Compendium

Introduction
Dieter Daniels and Sandra Naumann

The Perennial and the Topical

The time span and thematic area covered by this compendium range respectively from antiquity to the present day and from philosophical models to existing apparatus and tools, for example from the Pythagorean theory of universal harmony to the audiovisual software of music visualization plug-ins for mp3 players. The immense field under examination, both with respect to its content and its history, is, however, held together by an abundance of cross-references. This introduction will examine how apparently perennial, supra-historical questions are intertwined with highly topical issues. The relationship between history and the present is at times almost paradoxical here. Scientific and technological progress may lead one to believe that a wealth of conundrums and false turns from antiquity to the eighteenth century have been definitively resolved, whereas in actual fact questions that have been debated for hundreds and thousands of years are still being reformulated in similar ways today. The differences in methodology and chronology found across the many arts and sciences concerned complicate the issue further. This compendium seeks to address the problem by examining the subject matter from multiple specialist perspectives and by approaching it from two different angles: both historically (in section I) and systematically (in section II).

The point of departure is a review of the artistic fields and forms in which the current multiplicity of relations between sight and sound manifests itself.[1]

In today's media-oriented society, the coupling of images and sounds has become as ubiquitous as it is inescapable. Through audiovisual technology, not only hearing and seeing, but also the aesthetics, technology, and economy of the visual and the auditory have become connected with one another in multifaceted ways. This applies equally to our leisure activities and our work environments, to the active production of audiovisual content, and to the reception of the mass media. As indicated by the neologism "prosumer," production and consumption can no longer be sharply distinguished. Embedded as we are today in an audiovisual media environment, we find it difficult to imagine a time when the technical ubiquity of images and sounds did not exist. Yet we need

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[1] The analysis of the topic's history, proceeding from the present day, is the leitmotif of the entire *See this Sound* project, including the associated exhibition. Cf. Dieter Daniels and Stella Rollig, preface to *See This Sound. Promises in Sound and Vision*, Lentos Kunstmuseum Linz, eds. Cosima Rainer, Stella Rollig, Dieter Daniels, and Manuela Ammer (Cologne: Verlag der Buchhandlung Walther König, 2009), 12.

only look back barely one hundred years to realize that for the longest period in the history of civilization, the auditory and the visual were not technically linked.

The history of sound-image correlations began long before the media age, as the reader will learn from many of the contributions to this compendium. Three distinct pre-histories, which are fundamentally separate but also selectively connected, emerge:

1   The theory and practice of relationships between colors and sounds.
     Over history, numerous mythological, philosophical, mathematical, physical, and metaphysical models were constructed that postulated the correspondence of colors and sounds.[2] These models were often encyclopedic systems of analogies and references between planets, metals, the cardinal points, seasons, numbers, flora, and fauna; they were an expression of the yearning for a holistic formula to explain the world, which would subsume the cosmos and the psyche under the harmony of a higher order. They were also the point of departure for repeated experiments to construct color organs designed to translate such theoretical models into perceptible evidence, but these ultimately foundered on the reality that an intersubjective standardization of color-sound correspondences simply is not possible.[3] Although such models have been outmoded by modern physics research and media technology, they nonetheless dealt with questions that remain relevant today both for the study of neurological synesthesia and for the sonification and digital parameter mapping of visual and acoustic data.[4]

2   The evolution of human perception.
     This concerns the differentiation and (re-)synthesis of hearing and seeing over the course of natural evolution and their subsequent cultural conditioning, an aspect of human evolution that is represented by multimodal integration as an element of the perceptual capacity of the individual.[5] Several anthropological theories dating from the early twentieth century are based on the assumption that the senses had a single common precursor from which the individual sense faculties developed over the course of evolution. Also, it is allegedly possible to demonstrate that certain "primeval synesthesias" existed over the course of human development and history.[6] Today, neurologists are exploring the hypothesis that during early neonatal development the sensory regions in the brain advance from synesthetic processing to neurologically differentiated, single-sense processing.[7]

3   The combination of auditory and visual forms of expression in human culture.
     Since human prehistory, live performances of rituals and artworks have combined sight and sound as articulated by the body, voice, gestures, and

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2   See the chapter "Color-Tone Analogies" by Jörg Jewanski in this volume.

