PAINTING FOR THE BRAIN

PIETER ADRIAANS

ATELIER DE KAASFABRIEK

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BIOGRAPHY

O confronto com a paisagem e cultura açorianas têm tido um grande impacto sobre a obra do pintor-filósofo Pieter Adriaans. Em 2015 Pieter e sua esposa Rini abriram um centro cultural na antiga fábrica de queijo em Santo Antônio. As deslumbrantes pinturas de paisagem que ele fez desde 2002 formam o coração da coleção e estão em exibição permanente Além disso, o "Estúdio de Kaasfabriek" organiza exposições, concertos, cursos e outras atividades. As pinturas de Pieter estão presentes em várias coleções no mundo todo.

The confrontation with the Azorean landscape and culture has had a major impact on the work of painter-philosopher Pieter Adriaans. In 2015 Pieter and his wife Rini opened a cultural center in the old cheese factory in Santo Antonio. The stunning landscape paintings he has made since 2002 form the heart of the collection and are on permanent display. Apart from that studio "De Kaasfabriek" organizes exhibitions, concerts, courses and other activities. Pieter's paintings are in collections all over the world.

Painting for the brain
Pieter Adriaans
"Painting is the art of omission"
Jacobus J. Koeman (1889–1978)

Painting for the brain

Those who have read this book will never again look at a painting the way they did before. 'A painting is like a program for the viewing machine in our brain', such is the main postulation from which Pieter Adriaans, painter and Professor of Information Technology at the University of Amsterdam, is developing a new vision on the art of painting. Our brain constructs an image of reality, based on a limited amount of information supplied by our eyes. The painter uses this fact. Recent insights from neurobiology, information technology and mathematics can teach us a new way of looking at things. This is a book for all viewers, teachers, critics, amateurs and professionals interested in the art of painting.

People I would like to thank

Many different people have helped me along the process of writing this book. I could not possible name each and every one of them, but know that I hold dear all the good memories of friends and acquaintances with whom I discussed this subject, over the course of time. These discussions often took place in Breukelen, in the coziest Dutch gallery I know, owned by my friend Peter Leen and his partner Teem. And then there were some that commented specifically on the draft version of my manuscript. Adriaan van Olphen studied nearly every chapter in great detail, and discussed each with me at length – this I found very valuable. Some of the other people who provided me with their comments are Arnold Smeulders, Mies van Olphen, Harm van der Meulen, Margriet Barends, Dinie Goedhart, Bernard de Wolff and Yet and Jeroen Bezemer. Furthermore, the discussions held over time with Peter van Houten on the subject of painting have been of great importance for how my ideas developed. Courses on 'Philosophy for artists' that I gave at his 'Foudgumse Akademie' really helped me achieve clarity and structure. One of the course participants, Julia van Bohemen, I thank for helping me find a publisher for the Dutch version of the book. And last but not least, my gratitude goes to my wife, Rini. She studied all chapters meticulously and provided me with valuable comments – yet another new step in our journey through life, one we have been on for forty years now.

I A form of introduction

In this book you will find descriptions of discoveries that you rarely come across in publications on visual art. It is not an introduction to drawing or painting. Nor is it a guideline for drawing in perspective, for anatomy or mixing paints. There are thousands of books on those subjects doing a better job. No, this is a record of a quest; one of the most interesting adventures I have ever been on. There were many things I had never thought about before. What is the connection between writing and painting? What is the relationship between art and science? And what is its position in history? How much information does a painting hold? When did the technique of hatching begin and why? How come our brain looks at diagonal lines in a different way than it does at horizontal and vertical ones? Why is the composition of a hunting scene from the Middle Ages similar to an Egyptian drawing on a three–thousand–your–old slab of stone? The preliminary conclusions of this study form the guiding ideas behind this book:

1. The art of painting and drawing is alive and kicking. It continues to cause us to look at the world in new ways. Even in times when our senses are being bombarded by mechanically produced images, drawn images continue to have an appeal that keeps on interesting us and that form a driving force behind the development of our visual culture.

2. Science and the art of painting still have much to interact about. The common ground is not so much in the areas of anatomy and perspective, but rather in those of cognition,

information technology and new mathematical disciplines (e.g. the theory of fractals).

3. Realistic painting is an illusion. The world as we observe it all around us is construed by our eyes and our brain. Therefore, we must close the book on the notion that there are images that depict the world as it really is. Each picture (even a very clear photograph) is a cognitive construction that can be interpreted in an infinite variety of ways.

4. The history of the art of painting runs parallel to our understanding of what viewing really is. The human visual system is unbelievably complex and largely not yet understood. It is a product of millions of years of evolution and may take hundreds of years more in research before we understand just a fraction more than we do today. The real art of painting is yet to begin.

5. Painting well means having a good command of the visual language. Learning to paint is like learning a language, just as learning to look at paintings can be compared to learning to listen to a language. I will show how that language has its own cultural history and generates its own technical problems.

One possible misunderstanding has to be cleared up straight away: I am not particularly interested in painting in the 'style of the Great Masters'. Undoubtedly, they knew a great deal about the profession and it is useful to take in that kind of knowledge, but it would be wrong to idealize everything they did. The best art of painting stilllies ahead of us, in the future, and not in the past. The art of painting has never before been so new and never was there so much to discover.

From this perspective, it is remarkable that figurative painting is no longer taught at nearly all academies in the Western world. Existing knowledge has mostly been forgotten and new knowledge is not used; an entire generation of artists and art historians has grown up knowing barely anything of the technical aspects of painting. The managers of 'modern' museums and their curators particularly show an obvious lack of knowledge and professional insight when judging works of art. I state, therefore, that the technical reflection on the art of painting has come to a standstill over the last 50 years. I may elaborate some more on the philosophical, political and socio-cultural backgrounds of this phenomenon later on.

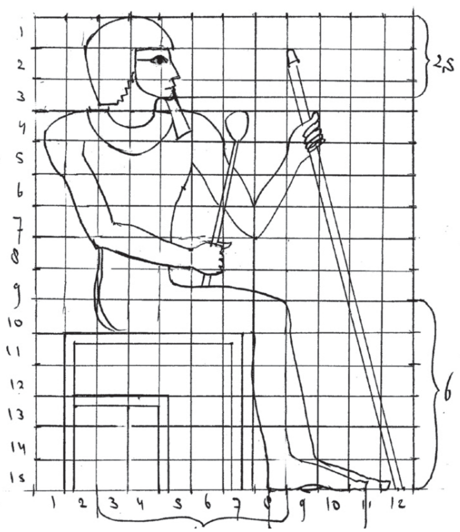
As the informed scientist that I am, I carelessly gaze beyond the boundaries of my profession, in an attempt to find unexpected connections. Without a doubt, this will also lead to the odd blunder, for which I hereby apologize in advance. Please let me know where and when in the text it happens and I will set things right in the next edition (if it ever comes to that; one of my previous books is on computers, sailing and philosophy and – much to my publishers disappointment – is only purchased by sailing philosophers with an interest in information technology). In addition, I tend to summarize in sweeping statements whose simplification undoubtedly will make professional experts cringe. A colleague of mine once said: "Modern scientists march so far ahead of the troops that they need intermediary messengers to remain in contact with society". From this perspective also applies: if I go too far, please let me know. This, thus, is not a book of science; it deliberately contains few literature references. The information that I use in support of my viewpoints can be found in any library or on the Internet. Many of the ideas that I have explored are much too speculative to qualify as science. It would take me many years to formulate them in a way that would be acceptable for publication in a scientific journal. I can only boast professional knowledge at such a level in the fields of philosophy and theoretical information technology. In any other field I am as much a well-intending amateur as anyone. And then there are bound to be certain things that, in another few years, I will see from a different perspective. It is all in the game, as they say. I have tried to write the kind of book that I would enjoy reading myself, both as a scientist and a painter. Painting itself is the central subject. Man-made images have a magical directness that cannot be achieved in any other way. This magic is as old as the first cave drawings at Lascaux and as current as the latest newspaper cartoon. It is this magic that is the subject of exploration in this book.

