job description that the industry itself provided for graduates, and thus also for America itself, in the 1990s.

These lectures, to put it with the requisite innocence, were formulated with a knowledge of this job description. There is every reason to believe, namely, that the educational program they outlined will be implemented throughout at least half of the world. Someone able to master both the old craft of writing and the recently developed technology of digital image-processing would therefore have better career prospects. And for me, that job description of the future serves as a welcome justification for the risky undertaking of dealing not only with conventional film and television but also with the newest technologies like imaging. It appears as if opportunities in the future are expected to be better in the field of video, which will explode through the link to computer technology, than they are for the practically obsolete dream of becoming the last and greatest of all feature film directors. The linking up of a fiber-optic cable network, which will replace the notoriously narrow bandwidth of copper wires, will increase the need for transmittable and processable images just as the need for mythical stories about Hollywood's mythical stories will decrease. It is not without reason that Bill Gates attempted in the last few years to realign his quasi-monopoly on computer operating systems with yet another monopoly on digital images. A Microsoft subsidiary by the name of Corbis travels around all possible museums, archives, and picture collections, generously abstaining from buying any of the stored originals, but receiving for a trifling sum the digital rights for those copies that Corbis itself has scanned (Schmiederer, 1998). And because you can imagine that cities like Florence or even Berlin have more beautiful pictures than Tallahassee or Petaluma, the lion's share of Corbis' loot comes from Europe, which has not yet learned enough about optical media to protect its own digital rights from Microsoft.

More cannot be said about the practical relevance of these lectures. But this also provides a transition to the third point to be dealt with today: the theoretical assumptions and basic concepts I will be working with.

— 1 —

THEORETICAL PRESUPPOSITIONS

The basic concept in the following history and analysis is the concept of the medium in the technical sense, which was developed above all by Marshall McLuhan, whose work was based on the fundamental historical groundwork laid by Harold Adams Innis. This Canadian school, as it was christened by Canadian insider Arthur Kroker (Kroker, 1984), attempted to examine the technical media and the immediacy with which they were let loose on the population of the western hemisphere following the Second World War. According to McLuhan, media are the intersecting points (*Schnittstellen*) or interfaces between technologies, on the one hand, and bodies, on the other. McLuhan went so far as to write that under audiovisual conditions our eyes, ears, hands, etc. no longer belong to the bodies they are associated with at all, let alone to the subjects that figure in philosophical theory as the masters of the aforementioned bodies, but rather to the television companies they are connected to. This connection between technology and physiology, which is not simply dialectical but rather direct, should be recorded and extended. Only McLuhan, who was originally a literary critic, understood more about perception than electronics, and therefore he attempted to think about technology in terms of bodies instead of the other way around. According to the analytical stress model, which had just been discovered at that time, technical prostheses of a sensory organ – in other words, media – were said to have replaced a natural or physiological function, and the biological function itself acted as the subject of the replacement: an eye that is armed with lenses or glasses (a beautiful expression) performs a paradoxical operation, according to McLuhan, as it extends and amputates itself at the same time. In this way, McLuhan is part of a long tradition that can be traced back

to Ernst Kapp and Sigmund Freud, who conceived of an apparatus as a prosthesis for bodily organs.

In *Civilization and its Discontents*, Freud above all formulated very drastically how, on the basis of telescopes, microscopes, gramophones, and telephones – as always, Freud does not mention film – so-called modern "[m]an has, as it were, become a kind of a prosthetic god. When he puts on all his auxiliary organs he is truly magnificent," yet he is abject without them because "those organs have not grown on to him" (Freud, 1953–74, XXI, pp. 91–2).

Nothing against this mixture of power and powerlessness, the sublimity and the absurdity of people according to Freud and McLuhan; but their unquestioned assumption that the subject of all media is naturally the human is methodologically tricky. For when the development of a medial subsystem is analyzed in all of its historical breadth, as the history of optical media is being analyzed here, the exact opposite suspicion arises that technical innovations – following the model of military escalations – only refer and answer to each other, and the end result of this proprietary development, which progresses completely independent of individual or even collective bodies of people, is an overwhelming impact on senses and organs in general. McLuhan, who converted to Catholicism long before his international career, hoped to gain something like the redemption of all literature or literary studies from the electronic media of the present and the future. To verify this point, which is cardinal for our context, I cite the following passage:

> Language as the technology of human extension, whose powers of division and separation we know so well, may have been the "Tower of Babel" by which men sought to scale the highest heavens. Today computers hold out the promise of a means of instant translation of any code or language into any other code or language. The computer, in short, promises by technology a Pentecostal condition of universal understanding and unity. The next logical step would seem to be, not to translate, but to bypass languages in favor of a general cosmic consciousness. (McLuhan, 1964, pp. 83–4)

In contrast to such an arch-catholic media cult, which simply confuses the Holy Spirit and Turing's machine, it is hopefully sufficient to point out that the development of all previous technical media, in the field of computers as well as optical technology, was for purposes directly opposed to cosmic harmony – namely, military purposes.