3   See the chapter "Color Organs" by Jörg Jewanski in this volume and the comparison of different analogies in terms of the position of the color red in "Color-Tone Analogies" by Jörg Jewanski in this volume.

4   See the chapter "Synesthesia" by Hinderk M. Emrich, Janina Neufeld, and Christopher Sinke, the chapter "Sonification" by Florian Grond and Theresa Schubert-Minski, and the chapter "Parameter Mapping" by Tina Frank and Lia in this volume.

5   See the chapter "Audiovisual Perception" by Gerhard Daurer in this volume.

6   On primeval synesthesia, see Albert Wellek, "Die Farbe-Ton-Forschung und ihr erster Kongreß," *Zeitschrift für Musikwissenschaft* 9 (1927): 576–584.

7   See Daphne Maurer, "Neonatal Synaesthesia. Implications for the processing of speech and faces," in *Synaesthesia. Classic and Contemporary Readings*, eds. Simon Baron-Cohen and John E. Harrison (Oxford: Blackwell, 1997), 224. Also see the chapter "Synesthesia" by Hinderk M. Emrich, Janina Neufeld, and Christopher Sinke in this volume.

mimicry in dance, theater, and music, and with the support of costumes, masks, and musical instruments, not to mention the use of light. From sacred torch-lit dances in prehistoric caves to the sound of the organ under the stained-glass windows of cathedrals, the creation of an audiovisual whole was deemed to be an extraordinary experience, often with a spiritual meaning. Whereas these audiovisual expressions were bound to the moment of their execution, technical mass media have now enabled the conservation and reproduction at will of auditory and visual sensory impressions on film, video, and DVD. Nonetheless, live performance is currently experiencing a renaissance: especially in the live visuals found in club culture, the transcendence and corporeal immediacy of an audiovisual coupling on the basis of the new media are celebrated more excessively than ever before.

At all three levels, then, nature, culture, and technology overlap: the physical, physiological, and perceptual basic conditions, and their active and conscious human shaping through cultural and artistic practices as well as their potential expansion by means of technical media.[8] All three levels also show how the apparently perennial and highly topical aspects are intertwined with one another.

But for all this entanglement between history and the present, the state of knowledge is different today, while the questions we pose are also different to those of our predecessors for there have been three decisive changes in the boundary conditions:

— Since the development of modern physics and the work of Isaac Newton and Thomas Young, we know that light and sound are two entirely separate phenomena: sound waves are oscillations of pressure that travel through a gas, liquid, or solid, which is why outer space is silent (there is no air), while what we refer to as light is that small part of the electromagnetic spectrum visible to the human eye—the same spectrum that comprises both the microwaves of kitchen appliances and the long waves of radio bands. Physically, it is not possible to integrate the frequencies of light and sound in an overarching cosmic harmony, as has been attempted time and again since the days of Pythagoras, and neither can they be placed in a mathematically expressible proportional relation with the planets, metals, cardinal points, seasons, and so forth.

— We know that our sensory perception is the actual "location" where light and sonic waves meet to become audiovisual experience because we have eyes and ears and our brain processes and interrelates the signals from theses sense organs in parallel. The complexity of our system of sensory perception has tasked a number of scientific disciplines from Hermann von Helmholtz's physiology up to contemporary neurological synesthesia and intermodal research, but is still imperfectly understood.

— Since the era of Thomas Edison, we have been constructing many and diverse audiovisual media devices, which in the meantime have become an integral part of our lives. In the nineteenth century, the first cinematographs and phonographs occasioned amazement and even fright; today, by contrast, personal privacy and public spaces are invaded by pervasive and often aggressive audiovisual messages or by omnipresent "ambient media" that are perceived almost below the threshold of consciousness.

