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BEYOND THE CUT : VIDEO

Toward a grammar of special effects

The aim of this paper is to show that special effects are not purely trick effects from the magic department, but formal derivations ~~from~~ of the two basic techniques of cinema, ~~the art of the moving image~~ which are cut and superimposition, comparable if we want to follow a suggestion of Roman Jakobson to metonymy and metaphor as the two basic procedures of language.

To fully understand this concept we have at first to forget what we have learned about the history of cinema, which always was shown to us under the perspectives of literature, narration and the humanities and only very recently ~~only~~ in the context of the socio-economical or socio-technological evolution (see Paul Virilio). For our argument it is important ~~is~~ to recall that ~~the contrary to popular believes TV was invented before Cinema.~~

The ~~art~~ history of the moving image has to be divided into the art of the cinematographic moving image and the electronic moving image. Both share common fundamentals, but both have ~~also a~~ different histories which ~~is~~ runs sometimes parallel and sometimes asynchronous. What they have ~~naturally~~ in common are ~~is~~ the destruction of the aesthetics and ontology of the stable image (painting, sculpture): the question is ~~even, if~~ whether an ontology of the moving image is even possible or whether the moving image destroys any ontology. ~~What they have also in common are~~ the early optico-chemical experiments and inventions, the ~~des~~ discoveries of the fundamental physiological laws governing the appearance and disappearance of moving images.

~~Two of this fundamental~~ principles are the persistence of vision and the stroboscopic effect. The persistence of vision, formulated by Peter Roget 1824, is based on the fact that the human eye holds light values for a fraction

Optico-physiologial laws founding the art of the moving image.

Two of th~~is~~ese fundamental principles are the persistence of vision and the stroboscopic effect.

The persistence of vision was formulated 1824 by Dr. Peter Mark Roget (later more remembered for his "Thesaurus") and is referring to the phenomen on of human perception, known already since the ~~antic~~ ancient Greeks, that ~~man~~ one is still seeing something for about one-tenth of a second after it has disappeared. The human eye holds light values for a fraction of a second - a tenth of a second maximally.

~~of a second or a tenth of a second maximally.~~ Therefore, if the images before us appear in .o9 seconds, they will seem to move. If a moving point of light can trace an entire image in atenth of a second or less, then the eye will perceive the entire image as one and at once. That means that the moving point of light, accordingly speeded up, will appear as a circle of light.

In the same year also the astronomer and physicist Sir John Herschel used the principle of the persistence of vision to demonstrate the effect of the afterimage. When the eye retains an image over a tenth of a second longer, the image appears in the retina longer than in front of us. Therefore successive still images, which can fuse in the retina, if speeded up enough. Sir Herschel turned a coin around fast enough ~~around~~ to create the simultaneous perception of both sides of the coin, therefore head and tail of the shilling fused to one image.

Following experiments of the great physicist d'Arcy, it was another physicist, Michael Faraday, the ~~great~~ experimental researcher in electricity, ~~who~~ created in 1829 a mechanical device which made use of the stroboscopic afterimage-effect. This device was a kind of wheel, a mechanical disk, the famous Faraday disk. This disk was a physical-mechanical implementation of the persistence of vision, the afterimage and the stroboscopic principle. The history of cinemato=graphy, of the moving image, starts with this Faraday disk, ~~with~~ this invention ~~of~~ by a researcher in electricity.

Scanning, Succession and Simultaneity

At this historical moment in the creation of the moving image during the age of the industrial revolution, photography ~~xxxxxxxxxxxxxxxxxxxx~~ was still in a state of experimentation. ~~Only 1835~~ Fox Talbot achieved a permanent negative only in 1835. So the host medium was not yet defined. It was only ~~Only when~~ in the last third of the 19th century, when photography was added to the problem of the moving image, that the result and immediate triumph was cinematography, the writing of motion on the basis of photography. ~~On the other and hand, and~~ Before ~~before~~ that, there had been ~~was~~ the search of transmitting images by electrical means, which ~~what~~ forshadowed Television. Finally a truly operating cinema ~~and~~ and television appeared in the same decade.

