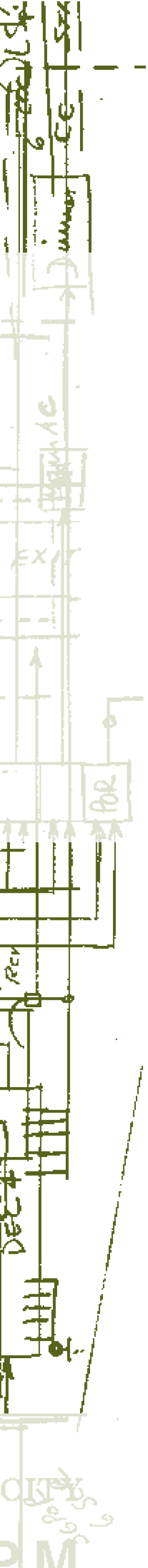
DIETER DANIELS / BARBARA U. SCHMIDT (EDS.)

ARTISTS AS INVENTORS

INVENTORS AS ARTISTS

Ludwig Boltzmann Institute
Media.Art.Research.

HATJE CANTZ



Using both historical and contemporary examples, this publication traces the complex relationships between art, technology, and science, focusing on technological and artistic media from the nineteenth century to the present day.

The interplay of technological invention and artistic innovation requires a variety of methods, ranging from the fine arts and cultural studies to the history of science and media archaeology. Among the key themes, which the contributions examine from a variety of perspectives, are: the status of technology as a shared feature of or "boundary object" between art and science; the conflicts among ethical, aesthetic, and economic values in the system of art versus that of technology; the paradox that inventions are regarded as achievements of individual geniuses but can actually only be made and successfully applied if they have been sanctioned by the sociohistorical zeitgeist.

Texts by Cornelius Borck, Dieter Daniels, Wolfgang Hagen, Karin Harrasser, Katja Kwastek, Sylvie Lacerte, Simon Penny, and Simon Werrett.

Interviews: Inke Arns with Amy Alexander, Dieter Daniels with Paul DeMarinis, Edward Shanken with Billy Klüver, Barbara U. Schmidt with Kirsten Pieroth, and Dominik Landwehr with Gebhard Sengmüller.

240 pages, 77 illustrations

ISBN 978-3-7757-2153-0

Contents

Thus one of the purposes of the present book is to make a proper assessment of the individual element in invention and discovery and of the cultural element.
Norbert Wiener, 1954[1]

1 Norbert Wiener, *Invention: The Care and Feeding of Ideas* (Cambridge, MA, and London, 1993), p. 6.

Introduction

DIETER DANIELS / BARBARA U. SCHMIDT

Thinking of artists as inventors and inventors as artists—that is, scrutinizing the reciprocal interaction of artistic practices and technological developments—is not something we take completely for granted. These domains' respective epistemological systems, modes of production, and results seem to be too disparate to do so. In the articles collected in this publication, the aim has been to examine the complex interconnections between art, science, and engineering on the basis of historical and contemporary case studies. The focus of these considerations is on the technical and artistic media that have emerged since the nineteenth century.

To do justice to this topic, a wide array of approaches, some of which are to no small extent mutually contradictory and nevertheless equally legitimate, are possible and even necessary. Accordingly, this book contains scholarly articles that employ very diverse methodologies, including:

- the history of science, and in particular the sociology of scientific knowledge and social construction of technology examined across a wide-ranging historical horizon (Simon Werrett);
- media archeology as the basis of an epistemology and a theory of art derived from it (Wolfgang Hagen), supplemented by anthropological aspects of the social studies of medicine (Cornelius Borck);
- art history as media history and vice versa, an essential part of which is a process of reciprocal investigation and cross-fertilization of the methods and themes involved (Dieter Daniels, Katja Kwastek);
- the artistic practice of art, science, and technology as the subject of critical reflection on its current status (Simon Penny), and a no less critical history of how this has been received by the public (Sylvie Lacerte); and gender studies in combination with media art and pop culture theory (Karin Harrasser).

Arranged contrapuntally to the scholarly-theoretical approaches taken in this publication is a series of interviews with protagonists—mostly artists—whose fields of activity are situated at the nexus of art and technology. In these dialogues with experts from different scholarly disciplines, they give an account of the transitory practices they utilize to avoid explicit definitions and polarizations. Their wide-ranging approaches include an analysis of the history of technology and retro-engineering (Paul DeMarinis, Gebhard Sengmüller), critical-ironic innovation (Amy Alexander, Gebhard Sengmüller), self-reflexive Conceptual Art (Kirsten Pieroth), and a radical dialectic that clearly differentiates between art and technology while at the same time establishing their compelling interrelationship (Billy Klüver).

Although the art-science-technology discourse is conducted by an international community in publications, festivals, and symposia, it often remains highly self-referential. Despite a claim to interdisciplinarity, what this discourse frequently lacks is a more profound methodological and epistemological connection to its own three component fields: art, science, and technology. The multiple methods presented here are meant to take this discourse beyond the realm of its own immanence. We want to show it as an exemplary context that provides the opportunity of relating diverging scientific cultures, embedded in the ongoing desire and never-ending negotiation for genuinely in-depth interdisciplinarity. At the same time, we aim to counter the danger of a diffuse generalization of the art-science-technology discourse in that each text is capable of standing alone as a case study of the specificity and differentiated nature of its topic. And this is precisely why there will perhaps never be a standard work on this subject, since only such specificity and differentiation that can do justice to it.

Despite the heterogeneity of the scientific methods used and artistic approaches taken in these contributions, cropping up among them again and again are key issues that transcend the boundaries of discrete, individual purviews. They include:

a) technology's status as a shared third realm or "boundary object" between art and science (Werrett, Hagen) and as an aesthetic apparatus (Borck, Penny);
b) the paradox of innovation and invention, which are both considered "ingenious" individual achievements but which are nevertheless made possible by and can be successful only under sociohistorically determined conditions of a zeitgeist (Werrett, Daniels);
c) the conflict between the art and technology systems with respect to their ethical, aesthetic, and economic values (Penny, Lacerte, Klüver), including consideration of their incompatibility within the framework of an individual biography (Daniels).[2]

POINTS OF REFERENCE

In order to put the articles collected in this volume into their proper historical context, each of these three points can be illustrated by several positions and methods culled from the ongoing discourses that have revolved around them since the beginning of the twentieth century.

2 A fourth question that has not been exhaustively treated here has to do with an astounding phenomenon that has been observed repeatedly in all three fields—art, science, and technology: the simultaneity with which certain inventions and innovations arise independently of one another at different places. The examples range from photography and telegraphy all the way to Abstract Painting and atonal music.

In the early twentieth century, at the high point of the modernist avant-garde, artists turned into inventors for practical reasons. To respond with their aesthetic visions to the impact of technology on the human senses, they needed a new apparatus that was not yet available. One of these artists was the Italian Futurist painter Luigi Russolo. In his manifesto for a new art of noise, he wrote that the sound environment of the industrial city had changed so completely that the traditional instruments could no longer compete with this experience. So he went ahead and built his *intonarumori,* which imitated the sound of machines, and made it available for his performances of the art of noise.[3] Another example is Walter Ruttmann, a Munich painter who decided to quit the easel and take up film instead. He also wrote a manifesto in which he declared that the static image no longer satisfies our perception, which is changed by the speed of media information.[4] His aim was a painting in time, using the cinema for a new kind of Abstract Art evolves like music. But there was no equipment available to make such a movie, because film only depicts images from reality, not from the inner vision of an artist. Ruttmann had to invent an apparatus that made it possible to capture on film flowing forms moving in time created by paint on a glass surface, and he was ultimately issued a patent for the device.[5] The first example of this new art was *Opus 1* (1921), an abstract film hand-colored frame by frame and accompanied by music written expressly for this piece. For these avant-garde artists, the technology of their time was a stimulus of perception and, at the same time, its limitations were a challenge to their search for new artistic media. So technology is both: objective motif and subjective motivation, impression and expression of their art.

A broader methodological debate on the interrelationship of culture, science, and technology has been taking shape since the mid-twentieth century. In his book *Invention: The Care and Feeding of Ideas,* Norbert Wiener investigated the disparate factors that must first come together in order to lead to an invention or in whose wake one might occur: individual genius and collective consciousness, hard technical and economic facts, as well as a favorable social and intellectual climate.[6] Back in 1954, Wiener conceived a chronological sequence of these factors; as for the accelerated innovation of modern-day technical developments, a simultaneous interaction of these factors can be assumed. Wiener's general mission statement, even if not shared to an equal extent by all of our contributing authors, might also serve as the motto for this volume: "Thus one of the purposes of the present book is to make a proper assessment of the individual element in invention and discovery and of the cultural element."[7]

A split between the "two cultures" of arts and humanities on the one hand and the sciences on the other was pronounced in 1959 by English novelist and scientist C. P. Snow.[8] He summarized

3 Luigi Russolo, L'Arte dei Rumori, Manifesto futurista, Milan, March 11, 1913. Cf. *The Art of Noises,* trans. and intro. Barclay Brown (New York, 1986),

4 Text from The Estate of Walter Ruttmann, untitled, undated, ca. 1919–20; published under the title "Malerei mit Zeit" in *Film als Film, 1910 bis heute,* ed. Birgit Hein and Wulf Herzogenrath (Stuttgart, 1977), pp. 63–64.

5 See the reprint of the patent in Jeanpaul Goergen, *Walter Ruttmann: Eine Dokumentation* (Berlin, 1989), pp. 75–77.

6 Wiener 1993 (see note 1), p. 7.

7 Ibid., p. 6. On this subject, also see Dieter Daniels, "Inventing and Re-Inventing Radio," in *Re-Inventing Radio: Aspects of Radio as Art,* ed. Heidi Grundmann et al. (Frankfurt, 2008), pp. 27–47.

8 See the original lecture, Snow's reply to the ensuing controversy, and an account of the subsequent debate in C. P. Snow, *The Two Cultures,* intro. Stefan Collini (Cambridge, 1993).

his personal experiences in both worlds and concluded that the two cultures were incapable of dialogue or mutual recognition. This address, which received a great deal of attention at the time and is still cited and just as often criticized to this day, targeted the hostility toward progress and technology on the part of what Snow referred to as "literary intellectuals" and called for the acknowledgment of the natural sciences and engineering as intellectual—and thus also cultural—achievements. Later, Paul Feyerabend, the *enfant terrible* of the philosophy of science, came out in opposition to precisely this absolutization of the positivist concept of progress in the natural sciences and, in *Wissenschaft als Kunst* (Science as Art), armed himself methodologically for this intellectual fray with Alois Riegl's theory of art as a sequence of stylistic forms of equal rank.[9]

In the mid-1950s, just as these positions on the theory of science were taking shape, the artistic practices that are today subsumed under the heading of media art began to develop. From origins in electronic music, media-based poetry, expanded cinema, and electronic visual arts there emerged a new form of artistic expression beyond the bounds of all established genres, one that does not merely take technology as its subject but rather uses it as a medium, and one that, in a way that is both experimental as well as exemplary, lets interdisciplinarity and intermediality become a process of self-reflection that can at the same time be a sensory experience. Accordingly, two of the inventor-artists in this book also emphasize that working with technology has to be personal and hands-on, since a collaborative process in cooperation with technicians does not permit an intuitive "working before words" approach.[10]

Today, these fields of knowledge and particularly the value systems inherent in art, science, and technology have diverged so far from one another that we are no longer even cognizant of the split that was conjured up in the 1950s. In his foreword to a new edition of C. P. Snow's *Two Cultures,* Stefan Collini wrote in 1993: "Reflection on this point should do more than simply soften Snow's original polarity into a more continuous spectrum. . . . We need, rather, something like multi-dimensional graph paper in which all the complex parameters which describe the interconnections and contrasts can be plotted simultaneously."[11] The theory of cybernetics, which was likewise developed by Norbert Wiener in the 1950s, and its subsequent popularization as the "third culture" correspond today to the widespread propagation of digital phenomena in the culture of everyday life.[12] The new proliferation of technologies throughout all spheres and aspects of life and the way this hardware and software increasingly shape creative work processes and cultural practices have given rise to aesthetic-technical hybridization. This manifests itself both in the digital and

9 Paul Feyerabend, *Wissenschaft als Kunst* (Frankfurt, 1984). Also see the chapter entitled "Fortschritt und Kunst" in Dieter Daniels, *Kunst als Sendung: Von der Telegrafie zum Internet* (Munich, 2002), pp. 154–161.

10 Cf. the essay by Simon Penny, pp. 142–157, the section entitled "Individualism and Collaboration," and the interview with Paul DeMarinis, pp. 70–85, in this volume.

11 Snow 1993 (see note 8), pp. lv.

12 John Brockmann, who popularized the term "third culture" with his book of the same name, draws support in this context both from C. P. Snow as well as Norbert Wiener, whose book *Cybernetics* was recommended to him by John Cage (John Brockman, *The Third Culture: Beyond the Scientific Revolution* (New York, 1996).) Cf. "When Cybernetics Meets Aesthetics," a conference held by the Ludwig Boltzmann Institute Media.Art.Research. in 2006 (http://media.lbg.ac.at/).

viral culture of everyday life as well as in contemporary media art as an experimental outpost of high culture. The utopias of an across-the-board reconciliation or even synthesis of these fields—concepts that, for example, provided the political justification well into the 1990s for the necessity of establishing specialized institutions of media art—have by now lost a good deal of their seductive power.[13] Nevertheless, the central question raised by media art regarding the interrelationship among art, technology, and society remains as current as it ever was. And this is the frame of reference of the Ludwig Boltzmann Institute Media.Art.Research., for which this book delineates an expanded theoretical background.

METHODOLOGIES OF HISTORY

Popular conceptions of technology and art are still characterized by the belief in a linear narrative of progress featuring an extensive canon of inventors and their machines, or of artists and their works. This book seeks to counter this linear mode of thinking by calling attention to elements of upheaval, transitional zones, and paradigm shifts. These resist conceptualization as logical, inevitable continuations of a causal chain of events and instead mark points of crisis or interference, and sometimes even failure. This linear methodology has outlived its usefulness in the field of art history, though it is hanging on a bit more doggedly in the history of technology. The latest research in this field is characterized by controversies surrounding two major points: the myth of the absolute novelty of the individual invention and its personification by a singular genius-inventor.

This can be illustrated by two recent publications. The classic approach to the history of technology usually seeks to establish a sequence of singular inventors and their apparatuses. Indeed, John H. Lienhard warns against uncritically mythologizing individual inventions as innovation *ex nihilo;* nonetheless, he insists that, "like any of our myths, they are based on essential truths." In his view, these inventor-heroes personify precisely those points of crisis that he calls tipping points and also points of no return, although a variety of "multigenia" have prepared the field as a complex pattern of interdependent technologies.[14] Most approaches in the field of cultural studies, on the other hand, emphasize that innovation is embedded in a social and economic context. Lisa Gitelman, for instance, has come out against today's prevailing "tendency to naturalize or essentialize media," which she has identified in the work of a number of scholars, including Friedrich Kittler.[15] Her objective, "to cut across the technological determinism of popular accounts," thus calls for seeing media inventions in a dual historicity—as both evidence of history as well as producer of it—so "that they share some of the conventional attributes of both art historical objects and scientific ones."[16] For this reason, she also defends their inevitable personification in the form

13 Examples of such institutions are the Center for Advanced Visual Studies (CAVS) at MIT in Boston, the ZKM Center for Art and Media Karlsruhe, and the Ars Electronica Center Linz (AEC).

14 John H. Lienhard, *How Invention Begins: Echoes of Old Voices in the Rise of New Machines* (Oxford, 2006), p. 233.

15 Lisa Gitelman, *Always Already New: Media, History, and the Data of Culture* (Cambridge, MA, and London, 2006), p. 2.

16 Ibid., pp. 18 and 4.

of inventor-heroes usually spotlighted by the classical history of technology. In the attempt to differentiate between causal necessity and personified individuality of technological inventions, both positions—that of the history of technology and that of cultural studies—run up against the limits imposed by their methodological point of departure.