II Art and science

That which a good artist can do is surrounded by mystery. All can see and yet none can explain. We would do well to realize that there appears to be a connection between the terms art and artificial. Between creation (artists, art galleries, art collectors and works of art) and imitation (artificial light, artificial leather, artificial legs and artificial flowers). There is a tension between the artist's impression of a thing and a copy that is intended to be as close as possible to the real thing. Rex Vicat Cole recants the tale of the farmer who was amazed about the fact that a painting of his farm appeared to be worth more than the actual farm; if the buyer was that fond of looking at a painting of his farm, he would surely have done better to buy the farm itself! Art is a comment on reality, but one that can only be made from a certain distance. Picasso once said, "Artists lie the truth". For this reason, Plato wished to ban all artists from his ideal state.

Throughout history, artists and scientists have always been closely connected. They both study reality and carry out experiments in order to do so. Their objectives differ; the scientist seeks consensus on verifiable models, while the artist aims to touch and surprise us - he is only able to show us. There is a relationship between scientific heuristics and artistic creativity. Scientists, over the course of history, have continually developed new models to interpret reality. Artists help scientists to look at reality in a different way by disclosing possibilities. The mathematization of reality plays a crucial role in this process. A walk through history in seven-league boots would reveal the following three snapshots in time:

Figure 1
The human
stature in Egyptian art was determined by strict geometrical proportions. In this drawing, the numbers 2,3,5 and 6 play a special role



1) The Greek worldview: Reality as a number
Science: Expose ideal numeric relationships in reality
Art: Represent reality according to ideal numeric relationships
2) The Renaissance worldview: reality as a geometrical space
Science: Expose geometrical relationships in reality
Art: Represent reality according to geometrical relationships
3) Contemporary worldview: reality as information for the brain
Science: Analysis of the brain as an information–processing machine
Art: Represent reality according to an informational structure

With its analysis of the art of painting as a language, a system of signs, this book is at the center of this last development. This chapter researches the relationship between art and science in further detail.

Over the course of history, artists have thought up various systems to make the work easier. These systems were often associated with religious or philosophical notions. Egyptian art used a precise framework as the starting point for depicting the human body, which did not allow for any artistic freedom. Within this framework, the body was exactly 7 heads high. This art remained purely synthetic and thus fit in well with the Egyptian worldview. That Egyptian artists in fact could create lively sketches is demonstrated by their exercises on potsherds that have been found. Skillful drawing is of all ages.

In Ancient Greece and Rome artists enjoyed greater freedom, but were still bound to the analytical ideal of striving for a perfect reality. The ideas of Pythagoras (around 570BC) and the Pythagoreans were of particular importance. They saw the world as being ordered according to mathematical principles. Here, the central issue was not geometry as much as number theory: for example, the sacred tetractys: $1+2+3+4=10$, which could also be beautifully arranged as a perfect equilateral triangle.
Figure 2 Tetractys

The relationship between musical notes and mathematics was discovered; half a string is one octave difference in pitch (red in the image, 2/3 string is a perfect fifth (blue in the image), 3/4 a perfect fourth, 4/5 a major third, and so on). The strings literally were the straight lines that could be used by architects in designing buildings.
Figure 3 Shorten a string by
half and the pitch becomes one octave higher. Shortening it by a third will produce a perfect fifth.

The universe was ordered according to such principles. There were seven pitch classes and seven planets that generated heavenly music for enlightened minds to hear: the harmony of the spheres. The Pythagorean number mysticism was of great influence on Plato. There was an ideal world of ideal shapes in ideal mathematical ratios. It was up to the artists to distill beauty from this world by observation of the imperfect life that surrounded them. "'And if', said Socrates, 'you wish to imitate beautiful bodies, then, as it is not easy to find a human being that is perfect in everything, you collect from many that which is the most beautiful, thus creating entirely beautiful bodies.'

Figure 2
Tetractys

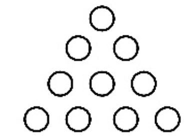


Figure 3
Shorten a string
by half and the pitch becomes one octave higher. Shortening it by a third will produce a perfect fifth.

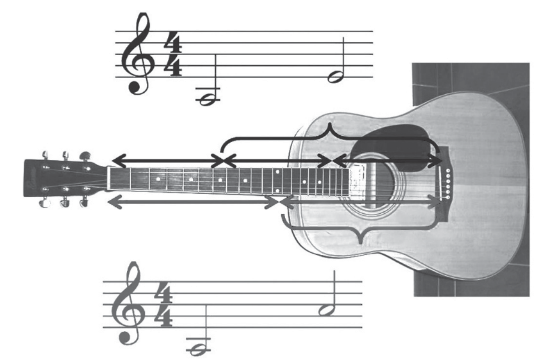
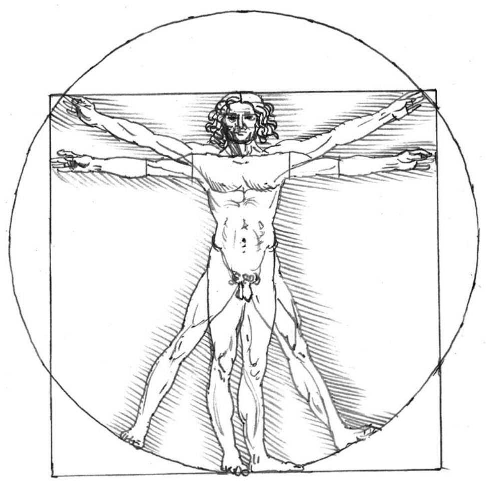


Figure 4
Da Vinci's interpretation of Vitruvius' rules.
The center of the circle is the navel.
The center of the square is the genitalia.



This is indeed what we do', said the painter." (Xenophon,Memorabilia III).The idea that also plays a role in the background is that works of art should reflect a divine order, based on simple rational numbers. Roman architect Vitruvius (around 85–20 BC) described a large collection of rules for building according to human measurements. His description of the proportions of the human body has had an impact well into our modern time: face from hairline to chin = 1/10of the total body height; hand from wrist to the tip of the middle finger = 1/10;head from top to chin = 1/8;length of the foot =1/6,and so on. These rules were the basis for the famous drawing by Da Vinci, which was an extrapolation from classical visual metaphysics; the man's navel is the center of the circle, his genitalia are the center of the square. Here, the human body has been fully embedded in the grammar of the world.
Figure 4 Da Vinci's
interpretation of Vitruvius' rules. The center of the circle is the navel. The center of the square is the genitalia.