But before the history of the art of the moving image was split into two different host media, electronic waves or photographic stills and their related founding principles, namely scanning or succession, it seems to be the case that the scanning method of the electronic image preceded ~~prior to~~ the succession method of the cinematographic image, and was considered the founding principle of the art of the moving image. The phenomenon of the persistence of vision itself was experienced as a kind of scanning experience. Roget arrived at his observation looking through the vertical slats of a fence at the wheels of a moving cart. Only in ~~at~~ their vertical position did the spokes appear straight; otherwise they ~~spokes~~ seemed to bend and distort. This illusion was clearly caused by his eye having retained the image of the spokes after they have passed behind the slats.

~~Also~~ The next step in the evolution of the moving image, the introduction of the wheel - and it is not a historical coincidence that ~~also~~ Roget also observed his principle at a wheel - had features of the scanning principle. The wheel was necessary to get a means of acceleration beyond human capability. Only with machine acceleration was it possible to gain the nessecary speed and duration to make use of the afterimage-effect. The disk was spinning like the coin, but the succession of the images on the wheel had to be watched through a slot (the former vertical slat of a fence). The succession and scanning principles combined in the stroboscopic disks of Plateau and Stampfer. And ~~But~~ before that, there was the

Thaumatrope, invented 1825 as a toy by W.H.Fitton and J.A.Paris, ~~which~~ other was a cardboard disk with the drawing of a bird on one side and the drawing of a cage on the other side. This optical toy employed the principle of persistence of vision or twirled rapidly on a string, . When the disk was spun, the bird would appear to be in the cage - the very first superimposition.

From the beginning we had the 3 basic principles: the scanning, the succession, the superimposition. The early machines by Plateau,Stampfer,Horner, which delivered moving images, made use of all ~~the~~ three principles, because the scanning principle is necessarily linked with the principle of succession. First I break down a continuous phenomenon into a discrete succession of lines, or points, or frames. Then I trace these lines or points or frames so fast in my retina or a TV-screen that they ~~appear~~ seem to appear simultaneously. In the case of a Faraday disk, points of light move so fast that the successive points are perceived simultaneously, just like the scan lines on a TV screen move so fast that they appear to be simultaneous, thereby creating the illusion of unity and continuity of motion.The scanning principle as the basis of TV and Video corresponds with the succession principle of the cinema, which is ~~the~~ simultaneous perception of successive frames.

The stroboscopic effect, discovered in 1832 by Simon Stampfer and Joseph Plateau, is based on the law of persistence of vision ~~and~~ the afterimage, and formulates the ~~above~~ earlier mentioned 3 steps of fraction, acceleration and simultaneity in terms that follow the scanning interpretation but turn to the cinematographic interpretation: interrupt a motion into 16 phases a second and show them again within a second, these phases would appear as unity and continuity. Simon Stampfer built the Stroboskop and Joseph Plateau the Phenakistioskop.Together with Faraday's disk they have been the first machines to create the illusion of motion based on the persistence of vision and the afterimage, which follows the persistence. ~~Since the eye retains an image over a tenth of a second longer.~~

The stroboscopic discs of Faraday, Plateau, Stampfer led to the invention of the "Vitaskop" or "Stroboskop" (Stampfer) or Phenakistoskop" (Plateau) or Phantaskop", which consisted of 2 discs, where one disc showed different phases of motion and the other disc had slits. These two discs were rotated mechanically with the help of a crank. Here for the first time the images moved, the objects in the moving images seemed to move and live. George Horner approved the Phenakistoskop and built the "Zoetrope" (1834). The zoetrope used a revolving drum with a succession of drwaings around the lower inside and with vertical slits at the outside to look through, instead of the slotted disks. When the revolving drum was spun, the illusion of coherent, continuous movement appeared. We see these disks and drums as evolutions of the wheel, the central metaphor of the mechanical age and the mechanically moving image, the cinema.

In 1845 Franz Uchatius combined ~~1845~~ the Stroboscope with light projection. He was not satisfied with the individual perception of motion through the Stroboscope. As a military officer, he wanted to teach his pupils about motion problems of the artillery collectively. Drawings of different phases of motion on glasses are placed on a disk. A second disk with slits was mounted together with the first disk and both moved in a black box with a crank. Another combination of scanning and succession, of light projection and stroboscopic effect, but clearly on the basis of photographic film has been the Praxinoscope of Emile Reynaud (1877) and the "Elektrotachyscope" (1887) of Ottomar Anschütz. Anschütz used a Geissler Tube for intermittent light projection of the glass slides mounted on a disk of steel.