The papers presented in this book pursue related methodological questions, and their conceptual models range from focusing on specific subject positions in their sociohistorical context (Daniels, Harrasser) to a structural objectification of media technologies as "incarnated knowledge" (Hagen). What all authors have in common, though, is that they avoid the popular generalizations operating via a cult of genius or an essentialization of technology and make their readers cognizant of the complex, contradictory, non-linear sequences that make up the history of art and technology.

The fields of a possible convergence and interference of art, science, and technology can only be described scientifically when their utmost separation remains consistently visible to the mind and eye. Here, especially artistic and technical media can assume the role of a "boundary object" between different intellectual cultures.[17] Another model is that of the "missing link and material linkage" by Cornelius Borck: "Often, art and science are seen or stylized as two oppositional approaches in a binary world of two cultures, rehearsing the contrast of facts and fiction, determination and meaning, or laws and values. Instead of calling for a cooperation between art and science for their mutual apotheosis, I want to start at the other end, namely investigating the existing overlap between both practices, where I see communicating vessels. Technology is the communicator, the missing link and material linkage between the art and science. Again, doing science and producing art remain different practices but they may share important procedural steps."[18]

INVENTORS AS ARTISTS

The "artist as inventor" occupies the focal point of this book; nevertheless, the "communicating vessels" metaphor chosen by Cornelius Borck functions only if the inversion into "inventor as artist" also remains open. This transition is, no doubt, more difficult to state precisely in terms of methodology; after all, as Billy Klüver put it: "But if a person says he or she is an artist, one can't say to that person: 'You are not an artist.' You are not allowed to say that."[19] This popular understanding of the term means that being an artist resists external definition, whereas the label "inventor," though indeed not the designation of a profession per se, can nevertheless be substantiated

17 The now-widespread term "boundary objects" originated in the social studies of science and was introduced by Susan Leigh Star and James R. Griesemer: "They have different meanings in different social worlds but their structure is common enough to more than one world to make them recognizable, a means of translation." These "boundary objects" can have in common with technical media that they are "versatile, plastic, reconfigurable (programmable) objects that each world can mould to its purposes locally." Susan Leigh Star and James R. Griesemer, "Institutional Ecology, 'Translations' and Boundary Objects: Amateurs and Professionals in Berkeley's Museum of Vertebrate Zoology, 1907–39," *Social Studies of Science* 19, no. 3 (August 1989), pp. 393, 404.

18 Cornelius Borck, *Spaces of Intervention: Towards an Epistemology of Artistic Experimentation,* lecture given at the symposium e-art, New Technologies and Contemporary Art, Montreal Museum of Fine Arts, in collaboration with the Daniel Langlois Foundation for Art, Science and Technology, on September 28, 2007.

19 Cf. the interview with Billy Klüver, pp. 176–181, in this volume.

by means of objective criteria such as patents. Thus, there exists no mirror-image symmetry between the social roles of the artist and the inventor. Maintaining that such symmetry did indeed exist would mean falling into the generalization trap. As a result, this bidirectional relation is dealt with in a wide variety of ways in the articles contained in this book. Simon Werrett looks at the early stages of certain devices, when their application and categorization are still the subject of negotiations among the spheres of culture and science, entertainment, and engineering, a process that is reversible in both directions. In light of today's highly differentiated knowledge hierarchies and specialized cultural disciplines, this mutability of an invention into a work of art has become increasingly improbable, examples of which are often under suspicion of being techno-kitsch, and justifiably so.

Nevertheless, both Katja Kwastek and Simon Penny call the cybernetic toys of Grey Walter and Claude Shannon apparatuses whose self-reflection and meta-irony clearly enable them to hold their own up against any work of media art. Accordingly, the two authors are quite correct in raising the question of whether the self-definition of a maker/author is decisive for the reception accorded to his/her artifacts, or, on the other hand, whether it is the reception itself that codetermines when and how the status of "art" or "technology" is attributed to them.[20] Even more far-reaching is the significance of this bidirectional relation when it is not personified but rather comprehended as an exchange of paradigms. As Dieter Daniels shows using the examples of photography and telegraphy, media technologies assume the role of the arts with respect to social context, audience reception, and production aesthetics. Since the second half of the nineteenth century, inventors such as Thomas Edison and Nikola Tesla therefore have also embodied the social understanding of the role of the mythical genius who creates that which is absolutely new and never before seen or conceived, which until then was reserved for the artist.

LEONARDO: A PERSON BECOMES A PARADIGM

Among the above-mentioned generalizations and mythifications driven more by spiritual longing than intellectual reflection, there has long been one particular one of unmatched fascination and seduction: the life and work of Leonardo da Vinci.[21] Here, the history of the debates about the roles of artist, inventor, and scholar cumulate in exemplary form; after all, here we have the only eminent figure in Western culture to whom a key role in the history of both art and technology can be assigned. The currency of his utopian and anticipatory dimensions is revealed by the inflationary use of the name "Leonardo" for software, cultural subsidies, magazines, and institutions.

20 Cf. the essays by Simon Penny, pp. 142–157, and Katja Kwastek pp. 182–195, in this volume.

21 For example, the closing remarks delivered by Manfred Schröter at Die Künste im technischen Zeitalter, a 1953 conference whose list of speakers included Martin Heidegger and Werner Heisenberg: "Like a symbol and a sign of promise, Leonardo's superhuman figure towers over the portal to our modern European culture. The three realms of mentality—art, science, and technology—whose crisis we have been discussing were united in equal measure and in supreme creative abundance in this greatest genius of them all." (*Die Künste im technischen Zeitalter,* publ. Bavarian Academy of Fine Arts (Darmstadt, 1956), pp. 134f.) A present-day example is the promotion mail by the Leonardo/ISAST Network of February 21, 2008: "Join the New Leonardos Working on the Burning Issues of Our Times: The Leonardo organization promotes the work of the New Leonardos—artists who are transforming science and technology as well as scientists and engineers whose innovative work is changing our cultural imagery."

In art historiography, Leonardo, along with his forerunners and contemporaries Masaccio, Filippo Brunelleschi, Leon Battista Alberti, and Piero della Francesca, is considered to have paved the way for a new conception of the artist's role, one that takes leave of aspects of handicrafts, of medieval workshop manuals full of specifications on how to produce undercoats, paints, and glues, and develops in the direction of scientifically systematized design procedures. Leonardo's uniqueness among Renaissance artists, however, is not based on his work as a painter, but rather on his extensive manuscripts, including his studies of the work by thinkers from antiquity and the Middle Ages and his descriptions and drawings of his own technical experiments and inventions as well as a wide array of natural phenomena. From a modern-day perspective, it is quite difficult to assess Leonardo's motivation for this detailed and comprehensive scientific-technical portion of his life's work (of which only a fraction has been preserved). This is still a point of discussion in present-day scholarship on Leonardo.

On one hand, there are pragmatic reasons related to the status of practitioners of the plastic arts at this time. This inclusion of elements from the exact sciences, the acquisition of proportion and geometry, was meant to emancipate the plastic arts and elevate them to the rank of the *artes liberales*. In his investigation of Leonardo, Frank Zöllner points out that the plastic arts were regarded "by the literary scholars of the Quattrocento almost without exception as 'ars mechanica,' as not 'free' art but rather as art arrested in the artisanal stage." He identifies the reasons for Leonardo's specific interest in elevating its status in the *paragone* of poetry and visual arts, which reached its first high point around 1492, and with regard to orders for his work around 1490. He sees here as well the background factors before which "in all probability Leonardo's efforts in connection with the 'scientificity' of the plastic arts are to be understood."[22] Nevertheless, there is absolutely no doubt that Leonardo received no recognition for his scholarly and technical studies during his lifetime. And even around 1500, after he had completed *The Last Supper* and become a famous and sought-after artist, he continued his studies. In fact, they were even grounds for criticism of him by his patrons, because they kept him from his artistic work. Accordingly, this gives rise to the supposition that it was not only the social status of the *paragone* but also Leonardo's self-definition as an artist that played an important role here.[23]

Perhaps Leonardo's artifacts—his inventions, constructions, and works of art—are less interesting with regard to present-day issues than several elements of his methodological approach. From this perspective, the current relevance of Leonardo da Vinci as a person is not that he embodied a new ideal of the artist, but rather that he came along during a historic transitional phase in which elements that had previously been separate were set in relation to each other and in which there was profound empirical exploration of procedures and processes of

22 Frank Zöllner, "Leonardo da Vinci: Die Geburt der 'Wissenschaft' aus dem Geiste der Kunst," in *Leonardo da Vinci: Der Codex Leicester*, ed. Haus der Kunst (Düsseldorf, 1999), p. 24. Published in conjunction with the exhibition *Leonardo da Vinci: Joseph Beuys; Der Codex Leicester im Spiegel der Gegenwart* at the Haus der Kunst, Munich, October 15, 1999–January 9, 2000.

23 Thanks to Frank Zöllner for our stimulating chats on this subject.

design and creation, investigation of the diversity of available possibilities and potential solutions to problems, reinterpretation of traditional wisdom, and elaboration of alternative rules. For example, an examination of his notebooks raises the question of differentiating between purely documentary observations (of nature) and what he developed further on his own, between what he recorded using language and what he registered visually. Equally ambivalent is the way Leonardo dealt with theoretical prescriptions; he frequently ordered them according to empirical exactitude, as he did in an entry written in around 1490 in which he remarked that "rules will enable you to possess a free and good judgment; since good judgment is born of understanding well and understanding well derives from causes *(ragione)* taken from good rules and good rules are the daughters of good experience: the common mother of all sciences and arts."[24] On the other hand, somewhat later (between 1493 and 1495), he wrote about his preference for acting in accordance with rules: "Effect of my rules/If you said to me what do your rules bring? To whom are they useful? I [would] reply to you that they serve as reins for engineers and investigators to not let them promise to themselves or to others impossible things and make fools and cheaters of themselves."[25]

Therefore, there does not exist one single method applied by Leonardo, the understanding of which would completely resolve his complexity and contradictoriness, since, in all of his writings about art and in the scientific experiments conducted throughout his career, he tested a wide variety of theoretical and empirical approaches.[26] And even though what he ultimately remains in the field of science as well as in art is a great Unfinished Work who left behind more fragments than completed tractates, some of his inventions have been invested with overarching significance in a number of different scientific disciplines.[27] And then there are his creations that remain in the utopian realm—for instance, on the subject of Leonardo's flying machines, British aviation historian Charles Gibbs-Smith wrote that some "are feasible, a few of them possible, but many of them quite fantastic and outside all realms of possibility"[28]. Nevertheless, just like Leonardo's artworks,

24 Codex Atlanticus 221vd, cited in Kim. H. Veltman, *Studies on Leonardo da Vinci I: Linear Perspective and the Visual Dimensions of Science and Art* (Munich, 1986), p. 64.

25 Ibid.

26 Kim Veltman describes the scientific systematization of Leonardo's writings as correspondingly difficult: "There is a vast literature on Leonardo da Vinci. Nonetheless, his ca. 6,500 pages of extant notes and drawings . . . still await detailed, systematic study." Ibid., p. 10. Veltman cites three basic reasons for this: Firstly, access to all these writings is hindered by the fact that the manuscripts, which are located in Milan, Paris, London, Windsor, Madrid, Holkam Hall, and Turin, were not published until around 1870 and then only in limited editions, so that the texts are not completely accessible even to this day. Furthermore, there are still no complete translations into one of the widely-spoken languages. Secondly, up to the end of the eighteenth century, effort was made to put Leonardo's uncategorized writings into a thematic sequence, the upshot of which was the destruction of Leonardo's own system. It was not until 1797, when J.-B. Venturi developed a new method of systematizing that took Leonardo's own system into account, that other scholars who worked with this material could be sensitized to this problem. Thirdly, Veltman criticizes the fact that, in all editions of Leonardo's work, his visual statements are neglected in favor of his writings, even though, according to Veltman, Leonardo's verbal and visual lines of argumentation complement one another and must therefore be analyzed together. Ibid., pp. 10–12.

27 The "pyramidal law" that Leonardo developed in his studies on perspective, for example, is of such fundamental importance that it can be applied to other entities. As Veltman points out, "He went on . . . to apply the same principles of linear perspective to his four powers of nature: percussion (light, heat etc.), gravity, force and motion. Perspective thus became a cornerstone of his physics." Ibid., p. 240.

28 Charles H. Gibbs-Smith, *The Inventions of Leonardo da Vinci* (London, 1978), p. ix.

these utopian flying machines were also based upon precise observation of nature.[29] Failed inventions, therefore, or purely creative artifacts? An artist as inventor, or an inventor as artist?

If one liberates Leonardo from the spiritual longings for a great synthesis, what remains as the core of his artistic-scientific method is a topic of great current relevance: visual, or even manual, thinking. A comparable form of non-verbal thinking and working that does not separate theory from practice and that is not conducive to translation into directives or descriptions is also cited by several of the artist-inventors presented in this book as the central method they use.[30] In this context, Martin Kemp wrote in his latest examination of Leonardo's manuscripts: "He was a supreme visualizer, a master manipulator of mental 'sculpture,' and almost everything he wrote was ultimately based on acts of observation and cerebral picturing."[31] The bidirectional relationship of artist and inventor established in the title of this book applies just as well to the question of the visualization and visuality of aesthetic, technical, and scientific thinking that has only recently entered into the consciousness of the general public.[32] Perhaps this approach also does more justice to Leonardo than the overstrained efforts to make him personify a synthesis of art and technology. From this point of view, Leonardo's counterpart as "visualizer" would be Galileo Galilei. According to Horst Bredekamp's new investigative study entitled *Galilei der Künstler* (Galileo the Artist), his drawings of the moon created with the help of the telescope are among the "great instances of the use of visual forms of thinking," and even "of the stylistic forms of manual thinking," and thus "among the precursors of the early modern period's process of determining science."[33] The origins of visual thinking, which today have been buried by the separation of science and art, is thus also characterized by a bidirectional relation: artist as scientist, scientist as artist.*

29 Cf. Martin Kemp: "The engineer learnt how nature designed its forms to fit functions, respecting her principles and the absolute sovereignty of her natural law, in order to become what he called a 'second nature' in the world. In this, the artist and the engineer are at one. They make new things on the basis of the inner workings of nature rather than simply imitating what nature has already done." Martin Kemp, *Leonardo* (Oxford, 2004), p. 113.
30 Cf. the essay by Paul DeMarinis, pp. 70–85, in this volume.
31 Kemp 2004 (see note 29), pp. 48f.
32 The Ludwig Boltzmann Institute Media.Art.Research. will explore the field of knowledge representation and visual interfaces in relation to media art.

* Acknowledgments
We wish to express our gratitude to the organizers of Refresh! The 1st International Conference on the Histories of Media Art, Science and Technology in 2005 at the Banff New Media Institute, where the modified papers by Cornelius Borck and Simon Penny were originally delivered at the Art as Research/Artists as Inventors panel. Thanks are also due to all those who have supported this publication through their inspiration and collaboration.

33 Horst Bredekamp, *Galilei der Künstler: Die Zeichnung, der Mond, die Sonne* (Berlin, 2007), pp. 6, 340, and 337.

Figure 1: S. F. B. Morse, *The Gallery of the Louvre,* 1831–33, oil on canvas, 180 x 274 cm. It shows works by Tizian, Rubens, Poussin, Watteau, and others, and Morse himself in the lower center of the painting. Terra Foundation for American Art, Chicago. Photo: Terra Foundation for American Art, Chicago / Art Resource, New York.