But such a lack of clarity in McLuhan's concept of media should not prevent further work on his fundamental theses. You are

presumably familiar with the famous formula that the medium is the message. Without this formula, which virtually prohibits looking for something else behind technically manufactured surfaces, media studies would actually continue to have a subject – just as mysterious fields like theology or World Ice Theory[2] have subjects – but media studies itself would not exist as such in isolation or with any methodological clarity. To determine the concrete subject of media studies one need only connect McLuhan's formula "the medium is the message" – as well as the mock formula he himself came up with in his later years, "the medium is the massage" – with its lesser-known explication that the content of a medium is always another medium. It is therefore obvious that, to take the first example that comes to mind, in the relationship between feature film and television the most popular content of television broadcasts is film, the content of this film is naturally a novel, the content of this novel is naturally a typescript, the content of this typescript, etc., etc., until at some point one returns back to the Babylonian tower of everyday languages.

Taking up McLuhan seems even more advisable because German media studies typically proceeds on entirely different grounds and with entirely different fundamental hypotheses. As Werner Faulstich, one of its leading representatives, repeatedly emphasizes, this media studies sees itself as a direct continuation of the research areas of popular fiction, on the one hand, and the sociology of literature, on the other hand, which both rose to prominence in the 1960s (Faulstich, 1979, p. 15).

Literary scholars who do not forget media would have thus been permitted to remain safely in the native realm of their own intellects; it is doubtful, however, whether such a trivial, content-based approach to media, which are themselves already the message according to McLuhan's contrary thesis, comes near enough to their technical complexity. We would always only be able to grasp the external façade that the electronics industry consciously displays, while the interior of the apparatus would remain concealed beneath its cover, whose instructions permit it to be opened only by an expert. Perhaps

[2] A cosmological theory proposed by Hans Hörbiger and Philipp Fauth, which was first published in their 1912 book *Glazial-Kosmogonie* (Glacial Cosmogony). Hörbiger and Fauth claimed that the Milky Way was composed of blocks of ice, and over time these blocks of ice collided and formed planets. They also claimed that the moon was a block of ice, and previous moons collided with the Earth on several occasions, causing the great flood and the destruction of Atlantis. Because it contradicted Albert Einstein's theory of relativity, the National Socialist Party promoted World Ice Theory as an alternative to "Jewish" science.

the voluntary self-control of German media studies and its particular focus on trivial or popular content was plausible for so long because on the side of media production itself content and technology fell into separate areas of competence, offices, and organizations. But it is obsolete in the age of the computer, which supersedes this separation on all levels. The only thing that remains is to take the concept of media from there – in a step also beyond McLuhan – to where it is most at home: the field of physics in general and telecommunications in particular. At the beginning of our next meeting, I will attempt to provide you with a systematic introduction to this topic by first of all presenting the basic concepts that Claude Shannon developed in his 1949 mathematical theory of communication – otherwise known as modern information theory (Shannon and Weaver, 1949). What emerges in place of a conglomeration of different media, as German media theorists always still describe it, is a systematic outline, a general connecting thread with which many individual threads could be strung together.

Second, the consequence of employing the media concept of telecommunications is that media studies cannot be limited solely to the study of media that (to be brief and clear) have a public, civilian, peaceful, democratic, and paying audience. For example, in Faulstich's *Critical Keywords in Media Studies* he proposes that closed circuit television systems, like those used for department store security, are of peripheral importance compared to the television, which is more often examined in media studies. That may be statistically true, but it is methodologically unacceptable. For when it can be shown that precisely the civilian and private use of video recorders has arisen from such security systems, it also becomes clear how artificial the dividing line between mass media and high technology is and how much it hinders the analysis of connections. In the end, the categorization of technical media according to their price and their display in department stores only conceals what the late Albert Einstein called the general explosion of information in the present. Einstein was thus strangely (and unforeseeably) in agreement with Heidegger that the explosion of information is more dangerous than all atomic bombs.

When one is methodologically inclined towards a general concept of media and information, though, the problem emerges whether and how some areas can be excluded. For this lecture especially, we are confronted with the problem of acoustic media; although they are not included in the title, they are increasingly networked with optical media. Because the general concept of information is not

philosophical but rather technical, which means that it has already ensured its own realization, it is increasingly difficult for telecommunications to be specified and defined through its contents or sensory fields. The development of optical media closely parallels the development of acoustic media, and in some cases they even developed in conjunction with one another. This can be seen in Edison's work on phonography and film and Nipkow's work on telephony and television. Indeed, there would be no television at all if radio technologies had not been developed, which then – after many technical contortions that would never have been necessary for the transmission of voice and music – were also brought to the point where they could be used to transmit images.