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8 On the difference between automatic "multimodal integration" and the conscious and active creation of "intermodal analogies," see the chapter "Audiovisual Perception" by Gerhard Daurer in this volume. A model with five levels is developed by Michael Haverkamp.

Today we are aware that our synthesis of hearing and seeing is a complex, subjective achievement, which has no counterpart in the physical nature of light and sound. Thus, the centuries-old quest to discover an analogy in nature between optical and acoustic phenomena failed of necessity. However, we have created in audiovisual media a counterpart to our complex achievement of synthesis, which we take entirely as a matter of course and which surrounds us like a "second nature." The yearning for correspondences between sounds and images has been satisfied by a techno-cultural achievement, and not by speculation about the physico-mathematical structures of the optical and the acoustic. Nonetheless, the mathematical models of correspondence that have been developed since classical antiquity are more relevant today than ever before because digital technology has rendered the optical and the acoustic de facto calculable, transformable, and manipulable at will.[9]

A Possible and Impossible Chronology

The paradox inherent in the subject area (that it is at once perennial and topical) is also reflected in this compendium of audiovisuology. Compiling an overall timeline from the chronological depictions of individual art forms proves to be difficult. The time frames of the individual themes vary too much: the connections between painting and architecture, on the one hand, and music, on the other, go back to classical antiquity; the audiovisual techniques of synchronization date from the late nineteenth century; audiovisual software, sound design, and live visuals developed only in recent decades with the aid of digital technology.[10] At the same time, all of the academic disciplines involved have meaningful timelines for their own particular subject, and there are also a number of common historical reference points that are considered as being of key significance, albeit in each case for different reasons.

In this way, a web of parallel narratives develops that has interlinks and stretches of common history with attendant bifurcations, but possesses no universal model in which each of the art forms, media technologies, and media practices dealt with here has its explicit, historical, and systematically defined place. The biased perspective of academic disciplines is demonstrated in an exemplary way by the manner in which the auditory is separated from the visual. The "deafness" of the disciplines that engage with images, and the "blindness" of the disciplines that engage with music and sound are of seminal relevance to the central concern of this volume. The attempt to delineate the transdisciplinary field of audiovisuology encounters similar problems to those described by Bruno Latour for science studies: the socio-technical networks that exist between the individual disciplines are not visible from the perspective of the disciplines themselves; at the same time, they have real effects that constantly defy scientific explanation.[11] The main concern of this volume is to take the interconnection points and synergy effects of the different disciplinary perspectives and to render them useful within a network comprised of the theories and disciplines involved.

The study is also complicated by the fact that the speed of audiovisual praxis today far outstrips that of theory formation. In the areas that are currently most

[9] See the chapter "Parameter Mapping" by Tina Frank and Lia in this volume.

[10] See the chapters "Painting" by Andrea Gottdang, "Architecture" by Ulrich Winko, "Synchronization" by Jan Philip Müller, "Software Art" by Golan Levin, "Sound Design" by Barbara Flückiger, and "Live Visuals" by Amy Alexander, all in this volume.

[11] Bruno Latour, *We Have Never Been Modern*, trans. Catherine Porter (Cambridge, MA: Harvard University Press, 1993), 3–11.

active, the process of defining historical situatedness and theoretical contextualization only begins retrospectively and at the same time serves as a strategy to legitimize the establishment of new forms of art. This is the reason why artistic self-contextualization often leads to historiography about precursors a posteriori, as in the example of the ocular harpsichord of Father Louis-Bertrand Castel from the eighteenth century, which is frequently claimed both as the forerunner of VJing as well as of audiovisual games and music videos. Particularly these very new fields often develop a desire for a historical pedigree, both with regard to their own ancestry as well as to the aforementioned genealogical research. Some genres, such as music video, for example, have in the meantime acquired the status of independent art forms; others, such as abstract film and abstract painting, are established art forms operating at the fringes. Some of these fields do have relatively clear time frames; for example, abstract painting as visualized music from around 1900 to 1920, or Absolute Film from 1920 to 1930.[12] In addition, there are thematic fields that defy classification in any of the established disciplines, forever lying "in between," and that for this reason have thus far been seriously neglected—the two-hundred-year-old history of color organs and the much longer history of color-sound analogies, which color organs sought to depict, are examples of this.[13] Scholarly research on these subjects risks treating them as relatively hermetic, specialist fields, as though they followed their own unique historic genealogy and an intrinsic logic that can only be explained in the context of their history. Yet it is especially this ambivalence and the negotiation of the position of such phenomena in the in-between that makes these topics highly interesting.