~~Industrial revolution and the moving image.~~

~~Wheels, disks and drums.~~

What is important ~~however~~ to keep in mind, however, is that the early pioneers of the art of the moving image, the physicists, the doctoss, the mathematicians, the physiologists, the opticians, spoke of light values and light points. The question was, how can I move a point of light fatser in a circle then a tenth of second in order to create the (illusion of) simultaneous perception of successive points and thereb the illusion of motion? How can I make use of the persistence of vision, of the lazyness of the eye? Only later the problem turned to the simultaneous percepti of successive frames. In the beginning the terminology was closer to the scanning principle of the electronic image than to the frame succession of the cinema.

The persistence of vision can be interpreted through scanning, thereby leading to the electronic moving image, or can be interpreted as a succession of frames, thereby leading to the cinematographic image. The host of the moving image can then be video or the photographic film. How ~~Is~~ the host medium is defined, from the basic difference, scanning or succession, will follow ~~also~~ the difference of ~~from~~ the two host media, which can be defined through the different strategies of transition between the moving images: strategies built on the cut in film, strategies built beyond the cut in the electronic image. A true understanding of the persistence of vision, the optico-physiologic axiom for the moving image, makes the principles of the moving image evident: 1) The break down, the fragmentation, the interruption, the atomisation, the rupture, the fraction of a moving object. 2) The simultaneous ("at once") perception of successive phases, elements, points, frames. 3) The speeding up, the acceleration of the points, the frames, the images, to make use of the persistence of vision, to overcome the laziness of the eye. This third moment was easy to create with the help of a machine, with a rotating machine, with a mechanical disk. Michael Faraday, ~~the great experimental researcher in electricity~~ created ~~1829~~ such a disk in 1839.

The atomisation and fragmentation of moving phenomena into a succession of points and afterwards the lining up of this points through a mechanical wheel, a disc, is clearly forecasting the principle of scanning, which was then declared in 1840 by Alexander Bain and Frederick Collier Bakewell.

If as often said, the history of the moving image starts with the Faraday disk, we can conclude that the history of the moving image starts also with the scanning principle, and therefore spans much more than a century.

The industrial revolution and the moving image: wheels, disks, and drums.

The mechanical acceleration comes into play as necessary link between the atomisation/scanning of motion and the successive synthesis of the fractured parts of motion. The physiological discovery of the persistence of vision had to be matched by a mechanical discovery, ~~likewell~~, to be able to make full use of the physiological discovery. This mechanical device, the wheel or the disk, could only be undertaken in the age of the mechanical wheel or the mechanical motion, in the age of the industrial revolution. Therefore it makes historically sense that the people who built the cornerstones of the industrial revolution also built the cornerstones for the moving image. Therefore I emphasize the fact that the first attempts of writing motion, of cinemato-graphy, of a graphical notation of motion have been undertaken by the very man who founded the industrial revolution, James Watt, the inventor of the steam engine. Watt had problems with the motion of the steam in the boiler. To solve this problem he needed a graphical notation of the motion of the steam inside the boiler. The device for this graphical notation of the motion invented by Watt was later (1860) the starting point for J.E.Mareys graphic investigation and recording of motion. Machine motion lead to the graphical notation of motion which led to cinematographic motion. The moving machines existed before the moving images. Only with the help of the moving machines and their metaphor and means, the wheel, the problems of the moving image could be solved. In form of the disk, the wheel formed also the beginning of the electronic image, from Faraday's disk to the scanning disk of Paul Nipkow (1884).

Scanning Systems.

After the first phase of founding the dispositive of the moving image, which was the optico-physiologigal exploration of the laws governing the perception of motion (persistence of vision, stroboscopic and afterimage effect) started the second phase, which was to find a physical lay out, a physical implementation for these optical discoveries. One lay out became evidently the mechanical or cinematographic foundation of the moving image with the help of photography (Marey,Muybridge,Edison,Skladanowsky, Le Prince, Lumière). The other way was the foundation of the electronic image with the help of wireles transmission.