After attempting to separate this lecture from sociological and other approaches, what remains are the problems presented by the history of technology itself. In spite of all the metamorphoses of art scholars into engineers, can there be a history of technology at all within the context of cultural studies? In a book about early silent film whose title, *Knowledge is Medium*, is borrowed from McLuhan, Thorsten Lorenz put his finger on the problem: film is simply patent number so-and-so – the plan to build a new device that the brothers Louis and Auguste Lumière submitted in 1895 and that was also awarded by the French government. Every additional word about film beyond this degenerates into cultural or cultural studies gossip. From this, Lorenz decides to take the next logical step and write his obviously cultural studies book not about film but rather about the cultural studies gossip about film.

In our context, however, the suggested practical relevance already excludes such radicality. I will therefore focus on the history of technology and will not exclude comments on patent specifications if only, at the very least, to convey a certain know-how. To a large extent, though, the technical explanations will be oriented towards each of the beginning stages of the development of optical media in order to avoid the difficulties associated with understanding the mathematics. For didactic reasons, it is advisable to present solutions to complicated technical problems at the moment they first emerged, as they are therefore in a condition where they are still easily comprehensible and apperceptible basic circuits, which the inventors themselves must first convert from everyday language into sketches of technical plans, so to speak. In contrast, a television appliance in its contemporary, practically finished form has been through so many development teams and laboratories that it is impossible for anyone to account for all of its individual parts any more.

This emphasis on solutions to early problems runs the risk, as in many histories of film, of falling under the spell of a cult of genius pioneers or inventors and so forgetting the quotidian aspects of the media industry once it is established. But when this developmental history is represented in some detail, as I will attempt, the aura of these individual geniuses dissolves. Not only is genius one percent inspiration and 99 percent perspiration, as Edison once said, but according to McLuhan's law the development of media under highly technical conditions always requires the development of other media and thus the sweat of others as well. One must therefore consider developmental teams, subsequent developments, optimizations and improvements, altered functions of individual devices, and so on; this means, in the end, an entire history of the industry. At this point, though, I immediately recognize my own limits: the history of film and television that I will present does not include the actual history of the industry. I am neither a publicist nor an economist, so I can only deal with the economic and financial conditions of what might perhaps be called the global image trade through hints and references.

In place of the missing history of the industry, which is and remains merely suggested, these lectures will stress two other themes, which follow quite directly from my previous comments on McLuhan. The first concerns the relationship between the history of technology and the body, and the second concerns the relationship between modern technologies and modern warfare.

First, technology and the body: the naked thesis, to place it immediately up front, would read as follows: we knew nothing about our senses until media provided models and metaphors. To make this brief thesis seem plausible, I will give you two extremely opposed historical examples:

a) As alphabetical writing, this new medium of Attic democracy, was standardized on a governmental level in Athens, philosophy also emerged as Socratic dialogue, which the student Plato then put into writing, as we know. Thus, the question was on the table as to which tools philosophers could actually employ. The answer was not the new ionic vowel alphabet, as a media historian like myself would have to answer; rather, the answer was that philosophers philosophized with their souls. All that remained for Socrates and his enthusiastic interlocutors (enthusiastic because they felt flattered) was to explain what the soul itself was. And lo and behold: a definition of the soul was immediately offered by the wax slate, that *tabula rasa* upon which the Greeks etched their notes and correspondence with their slate pencils. Under the guise of a metaphor that was not

just a metaphor, therefore, the new media technology that gave rise to the soul was eventually seen as the vanishing point of this newly invented soul.

b) Around 1900, immediately after the development of film, it appears that there was an increase in the number of cases of mountain climbers, alpinists, and possibly also chimney-sweeps who, against the odds, survived almost fatal falls from mountains or rooftops. It may be more likely, though, that the number of cases did not increase, but rather that the number of scientists interested in them did. In any case, a theory immediately began to circulate among physicians like Dr. Moriz Benedict and mystical anthroposophists like Dr. Rudolf Steiner, which even you may have probably heard as a rumor. The theory stated that the so-called experience – a key philosophical concept at that time – of falling (or, according to other observations, also drowning) was allegedly not terrible or frightening at all. Instead, at the moment of imminent death a rapid time-lapse film of an entire former life is projected once again in the mind's eye, although it is unclear to me whether it is supposed to run forwards or backwards. In any case, it is evident: in 1900, the soul suddenly stopped being a memory in the form of wax slates or books, as Plato describes it; rather, it was technically advanced and transformed into a motion picture.

In these lectures, however, the attempt to define the soul or the human being once more will be systematically avoided. As the two examples above quite clearly show, the only thing that can be known about the soul or the human are the technical gadgets with which they have been historically measured at any given time. That excludes the possibility of basing these lectures on the experiences of motion picture audiences and the opinions of television viewers, which most of the work in empirical German media studies continues to be based on (despite all the statistical tricks with which those experiences and opinions are then supposedly transformed into objective data). Fans will therefore not get their money's worth.