From this complex structure of mutually overlapping systems, extensive affinities, and mutual exclusions among the respective specialist narratives, two models can be extrapolated in the search for an overarching chronology. The first is a linear history of progress, which is oriented on the actual feasibility of the audiovisual and the technology that in the last approximately 150 years has brought forth the modern media-oriented society. The second model is a history of perennial ideas, whose origins reach far back into the ancient world; however, because these themes experience a revival in topicality from time to time, this leads to the constant recurrence of certain motifs, sometimes as conscious resumption and sometimes as naive reinvention. This permanent updating of the history of ideas is often driven by technical innovations of feasibility. To see this in terms of a one-sided cause-and effect-schema, though, is inadequate because time and again elements from the history of ideas stimulate the search for what is technologically feasible. This was already the case with Castel's ocular harpsichord mentioned above, which its inventor initially presented merely as a thought experiment. Through the debates it triggered, Castel found himself obliged to deliver the empirical proof by constructing such a device, an endeavor which was doomed to failure in view of the technology available at that time. Thus, in this case there is no right or wrong model of a chronology; both manners of representation have their specific justification. The result of this dichotomy is the difficulty of compiling a comprehensive, overall presentation that does justice to all aspects. Before this question is brought to a conclusion, however, it will be useful to sketch the two possible models of a chronology.

Perception and Apparatus: A History of Progress?

The history of audiovisual technology can be represented in a relatively clear

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12 See the chapters "Abstract Film" by Sandra Naumann and Marcel Schwierin and "Painting" by Andrea Gottdang, both in this volume.

13 See the chapter "Color Organs" by Jörg Jewanski in this volume.

chronological order. Its far-reaching effects on the modern audiovisual environment are the main focus of the multidisciplinary perspectives of this volume. Since the advent of telephone, phonograph, and film at the end of the nineteenth century, and since radio, sound film, television, audiotape, and video in the twentieth century, audiovisual culture has undergone historically unparalleled expansion and reformation. All these media have redrawn the borders of the visual and the auditory and reconfigured their relations. In the beginning, in the nineteenth century, media first separated images and sound, then in the twentieth century united them again. This led to the development of a new diversity of machine-based artificial image and sound relationships. To cite just one example: the synchronization of films is the technical affirmation of Michel Chion's synchresis, which he defines as the natural psychological automatism of a motivic connection of simultaneous sounds and images.[14] The gaps remaining in these image-sound techniques have since become the area of activity of (media) artists, who deconstruct their apparent naturalism and recombine its elements so as to interrogate perception and medium on an ongoing basis.

Since the mid-eighteenth century, color organs have represented a kind of prehistory of audiovisual media. There were numerous models of these apparatus; some existed only as concepts, some were also actually constructed, and in each case they were heatedly debated.[15] One could also describe these models as pre-electronic media dream machines because they often sought to achieve more than was actually possible with the technology of the period; nonetheless, they anticipated image-sound effects that later emerged as experimental or innovative uses of audiovisual media.