As the industrial revolution itself can be divided in a mechanical and a electronic epoch, the same happens with the moving image. As the postindustrial revolution is linked to Transistors, Integrated Circuits, Computers et al, we can say that the digital image is the postindustrial version of the moving ima The mechanical look however of the early cinematic apparatus disguised that the scanning principle,~~[illegible]~~ the basis of the electronic image, was already present before other more cinematic principles became evident. In that sense many of the early cinematographic toys forshadowed the scanned electronic image.

The scanned image

1840 the Englishmen Alexander Bain and Frederick Collier Bakewell introduced the scanning ~~method~~ for transmitting images. The image is registered a point or a line at a time, and a multitude of light values are transmitted one by one successively (serially), and then reassembled into a likeness of the original image by a reverse-scanning mechanism.

The transmission of still pictures by electrical means was discussed in Eighteenth Century, before the invention of the telegraph. Facsimile transmissio w regarded as the logical complement of the telephone, was the aim. The problem was the transmission system itself. Serial transmission of massive amount of data (of varying light values sensed simultaneously) or massively parallel syetems, utilizing a large array of sensors . The more sensors, the higher the resolution.The technical structure again was built on the known principles :

scanning, succession and simultaneity, the problem was the physical implementation, in the case the sensors, and the parallel system.

1870 irish telegraphers experimented with selenium resistros and found that they cha resistivity with varying light conditions. The possibilyty to change and controll
arouse
the light values of a system and thereby the possibility to ~~scan~~, transmit and reass reassamble a picture with the help of controlled light values. George Carey from Boston proposed 1875 the first television-system using a mosaic of selenium
parallel transmission
sensors and ~~a~~ separate transmission lines for each sensor. But ~~the xxxxxxx~~ improved to be totally impractical. Obviuosly only the scanning method would work.
The telegraph was the first practical use of electricity. The telegraph as ancestor of the electronic image is therefore a logical deduction. Image transmission by mean of scanning devices was the principal ~~output of this~~ telegraphic research.
~~Naturally~~, facsimile reproduktion over distances was in the beginning the immediate goal, but at the end of Nineteenth Century it was clear in theory how to use
even
scanners to transmit moving images. In the 1880s the principle scanning systems have been developped.

The prismatic scanning of William Lucas from 1882. His scanning system, called scansion, suggested that a light beam be focused with prisms , that the prisms be ~~sw~~
swiveled
~~switched~~ to swing the light beam back and forth across the scene to be transmitted. This was almost identical to the process that takes place in modern video cameras or picture tubes, but as a mechano-otpical process instead an electronic one.
The Scansion system ist the direct ancestor of the scanning device used in the first actual television exper iment by Charles F. Jenkins 1923.
Jean Lazare Weiller invented 1889 the third mechanical scanning system, a disk whose periphery was studded with a multitude of small tangetial mirrors, the reflections o which struck a selenium cell. Ernest Alexanderson of General Electric used this system in the late 1920s .
The most successful scanning device was invented by Paul Nipkow, a german engineer employed by a railway signal company. The Nipkow disk from 1884 consisted of a singl

rotating disk with a spiral arrangment of perforations along its periphery.The spira made only one circuit about the circumference of the disk, and the distance between t innermost and outermost perforation was equivalent to the height of the frame being scanned, while the distance between perforations was a little more thanthe width of the frame. Each perforation passed over the frame in a slightly curved path representing a single scanning line.Nipkow called his TV-founding patent "Electronic Telescop" . Especially in Nipkows round rotating disk with holes in form of a spiral ordered to dissect the image into lines we discover the return of Faradays disk. The basic process of image transmission and therefore of Television was found: serial scanning.

TELEGRAPH, TRANSMISSION, TELEVISION.

But before serial scanning could really triumph it had to move from the mechanical era to the electronic. Henry Adams, the american historian of velocity and progress, wrote correctly:"The modern world began in May of 1844 when the telegraph began and the first steamship came into Boston harbor". In this statement you will not only find defined the historical background for the moving image, which is the industrial revolution, the mechanical age, the machine motion on steam basis, but also the next step, the transition to information transmission with wire or wireless. As I have said, around 1940 also the scanning principle was demonstrated. After the telegraph facsimile transmission was the most important step to television. The first successful use of a mechanical scanning system for image transmission was the transmission of a photograph of the french presid by wire in 1904 through Arthur Korn. This first functioning fax machine was developed by Korn as a first step toward a p practical television system, in the research of which Korn has participated in the 1 189os.