Artists as Inventors and Invention as Art: A Paradigm Shift from 1840 to 1900

DIETER DANIELS

The innumerable inventions of the nineteenth century have not only paved the way for the industrialization of production, but also for the technicalization of culture that characterizes our lifeworld today. The invention of the technological media of telegraphy, photography, the phonograph, and film constitutes a special case of industrialization that Karl Marx, for example, hardly took into account in his *Capital* of 1867. Industrialization's dynamism lies in its ability to use machines to produce goods and deliver services more quickly and economically than those produced or delivered manually. This is why steam-powered looms replaced hand looms and trains replaced mail coaches. Technical media, on the other hand, engender a number of previously unknown phenomena that have few precedents in the history of humankind. By the same token, media devices take over capabilities that had once been the sole preserve of humankind, but give them a new dimension. Technologies of storage and transmission fulfill functions of human memory and direct dialogue, but in doing so, their mechanistic capacities, precision, speed, and range leave all human prototypes far behind. Thus began the technicalization and simultaneous industrialization of perception and communication that now penetrates the deepest spheres of our private lives.

Even today, storage and transmission remain the basic elements of all media. Their origins lie in the two original media: electrical telegraphy and chemical-optical photography. Almost all subsequent media technologies can be derived from combinations of these two, all the way to television and the Internet. The conditions for the emergence of these original media were very diverse. Transmissions via telegraphy or later by telephone required a complex system of devices connected into a network, which just like railway or gas networks could only be constructed on the initiative of the government or of industry.[1] Storage, on the other hand, was initially based on individual devices such as the camera or the phonograph. These storage media imitated human organs: a camera the lens of the eye, and the phonograph an eardrum. Yet even telemedia contained anthropomorphic elements, like the signal arms of the optical telegraph, the earpiece of the

1 The age of communication networks constructed by individuals first began with amateur radio enthusiasts. Cf. Dieter Daniels, *Kunst als Sendung: Von der Telegrafie zum Internet* (Munich, 2002), pp. 131ff.

2 This suggestion served as a source of inspiration for Paul DeMarini's installation *The Messenger* (1998), and he emphatically described it as follows: "Catalan scientist Don Francisco Salvá i Campillo . . . uses a separate wire for each letter of the alphabet, a Leyden jar to transmit a spark across these wires, but peculiarly, instead of the pith ball electroscopes and indicators, Salvá specifies a number of people, one for each wire. Upon receiving a sensible shock, each of these people, presumably servants, was to call out the name of the letter of the alphabet to which he corresponded. A twenty-seventh person, presumably literate, was to write down the message so shockingly spelled out. This is probably the system that Salvá operated between Madrid and Aranjuez in 1798. . . . The scene of a hall filled with the sighs, whispers and moans of humanity being shocked into literacy seems an appropriate and emblematic image for the events of 1789." http://www.well.com/~demarini/messenger.html (accessed September 7, 2006). Cf. C. MacKechnie Jarvis, "The Origin and Development of the Electric Telegraph," in *The Electric Telegraph: An Historical Anthology,* ed. G. Shiers and Arno Press (New York, 1977).

telephone, or even the idea of directly employing a series of humans as receivers for electrical telegraphy signals.[2] This anthropomorphic character allows media devices to affect the senses, and therefore they and the phenomena they produce have, implicitly or explicitly, an aesthetic dimension. They have a fascinating relationship with the arts, which had previously embodied and symbolically intensified these human sensory functions in the form of painting, music, or poetry.

This relationship between media and the arts shall be examined in the following in the light of two representative cases. The French painter of theater sets and dioramas, Louis-Jacques Mandé Daguerre, became famous in 1839 as the inventor of photography. Concurrently, the American painter of portraits and historical motifs, Samuel Finley Breese Morse, developed the system of electrical telegraphy that bears his name. These two artist-inventors with their individual biographies exemplify the substitution of media for the arts. Almost as if in a play, the dramatic transformation of these two protagonists sums up a development that pervaded the entire nineteenth century. Part two of this text outlines how the artist-inventor relation is inverted in the second half of the nineteenth century. In public opinion, the inventor more and more replaced the artist as the prodigal genius, but his popular mythology was modeled on the traditional artist type; Thomas Alva Edison and Nikola Tesla provide two contrasting examples here.

PART I: MEDIA AS A CONTINUATION OF ART BY OTHER MEANS
SAMUEL F. B. MORSE: AN AMERICAN IN PARIS

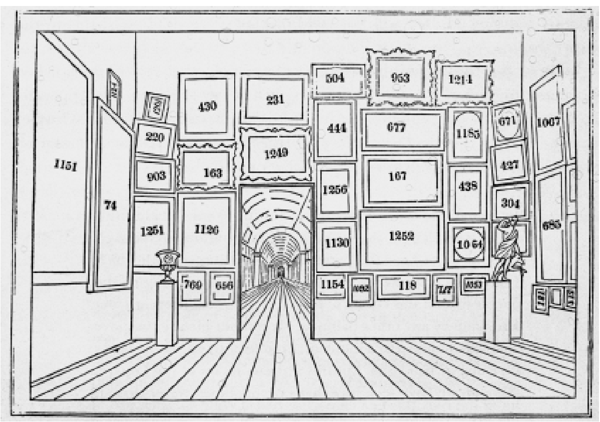


Figure 2: S. F. B. Morse, key to the pictures in *The Gallery of the Louvre* from Morse's catalogue on the occasion of its exhibition in New York in 1834.

As an American hungry for learning, Samuel Morse went on an educational tour of Europe from 1829 to 1832, concluding his travels with a visit to the Louvre in Paris. Throughout his journey, he produced numerous copies of works by the Old Masters. Most of these had been commissioned and paid for in advance by American collectors in order to enable Morse to make his voyage. Yet Morse's ambitions went further: he spent many months in the rooms of the Louvre working on his own behalf on the crowning conclusion of his studies, the *Gallery of the Louvre*[3] (figs. 1, 2). This painting, with the formidable dimensions of 1.80 x 2.70 meters, shows an arrangement of thirty-eight masterpieces in the Louvre's Salon Carré. This arrangement never actually existed; the picture was aimed at an American public for whom Morse wanted to summarize the world-famous museum's highlights in one painting. He therefore used a camera obscura to create a spatial montage, whereby he did not hesitate to make considerable adaptations in dimensions and proportions.[4] With his selections and combinations in this encyclopedic work, he was primarily pursuing politico-educational goals.The son of a Calvinist minister and a devoted American patriot, Morse had undertaken the missionary task of awakening the United States to art in order to encourage a strong and highly moral American artistic style. This was intended to throw off the decadent, feudal, and Catholicizing or even voluptuous ballast of the grand European tradition and take the lead in world culture with a new ideal in line with republicanism and Protestantism.[5] Even during his studies in London, the twenty-three-year-old hoped that "the palm of painting still rests with America and is, in all probability, destined to remain with us."[6] He also pursued this goal as the founder and long-standing president of the National Academy of Design, which among other things understood itself as advocating against the dominance of European artists on the American art market. His own, highest aspiration was history painting. As the culmination of his career, he hoped to receive a commission for one of the paintings in the Capitol Dome in Washington, the decoration of which was just being discussed. His educational voyage to Europe was also intended as preparation for this (fig. 3).

Figure 3: S. F. B. Morse, The House of Representatives, 1822-1823, oil on canvas, 86 1/2 x 130 3/4 in. The Corcoran Gallery of Art, Washington, DC, Museum Purchase, Gallery Fund. Photo: © Corcoran Gallery of Art by Mark Gulezian/QuickSilver.

Yet in America, which without public museums or noteworthy masterpieces was still cut off from European art at the time, there was initially a great need to catch up in terms of visual education. Morse believed that the only remedy to this would be to import art: "All we wish is a taste in the country. . . . In order to create taste, however, pictures, first-rate pictures, must be introduced into the country."[7] Morse was not alone in this line of thought. Over the next hundred years, a museum environment equal to that of Europe would be created in the United States, largely through private initiatives following this creed.

3 Today in the Terra Museum of American Art, Chicago.
4 Paul J. Staiti, *Samuel F. B. Morse* (Cambridge, MA, 1989), pp. 190ff., and William Kloss, *Samuel F. B. Morse* (New York, 1988), pp. 128ff.
5 Cf. in this regard the analysis by Staiti 1989 (see note 4), pp. 175ff.
6 Kloss 1988 (see note 4), p. 30.
7 Ibid., p. 37.

The first attempt in this direction was Morse's personal *Musée imaginaire* embodied in his *Gallery of the Louvre.* In the center of the picture, emphasized by the sharp perspective of the view into the Grand Gallery, Morse staged his programmatic appearance as the teacher of a group of eager young artists, most of whom can be identified as American and who thus represent the real audience of his personal mission.[8] He was "turning the Louvre into the ideal American classroom," as one interpreter wrote.[9]

Even during his travels through Europe, Morse declared: "America is the stronghold of the popular principle, Europe of the despotic. These cannot unite."[10] Later he also ran for mayor of New York on a similar political platform and composed nationalistic, anti-Catholic pamphlets.[11] With the *Gallery of the Louvre,* Morse was thus interested in the ideologically orchestrated and didactically dispensed importation of European art, always with the goal of future American superiority.

Artistically speaking, however, Morse's three-year journey to Europe was a failure. Back in New York, he rented an exhibition space on Broadway in order to present, along with an explanatory catalogue, the *Gallery of the Louvre* to a wide audience, and he shunned no expense or risk to spread his message to everyone of America's awakening to art. Thus his disappointment was all the greater when, despite euphoric reactions from the press, the crowds he had hoped for failed to appear and only between five and twenty visitors showed up daily, so that after two months the rent for the exhibition space had not even been covered.[12] When Congress finally also passed him by in awarding the commission to paint the Capitol, Morse resigned from his attempts to awaken America to art. He desperately wished "that every picture I ever painted was destroyed. I have no wish to be remembered as a painter, for I never was a painter: my ideal of that profession was perhaps too exalted."[13]

Yet in other respects, the weeks spent working on his painting in the Louvre would prove to be crucial for Morse. During this time, he visited the optical telegraph station that had been located on the building since the French Revolution, and its function was explained to him. According to James Fenimore Cooper, an American novelist who was his close friend at the time, Morse excitedly discussed telegraphy with him in Paris.[14]

Yet not until Morse's return voyage to America on board a sailing ship is the spark of the idea for electrical telegraphy said to have flared into life through conversations with fellow passengers with knowledge of electricity. For back then, Morse still had absolutely no knowledge about electrical engineering. He also did not know that other inventors were working on similar ideas at the same time. The situation seems markedly symbolic. At that time, even the most streamlined steamers and therefore all messages required at least two weeks to cross the Atlantic. Thus the six-week ocean voyage on a sailing ship was a logical framework for Morse's numerous sketches and designs for electrical telegraphy—the medium that, with the first transatlantic cable, would shorten the message transmission time for the same distance to seconds. Also transported from Europe to America on board this ship was the *Gallery of the Louvre,* still unfinished and destined to be the last large work by Morse in his career as a painter. For Morse, this passage from Europe to America was the beginning of his transformation from artist to inventor, and the consequences changed the relationship between the two continents more lastingly than any art.[15]

Morse's remarks about telegraphy sound just as missionary as his remarks about painting. This Calvinist, who was well versed in the Bible, did not shy away from comparing the electrically transmitted code with "the mythological voice of Jehovah."[16] In 1844, when after ten years of groundwork the first American telegraph line finally went into operation, the Bible provided the accompanying text. As every American schoolchild knows, the first message was "What hath God wrought!" The paper tape of this message is now exhibited in a display case at the Smithsonian Institution, like a Torah roll for a new era.[17]

Connecting the Old and New worlds proved to be just as much a motif in Morse's career as an inventor as it was in his career as an artist. Although Morse's importation of European cultural goods to the United States remained unfruitful for American culture, with telegraphy he succeeded in the other direction by exporting American technical know-how to Europe. When Morse died a wealthy and famous man in 1872, a million kilometers of telegraph lines worldwide were in operation according to his system.

Morse's telegraphy system owed its sweeping success not just to its technical basis, but above all to favorable political and economic conditions in America. Congress provided initial financing for the first test line between Washington, DC, and Baltimore in the year 1844. One year later, in order to seek his fortune from then on as a businessman instead of as a public servant, Morse bought this line back from the government using venture capital to form a private corporation. This decision had consequences which could hardly have been suspected at the time, for to this very day, the American government has left telecommunications development up to free-market forces.

8 All the figures were first painted into the work back in the United States and can therefore be traced back to American models, most of whom can also be identified; Kloss 1988 (see note 4), pp. 128f.

9 Staiti 1989 (see note 4), p. 194.

10 Ibid., p. 188.

11 Kloss 1988 (see note 4), p. 135.

12 Staiti (see note 4), p. 199.

13 Ibid., p. 208.

14 It is doubtful whether Morse had already discussed electrical telegraphy with Cooper, as the latter later claimed; cf. Volker Aschoff, *Geschichte der Nachrichtentechnik,* vol. 2, *Nachrichtentechnische Entwicklungen in der ersten Hälfte des 19. Jahrhunderts* (Berlin, 1995), p. 88. In *Gallery of the Louvre,* Cooper, author of *The Leatherstocking Tales,* is depicted at the rear left with his daughter.

15 Immediately after the failed exhibition of *Gallery of the Louvre,* Morse stated that his attitude had changed "I have changed my plans with relation to this picture and to art generally," and "I have need of funds to prosecute my new plans" (Staiti 1989 [see note 4], p. 202). Yet the decisive blow was that the commission for a painting in the Capitol Rotunda in Washington, DC, so ardently desired by Morse for many years, was finally awarded by Congress in 1837 to another painter (Carleton Mabee, *Samuel F. B. Morse: eine Biographie,* ed. Christian Brauner [Basel et al., 1991], p. 125ff. English original: *The American Leonardo: A Life of Samuel F. B. Morse* [New York, 1943].) Ironically, Morse's first presentation of his telegraph apparatus to the American President, members of the Cabinet, and representatives of Congress took place only half a year later in precisely that location where his desires as a painter had remained unfulfilled: in the Capitol (Kloss 1988 [see note 4], p. 143; Patrice Flichy, *Tele: Geschichte der modernen Kommunikation* [Frankfurt am Main and New York, 1994], p. 67).

16 Staiti 1989 (see note 4), p. 223.

17 *Old Testament,* Fourth Book of Moses (Numbers) 23:23; cf. Lewis Coe, *The Telegraph: A History of Morse's Invention and Its Predecessors in the United States* (Jefferson, 1993), p. 32. The quote was chosen at Morse's request by Annie Ellsworth, the daughter of a family with whom Morse was befriended.

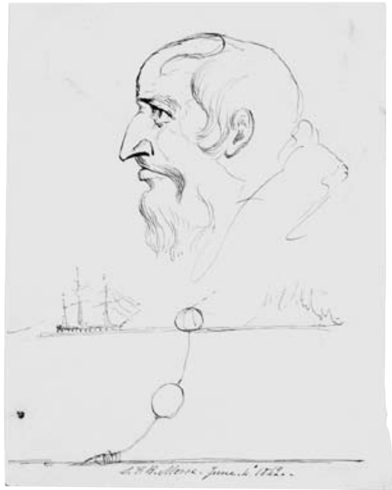


Figure 4: Samuel F.B. Morse: Profile of a bearded man and design for the Atlantic cable, 1842, pen and blue ink on cream laid paper, 7 5/16 x 5 7/8 in. National Academy Museum, New York (1981.967).

At a price of one cent for four words in the United States, telegraphy thus became a means of communication for everyone. However, in most European countries—with the exception of England—telegraphy was introduced as a state-owned institution to be used only by the government and the military, and telephone, radio, and television continued to remain in state hands for some time to come.