Attempts to overcome the separation of image and sound using the media machines of the nineteenth century (photograph, film, phototelegraph, telephone, phonograph, gramophone) led to not very successful mixed forms such as the Kinetoscope or Kinetophone.[16] The synchrony of these media combinations of the mechanical, chemical, and electronic was constrained by clear limitations. It was not until the 1920s that a significant step in the development of audiovisual media was taken with the electrical processing of signals in optical sound. Here, the sound is recorded using a microphone and optically recorded as an oscillographic track on the edge of the filmstrip. Thus, for the first time, both images and sound are recorded on the same storage medium. The optical soundtrack is read with the aid of a photocell during its rendition and made audible via loudspeakers.[17] "An eleven-fold transformation is necessary for the complete metamorphosis, it is claimed," wrote Siegfried Kracauer of this process, adding that thus "the esotericism of technology today already surpasses that of the Eleusinian Mysteries."[18] The most important achievement of the optical form was the precise synchronization of feature films with language and music—resulting in the so-called talkies. And this had effects of greater import than the mere addition of sound: it led to fundamental changes in the aesthetics, methods of production, and economics of cinema films.[19]

14 Cf. Michel Chion, *Audio-Vision. Sound on Screen* (New York: Columbia University Press, 1994), 63–64.

15 See the chapter "Color Organs" by Jörg Jewanski in this volume.

16 See the chapter "Synchronization" by Jan Philip Müller in this volume.

17 See the chapters "Transformation" by Jan Thoben and "Synchronization" by Jan Philip Müller, both in this volume.

18 Siegfried Kracauer, 1928, reviewing the first sound films in Siegfried Kracauer, *Der verbotene Blick. Beobachtungen, Analysen, Kritiken*, ed. Johanna Rosenberg (Leipzig: Reclam, 1992), 299.

19 See the chapters "Montage" by Hans Beller and Jörg Lensing, "Animation" by Maureen Furniss, "Film Score" by Helga de la Motte-Haber, and "Sound Design" by Barbara Flückiger, all in this volume.

Furthermore, optical sound facilitated for the first time direct inter-transforma-
tion of acoustic and optical signals. This is a technological necessity, albeit not
the primary goal but a side effect of the work on synchronization. It inspired
artists such as Oskar Fischinger and engineers such as Rudolf Pfenninger to
explore the soundtrack as a creative medium. The far-reaching ideas only
yielded a few isolated experimental results because of the complexity of the
techniques involved.[20] The actual breakthrough to the universal formability of
the audiovisual did not occur until the 1960s with analog electronics, and in the
1980s with digital technology.

Digital technology's development was highly diversified, which resulted in
complex possibilities for coupling and transforming audiovisual data that far
exceeded the "esotericism of technology" proclaimed by Kracauer in relation
to optical sound. For this reason, the development of digital technology is
explored in seven separate chapters in this volume.[21]

Electronic modulation of image-sound signals has repercussions for all existing
audiovisual media that contain electronic components. Through digitalization,
electronics integrate all current media formats. All the devices that once led
separate lives in photography, film, video, radio, television, and audiotape now
run as emulations in the universal machine of the computer, so that audiovisual-
ity does not have to be generated by the combination of separate media, but is
implicitly and explicitly already given.

To give a preliminary résumé of this history of technological progress: in the
1920s, it became possible to represent images and sound as analog, electrical
oscillations; from the 1960s as audio-video signals; and from the 1980s as digi-
tal code in one and the same medium; with these innovations it also became
possible to inter-transform, generate, and manipulate images and sound. This
fact may now sound self-evident, but against the background of the long pre-
history, its importance cannot be overestimated. Before the advent of techno-
logical media, human perception was the only place where sound and light
came together. The centuries-old search for correspondences of images and
sounds, which derived from the experience of human perception, was doomed
to fail as an "anthropomorphism" for as long as it referred to the reality of these
physically completely separate phenomena. It is only through audiovisual
media that human perception has obtained a counterpart in the world of
machines—the audiovisual is now located both in the human senses and in
things.