40 years after the telegraph and the first fax transmissions new tools and devices for image transmission have been discovered and the host medium for the electronic image was found. Heinrich Hertz demonstrates the existence of electromagnetic waves , 1873 found by James Clerk Maxwell. Hertz waves are the bases for wireless transmission. 1897 Ferdinand Braun built a cathode ray oscillograph tube,

which made electromagetic waves visible. This Braun Tube is the ancestor of the TV Tube. Ancestors to Braun's tube have been the vacuum tubes by William Crookes (1879) and a tube by Julius Elster and Hans Geitel from 1881, the first photoelectric tube. The tube produced the current for signal transmission, but electrical amplification was needed to make the photoelectric tube work. Experimenting with cathode rays in Crookes vacuum tube J.J.Thompson discovered 1897 the electron, which started the "tron forrest", electronic amplifiers, powertubes. The first practical electronic amplifier, a triode vacuum tube, was invented 1906 by Lee DeForest. Forrest had attached a grid to the diode (invented 1904 by John A. Fleming, a radio tube) for the purpose of controlling. With the diode and the triode start modern electronics.

~~The russian TV pioneer Boris Rosing~~

Around nineteenhundert it was clear that serial scanning is the right approach to image transmission,,especially for fax transmission. After Arthur Korn (1904) the german physicist Max Dieckmann developed a successful fax system in 1906, which used a precursor of the modern television picture tube in the receiver. But it became also clear that with the selenium cells-technology moving images could never be transmitted in real time. The replacement of selenium cell trough photoelectric cells made television possible. The photoelectric effect was discovered 1888 by W. Hallwachs. A photoelectric cell is a glass vacuum tube that produces electrical current when illuminated. But electrical amplification was needed to make the photoelectric tube work (see the Elster/Geitel tube). T.Thorne Baker perfected the Bakewell-Bain scanning method and transmitted hindwritten documents and drawings 1908.

The russian TV pioneer Boris Rosing devised a television system very similar to the fax machine of Dieckmann, but with a photocell. He also used a primitive picture tube. 1911 Rosing transmitted moving images. But the premier figures in mechanical television are John Logie Baird and Charles Francis Jenkins. Jenkins transmitted silhouettes of objects in Washington 1923. Baird used a Nipkow disk to perform scanning at both the transmitter and the receiver, 30 scan lines per second, and ~~Baird~~ transmitted the face of a mannequin 1926 in London.

Sine 1928 in USA and 1931 in England mechanical television regular broadcasts began. But mechanical television did not last long due to amateurish programs and technical flaws. 1936 BBC of London bought the electronic television system of Philo Farnsworth from San Francisco and inaugurated the madern television age. Mechanical television was also not a mass medium. Only around lo.ooo people have purchased receivers in the US. After the second world war, when the audiences started to embrace the new electronic television system, mechanical television was forgotten.

But it was mechanical television, at that time also called "Radiovision", that has inspired the foremost inventor of the electronic television system, Philo T. Farnsworth. Farnsworth was 14 years old, a farm-bred lad, when he learned about the electron: That a stream of electrons, diverted in a vacuum by a magnetic field striking a photo-sensitive surface would produce light. So he got the idea to use manipulated electrons instead spinning discs to produce television. 1922, when he was 16, he came up with a camera tube, later to be called the "Image Dissector". September 7,1927 Farnsowrth demonstrated his electronic television, filed it in as apatent which he got 1930. He had a patent interference case 1934 with the other inventor of the new electronic television system, Dr. Vladimir K. Zworykin from Westinghouse Company. Zwoykin had filed a camera tube, the "iconescope", as patent application in 1923. R.C.A. 's tv camera, the "Image Orthicon", from 1934, lost also a patent interference against Farnsowrth. Since Zworkyn' s tube was incapable of changing an optical image into an electrical as claimed , the patent examiners ruldd that Farnsworth was the true originator of Electronic Television. ~~wit 22 years.~~ Farnsworth basic idea was to scan an optical image row ~~by~~ after row, from left to roght. This would be converted into an electron image. The charge of each spot would correspond to the light value of the particular part of the optical image.With his dissector tube (comprising a cell having a photosensitive plate) and his straight line scanning method (a scanning under the control of a straight line wave form) Farnsowrth formed an electrical image and traversed each elementary area of the electrical image by an electric shutter at a velocity sufficient to cover the entire image within the optical peroid. The National Television System Commitee (NTSC) recommended 525 lines per 3o/sec. in 194o as standard. 194o also beamed CBS the first color transmission from Chrysler building. In the 195o's color television set off.