All initial doubt about whether any demand for this type of medium would actually come forth was quickly overcome by its immense growth rate. By 1850, there were already 12,000 miles of telegraph lines. Two years later, this number had increased to 22,000 miles, and in 1866, with 22,000 telegraph stations Western Union became the first nationally operating American company to offer service throughout America.[18] The French Revolution's utopian goal of placing telegraphy in the service of national unity became reality in the development of the American national consciousness after the American Revolution.[19]

Invigorated by this first economic boom in the history of telemedia, the strength of American capital soon began to press for expansion beyond the country's borders. A crucial factor in this was the telegraphic link between America and Europe. As early as 1842, even before he had built the first overland telegraphy line, Morse outlined a scheme for a transatlantic cable, soon thereafter making a corresponding submission to Congress[20] (fig. 4). Twenty-five years later, the moment finally arrived, and in 1865–66, after several dramatically failed attempts, a successful connection was finally built that has not been severed since. All efforts to create this connection came from the American side. Morse was still at least organizationally and financially involved in the realization of his idea, which from today's point of view marked the beginnings of globalization through media. Together with the first transatlantic cable connection, the Morse alphabet, still in use today, was also delineated at the International Telegraph Convention in Berlin in 1865. Against bitter competition from comparable German and British developments, Morse's system therefore gradually conquered all of Europe.

This also heralded the victory of the privately held American media industry over the European system of publicly held media, a contest that was only ultimately decided in the 1990s through the

18 Flichy 1994 (see note 15), pp. 71, 77; cf. also pp. 75ff. on development in England.

19 On the French Revolution and the utopian motives for the creation of optical telegraphy, cf. Daniels 2002 (see note 1), pp. 16ff.

20 Franz Pichler, "1990: Telegrafie- und Telefonsysteme des 19. Jahrhunderts," in *Vom Verschwinden der Ferne, Telekommunikation und Kunst,* ed. Edith Decker and Peter Weibel (Cologne, 1990), pp. 253–286, here p. 259; Kloss 1988 (see note 4), p. 150.

liberalization of the telecommunication market. Private satellite television and the Internet brought about the end of the last national protectionist measures set up on the pretext of protecting culture and the fall of Europe's state-entrenched media strongholds, which then had to adapt, for better or for worse, to the commercial American model.

MEDIA TECHNOLOGY REPLACES THE HUMAN HAND

In the field of electrical telegraphy, Morse had numerous competitors whose technical skills and knowledge of electrophysics were far superior to his, such as the German physicists Carl Gauss and Wilhelm Weber, their British colleagues Charles Wheatstone and William Cooke, and the German-Russian pioneer Schilling von Canstatt. Looking back today at the history of technology, it can be said that there was no single inventor of electrical telegraphy but that just as with photography, ideas arose and devices were created with astounding simultaneity in several places throughout the world.[21]

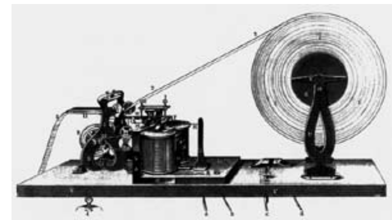


Figure 5: Electromagnetic telegraph recorder according to the Morse principle, 1846.

Morse's success has always been attributed primarily to economic and political factors. Yet the fact that he—as a complete layperson in the field of electrical engineering—had any chance with his system at all against technically far more experienced scientists and initially without any financial support is due to his greatest personal contribution to the development of electrical telegraphy. This is, as we shall see, directly linked to his abandoned career as a painter. Morse developed the first registering telegraph, while almost all of his competitors were working on electrifying optical telegraphy (figs. 5, 6).

Figure 6: Electromagnetic optical five-needle telegraph by Cooke and Wheatstone, 1837.

In optical telegraphy, every step of the transmission required human participation: at its stations, the signal was deployed on the semaphore mast by hand, read via telescope by the guard from the next station, and was finally written down by hand and delivered to the recipient at the end of the line. If secret messages were transmitted in code unknown even to the telegraphers, then these people worked just like a technical relay, without understanding the message's content. The sources of

21 Cf. Aschoff 1995 (see note 14), p. 67.

transmission error were comparably great for optical telegraphy, extending from poor weather to human error. In media-technology terms, this is comparable to the dissemination of writing before the invention of letterpress printing: transmission through copying out by hand, which likewise led to self-perpetuating errors. The electrical pointer telegraphy that developed out of optical telegraphy did manage to overcome distance by means of an electrical signal, but as before, it was read at the moment of transmission and then written down by hand.

In contrast to the numerous designs by other inventors for the electrical transmission of optical signals, Morse can incontestably be credited with pursuing right from the beginning the idea of a telegraph that wrote automatically.[22] He thus solved a problem that had plagued all optical signaling systems from ancient times to the French Revolution: it became possible for the first time to receive a message without the need of human attention and transcription—Morse's device wrote by itself.[23]

This method corresponds to that which photography since Daguerre had provided compared to the camera obscura: the photographic image now drew itself. It no longer required human intervention and perception to go from the eye through the hand and onto paper (figs. 17, 18). Now, only the appropriate placement of an apparatus in front of the subject to be depicted was required, and the actual image was then created without human involvement. With this in mind, Daguerre's competitor Henry Fox Talbot coined the term "pencil of nature," and François Arago, in his speech before the Académie française to announce the invention of photography, correspondingly pointed out: "It does not assume any knowledge of drawing, nor does it demand any particular manual skill."[24]

The inventions of Daguerre and Morse thus share a fundamental feature: instruments initially intended only as tools for extending perception, which in their respective applications had required the human hand to record their results, were transformed to create self-writing and self-drawing media. To put it another way: the "performative" media of optical telegraphy and the camera obscura, both of which were dependent upon human actions, became recording or storage media through Morse's and Daguerre's inventions.

This epochal transformation becomes even clearer when compared to the previous techniques of reproducing documents and images. While it had been possible to use letterpress printing to reproduce existing manuscripts since the time of Gutenberg, the recording telegraph began the

22 The second important developer of a recording telegraph was Karl August Steinheil, whose system, however, was never put into practical use. He had also made pioneering advances in photography (ibid., pp. 114–129; Helmut Gernsheim, *Geschichte der Photographie* [Frankfurt am Main et al., 1983], pp. 87ff.) The first ideas for a recording telegraph had already been developed in 1796, although at that time still as a complement to optical telegraphy (Volker Aschoff, *Geschichte der Nachrichtentechnik*, vol. 1, *Beiträge zur Geschichte der Nachrichtentechnik von ihren Anfängen bis zum Ende des 18. Jahrhunderts* [Berlin, 1989], p. 202).

23 In *The Oresteia*, Aeschylus had already described the difficulties of maintaining human attention, as his watchmen waited on the roof of the royal palace of Argos night after night during the ten years of the Trojan War, awaiting a signal fire as a sign of victory; cf. Aschoff 1989 (see note 22), p. 23.

24 Louis Jacques Mandé Daguerre, *Das Daguerreotyp und das Diorama oder genaue und authentische Beschreibung meines Verfahrens und meiner Apparate zu Fixierung der Bilder der Camera obscura und der von mir bei dem Diorama angewendeten Art und Weise der Malerei und der Beleuchtung* (Stuttgart, 1839), p. II.

history of writing that was no longer written by the human hand: machine writing. Correspondingly, photography marked the beginning of the machine-made image: instead of using graphical techniques to reproduce pictures made by hand, the image itself was now created by technical means.

THE ORIGIN OF MECHANICAL WRITING

This replacement of manually produced writing and images by automated processes marks the beginning of the final rupture between the arts and media technology. The origin of this rupture, however, can be traced back to a transfer of art motifs into media. In the cases of Morse and Daguerre, their individual biographies reveal both the continuity of their personal goals and ideals but also a radical shift in their roles. The switch from artist to inventor was final, as neither of them ever again took up their artistic work. These two artists-turned-media-inventors were the first protagonists in the comprehensive process of *substitution*, in which media took over, in almost all areas of life, functions that had formerly been considered the domain of art.[25]

Thus besides personal goals, very concrete remnants of art were also transferred to the media. The justification for these remnants may have been pragmatic for Morse, yet they are potentially highly symbolic, for his artistic career left clear traces on the first prototypes of the recording telegraph of 1835 (fig. 7). The entire construction was based on a canvas stretcher frame on which a pencil, remotely controlled by an electromagnet, marked or wrote on a ribbon of paper moved by a clock mechanism.[26] As a type of "remote draftsman," this device can certainly be recognized as stemming from the tools of the artist, although its powers of articulation were reduced to a simple jagged line.

Art had been released from its substrate and thereby also from its message. Only an empty frame remained, and this painting implement had now been adapted into a media apparatus. It is tempting to consider this a symbol of Morse's failed career as a painter. As already mentioned, Morse's missionary aspirations were also transferred from painting to telegraphy. According to Morse, the new medium was to have the following effect: "The whole surface of this country would be channeled for those nerves which are so diffuse, with the speed of thought, a knowledge of all that is occurring throughout the land, making, in fact, one neighborhood of the whole country."[27] This already hints at the "global village" prophesied by Marshall McLuhan 150 years later and which has become a truism today.

In fact, Morse's first primitive apparatus became the forerunner of far more complex media technologies. As the first automatic writing instrument, well before the typewriter, which would not be produced for another forty years, it began the development of machine writing that extended

25 That the biographies of Morse and Daguerre are only symptoms of a far more comprehensive process of substitution that continued until the emergence of radio and Internet is more thoroughly examined in Dieter Daniels 2002 (see note 1), p. 216.

26 This was not an easel, as often asserted, but rather a "canvas stretcher," which was part of the basic construction of the apparatus of 1835, later improved in 1837. For this information my thanks go to Bernard Finn, Curator of the Electrical Collections, National Museum of American History, Smithsonian Institution, Washington, DC, and to Anja Chavez.

27 Staiti 1989 (see note 4), p. 223.

Figure 7: S. F. B. Morse's first telegraphic device. At the back, the receiver built from a canvas stretcher, and at the front, the transmitter, 1835–37. National Museum of American History, Smithsonian Institution, Electricity Collections, Washington, DC, neg. 14593-B.

to the Telex and e-mail. The single line of his electrically guided stylus on paper was also, however, the precursor of the image drawn by magnetic deflection, which appears on the tubes of televisions and computer monitors. The beginnings of this line-by-line transmission were already contained in the first experiments in electrical image transmission, carried out ten years after Morse.[28]

Analogous to a primitive prototype of life, Morse's apparatus already seemed to contain the nucleus of the entire spectrum of media technology's technical diversification over the next century. It is all the more surprising then that Morse is entirely absent from Friedrich Kittler's examination, the most comprehensive to date, of systems of notation.[29] Here, Kittler emphasizes

28 The Scottish watchmaker Alexander Bain developed an "automatic copying telegraph" in 1843 for the row-by-row transmission of an image across telegraph wires, and this was followed by many similar attempts at transmitting images electrically.

29 Friedrich A. Kittler, *Aufschreibesysteme 1800/1900* (Munich, 1985). The English title, *Discourse Networks,* does not translate the ambivalence of the title, which is derived from Sigmund Freud's study of Daniel Schreber but also includes the history of the technologies of writing. "Inscription, in its contingent facticity and exteriority, is the irreducible given of Kittler's analysis, as the original German title of his book—*Aufschreibesysteme*—makes evident. That title, a neologism invented by Dr. Schreber, can be most literally translated as 'systems of writing down' or 'notation systems.' It refers to a level of material deployment that is prior to questions of meaning." David Wellbery in the introduction to Friedrich Kittler, *Discourse Networks 1880/1900* (Stanford, 1990).

the dependence of literary and artistic productions on the means and devices of media technology. Yet as Morse and Daguerre paradigmatically attest, formerly artistic aims can finally be manifested in the form of media technologies and apparatuses. The primacy of the technical medium over artistic content as repeatedly postulated by Kittler is turned around in this case.

The great promise held by Morse's recording telegraph continued even to the emergence of the computer, as the ancestor of this machine is considered to be the "analytical engine" developed almost concurrently by Charles Babbage in 1833. This project for a digital and mechanical calculating machine, however, was never realized. Not until the twentieth century did these two lines of development come together, when the synthesis of electrical signal processing and digital programming made the first functioning electronic computer possible. Yet the binary code of the dashes and dots marked on Morse's ribbon of paper can be compared directly with Alan Turing's "tape," which in his first and still purely theoretical description of a computer in 1937 was the only input and output of his "universal machine."[30] Media historians have claimed various models for Turing's "tape," although these seem more likely to have been derived from their own scientific backgrounds: the literary scholar Kittler nominated the typewriter, while the media theorist Lev Manovich, who views film as the dominant medium, claims the filmstrip.[31]

Yet not just technologically, but also ideologically and economically, Morse proves to be the precursor of today's media strategies. Due to the telegraph's privatization financed by American venture capital, the Morse system achieved a monopoly position certainly comparable to Bill Gates' Microsoft operating system. [32]

A still awkward, early work by the eighteen-year-old Morse shows him together with his father, the author of the most famous American geography book at the time, looking at a globe (fig. 8). Unable to make a geographically broad impact through art, the younger Morse finally achieved this goal by means of telegraphy. A caricature in *Yankee Doodle* in 1846 therefore correctly noted: "Professor Morse's Great Historical Picture" was the transformation of America through telegraphy, which left its mark on the landscape just as incisively as it did the on the economy, politics, and the dissemination of news

Figure 8: S. F. B. Morse, the Morse family standing in front of a globe, ca. 1809. National Museum of American History, Smithsonian Institution, Washington, DC, neg. 34215.

30 Turing's description of the computer as a "universal machine" suggests that it was directly modeled on a telegraph device: "We may compare a man in the process of computing a real number to a machine. . . . The machine is supplied with a 'tape' (the analogue of paper) running through it, . . . the machine is capable of printing 0 and 1." Alan M. Turing, "On Computable Numbers, With an Application to the Entscheidungsproblem," *Proceedings of the London Mathematical Society,* series 2, vol. 42 (1936–37) pp. 230ff. He also ascribed a decisive role to the telegraphic transmission of writing in the test he developed in 1950 to evaluate the question "can machines think?"

31 Cf. Friedrich A. Kittler, *Grammophon, Film, Typewriter* (Berlin, 1986), p. 32; Lev Manovic, *The Language of New Media* (Cambridge, MA, 2001), p. 24.

32 Is it just coincidence that Bill Gates is also trying to use technology to gain control of European tradition by purchasing the worldwide digital copyrights to art masterpieces in order to market them commercially over the Internet? The company Corbis, founded in 1989 by Gates, initially tried to purchase above all the image copyrights for artworks in European museums.

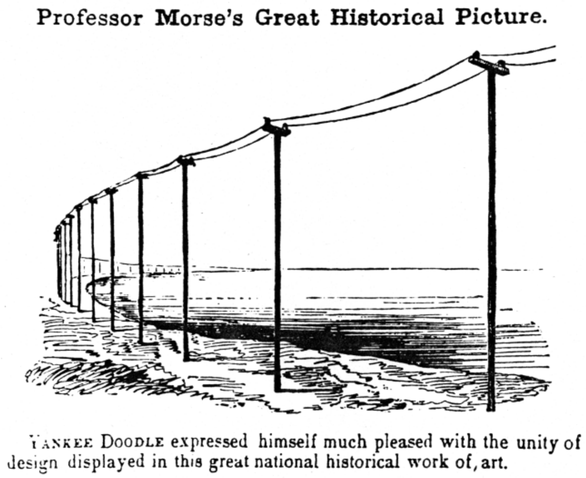


Figure 9: Caricature in *Yankee Doodle* 1, October 1846.