A parallel might be drawn here between the history of technology and the bio-
logical and anthropological evolution outlined above: the increasing differenti-
ation of the sensory organs to the point where acoustic, visual, haptic, and
olfactory stimuli are separated is in a sense reversed in the history of media.
The initially separate acoustic and visual phenomena are increasingly merged
by technological progress. It is only in this way that the potential of audiovisual

20　Thomas Y. Levin, "'Töne aus dem Nichts.' Rudolf Pfenninger und die Archäologie des synthe-
tischen Tons," in *Zwischen Rauschen und Offenbarung. Zur Kultur- und Mediengeschichte der
Stimme*, eds. Friedrich Kittler, Thomas Macho, and Sigrid Weigel (Berlin: Akademie Verlag,
2002), 313–355. English version Thomas Y. Levin, "'Tones from out of Nowhere': Rudolf Pfen-
ninger and the Archaeology of Synthetic Sound," Grey Room 12 (Fall 2003): 32–79; available
online at www.centerforvisualmusic.org/LevinPfen.pdf (all Internet references in this volume
last accessed on November 30, 2009).

21　See the chapters "Video" by Yvonne Spielmann, "Transformation" by Jan Thoben, "Software
Art" by Golan Levin, "Parameter Mapping" by Tina Frank and Lia, "Interactive Art" by Katja
Kwastek, "Sonification" by Florian Grond and Theresa Schubert-Minski, and "Live Visuals" by
Amy Alexander, all in this volume.

technology approaches the primeval synesthesias of the human senses postu-
lated by anthropologists and color and sound researchers in the 1920s.

The centuries-old dream of "eye-music," for which synesthesia has often been
used as a metaphor, has thus mainly arrived in the reality of appliances since
the rise of electronics. Without human associations or artistic interpretations
having to be involved, it is possible to generate images and sounds automati-
cally from the same signal, and to transform them into one or the other.[22] As in
the case of optical sound, the means to transform images and sounds was not
the goal of electronic media technology, which was actually designed for
audiovisual production and reproduction. But from this basic technical princi-
ple a creative spin-off and artistically innovative use of electronics developed
with its own, fascinating history. This ranges from the use of the oscilloscope
for visual music in the 1950s films of Mary Ellen Bute, Hy Hirsh, and Norman
McLaren, to Nam June Paik's TV experiments of the 1960s (in which he fed the
audio signal of an audiotape into the cathode-ray tube of a television set), and
then onward to an entire generation of artist-inventors, who in the 1960s and
1970s worked with audio and video synthesizers on special effects and manipu-
lation techniques.[23] Finally, in the 1990s, digital signal processing enabled the
mapping of images onto sound or sound onto images, as well as their simulta-
neous generation according to the same parameters. This created precisely
what Golan Levin describes as "inexhaustible, infinitely variable, time-based,
audiovisual 'substance'" that can be manipulated in real time.[24] In contrast to
the mainstream history of technological progress, these artistic and experimen-
tal applications link back to the long history of ideas of visual music. Such cre-
ative use of electronics for purposes other than those intended thwarts their
actual industrial and commercial functionality and the ostensible naturalism of
audiovisual high definition.

The artistically motivated image and sound experiments in visual music during
the 1920s, in intermedia art during the 1960s, and in media art during the 1980s
have entered the hybrid culture of digital mass media as standard procedures.
The now fluid technical boundary between image and sound has far-reaching
effects on all established genres (e.g., image-sound montage in cinema films
and television, live concerts with visuals, audiovisual ambience, and art installa-
tions). Its subliminal efficiency often has more significant consequences than
are demonstrated manifestly in a direct image-sound transformation. The
hybridization of the technical basis of all audiovisual media is of fundamental
importance both aesthetically and economically. Because there is no longer
any differentiation between the channels of distribution, models of marketing,
and output media of sound and vision, the synthesis of the arts that the avant-
garde movements of the nineteenth and twentieth centuries called for is no
longer a question of technical feasibility. Instead, today the artistic genres are
separated again more distinctly at the cultural surface than was envisaged by
the new spirit of optimism surrounding visual music in the 1920s or in the inter-
media euphoria of the 1960s. The theories of intermedia art and the Gesamt-
datenwerk (integrated data work) may be technically realizable through digita-
lization, but they forfeit their character of a cultural utopia.[25] Unlike the

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22 On the different approaches and processes to connect visual and auditory arts or phenom-
   ena, see the second section of this volume with its chapters "Conceptual Correlations" by
   Sabeth Buchmann and Rainer Bellenbaum, "Montage" by Hans Beller and Jörg Lensing,
   "Parameter Mapping" by Tina Frank and Lia, "Color-Tone Analogies" by Jörg Jewanski, "Syn-
   chronization" by Jan Philip Müller, and "Transformation" by Jan Thoben.