The Video Age

The video age begins 1956, when Charles Ginsburg and Ray Dolby of Ampex Corp. developed the first videotape (recorder). Before the advent of magnetic tape television was a transmission of live events, live images. Nothing could be recorded. The Bing Crosby Productions did the first experimental video= recordings 1950 with a modified audio recorder that ran at loo inches per second. But longitudinal video recording was impractical and used too much tape. Before 1956 programming was either live or was reproduced from kinescope films. The transmission of moving images by electronic means (TV) had to be coupled with magnetic image storage to produce Video. Technically speaking is Video Televsion plus magnetic storage. Without the tape there would be no video art, no mean to document and store a performance, but also no mean for later postproducing the stored image. VTR (videotape recording) is the cue to video art: the electronic image plus magnetic storage.

When videotape recording was introduced 1956 as a commercially viable product, it filled a definite need. The Quadruplex videotape ~~images~~ machines had 4 video heads on a cylinder. 1959 Quad video recording was refined to accomodate color. The 2-inch quad VTR was improved over the years and led to the development of portab models (1965). But in the eraly 6o's a new recording system was invented by SOny, Helical scan. It used 1-inch tape and had a different concept than quad. Instead of four heads writing ~~writing~~ trasversely across the tape, one track containing an enti field ran diagonally across the tape. The tape was wrapped around the head in a spir in order to create the slant track.Because several heads were placed on the drum in balanced pairs, both assembly and insert editing became much simpler. The helical recording with its two heads mounted 18o degree appart on a rotating drum made not only reappear the cinematic metaphor of the wheel, the disk, the drum, but also made disappear the cinematic cut, since it became a technical futility, an easy thing to do mechanically. When the cut reached a frenzy in the avantgarde movies of the fifties, it was exactly at the historical moment, when a technological invention arose, the VTR, with its great postproduction possibilities, which made cinematic cutting obsolete. Also the fact that the tape was usable and could be played back instantely changed the aestehtic of the moving imag In the late 6o's Helican scan appeared in the 3/4 inch U-matic format, making the outside production easier possible and the cassette made tape easier to handle. 1967 Sony brought also the first 1/2 inch b/w portable video recorders, the portabacks, ~~on the~~ 197o the first color portabacks. market, 1975 Sony came up with a new helical scan format: Betamax for home video recording. JVC rivals 1977 with VHS format. In the late 7o's portable home VCR's and inexpensive color cameras were available. The electronic image, on the basis of its magnetic storage, was not longer monopolized by the state and by the industry, but personalized and individually accessible.

Video: the taped image.

When the danish engineer Valdemar Poulsen 1898, significantly a year after Braun has invented his tv tube, first proved the capability of information storage through magnetic tape, he could not know what this one day would mean for the image. Because his device was thought to record sound. The magnetic recording process starts when a medium is moved at a constant speed in the vicinity of a varying magetic field, the variations representing information to be recorded. Poulsen's "Telegraphone" (a logical extension of the telegraph and the fax transmission) recorded speech magnetically to wire. All the decades afterwards the idea remained to use magnetic tape for sound recording only. In the 4o's german engineers made progress in the evolution of tape recording and produced the magnetophone, an audiotape recording machine. This machine together with the general access of magnetic tape on consumer basis, generated in the 50's the basis for the musique concrete and other forms of tape music which made manipulation with real sound, loop methods etc possible. Only 1956 the first image videotape recorder was developed. Tape music has already reached a climax at that time and should help to engender new musical movements like minimal music. Video art is therefore comparable to the early tape music. Video art is working with tape images. Tape image like tape music could be the appropriate name for video art, or magnetically taped electronic image.