Why this disappointment? Because the historical tendency to employ technical media as models or metaphors for imagining the human or the soul, which I have just illustrated, is anything but accidental. Media have become privileged models, according to which our own self-understanding is shaped, precisely because their declared aim is to deceive and circumvent this very self-understanding. To be able to experience a film, as it is so wonderfully called, one must simply not be able to see that 24 individual images appear on the screen every second, images that were possibly filmed under

entirely different conditions. This is particularly true of television, as we know that there is a recommended optimal distance between the slipper cinema, on the one hand, and the wing chair, on the other. Eyes that fall short of this distance are no longer able to see shapes and figures, but rather only countless points of light that constitute their electronic existence and above all their non-existence – in the form of moiré patterns or blur.

In other words, technical media are models of the so-called human precisely because they were developed strategically to override the senses. There are actually completely physiological equivalents for the methods of image production employed by film and television, but these equivalents themselves cannot be consciously controlled. The alternating images in film correspond roughly to the blinking of eyelids, which mostly occurs entirely automatically; with some effort, this blinking can be increased to at least half the frequency of film's 24 frames-per-second, which very graphically simulates the stereoscopic effects of film when combined with head movements, but the speed of 24 frames-per-second was intentionally chosen exactly because eyes and eyelids are unable to attain it. In a similar way, the construction of images on television corresponds to the structure of the retina itself, which is like a mosaic of rods and cones; rods enable the perception of movement, while cones enable the perception of color, and together they demonstrate what is called luminance and chrominance on color television. Retinas are themselves seen so rarely, however, that the place where they, and that means all of us, see nothing whatsoever – the blind spot where the optic nerve leaves the eye – was only first discovered by physiological experiments in the seventeenth century.

This implies, conversely, that for technical media, if they impinge upon our senses at all like film or television, it is completely justified to conceive of them as enemies (and without the cultural pessimism that Horkheimer and Adorno's chapter on radio and film in *Dialectic of Enlightenment* made fashionable). For the enemy is, according to Carl Schmitt, the embodiment of our own question. There are media because man is (according to Nietzsche) an animal whose properties are not yet fixed. And precisely this relationship – not a dialectical but rather an exclusionary or adversarial one – ensures that the history of technology is not so ahuman that it would not concern people.

The name for this problem area, which has yet to be negotiated in detail, is standards or norms. Standards determine how media reach our senses. All of the films that can be bought are known to be standardized according to either DIN or ASA. I employ the term

"standard" to distinguish those aspects of the regulations that are intentional from the accidental or contingent. Norms, on the other hand, were and are an attempt to cling to natural constants, like the standard meter of the French Revolution, which led medical historian Canguilhem and his follower Foucault to define post-1790 Europe as a culture of norms instead of laws. In this sense, I go one step further and say that after 1880 we find ourselves in an empire of standards (the word culture, as a concept associated with agricultural growth, has to be ruled out). The use of screens for film and panel painting already makes the difference between media standards and artistic styles abundantly visible. This will still be shown in technical positivity, but beforehand I will briefly sketch out the fundamental principles.

The eye sees. Is it seeing a film, a television broadcast, a painting, or a detail from so-called nature that (according to the Greek word) it projects from within itself? This question can only be decided by 1) an observer who sees this eye see, or 2) this eye itself, if and so long as the media standards are still a commercial compromise that reveals deficits, such as black-and-white images, no stereoscopic effects, or missing colors like the American NTSC television system. Like the film director von Göll in Pynchon's great world war novel correctly said: We are "not yet" in the film (Pynchon, 1973, p. 527).

From the perspective of the year 1945, therefore, Pynchon's fictional director, who is really only a pseudonym for his historical colleagues like Fritz Lang or Lubitsch, promises a standardization that will bring an end to the difference between film and life – like the subtitle of a novel by Arnolt Bronnen – while in the meantime already making some actual advances towards this goal. As you know, this convergence of mediality and reality has been discussed using the term "simulation" at least since Baudrillard. These lectures will have to take up this debate yet again, as the concept of simulation, which refers to the sublation of a separation, allows for the introduction of a sharper distinction between traditional arts and technical media than is customary in everyday language.

In the Greek tradition, there are fairly paradigmatic anecdotes about a competition between two painters, who both claimed to have absolutely fulfilled the allegedly Aristotelian postulate of a μίμησις φύσεως, an imitation of nature. The first painter, who was named Zeuxis, created a painting with remarkably realistic-looking grapes. His competitor was actually able to see that these grapes were painted, but a flock of birds immediately pounced on the painting, thinking that they were indeed real. According to Kant, these two reactions

exemplify the entire difference between art and life, disinterested satisfaction and desire. But the matter does not simply end there. It was left up to Zeuxis' competitor, Parrhasios, to take the painting competition to another level. When he presented his work for Zeuxis' assessment, a veil still hung over the painting. Zeuxis wanted to pull the veil away in order to take a better look, but when he attempted to extend his hand towards the veil he realized it was also painted. The first-order simulation was thus able to fool the eyes of animals, while the second-order simulation was also able to fool the eyes of humans.