Leonardo and his peers, incidentally, had long stopped depicting that world in terms of ideal mathematical proportions. The Renaissance worldview is geometrical. The material world essentially was considered from a spatial perspective, with extensiveness as its essential quality: the res extensa of Descartes. It was a golden opportunity for artists; the eyes being the most suitable scientific research tools – a camera obscura that would project the true structure of the world directly inside our brain. Hands could subsequently be used to further investigate the observed structures and to verify the systematics. The relationship between visual art and science has

rarely been closer.
Leonardo was convinced that the world essentially was spatial, and that the human eye was the most reliable route to scientific knowledge. This seems a very useful conviction for a visual artist to have. He wrote: "Let no one read me who is not a mathematician", and "The eye (...)is the queen of mathematics; the sciences founded on sight are truly reliable".
Figure 5 The workings
of the eye were understood in terms of the camera obscura

From this perspective, improving your painting skills would be to achieve a better understanding of the world. Therefore, there was a great deal of interest in the principles of perspective. Roger Bacon († 1292)already experimented with mirrors and lenses, Paolo Uccello († 1475)created complex constructions in perspective, and Leonardo himself illustrated "De Divina Proportione" (1498)ofFra Luca Pacoili. This presents the image of the scientist–artist exploring and explaining the world by pencil. In the Renaissance, a model of reality would, first and foremost, be a visual model. Indirectly, the principle of perspective, therefore, is a scientific methodology.

During the Renaissance, people researched things for themselves. Aristotle claimed that heavy objects fell faster than lighter ones. Galileo Galilei (1565–1642)proved this to be nonsense. One had to trust one's own observations. As an observer, Galileo incidentally had had extensive training in drawing, thus becoming familiar with perspective and the chiaroscuro technique (light and dark) that had been developed a few decades earlier by Leonardo da Vinci and Raphael.

Figure 5
The workings of the eye were understood in terms of the camera obscura.

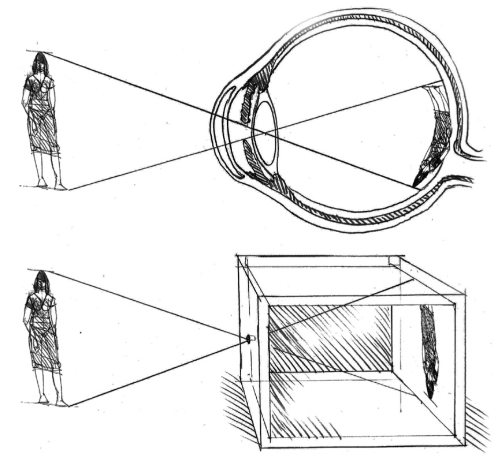


Figure 6
His knowledge on the art of painting helped Galileo interpret the structure of the moon's surface. On the lower right, a drawing of Galileo himself.

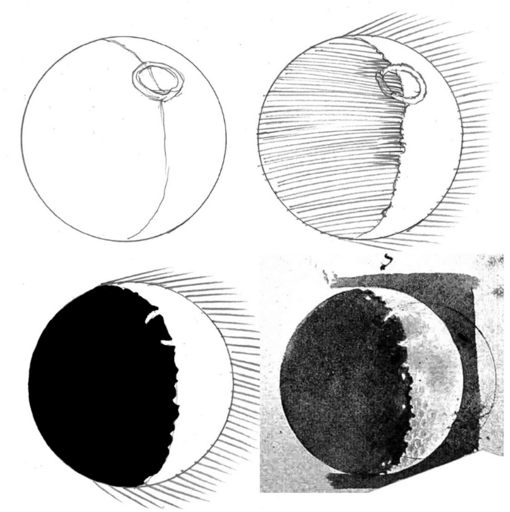


Figure 6 His knowledge on the art of painting helped Galileo interpret the structure of the moon's surface. On the lower right, a drawing of Galileo himself.

Chiaroscuro is the art of suggesting a spatial context for three-dimensional objects on a two-dimensional plane through the study of light and shadows. Galileo probably used this knowledge in his analysis of the moon as seen through his telescope. Others (e.g. Thomas Harriot in England) looked at the same moon, around the same time, without understanding that it had a rough surface full of craters. According to classical philosophy, the moon had to be a perfectly formed, undamaged and therefore smooth-surfaced celestial body. Galileo's artistic training seems to have helped his correct interpretation, judging from the fascinating sketches he made of the phenomenon. This is an example of the close relationship that existed between art and science during the Renaissance. The heuristics of the artist exploring the world while drawing is mirrored by the experiments of the scientist developing theories, testing them and reconsidering them again. To know how things were constructed, one had to be able to draw them. Scientific and artistic experiments went hand in hand. Experimental art and experimental science emerged around the same time.

And what about us? Where do we stand in this development? The mechanical worldview of Leonardo and Descartes, in which things can only affect each other through physical touch or collision, was proved untenable – starting with Newton's introduction of gravity. From the time we discovered that our space was curved and that light did not travel in a straight line, mathematicians no longer relied on their geometrical intuitions. Today's mathematics is a purely formal science that only relies on the manipulation of sign systems following strict rules. In philosophy, the 20th century was the century of "linguistic turn"; the turn towards language. Language in the days of philosophers such as Descartes and Kant used to be a reliable tool to help order the world, while in the hands of the 20th century philosophers it became part of the problem itself. Conducting science meant describing the world's structure using language. The world became a chaotic system of symbols, of signs. This 'turn' initially led to confusion in the world of visual art.

Visual artists were the scientists' natural allies until far into the 19th century – a position from which they derived a certain status. This privileged position as the natural partner of scientists evaporated with the disappearance of the geometrical worldview. Added to seeing fractals. The fern leaf shown in Figure 7 is such a fractal shape, which is constructed from a very simple, repetitive mathematical formula. This fractal viewing experience was not for Koekoek and Schelfhout, although they were aware of it, intuitively – judging from the skill with which they depicted structures in their paintings.

Serious articles are being written about the fractals in Pollock's paintings, and entire conferences are devoted to the animation of water, clouds and human hair in computer games. I hold a patent myself, on an algorithm that can improvise on music online, and I am studying the grammatical structures within the art of painting. For a few years now, I have been working on a mathematical definition of what I call "facticity", the degree to which information is interesting. An image is more "interesting" when it is made up of the right combination of bland and complex elements. This type of insight can then be used for studying the laws by which the composition of a work of art – a painting, piece of music or any other – is considered as "good". We continue to discover new things every day that are relevant in the art of painting. The marriage between art and science is very much alive again and the spouses are in love as never before.

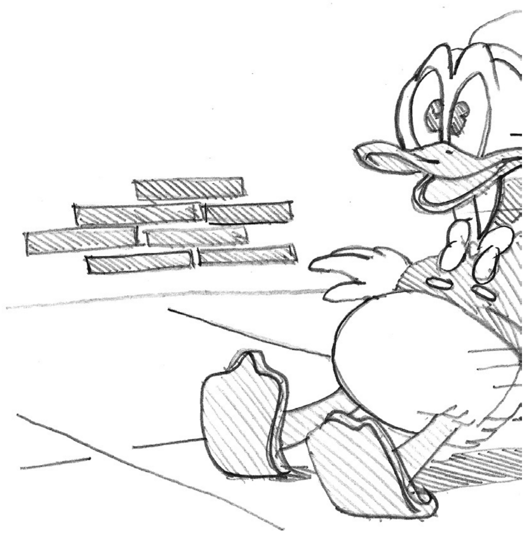
Figure 7 Drawing of a fern leaf as a simple and repeating pattern (lower left). Such figures are called fractals in modern mathematics.