Layer versus Montage:

Elements of an aesthetic of the ~~tape and~~ electronic image

I emphasize the tape character of the electronic image so much, because the storage technology of the electronic image renders also the basis for some aesthetic aspects. From the first acurate scan demonstration to the development of the latest products in 8 mm and even 1/4 inch helical-scan systems, certain fundamental features have prevailed.

The bandwidth of the recorded and reproduced signal is determinde, to a great extent, by the velocity of the tape motion relative to the recording head. The higher the writing speed, the wider the recordable bandwith. The complexity of any videotape format is increased by the matter of including one or more audio, control and even data or time-code tracks with the video.

Macking more tracks menas you can pack more information on the tape, comparable to the studio situation, where more channels can put more instruments and sound effects on the audiotape, creating a multitrack sound. That a tape can be rerun, can be reused, can be played back immediately, can have multitrackings these are corresponding features. Provided the adequate technology a tape must not be totally erased when played back. ~~Instead~~ By being played back and reused, additional information can be stored on the tape, like with audio tapes. Rerun, Playback, Tracking can be considered as corresponding concepts - the aesthetical correspondence of which is layering. Macking tracks means laying more information on the tape. The information is not stored or assembled serially like in the cut, the information is stored parallely on tracks of the same videotape. Because of its technology layering is the basic procedure of the tape image and not the cut, which is the basic procedure for the cinematic image. The two different histories of the moving image which startrted out from the same optico-physiological discoveries are finally split into two opposing basic strategies.

I see découpage and montage as the two adversary poles of the cutting principle.

The cut evidently is the necessary mean to make transitions from pictures to pictures, from scenes to scenes, from times to times, from spaces to spaces, from one image of a space to another image of the same or another space, from the image of a person, an object to another image of the same or another person or object. The difference between to pahses of motion in two frames, which provides the illusion of motion, is extended to the difference between two images or scenes, or spacetimes. The cut is the visible format of the basic difference, on which the illusion of motion is built. Découpage is an aesthetic strategy which tries to avoid this difference, which tries to cut in such a way that the cut is not seen. Découpage wants to continue the illusion of motion also on a materialistic and formal basis, wants to heighten the illusion of continuity itself. Découpage's ideal is a continuous flow of images with no abrupt interruption. Montage is just the contrary. Montage wants to emphasize the cut, the difference, the rupture, break down the continuity to the point, where every frame is different from the previous one. Montage is the art of the cut, making use of the cut in a visible formal way. Therefore découpage is applied in the narrative cinema and monatge led to the formal cinema of the avantgarde film, especially of the 5o's and 6o' s.

If montage is the art of the cut, layering is the art of the tracking. In Layering different images are not serially connected like in the cut, but parallely. Layering means to give up the concept of the total image and start to work with parts of an image. Layering is a particle aesthetic. By layering many different parts of many different images are layed parallely on top of each other. The concept of simultaneity, which was ~~named~~ claimed so often by Eisenstein and others, was not really achieved by montage, which is a serial technique. The true achievement of simultaneity is layering. Images of different spaces, times, objects and persons, partially or whole (digitally miniaturized), are layed on top of each other. A multitude of images is floating around in the video space as consequence of the basic tape technique which is layering, grounded by its very own technology.

In Woody Vasulkas opera "The Art of Memory" from 1987 or in John Sanborns work of the last 3 years or in my own work you will find a lot of layering techniques. An especially nice battle between cut and layering you can find in the work "Steps" (1987) from Zbigniew Rybzcynski, which is just demonstrating the opposition ~~with~~ between ~~x~~ montage and layering using the famous montage sequence "odessa steps" from Eisenstein.

Layering is a breakthrough in representation techniques in the moving image. The cinematic image rarely touched the picture elements within the frame. Only the most advanced formal film like collage films composed the images with different particles of the real. Even superimposition, based on the early Thaumatrope technique, worked most of the time with the totality of the two images. Layering is therefore not only a new way of transition between images (like the cut), but also within the image itself. The information generated through the cut happens between two frames or two images. The information generated through layering happens within the elements of the image itself. The realistic reference is broken down which was not the case in the cut. The cinematic technology favored cut and superimposition as its two basic structures.