This anecdote actually shows quite beautifully that art and media are fundamentally about the deception of sensory organs (Lacan, 1981, p. 103), but this seems to be just as beautiful as it is problematic. It implies that people can deceive others about the status of their own creations through the use of manual tools and abilities, such as painting, writing, or composition. "Whoever believes it is possible to lie with words might also believe that it happened here," wrote Gottfried Benn about his early novels. He himself believed it as little as I do. When one sees the remaining Greek panel paintings today, which have admittedly been poorly preserved, the anecdote about the two painters seems very doubtful, as these paintings were obviously done using a palette that included certain colors and simply lacked others. In place of the so-called truth of nature, therefore, these paintings reflect a convention that one must first ignore or overlook in order to fall under the spell of the illusion. In this respect, despite its realistic veneer, painting is not so very different from other arts like music or literature, whose encoding, and this means conventionality, is more readily apparent. The thesis would thus be that traditional arts, which were crafts according to the Greek concept, only produced illusions or fictions, but not simulations like technical media. Everything that was style or code in the arts registered a distinction that is quite the opposite of technical standards.

Artistic styles were certainly ways of acting on the senses of the public, but they were not based on measurements of the abilities *and* inabilities of visual perception like the standard use of alternating images in film; they were based on approximations, conventions, and the pure chance involved in the historical availability of raw materials. Certain artistic effects would not have been possible without oil-based paints, and therefore without petrochemicals and their world wars. If Foucault had been able to write his book about painting as the history of available pigments – as promised in *The Discourse on Language* – we would know more. But it is clear that pigments are just as visible as what they are supposed to show on the canvas. For

this reason, European culture up to early modern times was under the control of what Hans Blumenberg called the "postulate of visibility": that which exists also allows itself in principle to be seen (Blumenberg, 1983, pp. 361–75). Plato's concept of theory, which has already been touched upon, even implies that what exists in the highest state of being, namely in the realm of ideas, can itself be seen, although or because it remains absolutely invisible to the naked eye. Technical media and only technical media – according to the thesis of these lectures – destroyed this postulate of visibility. Being, in an eminent sense, allows itself in principle not to be seen today, although or because it allows the visible first to be seen. In this way, the history of optical media is a history of disappearance, which also allows me the freedom to disappear for today.

It is astonishing that the anecdote about the optically deceived birds has returned today in the form of a scientific theory: first, behaviorism has actually established that with female pigeons the ovulation necessary for fertilization occurs not only when they see a cock pigeon, but also when the laboratory deceives them with a two-dimensional dummy. In a second step, French psychoanalyst and structuralist Jacques Lacan then based an entire terminology on the experiment, which has since also made careers among film scholars, particularly in Anglo-Saxon countries. For Lacan, all of the phenomena associated with figure recognition go by the methodological title of the imaginary, and the point is actually that they are just as automatic as they are deceitful. Lacan cites both the pigeon experiment and the ancient painter to support his theory (Lacan, 2002, p. 5), but the example he offers is different: unlike animals, human infants learn from an early age, approximately in the sixth month, to recognize themselves in mirrors. The point of this early childhood figure recognition, however, is that it is also simultaneously a misrecognition – simply because the apparently superior sensory capabilities of human infants as compared to those of baby animals, who see adversaries in the mirror rather than themselves, are inversely proportional to or compensate for their delayed motor skills. It is precisely because they are not yet able to walk and their immature central nervous systems have not yet registered the unity of their own bodies that they project a closed, visually perfect identity onto the mirror image. The tremendous joy they express upon recognizing themselves in the mirror conceals the reality that their bodies are still physically uncoordinated. According to Lacan, this is how the ego itself emerges from the imaginary. And the fact that Lacan found proof for his theories in a scientific experimental film that

demonstrated this process of self-(mis)recognition in the mirror also clearly shows how the mirror stage and the imaginary are related to film. I will return to this complex in my discussion of early German silent films, which were full of mirrors and *doppelgängers*.

For the moment, it is more important to emphasize the idea that the imaginary represents only one of the three methodological categories of the structuralist theory. According to Lacan, the dimension of code, which I have just illustrated through artistic styles and aesthetic rules, appears under the title of the symbolic, which turns out to be essentially at home in the code of everyday language.