Figure 7
Drawing
of a fern leaf as a simple and
repeating pattern (lower left).
Such figures are called fractals
in modern mathematics

III The Viewing Machine

During the Renaissance, the workings of the human eye were compared to those of the camera obscura. Today, we mostly consider the brain an information-processing system. The eye does much more than relaying signals to the brain. It chops information into small pieces and subsequently processes them. We are able to roughly imagine what happens, from the perspective of information science; our retina contains around 130 million photoreceptor cells, but the optic nerve only has a 1.2million 'telephone-wire' capacity. Information, therefore, must be preprocessed in the retina. Ten per cent of these receptor cells is located in a small area covering less than one per cent of the total surface of the retina: the fovea. This is the area, of around two degrees of our field of view, where vision is most acute. The information-processing capacity of the optic nerve is only a mere 60 kilobytes per second; much less than the information included in your average holiday snapshot. When we watch a film of 24 frames per second, we are only able to process less than 3 kilobytes of information. The process by which these snippets of information are subsequently welded together by our brain into coherent observation, is a miracle of which we understand very little, as yet, but one thing is clear: in order for us to enjoy the rich visual experience of the world around us, our brain must add a fair amount of information itself. It appears to be a type of storage warehouse, filled with experiences and acquired knowledge. The information provided by the eye is like a blueprint from which our brain constructs an image of reality, using material from our past. Incredible as it may sound, much of what we think we are seeing is actually engineered by our brain. This also explains the book's motto: Painting

Figure 8
Donald Duck



is the art of omission. The basic rule of painting could be considered the principle of inversion: 'Because the brain adds information, the painter can leave information out.'

Which information can be left out has been discovered by artists over the course of centuries, but that does not mean that we understand it all. Below, some examples of the principle of inversion are discussed. An obvious illusion that is important for the art of painting is our eye's ability to complete patterns. On the inner surface of the eye, there is no room for receptors at the point where the optic nerve leaves the eyeball; the so-called blind spot. The eye gathers no visual information in that spot. This usually does not present a problem, as the blind spot is located outside our field of acute vision. We all know the illusion that is created when we look at two dots on a sheet of paper, horizontally spaced around 6 cm apart. When we move the paper towards one eye, at a certain point, one of the dots disappears. The eye simply fills in the missing information with the surrounding texture. This ability to fill in texture is often used intuitively by sketch artists and painters. It is used particularly often in comic strips. Carl Barks, the US cartoonist who drew Donald Duck and who initially was paid no more than USD 12.50per page, was a master at it. Whenever a picture required a brick wall, he often drew no more than 7 bricks. This is effective, among other things because our eyes are drawn towards the action of the Duck in the picture. The wall is located within the periphery of our visual field, where we cannot distinguish much detail. Comic strips are full of examples of the principle of inversion.

Figure 9.Schematic representation of the workings of the human eye. The eye dissects paintings into modular information that is then transported along the optic nerve to the visual cortex. This contains a number of collaborating modules that re-assemble the information to form a coherent visual experience. How this system works is as yet largely unknown.

Figure 9 presents a schematic overview of what happens inside the brain. Our retina is covered by a complex layered network of collaborating cells. It is important for painters to know that the density of the cells is not the same in all places, due to a lack of space on the retina. Evolution has led to a more or less optimal distribution. Describing the complete biology of the eye here would be taking it too far, but broadly speaking, the following subsystems can be distinguished:

Figure 9 Schematic representation of the workings of the human eye. The eye dissects paintings into modular information that is then transported along the optic nerve to the visual cortex. This contains a number of collaborating modules that re-assemble the information to form a coherent visual experience. How this system works is as yet largely unknown.

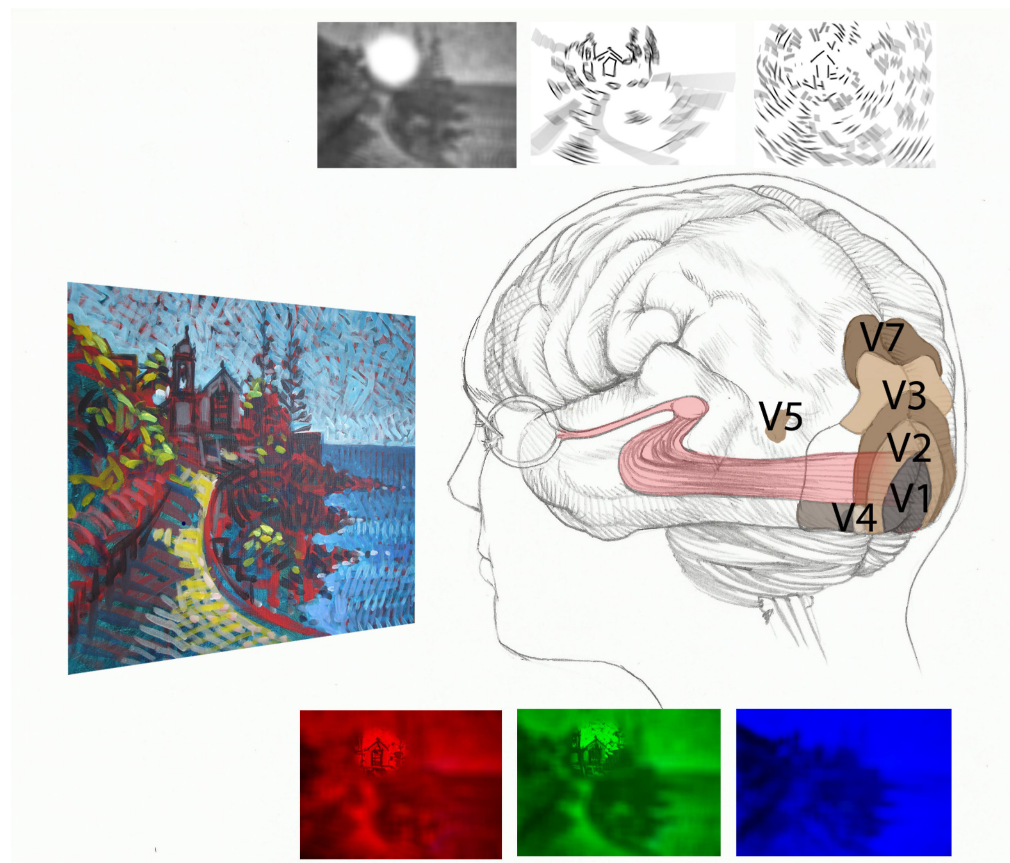


Figure 10
Contours versus planes.

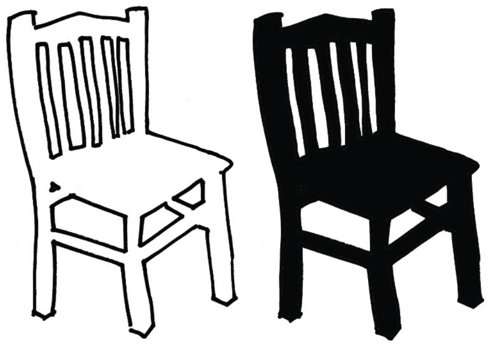
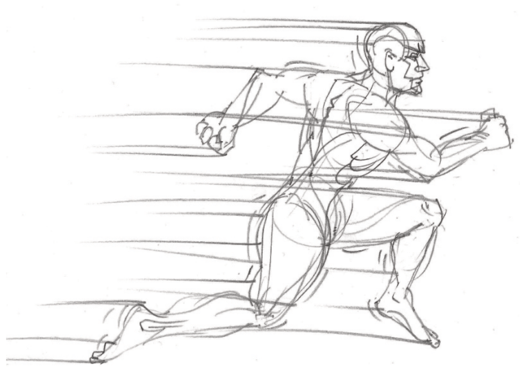


Figure 11
Running hero, using speed lines. A visual program for the viewing machine.