The electronic technology favors layering and its proliferations. The very nature of television - not only the tracking technology alone - heads toward layering. In television an image is sent by radio waves as thousands of dots (pixels), 3oo.ooo ,which change 3o times a second. This field of hundertthousands variable, always changing spots shows you the elctronic image as an absolutely discontinuous field (opposite to the cinematic image). This and the electronic line scanning (dissecting each image into hundreds of lines) and the tracking storage on tape generate a technique of representation (layering) and transition which is completely different from the more mechanical technique of cinematic representation. This new electronic technology of representation cannot be restricted to cuts or superimpositions - this would violate their own technical laws. This new technology of representation m be consisered just to the contrary as an extension of the grammar of the moving image and therefore also of the cinematic image. And naturally, when you look back, you will find a whole array of cinematographic effects, through which the cinema itself tried to extend its grammar. These effects are in some way forecasting on a mechanical basis the digital effects of today.

Glass-shots, where parts of a scene have been painted on a glass or photo-cut-outs combine with the real scene, all kinds of mate paintings, mirror shots like the famous Schüfftan effect, in the camera matte shots, rear projection, front projection, rotoscoping and especially optical printing which is a direct link between cinema and video, - all these difficult to execute effects can be seen as cinematic versions of contemporary digital effects, built on more or less ~~mechanical~~ analog techniques of representation.
The grammar of special effects can be compared to poetry, to experimental poetry, where, too, not the content tells the story, but the form, where the ways of representation, the means of language itself, constitute the meaning.

Everybody has learned to accept the artificiality of the cut, to use the montage and the superimposition as naive grammar of the moving image how to handle transitions of images,spaces,times. Nobody finds ist too simple that a cut does not make a difference between a cut showing two persons in the same room or showing two different images of the same person or that we cut from one ~~room~~ place to another place or from one time to another time. The cut makes believe in isotopic and isochronic space and time, which is natural spacetime . But the very cut itself destroys natural spacetime,therefore it is less illusionistic to show formally, to exhibit this destruction of spacetime and to visualize the new social electronic space, which is a parallel and even plural, multiple spacetime, polytopic space and polychronic time

Artists, experimental filmmakers, who have been sensitive to these problems, tried therefore very often to go beyond the limits of the cut in cinema. They used all kinds of matrixes like Peter Rose or Paul Winkler or Zbigniew Rybzcynski. They used time consuming operations on the optical printer like Henry Jesionka to make partial superimpositions or windowing effects, or they invented split screen effects like John Whitney sr. If the cinematic community accepted the cut and the superimposition as techniques of transition, then it should also accept the extension of these techniques through the electronic or taped image.

Because the special effect like wipes, dissolves, windowing, key effects, switching, masks etc are only formal extensions of the grammar of the moving image, extending cut and superimpositon, using the new scanning and tracking technology of the electronic and magnetic tape industry. This can be demonstrated naturally on pur formal ground, too.

Instead of alternate images A and B serially (by cutting), you can superimpose them or you can show them side by side simultaneously (split screen). Then you reduce the totality of the superimposition and make partial superimpositions. These partial superimpositions can have regular shapes or any shape, therefore the are heading towards windows. From the split screen, which is the first ~~and~~ matrix, you can go forward to a quadruple split screen, then you can double this and you get a screen matrix of 16 images, finally of 32 images, etc. The images can be the same or different ones. The superimposition must not be stationary. The new image can move in, from different directions, as a wipe. Even the form of the wipe can be different, regular or jagged. The superimposition can be ~~stationary or~~ temporary, in that case it is a dissolve from one image to another. But the dissolve must not go from image to image, but also can go from image to black or from black to image, then we have fade outs and ins and ups. When you take from the partial superimposition the transparency, then again you get layering techniques or mask techniques or even keying techniques. We have to choose between luminance keys, depending on light values, chroma keys, depending on color, or pur electronic keys. Multiple layers of windows, masks, partial superimpositions, rotating, scaled down images, etc. create the multilayered ~~space~~, multiperspective, polytopic space and the polychronic time of the electronic image, where special effects are the metagrammar.