(fig. 9). Humor was able to express what nobody dared say otherwise: *that art's function as a social model could migrate to the media.*[33]

J. L. M. DAGUERRE: PHOTOGRAPHY AS THE END OR THE PERFECTION OF PAINTING

In 1839, the announcement of the invention of photography immediately triggered a debate in France over the relationship between art and media. The arguments anticipated discussions that would later be introduced on the artistic character of film, video, or digital images in the twentieth century. Some, like art critic Jules Janin in 1839, dramatically proclaimed the end of art through photography: "There is nothing more to negotiate between art and its new rival. . . . From now on, the Daguerreotype shall fulfill all artistic needs, and all moods of life. . . . If things continue as they are, then we shall soon have machines that dictate to us Molièresque comedies or verses as written by the great Corneille. And so it should be."[34] On the other hand, the painter Paul Delaroche, when asked his position, saw photography only as an aid in the artist's search for motifs. The idealistic and romantic defense of human inimitability formulated by the German art critic Eduard Kolloff, who was sojourning in Paris in 1839, went even further: "The graphic arts have from the Daguerreotype . . . nothing to fear: its results lack the highest beauty of a work of art—the soul, the senses, and the spirit of the artist who has conceived and depicted it."[35]

Daguerre, on the other hand, had previously used painting techniques to let viewers forget that what they saw had been "conceived and depicted" by an artist. He had escalated the illusionistic effects of the panel paintings in his stage designs and then in dioramas, the images of which became as close a substitute for reality as possible. Daguerre first achieved celebrity as a theater set painter with his new stage effect, admired by "tout Paris," of a revolving sun and a wandering moon.[36] He employed various transparent substrates and changing light effects in this work, which then led to the development of his dioramas in 1822. The "double effect" achieved through dynamic lighting changes added a temporal dimension to the spatial effects in his dioramas created by semitransparent canvases painted on both sides. According to contemporary descriptions, this produced "the highest possible degree of illusion," in which "life, movement and human figures which animate and complete the landscapes and monuments" also found a place.[37] This anticipated in the staging of a single painted picture what film would later achieve using a sequence of images. Even before the invention of photography, Daguerre had thus taken the principle of painting to the very limits of its medium-specific boundaries. The picture became a "screen" built especially for an auditorium and was thus a precursor of the cinema—in economic terms as well, since the undertaking was now financed by admission and not by the sale of pictures (figs. 10, 11).

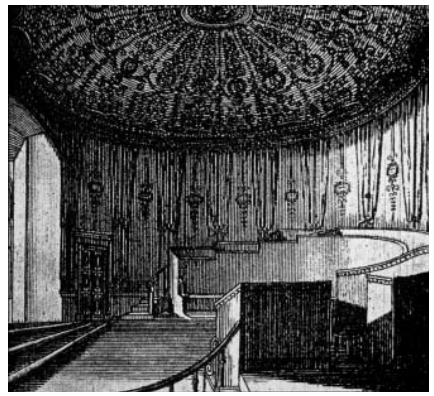


Figure 10: Diorama by J. L. M. Daguerre, Paris, view into an empty auditorium.

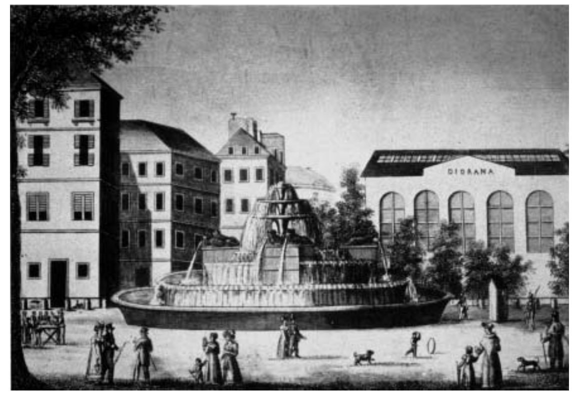


Figure 11: Outside view of the diorama by J. L. M. Daguerre in Paris, 1830.

The reaction of contemporary viewers speaks for itself and must replace the spectacle of the diorama's images, none of which have survived: "This was magic," concluded journalist Gustave Deville in his description of *Midnight Mass at St. Etienne-du-Mont,* one of Daguerre's most successful works.[38] In this animated painting, the nave of the church slowly sank into darkness. Candles began to glow, and the empty benches successively filled with churchgoers until the mass began, accompanied by organ music. With the returning daylight, the faithful left the church,

33 Professor Morse's Great Historical Picture, in *Yankee Doodle* 1, October 1846.
34 Wolfgang Kemp, ed., *Theorie der Fotografie,* 2 vols. (Munich, 1980), vol. 1, pp. 48, 49, 50.
35 Ibid., p. 65.

36 Cf. J.-Fr. Michaud et al., eds., *Biographie Universelle ancienne et moderne,* vol. 10 (Paris, 1854), pp. 14ff.
37 Cf. Helmut Gernsheim and Alison Gernsheim, *L. J. M. Daguerre* (New York, 1968), p. 36. The diorama was not Daguerre's invention, but rather had several precursors. Daguerre's new contribution was the "double-effect" employed in 1834.
38 Ibid., p. 34.

Figure 12: Lithography of the diorama of an Alpine village by J. L. M. Daguerre, daylight.

Figure 13: Lithography of the diorama of an Alpine village by J. L. M. Daguerre, nocturnal light.

which finally stood just as empty as it had at the beginning. The diversity of these effects is all the more fascinating when one considers that they were achieved solely by using large blinds and colored filters to control the daylight. Sound effects supported the changing scenario, and in only fifteen minutes Daguerre simulated the course of day and night so that, as he noted in 1839, "the observer's interest was no gauge of the brevity" of the actual duration.[39] In this, he even anticipated the accelerated time lapse of film (figs. 12, 13).

His great success permitted Daguerre to open a second diorama in London in 1823, so that the elaborate pictures, which were fourteen meters tall and twenty-two meters wide, could now be shown in two locations in succession. In this respect, the dioramas could even be compared in economic and aesthetic terms with today's IMAX cinemas. In both cases, elaborate illusions are presented in a specifically designed architecture. Yet where in film a simple cut suffices for a change of scene, with a diorama the entire theater must be turned. A mechanism allowed the auditorium to be swung between two different pictures.[40] Thus instead of a cinematic montage, the diorama offered at most two different views per presentation in half an hour.

Even before the invention of photography, dioramas had already occupied an intermediate area between art and technology. According to a German visitor at the time, this placed it "among the most interesting productions of optics applied to the production of artistic portrayals, or if one prefers, to the art of painting aiming for optical illusion through the application of the laws of optics."[41] As a commercial enterprise, it depended on constant innovation. Daguerre therefore did not shrink from furnishing his Mont Blanc diorama with a real Swiss mountain hut and a live goat grazing in the foreground. At presentations for the press, he had girls in traditional Swiss folk dress serve journalists a breakfast of milk, cheese, and rye bread to the sound of alpenhorns. Some public relations work was necessary to keep the 350 seats for his audiences regularly filled. Thus he did not forget to complain about the lack of recognition by art critics, who accused him of mixing nature and art, and who judged the goat and the mountain hut as "illegitimate aids for a painter."[42] Daguerre's artistic career was more successful than Morse's, to be sure, yet he was just as much a failure in his desire for artistic recognition—not least because of his attempts to perfect illusionism, which were perceived as being not artistic.

39 Daguerre 1839 (see note 24), p. 60, which also includes a further contemporary description.
40 The images of the diorama remained stationary due to their size and to the complicated positioning of the lights. An illustration of the mechanism for turning the auditorium can be found in Georges Potoniée, *Daguerre: Peintre et décorateur* (Paris, 1935), p. 49.
41 Daguerre 1839 (see note 24), p. 59.

The logical extension of Daguerre's efforts towards reproducing reality perfectly, which he was already striving for through painterly means, was the self-creating portrayal of reality through photography.[43] The daguerreotype technique is thereby particularly persuasive because of its sharp focus, and this is precisely what almost all of his contemporaries saw as the new technique's superiority over painting. Thus at the official presentation of the invention, the physicist François Arago said: "These drawings shall surpass the works of the greatest painters in their faithfulness to detail and athmosphere."[44] Similarly, after his first encounter with daguerreotype, Samuel Morse said: "The exquisite minuteness of the delineation cannot be conceived. No painting or engraving ever approached it." He compared the examination of a daguerreotype through a strong magnifying glass with looking at reality through a telescope.[45] By means of a machine-made image, Daguerre could now achieve exactly the effect he had already sought using the techniques of painting: the viewer accepted the picture as a substitute for reality.

It was certainly no accident that Daguerre's preoccupation with photography began at a time when he began experiencing financial problems due to waning interest in the dioramas. Photography's invention and its strategically skillful and promotionally effective presentation to the public provided Daguerre with a solution to this crisis in his personal career, as well as the crowning glory to his quest for fame. For seven long months, Daguerre kept the public in suspense. He had, to be sure, presented the initial results of photography at the beginning of 1839 before the Academy of Sciences, and word of this spread quickly throughout Europe. It was not until after his efforts had been financially secured through an annuity from the French government, however, that he officially made the photographic process public on August 19, 1839. The striking setting for this was an otherwise very rare collective meeting of the Academy of Sciences and the Academy of the Arts, so that eight hundred representatives from France's elite were present as the invention was made available to humanity under the name "daguerreotype".[46] While François Arago, who chaired the meeting, still asked "whether the photographic methods could become the object of everyday practice," it was soon seen that the general public accepted this first "public-domain" invention more quickly than had been assumed.[47] "One hour later, all opticians' business were already being besieged, and they admittedly could not produce enough instruments to cover the needs of the army of future Daguerreotypists. After only a few days, one saw cameras in all the squares of Paris, which, mounted on tripods, were being brought into position in front of churches

42 Gernsheim/Gernsheim 1968 (see note 37), p. 31.
43 For the landscapes of his dioramas, he often used a camera obscura, so that an article correctly emphasizes that the sketches for them were "recorded on location." Ibid., p. 38.
44 Kemp 1980 (see note 34), vol. 1, pp. 48, 52.
45 Beaumont Newhall, *The History of Photography* (London, 1982), p. 16.
46 Michaud et al. 1854 (see note 36), p. 15.
47 Kemp 1980 (see note 34), vol. 1, p. 50.

Figure 14: Theodore Maurisset, *La Daguerrotypomanie,* 1839, lithograph.

and palaces."[48] This contemporary report corresponds to a caricature, also from the year 1839, about the eruption of "daguerreotype mania" (fig. 14).

Within only five months, Daguerre's description of the process had been distributed worldwide in twenty-nine editions and six languages.[49] Due to this technique becoming common property so quickly, however, its fascination became completely disengaged from the person of the inventor. It developed further amongst a worldwide mass movement of users who were enthusiastic about the new medium both for commercial reasons as well as out of pure amateur passion. These first amateur media enthusiasts were the forefathers of a movement that has continued into the twenty-first century. It was here that the power of amateurs in shaping a medium was revealed for the first time in media history.[50] Further examples extend from the "bottom up" rise of radio out of the practice of amateur radio enthusiasts all the way to today's discussions about the role of users in Web 2.0 under the slogans "We are the Web" or "Person of the Year: You."[51]

48 Gernsheim 1983 (see note 22), p. 61.
49 Ibid., pp. 61f.
50 Cf. Daniels 2002 (see note 1), pp. 206ff.
51 Cf. Kevin Kelly, "We are the Web," *Wired* (August 2005), as well as the title story by Lev Grossman, "Time's Person of the Year: You," *Time Magazine* (December 13, 2006) and the *Spiegel* special "Wir sind das Netz," no. 3 (2007).

ARTISTIC REMNANTS IN THE TECHNOLOGICAL MEDIUM

For Morse and Daguerre, the invention of electrical telegraphy and of photography can be understood to some extent as an expansion of their artistic ambitions beyond the boundaries of art. This elaboration of a painterly approach can also be seen in the *specific misunderstandings* of both of them towards "their" respective media.

The reason Daguerre pursued the goal of a perfectly detailed depiction of reality in his photographic process was that he believed photography could only be successful in this way. Herein lay the difference from his precursor Nicéphore Niepce, who in 1827 had achieved the first still-shadowy photographs, and who has long since been pushed into the background of history by Daguerre. Inspired by lithography, Niepce sought a new printing process for the technical production and duplication of images. Daguerre sacrificed this reproductive characteristic of photography to his compulsion to seek the perfect illusion. The daguerreotype process produced unique images from which no further prints were possible. It was therefore not suitable for the kind of industrial reproduction of images that Niepce was striving for.[52] Daguerre may well have been correct in his estimation of public opinion, as the enthusiasm for daguerreotype's faithfulness to detail showed. Despite this, his process led to an absurdity in the history of the medium: machine-produced originals instead of reproducible graphic artworks.

The negative process developed by William H. F. Talbot contemporaneously with Daguerre allowed making as many prints as desired from a single photograph. Daguerre expressly protested, however, against the attempts to make copies by means of producing prints on paper that began soon after his process was announced.[53] The daguerreotype thus created an artificial form of the unique original, just as panorama painting created a unique experience in front of a non-reproducible original. A further similarity is that just like daguerreotypes, dioramas use the unaltered white of the substrate as the brightest light and depend upon daylight and changes in daylight to produce their effects.[54] Thus it was precisely because of Daguerre's desire to improve upon the perfection of the image achievable with painting that the daguerreotype, no longer in use today, led to a dead end in the development of photography.

Coming back to Morse's first telegraph device of 1835, the inclusion of a canvas stretcher frame was a somewhat coincidental but quite symbolic remnant of its inventor's artistic past. Traces of painting also remained in the device's technical functioning, for it was a tele-writer in the literal sense of telegraphy, or more precisely, a remote drawing device, the pencil of which, steered by an electromagnet, drew a jagged line on a strip of paper (fig. 15). Thus Morse initially wanted to transmit information through the modulations of a continual line, analogous to the process of drawing or writing. Not until 1840 did Morse's team achieve the reduction to a yes/no command,

52 Cf. also the contemporary commentary by Arago in Kemp 1980 (see note 34), vol. 1, p. 53, and the investigation by Bernd Busch, *Belichtete Welt: Ein Wahrnehmungsgeschichte der Fotografie* (Frankfurt am Main, 1995), pp. 194ff.
53 Wolfgang Kemp, *Foto-Essays zur Geschichte und Theorie der Fotografie* (Munich, 1978), p. 19.
54 Daguerre 1839 (see note 24), p. 61.

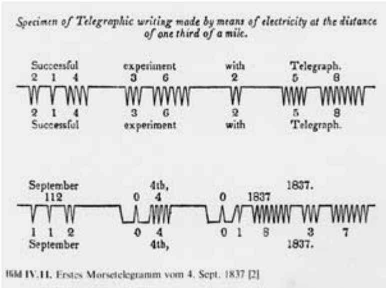


Figure 15: The zigzag lines made during the first successful test of S. F. B. Morse's telegraph in 1837.

Figure 16: The international Morse code, 1865 (excerpt).

meaning electricity or no electricity, which was so necessary for the function of the apparatus, whereas this so-called Morse code still had dashes and breaks of various lengths.[55] It was only in 1848 that the Hamburg telegraph inspector Friedrich Clemens Gerke simplified it to the binary code of dots and dashes, precursor of all binary media information, including today's digital code of zeros and ones (fig. 16).

Artistic elements continued to find their way even into the technical construction of the devices, and both artist-inventors misunderstood the actual capacity of their respective media invention. Instead of recognizing the principle of the unlimited reproducibility of images as the heart of his medium, Daguerre focused his method on producing originals which were superior to painting in terms of faithfulness to detail, and which remained convincing even under a magnifying glass. Morse's first recording telegraph still strove to be analogous to handwriting instead of taking the step to binary code, which would then make it the forerunner of digital information processing. Yet at the same time, both inventions very precisely defined the division between art and media technology, which lies precisely in the person of the artist. This is revealed by the common feature of the two methods already mentioned: in the already partly automated process of producing images using a camera obscura or of transmitting communications using optical signals, both Daguerre and Morse *eliminate the human factor* (figs. 17, 18). Both recognized the pathway from the eye or from the thoughts, through the hand, and onto paper—and thus the true process of artistic creation—as the weak point of the media-technology transfer.