1. The black-and-white system. This is the oldest system, from an evolutionary perspective. Many animals are color blind. The cells of this system are rod-shaped and very sensitive to light. They form the foundation of our night vision. There are few of these cells in the center of our visual field, which is why we cannot see very clearly in the dark.

Figure 10Contours versus planes

2. The color system. The cells of this system are cone-shaped and come in three types, depending on the color of the light they respond to: red, green and blue. The center of our field of view holds many green and red cones. The blue ones are divided more evenly. Therefore, we only have sharp vision in red, green and yellow. This also seems efficient from an evolutionary perspective. In nature, the need for detailed information on blue-colored objects is rare. Blue is mostly located on the periphery of our field of vision. Fast and clear recognition of red, yellow and green objects appears to carry evolutionary benefit. The distribution of receptor cells seems to explain why we consider blue to be a 'deviating' color and why green, yellow and red are more at the forefront. We in fact see blue predominantly in our peripheral vision and the other colors more in the center of our field of vision. This may also explain why Picasso's paintings from his blue period hold such fascination. The eye is not built for viewing detailed depictions in blue.

Figure 11Running hero, using speed lines. A visual program for the viewing machine.

3. The contour system. Our retina contains a system of collaborating cells able to decode contour lines. This information is transmitted separately to our brain, which explains the remarkable fact that, to our brain, a drawing in planes is more or less identical to one drawn in contour lines. This is also due to the principle of inversion. For the sake of efficiency, the eye encodes planes in terms of their contours. The painter, therefore, could just as well only draw the outlines. The brain subsequently interprets the whole as a colored plane.

4. The system of direction. There are cells specialized in detecting movement in certain directions and in the orientation of textures. This type of data compression can also be reversed. Look, for example, at the picture of the running super hero in Figure 11. The horizontal lines enhance the illusion of movement, even though the lines bear no relation to the actual movements of the running hero, as these cannot be depicted by a static image. The orientational cells are being stimulated by the horizontal strokes in a way that is comparable to what happens when actual movement is detected. This is no realistic image but a two-dimensional program for the brain. The eye has specialized cells for horizontal, vertical and diagonal orientation.

This information is processed in various ways in the visual cortex of the brain. The system is very complex and its workings are mostly still unclear. V1 is the primary visual cortex. This area contains a direct image of the information on the retina. From here, the information is distributed over the other areas. Areas V2 and V4, for example, play a role in discerning color, whereas V2 and V5 discern movement.

Details are not very important to the painter, at this stage. We have to keep bearing in mind that a painting is not so much a representation of reality, but rather a program to activate our visual machine. Because our visual system fills in information, the painter may create images that are much stronger than a direct observation of reality.

I end this chapter on a more speculative note. Our brain is plastic, it changes over time. It is a learning system that focuses on the particular world it has to interpret. The distribution of direction-oriented cells within the eye, for example, seems to depend on culture. The eyes of Eskimos and American Indians living in wigwams react stronger to diagonal visual stimuli than those of contemporary humans living in an environment of office buildings with strong vertical and horizontal features. This insight could help us to better understand the development of art throughout history. Perhaps the rise of the Modernism of Mondriaan and his contemporaries resulted from reprogramming of the observations of inhabitants of metropolises due to their visual environment – containing straight-lined streets and high-rise buildings with only horizontal and vertical aspects. Perhaps modern world citizens are affected to a lesser degree by paintings by Fragonard and Ruisdael because their visual system is no longer used to the complex but static visual information these paintings contain. Perhaps the megalomaniac modern museums with their enormous white halls and primitive geometrical constructions are particularly unsuitable for displaying well-painted art. We laugh at pictures of 18thcentury 'showcase rooms' with paintings lining the walls up to the ceiling, but we seem to forget that people in those days were able to really look at a painting. A painting, basically, was an object so rich in visual information that is could maintain itself in a complex environment. And the beholder was prepared to take the time to let the painting do its work. Perhaps the fact that we are only interested in paintings when they are displayed on at least 100square meter walls is a sign of our own visual inability.

And I have not yet mentioned the influence of televisions and computers. Most people do not realize that they have seen most paintings only on photographs or from computer screens. Computer and television screens are distinctly unsuitable as a means to experience well-painted art. They are conducive to a fast manner of viewing that does not do justice to the painting.

If this train of thought indeed is going in the right direction, it has to be concluded that the art of painting will never be able to develop into a medium for the masses. The viewing experience remains an individual one, and the average 21st century beholder is no longer capable of effortlessly seeing the subtleties of a good painting – merely because his brain lacks the required program.

V Visual language

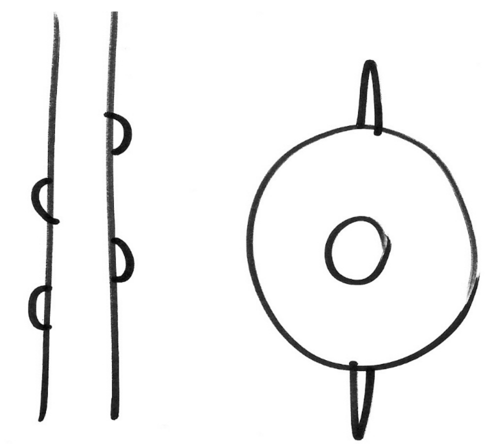
Understanding a sketch or a painting can be compared to reading a written message. In itself this is not an obvious comparison. After all, painters have always claimed they painted the imagery of reality. There appears to be a natural connection, a symbiosis, between a thing and its image. This connection is thought to be very different than the arbitrary relationship between a word and the item it describes. The word 'horse' is fully unrelated to the shape of a horse, while a drawing of a horse appears to follow its natural shape. A common example is that of drawing a shadow; place a horse in front of a high wall in the rising sun and follow the contours of his shadow with a crayon. This will provide an image in the natural shape of a horse. Claiming the absence of a direct relation between words and the objects they stand for, however, is not really fair. In language, next to arbitrary words like 'horse' and 'dog', there are also words that mimic sounds, such as 'hiss', 'clap', 'hack' and 'pop'.

When looking at the methods used by prehistoric painters to paint horses, in addition to following contour lines, we find a collection of other expressional tools that are anything but natural. Moreover, tracing the contours only works in certain cases; the horse in the example must be placed exactly sideways in front of the wall – a pose that is distinctly artificial. There are plenty of 'natural' contour drawings that we hardly recognize as such; for example, look at the image of the cat climbing up a telephone post and the Mexican on a bicycle.

Figure 14 Contour lines that are hard to identify.

On second thought, drawing a horse by tracing his contours is a trick with few natural aspects. And the fact that our eyes are prepared to recognize the image of horse in a thin line that has been drawn around a shadow says more about our visual system (which, as we have seen, has specific functions for reconstructing contours) than it says about the nature of such a drawing itself. The trick of using contour lines is rather a discovery of the specific functioning of our vision, similar to how we once discovered that pronouncing the word 'hiss' in fact mimics the sound made by snakes and the word 'drip' sounds like water trickling from a tap. Nothing natural about that.

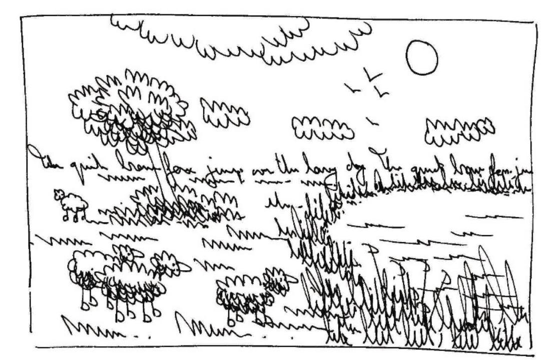
Figure 14
Contour lines that are hard to identify.



