchronizations between the rhythmic energies that make our bodies what they are with the rhythmic but irregular streams of energies from outside our bodies (like our dependence on the sun) make this very evident and not merely a “New Age” romanticism.

ACKNOWLEDGEMENT

For the permission to reproduce the artworks discussed in this paper I am grateful to the artists and to Maxwell Davidson Gallery for Prentice and De Movellan, to Nancy Hoffman Gallery for Okulick, to Feigen Inc Gallery for Carwell and Rezac.

NOTES

¹ this quote has been published in De Stijl, Series XII 6-7, (1924), 78-83, this translation is quoted from Baljeu (1974, pp.144) (emphasis mine); see list of literature;

² This is discussed in Railing, *PROUN: The Interchange Station of Suprematism and Constructivism*;

³ In his famous lecture “New Russian Art” from 1922 in Hannover, Germany, presented in relation to an exhibition of his own art;

⁴ including the Stenberg brothers, Meydunyesky, Yoganson;

⁵ Syenkin, Chasnik, Klutsis, Ermolayeva, Khidekel, Kogan, Noshov, and others led by Malevitch and El Lissitzky;

⁶ see especially Bann, Turowski and Stanislawski/Brockhaus, list of literature;

⁷ every object in our environment has some effect on our perception of reality, therefore, on our well-being; the artists researched how more consciously developed design could have a more positive effect; this coincided with the emergence of serious interests in hygiene as a social topic, like in working class households, but also this coincided with the emergence of commercial graphics (advertisement) in the West and the need for new propaganda-tools in Russia after the revolution;

⁸ the discussion on our fascination for geometry, both Euclidian and Non-Euclidian, is exemplified by the publications of Poincaré, Hüsserl and Russell around the turn of the 19th-20th centuries;

⁹ exemplified in Schopenhauer’s “worldwill” in philosophy and reflected later in the 19th century in Cézanne’s search for a structure parallel to the structure of nature through painting in his typical style of “modulations” or repetitions of certain interrelated quantities of paint;

¹⁰ like Goethe or Helmholtz;

¹¹ especially in the application of a certain choice or in the repetition of similar shapes (often geometric) and colours (often primaries) on every object and clothing; Kandinsky is known to have stated that his visit to a farm in the north of Russia, where everything of the house was decorated in a non-figurative folk-art style, was instantly perceived by him as walking into an abstract painting; he has written himself that this inspired him to find pure abstract painting;

¹² in 1910 there was a large exhibition on Islamic art in Munich where for instance Kandinsky lived at the time; from Popova, the contemporary of Malevitch, the Tretjakov Gallery in Moscow owns a study of an Islamic geometrical composition; in old 7th century Tantric illustrations one can find marvelous similarities to Malevitch’s paintings of the famous black square or black circle,

¹³ a very good example I found in a book-antiquariat: a 1922 publication of the encyclopedia by the famous and popular French publisher Larousse on "*Le Ciel*", including many photographs of stars, nebulae, comets, explanations of star- and galaxy-structures and with an essay on Einstein's theories (!),

¹⁴ in Cubism. the looking at an object or a portrait from many different angles at the same time as was already experimented on by Cézanne in his still-lives, in Futurism the simulation of dynamic motion by a repetition of the object or by repetition of its contours, Futurism as such inspired the simulation of motion as we today know from popular comics;

¹⁵ examples: graphic design or theatre set-design; this development was stimulated by a fast growth in commissions for artists to make designs for advertisements, posters, murals, industrially produced products for the new mass consumer-markets, stage design and architecture for promotional political purposes, including promotional activities to enhance the public awareness on national health and hygiene - as was mentioned before;

¹⁶ important schools institutionalized these ideas, making their impact so large: the German Bauhaus, the Russian vChutemas, both from 1919 till about 1933; later the American New Bauhaus at Chicago and in the 1960's the German *Hochschule fur Gestaltung Ulm* (initiated by the Swiss artist/architect Max Bill);

¹⁷ see Reber, pp 119, see list of literature;

¹⁸ Barbara Held discusses in a recent paper the confusion and different interpretations in psychotherapy around the meaning of "constructivism"; it is interesting to note that "constructivism" started in the early 20th century in art and mathematics with a lot of confusion about its meaning to be taken up by a very different field at the end of the same century in a similar state of confusion about its meaning;

¹⁹ this field was initiated by Linus C Pauling's idea to structure the spatial arrangements of atoms in molecules and crystals and the interactions that bond substances, published in his "The Nature of the Chemical Bond" in 1939,

²⁰ Jakobson, by the way, originally belonged to a group of artists, poets and early linguists called the "Moscow Circle" in the time of early constructivist pioneering of graphic-design; later he initiated the Prague School of Phonetics before going to the USA, where he acquired his fame;

²¹ published in 1958-1964 by the Dutch artist Joost Baljeu in English only,

²² published and edited since 1960 by Canadian artist Eli Bornstein, University of Saskatchewan, Saskatoon, Canada;

²³ it must be stated here, that the early constructivist pioneers already experimented with actual motion, especially Naum Gabo and Moholy-Nagy (and Rodchenko, Klucsis and Kobra made suspended sculptures), but also one should recall Tatlin with his flying machine "Letatlin" or El Lissitzky with his moving stage-designs and exhibition-design projects; maybe one could also mention Austrian Friedrich Kiesler with his fabulous stage-design, which later led him to his utopian project for an "endless house";

²⁴ GRAV = *Groupe de Recherche de l'Art Visuel*;

²⁵ Maury and Prentice do not know each other as yet, but are of the same generation, their mutual interests could also be the natural result of living in the same "*Zeitgeist*", could not they?

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