The third and final category is called the "real," but please do not confuse this category with common so-called reality. *Le réel* refers only to that which has neither a figure, like the imaginary, nor a syntax, like the symbolic. In other words, combinational systems and processes of visual perception cannot access the real, but – and this is one of the leitmotifs of these lectures – this is precisely why it can only be stored and processed by technical media. The present can be distinguished from every earlier period by the fact that we live at a time when, with the help of Mandelbrot's fractals, clouds can be calculated in their full randomness and then be made to appear on computer screens as calculated, unfilmed images. Practically speaking, however, this means that we must employ a considerable part of film theory – which usually goes by the name of film semiotics – in order to clarify the radically new ways in which optical media handle the symbolic. This concerns, more concretely, techniques of montage and editing, and thus everything that has been regarded as specific media aesthetics since the time of Walter Benjamin. Above all, it must be made clear how media, in contrast to all of the arts, can nevertheless include the impossible real in their manipulations, techniques, or processes, and thus treat the pure chance of a filmed object or a television camera setting as if it had the same structure as the manipulable codes in the arts. To shed some light on this possibly vague suggestion, I will conclude these comments on media technologies and the body with a quotation from Rudolf Arnheim's film theory. In an essay on the systematics of early cinematographic inventions, Arnheim claims that "since we have known photography" there has been a new and "more ambitious demand placed on the image": "It is not only supposed to resemble the object [as in all representative arts], but it is also supposed to guarantee this resemblance by being the product of this object itself, i.e. by being mechanically produced by it – in the same way as the illuminated objects in reality mechanically imprint their image onto the photographic layer" (Arnheim,

1977, p. 27). This passage hopefully shows what a manipulation of the real can be in contrast to all figures and cultural codes. And if the body belongs to the real, as Lacan argues, then this introduction to optical media and the body is where it should be.

In terms of methodology, it only remains to be noted that I am employing Lacan's terms as a useful set of conceptual tools, not as immutable truth – for the simple reason that over the course of the semester we must ask whether the basic concepts of current theories are absolutely independent and thus true frames of reference or rather a direct result of the media explosion of our own epoch. Lacan's notion of the symbolic as a syntax purified of all semantics, meaning, degrees of figuration, and thus also every conceivability could in the end coincide with the concept of information in telecommunications.

The question still remains as to where the untraditional concept of information itself – the basis and goal of all technical media – originally comes from. To get to this, as well as the relationship between media and war, I will stay with the example of photography and quote an extremely early passage from 1859, in which (as far as I can see) something like media-technical information appears for the first time. Oliver Wendell Holmes, Sr., the first real theorist of photography, wrote at that time:

> Form is henceforth divorced from matter. In fact, matter as a visible object is of no great use any longer, except as the mould on which form is shaped. Give us a few negatives of a thing worth seeing, taken from different points of view, and that is all we want of it. Pull it down or burn it up, if you please. (Holmes, 1859, p. 747)

According to Holmes, therefore, modern information conceals itself under the ancient philosophical concept of form: the possibility of storing, transmitting, and finally processing data without matter and also without the loss of accuracy that was unavoidable in artistic reproductions. The point of his example, however, is only that chemically pure information becomes a correlate of chemically pure destruction. What Holmes is describing already sketches out the path to the bomb over Hiroshima, which, according to the similar insights of Thomas Pynchon and Paul Virilio, represents both a photographic flash and an annihilation, or that Black Forest mine station where the plans and photographs of all of our monuments have been stored in bomb-proof shelters by the federal government of Germany.

In other words, the concept of information itself has a military, strategic component. It is no accident that the age of media technologies

is at the same time also the age of technical warfare. French architecture and military theorist Paul Virilio has made this point quite clearly, especially in the case of optical media. In Germany, however, he is overlooked by most media theorists – with the exception of Heide Schlüpmann and her lucid discussion of silent film and World War I. These lectures must and will therefore satisfy a pent-up demand to catch up with his work.

Virilio's argument, above all in his book about war and cinema, follows two separate tracks: the first concerns everything that optical media produce that can be considered imaginary, in the sense that I have just defined, such as all the means of fascination, blinding, disguise, or – to use a term from this media-technical century – optical illusions in general. And because Virilio defines war first of all as basically a game of hide-and-seek between two enemies, he is able to show how media effects are linked to military stratagems through optical illusions. This appears to be a rather simple model to explain the present global image trade and image war. For this reason, I prefer to follow Virilio's second line of argumentation, which especially concerns optical media. In contrast to sound waves, which are known to cover a distance of approximately 330 meters per second at normal temperatures (and completely ignoring the speed of letters or orders sent by mail or pony express), the speed of light waves or light particles is Einstein's constant *c*, which cannot be surpassed by any other speed. Accordingly, Virilio's second argument is that the strategic interest in faster information – the supervising and directing of one's own troops, the monitoring and surveillance of enemy troops, and above all the supervising and directing of one's own response to enemy actions, which should be as immediate as possible – crucially accelerated the explosive rise of optical media over the last hundred years.