The physical action of the manual process, which holds the highest rank particularly in painting's cult of the original, was eliminated from their respective media by the former painters Daguerre and Morse. Historically, this elimination of the artistic from media technology remains very closely connected with their artistic and personal goals. The intertwining of biography and technology, and at the same time the separation of media and the arts, can hardly be more symbolically formulated than in this contemporaneous transition. Only by eliminating the last remnants of the artistic in media technology did Morse and Daguerre achieve the worldwide fame as inventors that had

55 Morse's contribution to the dot-dash code is disputed (Aschoff 1995 [see note 14], pp. 90, 190ff.).

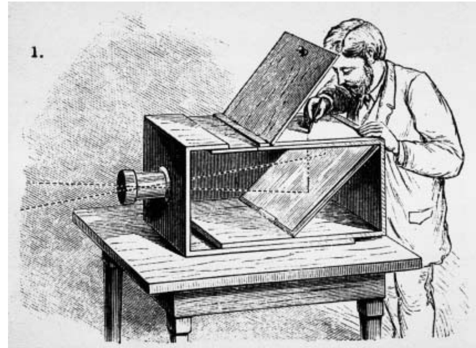


Figure 17: Camera obscura and draftsman.

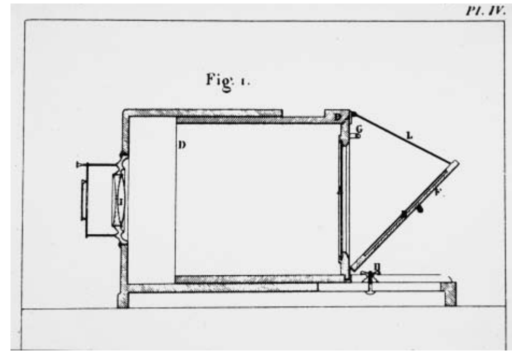


Figure 18: Sectional drawing of a camera from J. L. M. Daguerre's publication on the method of photography, Paris, 1839.

been unattainable to them as artists. Their artistic means and artistic goals were transformed into processes of media technology. On two counts, the thesis can thus be formulated: *media are the continuation of art by other means.*

TELEGRAPHY MEETS PHOTOGRAPHY

Morse and Daguerre became heroes of the nascent media age, although they were only partly responsible for the inventions named after them. Even media technologies need heroes in order to become more comprehensible in the public consciousness. This identification with specific persons, often unjustified in terms of technological history, can also be partially understood through the artist careers of Morse and Daguerre. Among their personal similarities is a good intuition for public appeal. Although they ultimately failed as artists, they succeeded in transferring a reflection of artistic brilliance onto their roles as inventors. With this strategy, today called "image transfer," they secured an advantage over their competitors who were simultaneously developing methods for telegraphy or photography. The next section shall examine the ways in which this relationship reversed itself in the second half of the nineteenth century, when inventors began to compete with artists to be designated as the personification of genius. Furthermore, Morse and Daguerre were very concerned to have their inventions known solely under their names and persuaded their respective associates to acknowledge this contractually.[56] This allowed them to immortalize themselves in the name of their respective media despite the controversy, even in their own time, about how unique their technical achievements had been. Thus photography was at first exclusively called "daguerreotype," and today one still speaks of "Morse" code.

56 Cf. Coe 1993 (see note 17), p. 31 on Morse's contract with Alfred Vail as well as Gernsheim 1983 (see note 22), p. 57, on Daguerre's contract with the son of Niepce.

This astonishing synchronicity in their personal battles to implement their inventions finally led to a theatrical finale. Just as Daguerre was releasing examples of photographs to the public, but was still keeping his process secret in order to first secure financing for his efforts, Morse was also seeking financial backing for construction of the first telegraph line. His path led him to London and Paris—and what had to happen, did happen. On March 7, 1839, Morse met with Daguerre in order to be shown the latter's invention as well as the diorama.[57] He invited him to return the visit the next day so he could demonstrate the principle of electrical telegraphy to him on a test line between two rooms. As if this coincidence alone were not historically significant enough, it was on precisely this same day that Daguerre's diorama went up in flames and with it the basis of his livelihood. For Daguerre there was now no way back; he had to go from painter to photographer, and he bet everything on the success of his invention. The result was Daguerre's sale of his secret, for an annual stipend, to the French government, which in turn made it freely available to the general public.

We do not know what Morse and Daguerre spoke about when they met, but it does not take much to imagine that the future convergence of their inventions, all the way to television and Internet, could have been in the air. In any case, Morse was enthusiastic about Daguerre's invention. This was expressed in the report he sent in a letter to his brother, who was an editor at *The New York Observer* and who was the first to publish information about photography in the United States.[58] Back home, Morse went on to become one of the pioneers of American photography. Indeed, years earlier he had already experimented with a camera obscura in an attempt to create photographs.[59] The two artist-inventors remained in contact, as evidenced, among other things, by the portrait photo of Samuel Morse taken by Daguerre six years later (fig. 19).

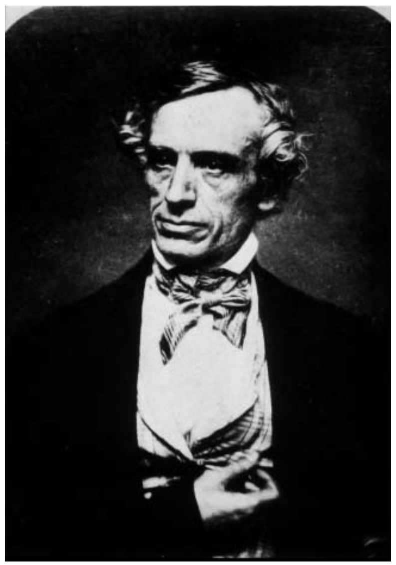


Figure 19: Portrait of S. F. B. Morse, 1845, daguerreotype, attributed to J. L. M. Daguerre.

Morse and Daguerre had to transform from artists into inventors because their goals could no longer be realized within the framework of art. Thus as inventors they achieved a place in history that had been denied to them as artists. In the end, however, they were not striving for personal prestige, but pursuing supra-individual goals which simply could no longer be formulated in individualistic works of art—for Daguerre the production of mass illusions, and for Morse the elevation of America's prestige in comparison with that of Europe. While their inventions still contained reminders of their artistic careers, these therefore had to end for good so that everything could now be transferred to invention.[60] For Morse and Daguerre, there was no synthesis of art and media technology but only a radical transformation of what had once been goals of their art into a technical invention. Morse and Daguerre can therefore not be compared with Marcel Duchamp, Alexander Rodchenko, Walter Ruttmann, or others who gave up painting around 1920 to devote themselves to early forms of the media arts.

The continuation of art by other means, regarding the initial artistic goals of Morse and Daguerre, corresponds to a *substitution* of art by media technology. Because their transformation from artist to inventor is total, there is no way back and no symbiosis of art and technology. This substitution of art by media extends far beyond the personal lives of Morse and Daguerre, right into the development of media in the present day. The invented apparatus or technology is not a work of art in itself, but the activities it enables and the results it produces can take the place formerly occupied by art. This is evident in the case of media amateurs. The origin of the concept of the "amateur" is in the field of art. An amateur follows his masters by way of imitation and exercise, but ultimately only in order to understand and adore the master's superiority. Media amateurs, beginning with photography, at first embrace the media technology as a substitute for their own lack of artistic mastership. Through the nineteenth and twentieth centuries, the attitude of the media amateurs develops with the changing media. They create their own aesthetic criteria, which no longer require any reference to the established art forms. And in the case of the radio amateurs of the early twentieth century and the hackers of the late twentieth century, this substitution of art by media takes the form of a completely new discourse that is without precedence in cultural history.

PART II: FICTION AND SCIENCE

The biographies of Morse and Daguerre prototypically anticipate a development that led to a general paradigm shift in the second half of the nineteenth century. Inventors took the place of artists as the embodiment of creative genius, and technology instead of art became the leitmotif of a new world view. However, in the creation of legends, the stylization of the personality, and the identification of authors with their creations right down to personal details, the inventor-genius type continued to follow the model established in art.

The most prominent examples of this pseudo artistic characterization of inventors are Thomas Edison and Nikola Tesla. At the same time, they represent contrasting manifestations of this paradigm shift. Edison is considered an American self-made man who made a business model from

57 Morse's telegraphy device was presented by Arago at a meeting of the French Academy of Sciences on September 10, 1838, and thus even before Daguerre's photography (cf. Mabee 1943/1991 [see note 15], p. 157).
58 Newhall 1982 [see note 45], p. 16.
59 Gernsheim 1983 [see note 22], p. 112.

60 Morse wrote in 1841 that after Congress's 1837 decision against him, he had not painted any more pictures. In 1845, during another stay in Paris, he visited neither his beloved Louvre nor any other museum (Kloss 1988 [see note 4], p. 147ff.). From 1839 onward, Daguerre lived in Bry-sur-Marne, where he had a new house built. It did have a studio, but one which he hardly ever used. His only important work is an illusionistic painting created in 1842 in the church in Bry, which appears to extend the church's interior space by a gigantic Gothic choir (Potoniée 1935 [see note 40], pp. 75ff.).

every invention, while Tesla is seen as a financially inept, hyper-intellectual visionary. Using these two prototypes, the following shall investigate how the inventor persona was modeled on the example of artists in the second half of the nineteenth century. Thus not Edison himself, but rather a contemporary science-fiction novel about him shall be the focus of interest. In contrast, Tesla's biography already reads like a novel. The interplay between art and technological invention, which for Morse and Daguerre was a biographical one-way street, is mirror-reversed in the way Edison and Tesla were viewed by society. Instead of failed artists who had to become inventors, it was now inventors themselves who, as pseudo artists, provided the material for fiction and utopias. Since then, this reciprocating relationship between science and fiction has continued to develop and only reached its full significance at the end of the twentieth century. The term "cyberspace," for example, was coined in 1981 by the science-fiction author William Gibson, soon thereafter becoming the leitmotif for numerous technical developments and research programs costing millions.

THE EMBODIMENT OF THE MEDIA: STORAGE AND TRANSMISSION OF IMAGES AND SPEECH

With the phonograph and the telephone, the basic functions of storage and transmission simultaneously entered a new phase around 1876/77. Both media are based on physiological insights into the function of the human voice. While photography and telegraphy release the production of images and the transmission of signals from reliance upon the human body, the telephone and phonograph assume characteristics of the body and expand the body's functions into new realms of space and time. The telephone permits one—at least acoustically—to be present at a location where the body is not. The phonograph made the same kind of presence possible in a different time. In addition, the phonograph was the first device to take over a previously exclusively human function, recalling the memory of moments in time beyond their pure description (fig. 20).

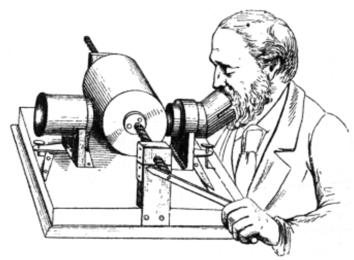


Figure 20: The first model of a phonograph during recording, from *La Nature*, May 25, 1878.

With the telephone and the phonograph, technology became an enhancement and copy of human senses and the human mind, "extensions of man," as Marshall McLuhan was to describe them a hundred years later.[61] The two inventions therefore have epistemic prerequisites as well as consequences, and are epistemological devices in their real application and in the metaphorical sense.[62] The principle, incontrovertible since the time of Aristotle, that a person can only be present in one place at a time, was first qualified due to the telephone, and the further consequences of this extend to the possibilities of telepresence discussed today. Even more incisive is the phonograph's ontological quality. For the first time, the relentless passage of time, or at least its acoustic dimension, became repeatable. By turning the phonograph crank more slowly, more quickly, or in the reverse direction, time could be manipulated and even reversed.

Many culturally and philosophically important things have been said about photography since its invention, but comparatively little about telegraphy. In the same way, the phonograph was immediately regarded as a cultural challenge, but the telephone, in contrast, was seen primarily as a technical and economic achievement.[63] Of the two basic functions of media technology, storage and transmission, storage was the one more commonly understood as a cultural process. Cultural history as a physical memory of discursive knowledge and aesthetic experience established itself in the form of literature and painting before the advent of all other media technologies. By way of these two fundamental recording techniques, the difference between writing and images had also impressed itself so deeply in the cultural consciousness that it was equated with the separation between language and body. The telephone and phonograph were the first to revoke this separation. Even in its transmission through a technical medium, language became physical. The voice transports more than just symbols: it is an expression of the body and the psyche. Friedrich Kittler has illustrated how the phonograph revoked the disjunction between sounds and words, thus also rescinding the foundation for the millennia-old writing culture.[64] Yet because the telephone and phonograph only record acoustic phenomena, a gap appears in media-related perception with respect to the body. Thus, for example, Marcel Proust writes of disembodied voices that are "invisible but present."[65] Not until the twentieth century was this gap closed again by television and sound film, allowing the image of the body to bridge time and space synchronously with the voice. Not until then was the separation between visual storage and verbal transmission, which had existed since the beginning of photography and telegraphy, completely overcome. Yet even in the nineteenth century, the products of technical, literary, and artistic imagination immediately began to complete this picture. This is where the novel of 1877, which shall be examined in the following, begins. Also commencing punctually in 1877 were the first publications of technical proposals for electrical television techniques as well as the first caricatures on the topic of electrical image transmission.

61 Thereby the immediate source of this expansion of the senses was the body: in 1874 Bell and Clarke used the eardrum of a corpse to develop a prototype for a telephone receiver (cf. Kittler 1986 [see note 31], ill. p. 130).

62 On the concept of the epistemic things cf. Hans-Jörg Rheinberger, *Toward a History of Epistemic Things: Synthesizing Proteins in the Test Tube* (Stanford, 1997).

63 On the phonograph in nineteenth- and twentieth-century literature cf. Kittler 1986 (see note 31), pp. 37ff., and Charles Grivel, "The Photograph's Horned Mouth," in Douglas Kahn and Gregory Whitehead, eds., *Wireless Imagination: Sound Radio and the Avantgarde* (Cambridge, MA, and London, 1992), pp. 31–61. On the telephone cf. Forschungsgruppe Telefonkommunikation, ed., *Telefon und Gesellschaft*, 3 vols. (Berlin, 1989–91); Jörg Becker, *Fern-Sprechen: internationale Fernmeldegeschichte* (Berlin, 1994), pp. 11–43; and Avital Ronell, *The Telephone Book: Technology, Schizophrenia, Electric Speech* (Lincoln and London, 1989).

64 Kittler 1986 (see note 31), pp. 37–49.

65 On the phenomenology of telephoning by Proust and other authors of the nineteenth century cf. Christoph Asendorf, *Ströme und Strahlen: Das langsame Verschwinden der Materie um 1900* (Berlin, 1989), p. 66.