Let us further analyze the analogy between drawing and writing. Both have a lot in common, from a motor system perspective. Anyone who can write can also learn basic drawing skills. Before reading on, first carefully study the sketch of sheep in a meadow (Figure 15).

Figure 15 The relationship between painting and writing.

Figure 15
The relationship between painting and writing.



All the elements of this image are literally derived from writing. The sun is the letter O. The bottom of the clouds consists of multiples of the letter w, and the tops consist of letters m or n. The same applies to the bodies and heads of the sheep; their legs are the letter b d. And the foliage of the tree is a collection of multiples of m and w. The horizon is two times the sentence 'the quick brown fox jumps over the lazy dog', written in tiny letters. The birds in the sky are a v, and the waves on the water are the letters u and w in italics. The tufts of grass are depicted by repetitions of the word 'mum', while the reeds surrounding the water consist of letter combinations such as 'lili', 'lll, 'lw' and 'llu', interrupted by p representing flowers. I have drawn them increasingly smaller to suggest they are further away, in order to create depth.

It is not always obvious why these types of elements or what I call 'visual words', such as the sheep and clouds in the sketch, have this effect. Perhaps Indians from the Amazon region or Papuans from New Guinea would not see any of this is such a sketch. It is up to cognitive psychologists to explain it. But I do know that it works like this for those of us who have grown up in the Western world, with a wealth of cultural visual material stored in our brain. Alphabetical characters, used in writing to form words, can easily and effectively be applied as visual elements. Some examples:

- The letter c; a row of them may suggest a string of beads, a stack of roof tiles, waves or cobble stones...
- The letters e and l may represent boscage, a collection of shrubs, the edges of a rug or an old-fashioned, twisted telephone wire...
- The letter f could depict a lace collar, the edge of a hat, uniform braiding or frills on a dress...
- The letter i may be used for all that is stripy: reeds, grass or nails, or hatching shadows ...
- The letters m and n can represent grass, the edge of a cloud, small waves, corrugated cardboard, or animal teeth...
- The letter o is the sun, the moon, buttons, the disk of a flower, or a soup plate ...
- The letters u, v and w could be grass, saw-toothed edges, shark teeth, or birds in the distance...

The possibilities are endless. This also explains why we speak of 'the artist's handwriting'. Handwriting and sketching style are closely related. In the drawing of Robinson Crusoe (Figure 16), I used the elements derived from writing a little more freely. Figure 16 Robinson Crusoe

See if you are able to decipher the structures used. For example, look at the trunk of the palm tree. And the nearby cloud was drawn according to a very different method than those further away. Nearby clouds often have less sharp edging - here depicted using double, more or less parallel lines. These lines also indicate a certain shading. I drew the birds using four different methods; a detailed one for up close, a simpler version for those at a medium distance, the well-known 'v's for those further away, and finally only dots for those in the faraway distance (lesson 0: all faraway animals can be drawn as dots). Figure 17 shows three of these elements drawn on the same scale. I use various line rhythms to suggest a variety of plants; from circular to angular, or sometimes only short stripes. Other well-known visual words are the ship and the small male figure. The miracle is in the fact that our eyes recognize the intention with ease. These types of written elements can be seen everywhere throughout the art of painting. With this in mind, study the drawings of the great masters. Written elements can be found also on Ancient Greek vases, in the frescos of Pompeii, in Chinese and Japanese brush drawings, as well as in drawings by Da Vinci and Rembrandt. Just look at how Rembrandt drew shrubs and trees, or cart ruts along a country road.

By considering the image to be a language construction, we indicate the arbitrary character of the relationship in meaning between the elements of the image and the subject of what is portrayed.

Figure 16
Robinson Crusoe

Figure 17

Visual words for bird.

There is an important insight, in this respect, which can be coined by the phrase by composer John Cage that 'designing art, making art and looking at art are three different things that have nothing in common'. Let me give you another example.

Figure 17 Visual words for bird.

1. There is a well-known and simple method to paint clouded skies using watercolors:
Take a sheet of watercolor paper and moisten it. I usually dip the paper in a tray of water and then pat it dry between two towels.
2. Take a brush with blue paint (aquamarine of cobalt blue) and paint the paper blue, starting from the upper edge. Ensure the blue at the top is the darkest and make it gradually lighter by adding more water as you go down. Leave the lower edge of the paper more or less white.
3. On the lower side, apply a few light red and yellow accents.
4. Take a Kleenex and crumple it up. Dab away large, irregular shaped patches of color from the top part of the paper, then smaller patches from the middle and many tiny patches on the lower end of the paper - and that is all there is to it - success guaranteed!

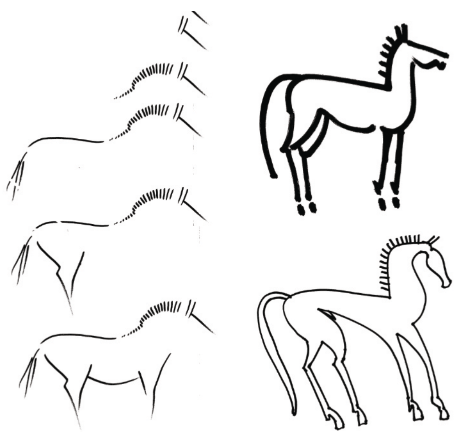
Why this has the desired effect can of course be explained by the sky being deep blue right over our heads (on a nice day) and becoming increasingly hazier towards the horizon, due to water vapor close to the earth's surface. On the horizon, the light is also refracted differently, causing the red-yellow haze. Clouds are the result of water vapor condensation within chaotic air flows and, therefore, they all have irregular shapes. The clouds high up in the sky are closer to us and thus seem larger, while further towards the horizon they appear smaller. The actions of the watercolor painter, however, have no real bearing on these physical explanations, which, in turn, have nothing to do with the fact that our eyes are prepared to recognize a clouded sky in these structures. Had our eyes been designed differently and would they have been susceptible to other wavelengths, we may not even have noticed the analogy to the sky. The painting probably means nothing to, say, a dog or a bat.

Therefore, when analyzing visual art, we should distinguish at the very least the following four individual dimensions:

- The depicted object itself.
- The artist's impression of the object.
- The method or grammar used by the artist to create the image of the object.
- The cognitive skills of the viewer.

By seeing the image as an expression in visual language, we in fact indicate there to be no natural relationship between these elements. In theory, all possible connections are arbitrary. And if we find any connection, we will have to try and understand why it exists. Let us take the prehistoric method for drawing a horse as an example. There are limitless numbers of individual horses all sharing the same biological basic design. In addition, there are endless possibilities for transforming that shape into a design of something that we recognize as the image of a horse. Those designs, in turn, can be realized in numerous ways. The caves of Lascaux show the work of a generation of brilliant artists who found the visual word for horse (see Figure 18). The method for drawing this visual word consists of a few steps. Have a good look. Everyone with basic drawing skills will be able to follow these steps, but

Figure 18
Various ‘horse grammars’; the one on the left is prehistoric, the other two were derived from Ancient Greek vases. The prehistoric method, in particular, is an interesting example of the principle of inversion (see Chapter 3); nearly all non-essential information has been left out.



from the perspective of painting technique there is a great deal going on in this seemingly simple little sketch. We will consider each separate phase.

Figure 18 Various ‘horse grammars’; the one on the left is prehistoric, the other two were derived from Ancient Greek vases. The prehistoric method, in particular, is an interesting example of the principle of inversion (see Chapter 3); nearly all non-essential information has been left out.