It seems necessary to absorb this point and trace it through film and television to the digital future of image technology. I will thus attempt to pass on the factual evidence Virilio has laid out, which in other contexts has been simply ignored, and on the basis of this evidence I will attempt to demonstrate the plausibility of his often radical theories, such as his claim that between the wars popular cinema was (to use Eisenhower's famous phrase) a military-industrial complex.

This naturally implies, as has already been emphasized, that the list of technologies to be addressed does not end with popular films and television programs, but rather the category of optical technology also encompasses such cryptic things as radar or night vision

devices. In these times, when a wall separating Germany has fallen, perhaps it is also possible to conceive how relative every distinction between civil and strategic image technologies has gradually become: apart from the eastern European delay in informatics and computer-controlled production, which Gorbachev himself admitted and which he described as a motive for opening his country to the West, this wall fell as a result of a constant 25-year bombardment of television broadcasts.

And such events, which are triggered by technical media, possibly represent the conclusion of more than just a chapter in postwar European history. Perhaps telecommunications brings history itself, which was always a metaphor for the possibility of written inscription, to a point beyond which it is no longer history in the traditional sense. In any case, it is worth reconstructing the history of film and television within this context. After all, events that exist as nothing but documentary films or television recordings (Kennedy's murder in Dallas, the attack on Reagan in New York) continue to multiply. Such events can no longer be traced back to other, historically correct (that is, written) sources, just as it is also impossible to magnify the corresponding film documents any further without ending up in the pure grain of the celluloid and therefore in a white noise where there is nothing more to recognize (as Antonioni proves in *Blow Up*). It could thus be said that whereas history has handed down to us the opposition between writing – a manual art – and the ocean of undocumented events that remain inaccessible, this is precisely where the new opposition of the media age between technical information and white noise, the symbolic and the real, emerges.

Now that the concepts of information and noise have at least been introduced, I can finally conclude this methodological introduction, as promised or threatened, with a brief sketch of Shannon's technical model of communication and information.

Claude Elwood Shannon, a leading mathematician and engineer in the research laboratory of AT&T, which remains at present the largest telephone company in the world, outlined this model in 1948 in a work with the modest yet equally ambitious title *The Mathematical Theory of Communication*. After the Second World War brought about a surge of innovations in all fields of telecommunications, particularly in television and radar, it became historically necessary no longer to produce theories about individual media, as everyone had done for film from Hugo Münsterberg to Walter Benjamin, but rather to pose the simple and common question of what media technologies in general do; what are their functions and constituent elements

that enable information even to occur? Shannon was able to answer this question thanks to mathematics and its elegance. Although this mathematical aspect must be toned down for it to come in useful here, for our purposes it offers the advantage of introducing clearly delineated concepts that make it possible for the first time to compare the performance and limits of individual media, like film and television, with each other. Once the general functions and elements are known, they can be found at the most varied degrees of technical complexity, from the simple, old-fashioned book to the newest computer screen.

There are five interconnected elements in Shannon's general model of a communication system: first, a data source that generates a message; second, one or more senders that translate this message into signals according to the rules of a prearranged code so that the system is able to transmit them; third, a channel that actually conveys the transmission (with a considerable or slight loss of information); fourth, one or more receivers that treat the signal in the opposite or inverse way to the senders, if possible, and reconstruct or decode the message from the received flow of signals; fifth and last, one or more data sinks to whom, Shannon writes, the message is addressed. According to the mathematical theory of communication, it is completely unimportant what kinds of entities serve as data sources that transmit a message and data sinks that receive a message, such as humans or gods or technical devices. In contrast to traditional philosophy and literary studies, Shannon's model does not ask about the being for whom the message connotes or denotes meaning, but rather it ignores connotation and denotation altogether in order to clarify the internal mechanism of communication instead. At first glance this appears to be a loss, but it was precisely its independence with regard to any sense or context that allowed technical communication to be emancipated from everyday languages, which are necessarily contextual, and that led to its global victory. When Shannon explicitly says that we have no need for a communications system for eternal truths, whether of a mathematical or even, I would add, religious nature because such truths must be continuously reproducible at different times and places without technical transmission, it becomes abundantly clear how the essence of media diverges from our everyday concept of faith. Let us therefore forget humans, language, and sense in order to move on to the particulars of Shannon's five elements and functions instead.

Because it is conceived without reference to any semantics, the message can be of an arbitrary type: a sequence of letters as in books

or telegraph systems, a single quantity that changes over time like the vibrations of voices or music on the radio or on records (if we disregard the two variables of stereophony), or, in an extremely complex case like color television, it can also be an entire conglomeration in multiple dimensions of both space and time. For a single color image to be seen, the two spatial dimensions of a red value, a blue value, a green value, and a brightness value must be transmitted at the same time as the temporal dimension of sound.