By inventing the telephone and the phonograph, Alexander Graham Bell and Thomas Alva Edison became heroes of the media age, as Morse and Daguerre had been in their era. Just as telegraphy and photography were not the accomplishments of single inventors, parallel ideas for the later inventions also arose with astonishing simultaneity. The most famous case was the telephone, for which Bell presented his patent on February 14, 1876, in Washington, DC, followed only two hours later by another patent registration by Elisha Gray.[66] As early as 1861, the teacher and amateur technician and scientist Johann Philipp Reis had introduced a telephone in Germany. He never registered it for a patent, however, because he only sought academic recognition for this epistemic device, which he nonetheless failed to receive. The relationship to telegraphy and the groundwork done by Reis may be reasons that the telephone was invented by two people simultaneously in 1876. For the phonograph, however, there were no early prototypes. It is therefore all the more surprising to find two parallel inventions here as well. The Parisian poet, inventor, and bohemian Charles Cros registered a precise description for a "method of recording and playing back phenomena which may be perceived by the ear" on April 16, 1877, at the Academy of Sciences, although this inventor's notorious lack of money prevented the practical realization of the device.[67] On December 6, 1877, Edison presented his phonograph, which worked on the same principle, to an astonished public. He had already registered it for a patent and was preparing to produce it industrially.[68] All that remained for Cros to do for his invention, with which he had wanted to record "beloved voices" and make the "musical dream of short hours" repeatable, was to compose a poetic memorial ending with the line: "Time wants to flee, I hold it fast."[69] In this regard, Cros seemed particularly prone to bad luck. He had also worked out a theory for color photography through subtractive color mixing, which he published on February 23, 1869, in *Le Monde,* only two days after the French pianist Louis Ducos du Hauron was granted a patent for his comparable, independently developed process.[70] The history of this remarkable simultaneity, with which ideas arise in several minds at the same time, still needs to be written.

The failure of the poet-inventor Charles Cros showed that the era of artist-inventors such as Morse and Daguerre had passed and that the future called for a pragmatic generation of inventors, of which Edison and Bell were representative, who concentrated right from the beginning on technical feasibility and commercial marketing. Hence in our perception of the era, the telephone and the phonograph, although both conceived in Europe, remain typical American innovations that quickly became the basis for new industries in the United States. As water, electricity, and gas utility networks connected the private sphere of households, at the end of the nineteenth century, the telephone and the gramophone became the first personal communication and entertainment media. On this basis, the United States continued to expand its leading role in the field of media

66 Cf. Flichy 1994 (see note 15), pp. 127–144.

67 Cf. Charles Cros, *Œuvres complètes* (Paris, 1970), pp. 579–582, 1223f.

68 Edison's first notes about a "talking telegraph" date from July 18, 1877, and the first public presentation of the phonograph took place on December 6, 1877.

69 Cf. Kittler 1986 (see note 31), p. 38.

70 Gernsheim 1983 (see note 22), p. 693, here falsely named Charles Gros.

technology, a role already established by electrical telegraphy according to Morse's system. The inferiority complex of Americans toward the cultural traditions of the Old World, which so preoccupied Samuel Morse as a painter, was replaced in the second half of the nineteenth century by Europe's technological inferiority complex toward America. The personification of the superiority of American business creativity over the old European ideals of progress through culture and science was the self-made man and tireless inventor-entrepreneur Thomas Alva Edison.

THE PHONOGRAPH: A PHILOSOPHICAL MACHINE?

The phonograph's principle of sound storage was discovered by Edison as a coincidental by-product of his work in the field of telegraphy (fig. 21). At variance with Edison's systematic strategy of developing inventions for a recognizable need in order to achieve quick commercial success, the phonograph was initially created with no clear purpose. To be sure, Edison touted the machine's "unlimited" possibilities and made every effort to support this with numerous examples. Among these uses were: singing children to sleep, recording the last words of famous men, disseminating spoken books by the millions, playing musical compositions backward, more slowly, or more quickly, or—half jokingly—recording men's professions of love so that deceived women could play them back to them later.[71] Yet these ideas can hardly conceal the fact that the device had certainly not yet found its "killer application."

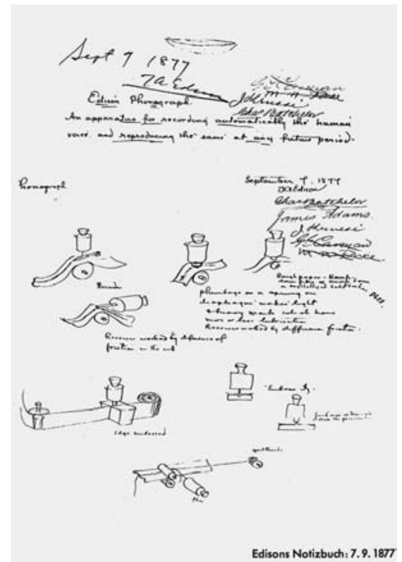


Figure 21: Thomas Edison's notebook entry from September 7, 1877, on the phonograph.

Admittedly, the phonograph initially fulfilled a very different purpose: it made its inventor world-renowned, which was not unwelcome to the entrepreneur Edison, who was very interested in publicity. Most crucial were the device's epistemic implications. The fact that the past had become reproducible triggered far-reaching speculation. The numerous reactions in the United States and even more so in Europe can be summarized in a question: If an apparatus can factually demonstrate something that had previously been impossible in the conception of the world according to Aristotelian physics—namely that the river of time can be stored, reproduced, and even played backward—does this mean that future advances in science, philosophy, physics, and physiology may be achievable through technology from now on? Did this mark a victory of apparatus-based

71 Cf. in this regard Edison's article of 1878 (Neil Baldwin, *Edison: Inventing the Century* (New York, 1995), p. 403); further sources in Villiers de l'Isle-Adam, *Œuvres complètes,* 2 vols., ed. Alan Raitt and Pierre-Georges Castex (Paris, 1986), vol. 1, p. 1445. As Lisa Gitelman points out, it took more than ten years before Edison launched the first successful product based on the phonograph. This was the simple nickel-in-the-slot phonograph as a public playback medium and not the entertaining-epistemological device of the early public demonstrations, and it shifted the medium's main purpose from recording to playback (Lisa Gitelman, *Always Already New: Media, History and the Data of Culture* (Cambridge, MA, 2006) pp. 25–57).

experimentation over the central territory of humanistic thought? Analogies were drawn with the function of the human memory, which had previously been the sole means of storing time. "Is the brain a phonograph?" was the seriously discussed question.[72] Yet that the phonograph was actually a philosophical machine or epistemic thing that changed humanity's view of the world just as photography had was a potential explored neither by Edison nor by anyone else in America, but by a writer of the Parisian bohemian milieu.

BOHEME AND BUSINESS: VILLIERS AND EDISON

Parallel to the announcement of the invention of the phonograph, Phillippe Auguste Mathias Comte de Villiers de l'Isle-Adam decided to dedicate a leading role to its creator in his novel *The Future Eve*.[73] This was not a topic he came across by chance, for he was a friend of precisely that ingenious inventor Charles Cros who had discovered the principle of sound recording a few months before Edison.[74] Moreover, Cros wrote satires about contemporary technical materialism which only accepted the factual and declared the imaginary to be superfluous. This was something he had been forced to painfully experience through his own never-realized inventions. Cros' companion Villiers now made Edison, nine years his junior and whom he did not know personally, the hero of a novel. He has him express all the philosophical speculations that people in Europe contemplated in regards to the New World's technical advances. Thus in the introductory monologue, he agonizes about those sounds that are lost forever, such as the trumpets of Jericho or the words of Christ.

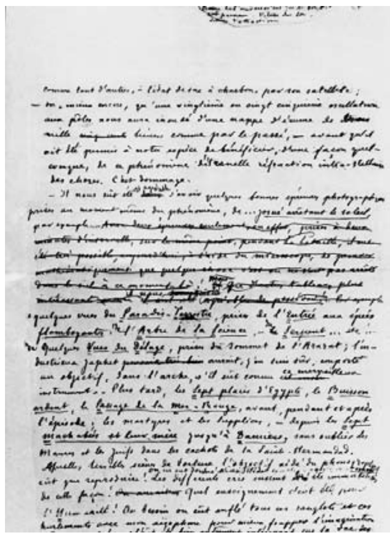


Figure 22: A page from Villiers de l'Isle-Adam's manuscript for *L'Eve future*.

According to Mallarmé, Villiers had written the novel in complete destitution, "flat on his stomach on the floor of a room completely empty of furniture in the glow of a candle stump" and in the icy cold (fig. 22).[75] As a prototype of the nobleman reduced to the rank of poor poet, whose forefathers nonetheless had conquered Paris for the Burgundians in 1418 and defended Malta in 1521 against Sultan Suleiman, he had devoted himself to the new rulers legitimized by technology. His Edison lived in a castle surrounded by the broad expanses of a protected park. Edison himself, in his functionally organized workshop in Menlo Park twenty-five miles outside of New York and which had more of a Wild-West atmosphere, could initially have hardly known anything about the honor of poetic immortalization accorded to him, especially since Villiers's novel was not published as a book until 1886. When Edison first came to Paris for the World's Fair in 1889, he was celebrated as a star and introduced to numerous monarchs, industrialists, and intellectuals. Friends of Villiers, who in the meantime had become terminally ill, tried in vain to arrange a meeting with Edison. Whether he acknowledged the copy of *The Future Eve* they had sent him in advance is not known.[76] He evidently never mentioned the novel, for in Edison's many very detailed biographies, one searches without success for the name Villiers. As the cruel irony of fate would have it, Villiers died in complete poverty in 1889, just as Edison was courting the entire world in Paris.

THE MEDIA-TECHNOLOGY SYNTHESIS OF VILLIERS'S *EVE FUTURE*

The ideas in Villiers's science-fiction novel were so far ahead of their time that they were not widely understood until a century later. The interchangeability of man and machine through simulation by an avatar that is just as intelligent as it is physically attractive anticipates the themes of cyborgs and cybersex that have been popular since the 1990s.[77] Villiers managed these astonishing foresights by looking ahead at the potential of a synthesis of storage and transmission media. Starting from the phonograph and photography, he extended the ability to record the voice to all gestures and movements of the body, and it should be noted that this was more than ten years before the invention of film. At the same time, he assumed that anything that was technically reproducible could in principle also be technically produced.

There has been some examination of the role of the phonograph in Villiers' novel, but less study of the role he imagined for telemedia. Control of the female robot named Hadaly was based on a telephonic transmission between Edison and Hadaly's invisible alter ego, the psychic medium Sowana, lying in a trance, who in turn was telepathically linked with Edison. Thus the concepts of the nineteenth-century spiritualist medium and the technical medium of the twentieth century overlapped. Yet this telematic-telepathic two-channel connection was only the first step toward Hadaly's media-technology genesis, which quickly followed her electrical recreation. Lord Ewald, a young Englishman who was just as unhappy as he was head over heels in love, allowed Edison to project the object of his affections, Alicia Clary, an American who was perfectly beautiful but unutterably

72 Baldwin 1995 (see note 71), p. 439.

73 Villiers de l'Isle Adam, *L'Eve future*, ed. J. Bollery and P.-J. Castex (Paris, 1957), and in Villiers 1986 (see note 71), vol. 1. Villiers's idea for the novel went back at least to the year 1877, and after several drafts, the manuscript was completed at the end of 1879. The significance of the phonograph for the novel's inception is unclear, since before the end of 1877, the device could hardly have been spoken of in Paris, just as Edison did not become known there until 1878. Yet Villiers specified him in February 1877 as the subject of his novel (Villiers 1986 [see note 71], p. 1444). In the first longer drafts, the phonograph is only mentioned in passing, while electricity is more important (Villiers 1957, p. 379). The novel's publication history is complicated and confused; after two partial publications in magazines beginning in 1880, it first appeared in complete book form in 1886.

74 On Cros's influence on the determination of the theme cf. Villiers 1986 (see note 71), pp. 1442ff. Cros wrote with corresponding cynicism: "J'ai résisté, pour ma part, a l'envahissement bruyant de l'Amerique—en fait d'inventions: phonographe, photophone" [I resist, on my part, America's loud invasion—in terms of inventions: phonograph, photophone] (Cros 1970 [see note 67], p. 649).

75 Mallarmé in Villiers de l'Isle Adam, *L'Eve future* (Lausanne, 1972), p. 10. This episode was confirmed by a close friend of Villiers, Gustave Guiches (Alan Raitt, *The Life of Villiers de l'Isle Adam* [Oxford, 1981], p. 188).

76 Ibid., p. 354, and in id., *Villiers de l'Isle-Adam, Exorciste du reel* (Paris, 1987), pp. 359, 428, note 15.

77 Cf. http://www.medienkunstnetz.de/themen/cyborg_bodies/.

stupid, onto the female android as a simulation. To make her voice, facial expressions, and gestures available to Lord Ewald, Alicia was put into a trance and then through the use of an acoustic and optical phonograph systematically recorded in all possible poses.[78] The description of the procedure anticipates elements of film technology, the first rudiments of which were in fact preoccupying Edison even at that time, but which would not lead to his "kinetoscope" until ten years later.[79] Yet because the goal of the technology imagined by Villiers was not reproduction but simulation of physical appearance, the process has actually only been realized today through the Motion Capture System, which makes it possible to store a real person's movements in order to transfer them onto a computer animation as a virtual actor. After Villiers' female android Hadaly had completely assumed Alicia's features, she was given a basic intellectual repertoire consisting of sentences, also spoken by Alicia, from some of the greatest minds in the world and which her inventor, Edison, had acquired solely for this purpose. Thus the defect of simplemindedness in the beautiful body was corrected, and Hadaly became far superior to all female robots preceding her, of the ilk of E. T. A. Hoffmann's Olimpia, admirers of whom always had to be satisfied with an ever-identical "alas."[80]

MACHINE POETRY AND VIRTUAL BODIES

Villiers selected Thomas Edison to be his hero since he saw in him the exponent of a new form of imagination that was no longer satisfied with poetic fictions, but instead articulated itself in technical devices and thus led to real functions against the wondrousness of which all poetic inventions paled—at least in the judgment of his time, which was characterized by a belief in progress and positivism. Villiers attempted to respond to the competition of technology by trying to anticipate its possible consequences all the way to its final, still fictitious culmination. In the novel's key scene, upon first meeting the female android Hadaly, Lord Ewald believes her to be the intellectually matured Alicia—and even after he realizes his mistake he is willing to spend the rest of his life with this machine. The scene ends with a eulogy to the imaginary, the deep irony of which lies in the fact that it is recited by the android.[81] Thus the Edison of the novel can finally be as "enthusiastic as a poet" about his creation.[82] This shows that Villiers's novel also deals with the substitution of media for art that began with Morse and Daguerre. Not until the avant-garde era at the beginning of the twentieth century did the phonograph become a feasible instrument for sound poetry freed from the written word and thus a means toward literature expanded by media instead of being its end.[83]

78 For Villiers, 1957 (see note 73), p. 319.

79 A common source of inspiration for Edison and for Villiers could have been an article about a "kinesigraph" from *La Nature* in 1878, which also appeared in New York's *Sunday Star* and can be found in the notebooks of Edison's assistant (Baldwin 1995 [see note 71], p. 211). For Villiers, an important source of information on Edison seems to have been the article "Le Phonographe e l'Aerophone", *La Nature* 260 (25.5.1878) p. 405. Here Edison also promotes the idea of speaking dolls with a small phonograph in their body. Only ten years later, Edison tried to put such dolls on the market. To produce them, young girls had to sing all day children's songs into the phonographs, because there was no way to reproduce the recordings mechanical (Baldwin 1995 [see note 71], p. 195f).

80 E. T. A. Hoffmann, *Der Automatenmensch*, ed. Lienhard Wawrzyn (Berlin, 1994), pp. 85–88, 122.

81 Villiers 1957 (see note 73), p. 288.

82 Ibid., p. 320; about Hadaly as a "new artwork," p. 321.

83 Cf. the essay by Cornelius Borck pp. 108–129, in this volume.

Yet what type of imagination does technological progress require? According to one of Thomas Edison's notorious dictums, inventions are ninety-nine percent perspiration and one percent inspiration, but even then the question remains of where that decisive last percent comes from. In his old age, Edison wrote less pragmatically: "Inventors must be poets that they may have imagination."[84] This certainly does not mean, however, that inventors also have to read literature. Nevertheless, the importance of science fiction as a stimulus for technical innovation is generally recognized today.[85] Due to the difficult circumstances of its publication, Villiers' novel, however, could hardly have served as a source of inspiration for inventors of technology in its day.