1. The artist begins with a diagonal brush stroke with a pointed, awl-shaped tip, basically creating the outline of the upper side of the horse’s head. By giving the line a pointed ending, it also suggests the shape of the head. Although this is not self-evident, our eyes seem prepared to see it in this way. Also note how the first brush stroke determines the size and overall proportions of the entire image. On the cave wall it is probably the size of an adult hand.
2. Then the artist does something that shows a more than ordinary skill; he places another two small lines diagonally on the original one. The first a little smaller and forming a T-crossing with the original line. The second little line closes the outline of the head, also in a T-crossing. The effect is very suggestive; we see two ears pointed forward! The two lines are clearly separated from the larger wave of smaller lines that form the manes of the horse.
3. Subsequently the horse’s back and tail are drawn...
4. Followed by the hind leg. The straight position of the hind leg is also strikingly accurate – something that is notoriously difficult.

A) The full, round belly is drawn with one bold brush stroke.

B) The final step is that of drawing the front legs, in two brush strokes.

Figure 19 Birds are particularly suitable to depict with rapid brush strokes.

This drawing has nothing childish or primitive; it has been made with great skill. Note also that, in contrast to the method for drawing skies, this method is one that is difficult to put into words. We really need the image. Our Western languages hardly have any words to describe form, or the direction and proportion of brush strokes. However, in Japan and China they do with their writing based on characters. They have many painter’s guides that teach how to depict a bird, horse, cow or person, using only a few brush strokes. Those images tend to use visual elements that also are present in the definition of the characters.

What can we learn from this analysis? In the first place, the fact also applies that the image of the horse is only loosely related to the actual shape of the horse itself. The image has no eyes, no mouth, and no hooves. It consists of only a few outlines. The brush strokes are not even all connected to each other. Apparently our eyes are prepared to see a horse in this collection of lines, but again the strokes of the artist do not have much in common with the experience of the viewer. Secondly, we learn that prehistoric art is not primitive at all. It has an arsenal of means of expression at its disposal; outlines are being used, but they are alternated with other, more subtle means of expression, such as volume lines, hatching, and awl-shaped lines.

Figure 19
Birds are particularly suitable to depict with rapid brush strokes.

Figure 20
Methods for drawing faces. Upper row according to Villard de Honnecourt (13th century). The children's heads are according to Fioletti (17th century).

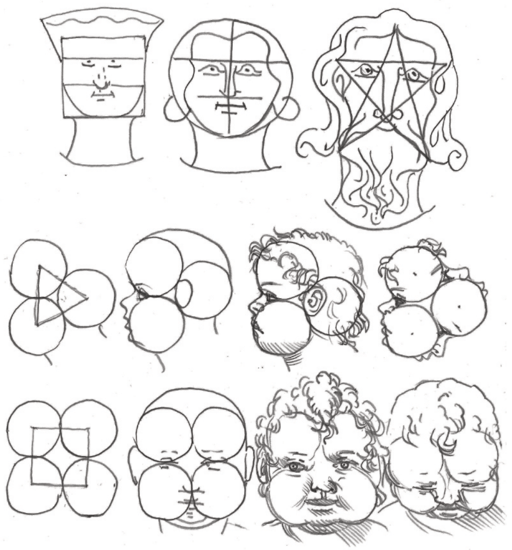


Figure 21
Visual words describing deer.

Figure 20 Methods for drawing faces. Upper row according to Villard de Honnecourt (13thcentury). The children's heads are according to Fioletti (17thcentury).

Books on drawing, throughout history, have provided tips and tricks on how to draw people, animals, trees and plants. That the method often was separate from the actual 'logical' organization of the image can be seen in the examples by Fioletti and Villard de Honnecourt. The children's heads based on four circles, by the way, can still be seen in the work of extremely skilled painters such as Rubens, who really was very skilled at drawing his own children. The drawing suggestions by Honnecourt are also far less naive than they seem. When I am sketching, I also try to arrange my subject in terms of mathematical shapes, unrelated to the image (rectangle, square or oval). Seeing abstract shapes is still being taught in textbooks on drawing today. In that sense, Villard de Honnecourt can be regarded as very modern.

Figure 21 Visual words describing deer.

Reality has its structures that science tries to interpret and cement into text. Grammar describes the structure of a language and thus dictates its means of expression. Just about every structure within an image that consists of more than mere static can be described in terms of visual grammar. Painters use this grammar to communicate with each other and with their audiences. Visual grammar is also the basis of an artist's education. The history of the art of painting may be considered in light of the visual grammar's development. Over the course of time, a multitude of methods have been developed for making paintings and drawings – with the human body as an essential element. The various grammars lead to methods that describe how you can use your body. The history of such grammars, to date, has not been documented. It would also, in part, be the history of the development of our visual understanding of the world.

VI Visual grammar

A writing system can be designed, roughly, according to two basic principles. One way would be that of a direct coding of concepts into images. This leads to writing in characters, such as in Chinese where a separate little drawing has been defined for each word. In cultures with character writing, the relationship between word and image is much more direct than in our culture. Writing and painting interconnect seamlessly, as the characters can be used directly in a painting. Western cultures have chosen a different method, namely that of coding the sounds by using symbols. Our writing is alphabetical. The symbols used are abstract, by definition. They cannot be coupled to concepts. However, this does not mean that Western painters do not use visual words in their paintings and drawings. Because there, too, we see standardized visual elements that show a certain kinship with characters. A Western painter also uses a visual language, in which visual words and visual sentences exist as much as in our written language.

The main differences between visual language and written language is that, in the former, symbols can be placed on a flat surface, freely and in random orientations and sizes – whereas the latter places the symbols at regular distances from each other and their size is ordered linearly. Writing is one-dimensional. The order of the letters is important; the words ‘pot’ and ‘top’ have entirely different meanings. The orientation of the letters is also predetermined; thus, the letters p, d and b can be distinguished from each other. Syntax studies the way in which words can be strung together to form sentences. The words of a sentence cannot be shuffled around and retain their meaning: ‘The sees dog John’ is not a comprehensible sentence, while ‘John sees the dog’ is. Words of the same word class (verbs, nouns) can be substituted; ‘dog’ and ‘cat’ are both nouns and are thus interchangeable. ‘John sees the cat’ works just as well. But outside the word classes, things become unintelligible: consider ‘John dog the cat’. In addition to syntax, there is also semantics, the study of the meaning of the expression of language. Some sentences are correct from a syntactic perspective, but we cannot derive a clear meaning from them. A famous example of a semantically incorrect sentence is given by Chomsky: ‘Green ideas sleep furiously’.

Visual language works differently. There is a structure of two dimensions, and orientation and mutual relationships of the visual elements are important. Visual grammar, as I see it, describes the construction of images in terms of their composing elements. A visual syntax sets the specific mutual positions, relationships and orientations of the basic visual elements. We distinguish:

1 Visual plane: a defined space of fixed dimensions and orientation (horizontal or vertical).

Figure 22 Various types of brush strokes.

2. Visual elements: points, lines, brush strokes. These are the basic building blocks of an image. The artist places them in the visual space. The technique that is used will largely determine the types of visual elements he has at his disposal; for a drawing these are fine lines in all sorts of shapes, for a painting they consist of brush strokes, whereas for a collage they are torn pieces of paper, and a mosaic requires little pieces of stone or glass.. Visual elements have a certain scale – brush strokes or pencil lines cannot simply be made ten times as large.

Figure 22
Various types of brush strokes.