The sender, the second link in the chain, predictably has the function of serving as the interface between the aforementioned message and the technical system; it must therefore find a happy medium or compromise between the complexity of the message and the capacity of the channel. In principle, there are two possible solutions: in the first case, the signal generated by the sender corresponds proportionally to the message, which means that it follows all of its changes in space and/or time. This is called analog communication, as in the case of gramophone, microphone, radio or even photography, and while it is more familiar it is also unfortunately more difficult mathematically. In the second case, the message is broken down into its pure constituent elements prior to transmission in order for it to fit the capacity of the channel, which is in principle always physically limited. These elements are entirely of the same type, such as letters in the case of a spoken message or numbers in the case of computer technology or the individual pixels of a monitor. Because these elements can only assume certain values – there are, for example, far fewer Latin letters than the number of possible sounds produced by the larynx and mouth – they cannot match all of the variations, intricacies, and details of the message. Communication systems that employ such mathematically and technically verifiable signals are called discrete or – following the model of the finger of a hand – digital.

And the entire difference between film and television studies will amount to the clarification of how the transition of a largely analog medium like film to the digital television screen changes or revolutionizes visual perception.

Third, the channel is equipped for the technical bridging of space in the case of transmission media or of time in the case of storage media, and it can consist of material, like telephone wires or fiber-optic cables, or it can simply be a vacuum through which electromagnetic waves propagate, like radio or television. As a physical medium, in any case, every channel also generates interference or noise, which is the conceptual opposite of information. When a television is set on a frequency between the regular channels, this noise appears to our

sensory organs (which are otherwise blind to noise) like snow made of points of pure light that correspond to some accidental event like spark plugs or distant galaxies. It is impossible to determine whether the noise represents a single ongoing accidental process or the sum of an endless number of such processes. In any case, for all media the technical specifications must aim to reduce the level of noise in the channel – eliminating noise altogether is impossible – and increase the level of signal. And Shannon's theoretically crucial computational result was that this is primarily possible by cleverly coding messages and repeating them until they are received with the desired level of accuracy.

Fourth and last, the task of the receiver in a communication system is to decode the technically encoded signal and thus reconstruct as far as possible and feasible the message submitted from the sender. In the case of a book, this amounts to the simple act of reading. In the case of technically complex media like television, on the other hand, an electronic signal that is not perceived by any sensory organ must first be transformed back into a form that to some degree accommodates the physiology of our eyes. In the case of digital media, like electronic image-processing, this transformation requires a digital-to-analog converter to allow for human sensory organs. What one sees in the end is therefore only the outer onion skin of an entire series of conjuring tricks that must first be invented, calculated, and optimized, and Shannon drew up formulas for precisely these calculations, which can be applied to absolutely all technical media in general. If you have noticed, like movie fans for instance, that in my lecture about the five functions of communication the seemingly fundamental and necessary function of storage does not appear in Shannon's work at all, I can only respond in two ways: first, the function of storage is concealed but also thoroughly explained by the mathematics of code optimization, which I mentioned only fleetingly, and second, it is probably an indication of our own situation if all media, as in Shannon's work, are defined as transmission rather than simply storage media. While the purpose of a Christian festival like Easter is to be ritually repeatedly every year simply because it is supposed to store and transmit a fixed and well-known message, namely the gospel (good news), no one is particularly pleased about repeated broadcasts on the television. Shannon's technique of measuring information mathematically was specifically developed to distinguish and determine the newness or improbability of a message compared to the mass of repetitions that are necessarily implied in every code.

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TECHNOLOGIES OF THE FINE ARTS

2.1 *Camera Obscura* and Linear Perspective

2.1.1 Prehistory

By panning from Christmas to prime time television, from the Christian message to technical signals, I have already arrived deep in the prehistory of optical media. To express it in one sentence: today images are transmissible; however, over the course of history images, at least in principle, could only be stored. An image had its place: first in the temple, then in the church, and finally (to Heidegger's dismay) in the museum. And because this place – according to Benjamin's theory of the aura – was far away, perhaps even "the unique phenomenon of a distance" (Benjamin, 1969, p. 222), there was at best the possibility of a museum visit or an image trade and at worst the possibility of an image theft. Writing, on the other hand, served not only as a storage medium for everyday spoken language, but also (I admit) as a very slow broadcast medium after the practice of inscribing on walls or monuments was superseded by the use of papyrus and parchment. Books can be sold, sent, and given away. Writing was therefore not merely literature but always mail as well. And the evidence supports the assumption of Harold A. Innis, McLuhan's predecessor in media studies, that it was the portability and transmissibility of scrolls that brought the two nomadic tribes, first the Jews and later the Arabs, to replace the worship of extremely heavy images of god with a god-given or even god-written book (Innis, 1950). The Bible and the Koran were only able to begin their victory march against all the temple statues and idols of the Near East and Europe because they were mobile relics. Because writing combines storage and transmission in a unique way, its monopoly held sway