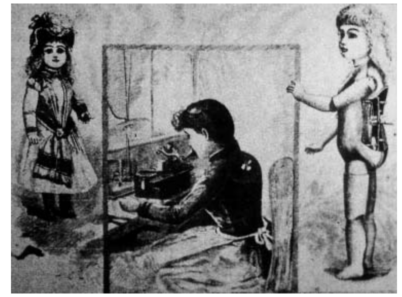


Figure 23: Thomas Edison, a doll with a phonograph and a young woman, whose voice is being recorded onto the cylinder, from *La Nature*, 1890.

Figure 24: Kyoko Date, 1996, the first virtual pop star.

Today, poetic fiction and media-technology function are hardly closer anywhere else than in precisely that field which Villiers first recognized the implications of: the embodiment of media. To name just two examples of this: William Gibson's 1996 novel *Idoru* describes an entity born in the Internet with the Japanese-sounding name Rei Toei. While it looks like a charming young woman, it is composed of pure information. That same year, the Japanese model and music agency HoriPro introduced the world's first virtual star, Kyoko Date, onto the market (fig. 24). Not based on any real human model, this computer-animated simulation of a pop star appeared in video clips and television shows, gave interviews, and had a fictitious biography. She maintained contact with her community of fans over the Internet, where some of her admirers are said to have fallen in love with her, and the rest at least bought her music CDs. The futurological vision and the first steps of its realization are linked in the person of the computer scientist and futurologist Ray Kurzweil. For the year 2029 he prophesies the emergence of art by machines for machines: "Cybernetic artists in all of the arts—musical, visual, literary, virtual experience, and all others—no longer need to associate themselves with humans or organizations that include humans."[86] As a

84 Baldwin 1995 (see note 71), p. VIII.

85 Cf. Klaus Burmeister and Karlheinz Steinmüller, eds., *Streifzüge ins Übermorgen: Science-fiction und Zukunftsforschung* (Weinheim, 1992).

86 Ray Kurzweil, *The Age of Spiritual Machines* (New York, 1999) p. 223. Cf. the on-line glossary: "Cybernetic artist: A computer program that is able to create original artwork in poetry, visual art, or music. Cybernetic artists will become increasingly commonplace starting in 2009." (http://us.penguingroup.com/static/packages/us/kurzweil/excerpts/glossary.htm (accessed October 11, 2007).

foretaste, he built himself a second, virtual identity in the form of a rock singer named Ramona, the computer animation of which he controlled with his own body movements during live performances, also digitally altering his own voice to a female pitch. One can also chat with Ramona in the Internet, and she will guide visitors through Kurzweil's Web site.[87] Avatars like this, which partially through human control and partially by means of intelligent programs become entities with relatively complex interactional behavior, correspond in principle to the composition of Villiers's female android, for which a human psychic medium also controlled its phonographically stored patterns of behavior.

INSPIRATION INSTEAD OF PERSPIRATION: NIKOLA TESLA

In the typology of inventors, Nikola Tesla is an antipode to the American self-made man and inventor-entrepreneur Thomas Alva Edison. Tesla studied electrical engineering at the University of Graz, had a deep knowledge of mathematics and physics, and succeeded at times in combining the fundamental research of the European tradition with American business technology. He never achieved Edison's economic success, but after a short collaboration became his greatest competitor, particularly in the famous battle of the systems between Tesla's alternating current and Edison's direct current, which Tesla's scientifically supported theory ultimately won.

During his lifetime, Tesla did not become the hero of a novel, yet the facts and myths about his life nonetheless make just as exciting reading.[88] He styled himself as a dandified, walking work of art. He was always elegantly dressed and lodged as a long-term resident in the best hotels. Besides leading a completely mysterious and absolute celibate private life, he had various obsessions, phobias, and neuroses, such as never using a napkin more than once or being unable to stand the presence of women with earrings. His intellectual abilities were just as legendary—from having a photographic memory to his hypnotic ability to convince potential sponsors of his projects. Although Tesla dismissed the greatly popular spiritualism and occultism of the time, his legend continues to be particularly associated with esoteric circles and conspiracy theories. The mythification in this regard exceeded common sense, at least since the 1950s, in a huge amount of pseudo-scientific Tesla literature. Tesla may have claimed to have received radio signals from Mars—although he may only have discovered radio astronomy—but now he was being stylized as the ambassador of a distant planet, who as a "Venusian" was taking care of things among us earthlings.[89]

Tesla's valid scientific accomplishments lay in the field of high-voltage engineering and the invention of alternating current. The flux density of electrical induction is therefore still measured in a unit called a "Tesla" to this very day. Tesla also carried out experiments with radio technology

87 www.kurzweilAI.net.

88 The details are from the biography by Margaret Cheney, *Tesla: Man out of Time* (Englewood Cliffs, 1981), and that by Tesla's contemporary John O'Neill, *Tesla* (Frankfurt am Main, 1997). A comprehensive and reliable biography about Tesla is unfortunately not yet available.

89 As stated in 1959 in the biographic novel *Return of the Dove* by Margaret Storm (Cheney 1981 [see note 88], p. XIII).

very early on—beginning around 1893—which gave rise to the ongoing debate about his or Marconi's precedence. Descriptions of Tesla's laboratory and of his experiments sound just as fantastic as those of Edison in Villiers' novel. He became world famous in his own time through his lectures and demonstrations, the sensational effects of which surpassed any magic show and made him the worthy successor of the Baroque era's electrical amusements. He surrounded his entire body with an aura of electrical flashes, for example, or allowed flames of electricity to wander like ghosts through the room.

Behind the façade of the dandy and showman-experimenter was Tesla's unique combination of an intuition that could not be rationally comprehended and his knowledge of mathematics and physics. Edison achieved most of his results through obstinate trial-and-error work, and many of his inventions were based on clever combinations of already-known patents. In contrast with Edison's famous dictum that inventions were ninety-nine percent perspiration and one percent inspiration, Tesla conceived of his inventions in a flash of intuition that can only be compared with divine inspiration, artistic genius, or paranormal delusion.[90]

All three of these elements can be found in his biography. Tesla was born the son of an orthodox clergyman and was supposed to follow in his father's footsteps. In his youth, he had seen sudden apparitions accompanied by strong flashes of light, and percieved intensive synaesthetic connections between objects and words.[91] According to his own accounts, Tesla wrote poetry throughout his life, but because he considered it too personal, he never had it published.[92] He is said to have surprised friends by reciting poetry in their respective mother tongues, be it English, French, German, or Italian.[93]

Tesla's essays in scientific, technical, and popular magazines are distinguished by literary style, and they are more likely to concern philosophical questions than just dry facts. Because they stemmed from an acknowledged researcher but touched upon subjects completely beyond the scope of technology, they were an eminent source of inspiration to his contemporaries. In the text "The Problem of Increasing Human Energy," published in 1900 in the widely circulated *Century Magazine,* he described in Faustian style a cosmic panorama of human history, ending this with a poem by Goethe. Soundly based and from today's point of view, completely correct prophecies, such as the production of aluminum airplanes, global wireless communication, or the development of artificial intelligence, appeared there in the context of his far-reaching metaphysical speculations. The text delineates a whole philosophy of life, extending from hygiene to war and peace, and

90 In an obituary on Edison in the *New York Times* Tesla wrote: "His method was inefficient in the extreme, for an immense ground had to be covered to get anything at all unless blind chance intervened and, at first, I was almost a sorry witness of his doings, knowing that just a little theory and calculation would have saved him 90 per cent of the labor. But he had a veritable contempt for book learning and mathematical knowledge, trusting himself entirely to his inventor's instinct and practical American sense." (*New York Times*, October 19, 1931, p. 25).

91 Nikola Tesla, *Lectures, Patents, Articles* (Belgrade, 1956), p. A-120.

92 Cheney 1981 (see note 88), pp. 7, 195.

93 The only bibliographical trace of this poetic passion is Tesla's introduction to and translation of poetry by the Serbian poet Zmai Jovan Jovanovic, in which he emphasizes the role of poetry as the savior from despair. Zmai Jovan Jovanovic, *Songs of Liberty and Other Poems* (New York, 1897).

from ecology through sexual morals to religion. The solutions that Tesla offers to all of these questions always appear with the aspiration of being ultimately justifiable in positivist, scientific terms. Thus he makes the sweeping statement that all movements of nature, including human life, must be rhythmic. In doing so, Tesla's wish is also to provide a metaphysical justification for alternating current: "Man, however, is not an ordinary mass, . . . his mass, as the water in an ocean wave, is being continuously exchanged, new taking the place of the old."[94] Long before all scientific analysis, Goethe had comparably described electricity in a romantic-emphatic sense as the "soul of the world." While such universalistic imagery promoted the popular success of Tesla's theses, they nonetheless caused lasting harm to his scientific credibility.

Even more drastic was Tesla's own description of a synthesis of poetry, delusional intuition, and real scientific innovation:

> On one occasion, ever present in my recollection, we were enjoying ourselves in the City Park. I was reciting poetry, of which I was passionately fond. "Sie rückt und weicht, der Tag ist überlebt, Da eilt sie hin und fordert neues Leben, Oh, dass kein Flügel mich vom Boden hebt Ihr nach und immer nach zu streben! Ach, zu des Geistes Flügeln wird so leicht kein körperlicher Flügel sich gesellen!" As I spoke the last words, plunged in thought and marveling at the power of the poet, the idea came like a lightning flash. In an instant I saw it all, and I drew with a stick on the sand the diagrams which were illustrated in my fundamental patents of May, 1888.[95]

Thus, according to his own account, the inspiration came to him for the most important of his numerous three-phase current engine patents while reciting a Faust monologue in German. Even during his lifetime, however, Tesla strictly dismissed all paranormal phenomena, wholly unlike Edison, who even in the 1870s unsuccessfully attempted to propose an "etheric force," a crude mixture between the anticipation of wireless telegraphy and spiritualist influences. In fact, Edison was a member of the theosophical society of Madame Blavatsky at that time—thus a simple comparison of the pragmatist Edison and the visionary Tesla is not enough to explain their differences.[96]

Crucial to an understanding of Tesla is his parareligious and poetic dimension. For him, science and technology were morally founded, and according to his own statements, this led him back to the Christian roots of his childhood.[97] In Tesla's manifesto at the turn of the century, visions and knowledge combined into an amalgamation of a poetically evoked technoreligion that at the same

94 Nikola Tesla, "The problem of increasing human energy," *The Century Illustrated Monthly Magazine* (June 1900), cited in Tesla 1956 (see note 91), p. A-111.

95 Ibid., p. A-198. The German poem is from Goethe, *Faust I*, the Faust monologue "Before the Gate" (thanks to Wolfgang Hagen for the suggestion). Translation: "He [the sun] sinks and fades, the day is lived and gone, he hastens forth new scenes of life to waken. O for a wing to lift and bear me on, and on, to where his last rays beckon!" From Johann Wolfgang von Goethe, *Faust*, trans. Charles T. Brooks (Boston, 1858).

96 Baldwin 1995 (see note 71), pp. 62–65, 376, 440, note 93. A possible connection to the spiritualist aspect of Villiers' novel also exists here. At the Paris World's Fair that Villiers certainly visited, Edison exhibited—among his telegraph tickers, telephones, phonographs, and generators—his "etheric force black boxes" to demonstrate this new power (ibid., p. 131).

97 Tesla 1956 (see note 91), pp. A-147, A-128.

time laid claim to absolute positivist truth, and in this respect it can be compared with Scientology. As a result of the publication of this text, in which he introduced his world energy transmitter, he was able to find a financial backer for the project. In the same year and with the support of the most powerful banker in America, J. Pierpont Morgan, Tesla began construction of the large transmitter tower on the Long Island property he had named "Wardenclyffe" (fig. 25). In 1904, he summarized the aims he was pursuing with this project as follows:

Figure 25: Nikola Tesla, advertising brochure for the world telecommunications tower in Wardenclyffe.

> World telegraphy . . . will prove very efficient in enlightening the masses, particularly in still uncivilized countries and less accessible regions, and . . . will add materially to general safety, comfort, and convenience, and maintenance of peaceful relations. It involves a number of plants, all of which are capable of transmitting individualized signals to the uttermost confines of the earth. Each of them will be preferably located near some important center of civilization, and the news it receives through any channel will be flashed to all points of the globe. A cheap and simple device, which might be carried in one's pocket may be set up anywhere on sea or land, and it will record the world's news or such special messages as may be intended for it. Thus the entire earth will be converted into a huge brain, capable of response in every one of its traits.[98]

Such prophecies made Tesla a shining example for the next generation of radio inventors, such as Lee De Forest and Reginald Fessenden.

Yet Tesla's world transmission tower ended on a less utopian note. It was not supposed to radiate Hertzian radio waves, but to disseminate messages by modulating high-frequency electrical vibrations, the resonances of which were to spread across the globe. In line with Tesla's credo of the universality of rhythm, he also foresaw the ability to transmit large amounts of electrical energy in this manner throughout the entire world. Before it ever became quite clear what actually happened in the tower or how its technical function had been conceived, criticism multiplied about Tesla's grandiose plans. His obstinate claims that wireless telegraphy would not be based on Hertzian waves also contributed to the undermining of his scientific reputation. But above all,

98 Tesla in an article in *Electrical World Engineer* (March 5, 1904), cited in Cheney 1981 (see note 88), p. 178.

Marconi's transmission across the Atlantic of the three 'dots' of the letter 's' using far simpler means in the year 1901 was the signal for Tesla's financial backer that something was awry with Tesla's plans. Thus due to a lack of further funding, the tower remained an imposing ruin. After years of disuse it was finally demolished in 1917. Its value as scrap paid the accrued hotel bills for its creator's long-term residence in New York's Waldorf Astoria. Tesla became a mockery in the press, and his career as an inventor was over.

By returning to his childhood roots, the inspirations and visions of the poet and preacher Tesla finally exceeded his own scientific capacity as well as those of his era. His fate can be summarized against his contemporary background as follows: where science and fiction remain separated in the case of the two protagonists Edison and Villiers, they form a hybrid identity in Tesla's person in a manner just as fascinating as it was ruinous. His prophecies about the functioning of the tower as a "magnifying transmitter" even escalated in various articles after the project's inglorious end; to the worldwide transmission of music and images, he then added a global, wireless navigation system and a constant time-signal transmission for clocks. None this would be fulfilled, however, until a hundred years after Tesla's "world system," in the illustration of which he lapsed more and more into the technological mythification of universal vibrations. While this mixture of prophesy, poetry, and technology led to his bankruptcy, his futuristic visions were nonetheless just as momentous as his actual inventions.

Today, Tesla's popularity in various fields of culture significantly exceeds his scientific legacy. In contemporary media art, his inventions serve as an inspiration just as much as his utopias and legends. The spectrum ranges from Marko Lulic's reenactments of the famous—but fake by means of double exposure—photos showing Tesla surrounded by flashes of electricity in his laboratory, to Jan Peter R. Sonntag's *sonArc::ion* installations and performances with high-tension plasmas and Tesla coils, as well as the tesla medien kunst labor (Tesla Laboratory for Media Art, 2005–07), which has dedicated itself to the production and presentation of media art in Berlin. As the most notorious *inventeur maudit,* Tesla has become part of popular culture. He has featured in several fiction motion pictures; the most famous actor in the role of Tesla being David Bowie.[99] A hard-rock band from Sacramento, California, call themselves "Tesla," and a Tesla theme park has been opened in his native Croatian village of Smiljan.

Translated from the German by Sean Gallagher

99 *The Prestige,* 2006, directed by Christopher Nolan, with David Bowie as Nicola Tesla. For an extensive list of references go to http://en.wikipedia.org/wiki/Nikola_Tesla_in_popular_culture (accessed November 12, 2007).
* Parts of this essay have been pubished in Dieter Daniels, *Kunst als Sendung: Von der Telegrafie zum Internet* (Munich, 2002).