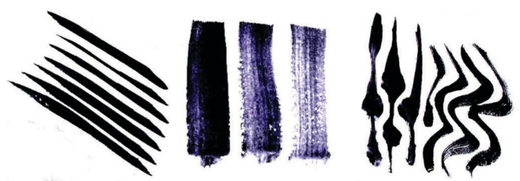


Figure 23
Lying nude. Bernard de Wolff.

Figure 23 ying nude. Bernard de Wolff.

Visual words: a visual word is composed of one or more visual elements. It has fixed characteristics and is an image's smallest element to which meaning can be awarded, irrespective of the image. A visual word can be either simple or compounded . A 'smiley' is an example of a simple visual word, from which no elements can be removed without it losing its recognizability. You could also draw a more complex variant of the 'smiley', which will be recognized as such, because the image has a structural kinship to the original simple version. Some paintings consist of more or less one visual word that contains thousands of visual elements – see, for example, the painted nude by Bernard de

Wolff. Without knowing the full context, we could only discern (read) the details of this painting with great difficulty. That said, the painter could also easily change a number of details without it affecting the recognizability (readability) of the full image.

Figure 24 Simple and complex smileys.

4) Visual sentences: complex descriptions with an independent meaning, compiled from visual words with a fixed visual syntax. Visual words in a visual sentence may have many syntactic relationships. To name a few:

–Spatial orientation. For instance: next to, above or below each other. The beret is positioned above the head.

–Part-whole. The handlebars are part of the bicycle.

–Occlusion (one visual word overlaps another). The leg is positioned in front of the bicycle.

The professor on the bicycle, depicted in Figure 25, is an example. The individual visual words, such as hand, face, leg, shoe, hat, bicycle, handlebars and tire, can each be recognized with ease. They could also be used in other images.

Figure 25
Portrait of Professor Van Emde Boas, bicycling in academic regalia.

5) Image: visual space containing a combination of one or more visual sentences with a fixed visual syntax.

Figure 24
Simple and complex smileys.

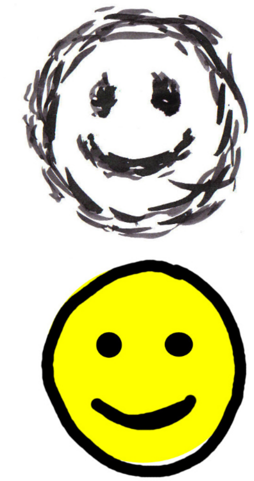


Figure 24
Portrait of Professor Van Emde Boas, bicycling in academic regalia.

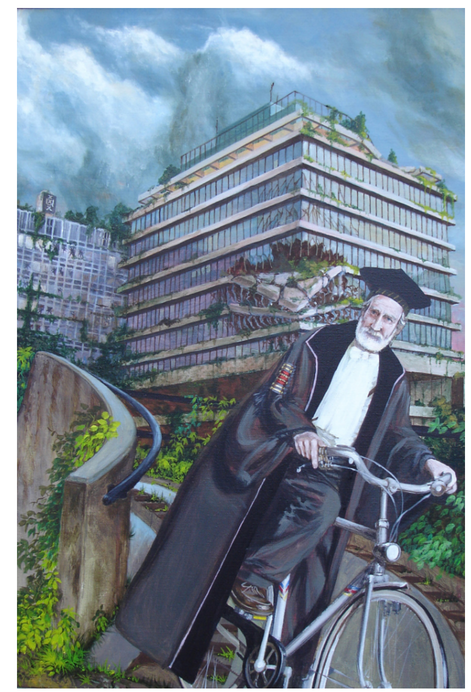


Figure 26
Individual visual elements.

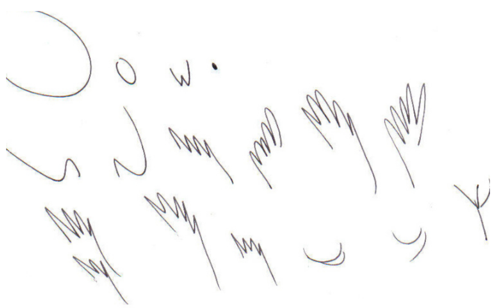


Figure 27
Combine to form a sentence.

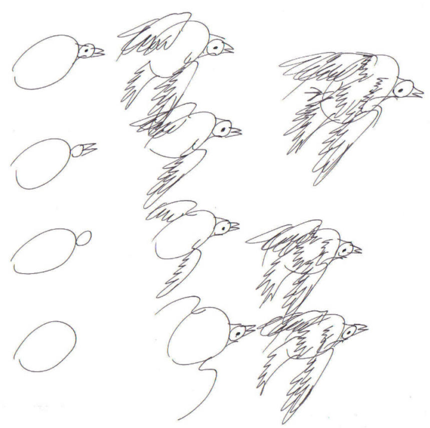


Figure 28
A study of the possible variations of smileys.

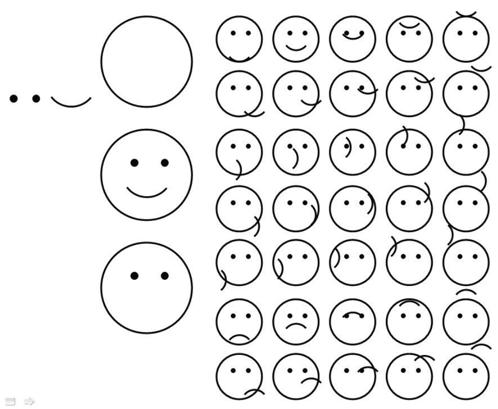


Figure 26 Individual visual elements.

Let me give you an example. Figure 26 shows a number of individual visual elements. You could call them the letters of the artist's writing. In the figure underneath, I have indicated how these elements could be used to quickly draw a bird. The actions have a relatively fixed order in time; it is an algorithm. You always start by drawing an oval. This is the basic shape of the bird's body to which the rest can be added. Then comes a smaller oval for the head. In themselves, the visual elements mean nothing; only by arranging them in a certain order, our eyes are prepared to interpret the image to represent a bird. Such ordering could be considered the image's syntax. This visual word can be used as one of the building blocks of an image. Similar to those in the drawing of Robinson Crusoe, in the previous chapter. In general, any painting or drawing can be analyzed in this manner, in terms of their composing brush strokes or pencil lines.

Figure 27 Combine to form a sentence.

Figure 28 A study of the possible variations of smileys.

In order to demonstrate how variations of visual elements can change the meaning of a visual word, let us look at the smiley. In hindsight, it is curious that such an archetypical image had never been used before 1963(by Harvey Hall in a commercial for State Mutual Life Assurance). The visual elements consist of a circle, a segment of a circle and two dots. These elements in themselves hold no particular meaning. In the smiley itself we recognize a smiling face. Smileys can be mirrored, rotated or enlarged and still remain recognizable as a smiley. This makes them elementary (basic) and therefore a true visual word. The visual elements of the smiley can be used to create a near endless number of other visual words, each with their own visual syntax. Figure 28 shows a range of them. I preserved the syntactic relationship of the circle and the dots and experimented with systematic variations of the circle segment, on the basis of translation, mirroring and rotation. Subsequently, I took on the role of viewer and wondered what meaning I would award to the circle segment in the various compositions. The result is provided in Figure 29. The meaning of the circle segments changes, depending on their orientation and position. Our eyes award different meanings to visual elements in various syntactic contexts.

Figure 29. Interpretations of the visual elements by our visual system.

Figure 29
Interpretations of the visual elements by our visual system.