23 See the chapter "Video" by Yvonne Spielmann in this volume.

24 See the chapters "Software Art" by Golan Levin and "Interactive Art" by Katja Kwastek, both
   in this volume.

25 See the chapter "Gesamtkunstwerk" by Barbara John in this volume.

Gesamtkunstwerk (total art work) of the nineteenth century, today praxis is forging far ahead of theory. Accordingly, the audio and visual arena is situated less in high culture, which in many places is again defending the specificity of its genres and focusing them aesthetically, and more in mass-media-permeated everyday culture and the perceptual habits informed by it. The utopia and praxis of a programmatic, theoretical, and aesthetic emphasis has been replaced by the permanent linkage of image and sound as a commodity, which proves itself to be, for good or for worse, more of a way of life than an art form.

Eternal Recurrence—or Constant Reinterpretation?

A linear chronology of the evolution of relations between image and sound as outlined above is very straightforward from the perspective of media technology, especially, but still neglects important aspects of the historical multiperspectivity of the subject. In spite of this deficit, in many overview publications it is this history of progress that has become established as the way to present the subject.[26] However, a brief glance at the chronology sketched above suffices to show that image-sound relations are located at the center of a complex fabric of technology, aesthetics, perception, worldview, and economics, whose mixture of constants (physiological, physical, and some derived from the history of ideas) and variables (technical, cultural, and in the broadest sense ideological) cannot be depicted as permanent progress.

The history of the ideas of audiovisual synthesis is often far ahead of the history of technology. Feasibility sometimes only catches up with utopias when their most intense phase is already past. Absoluteness, which in Richard Wagner's day and again in the 1920s and 1960s was the basis for the demand for and expectation of increasing synthesis in "the artwork of the future," for the abolition of all boundaries between genres, and for universal audiovisualization of aesthetics, today is obsolete. Yet the arts have undoubtedly undergone extensive *Verfransung* (fraying). This metaphor of Theodor W. Adorno's clearly shows that although such fraying may blur the margins of the fields, it does not call the core area into question. The countermovement to the fraying of the edges is the conscious, radical return to one's own genre, as, for example, Clement Greenberg's modernism demands. To Greenberg, culture that focuses on its own medium is a bastion against capitalist kitsch that mixes all media and materials.[27]

Rather than permanent progress, one can certainly describe the two-hundred-year-old history of the color organ and related constructions by artist-inventors right up to audio-video synthesizers as a history of permanent failure. The search for an ideal, scientifically established, objective correspondence of colors and sounds, which some of the color organs were intended to demonstrate, proved to be unsustainable and not even capable of being universalized. It is not possible to justify specific linkages of image and sound scientifically or aesthetically; ultimately, they are based on individual preferences. Although intuitive access to the quality or intensity of the linkage of sound and image through direct experience of audiovisual culture is still possible, it is very difficult to abstract from this or make comparisons with other examples because we are virtually unable to name this "third party" situated between hearing and seeing or to subsume it under objectifiable criteria.

26 For an example of a typical genealogy of progress, see Peter Weibel, "Von der visuellen Musik zum Musikvideo," in *Clip, Klapp, Bum. Von der visuellen Musik zum Musikvideo*, eds. Veruschka Bódy and Peter Weibel (Cologne: DuMont, 1987), 53–141.

27 See Clement Greenberg's famous essay "Avant-garde and Kitsch," *Partisan Review* 6 (1939): 34–39.

Comparable questions, which are just as irresolvable as those concerning perception, apply to the area of the relevant apparatus. These are hybrids located somewhere between a work of art, an instrument, and media technology. From Father Castel to Thomas Wilfred, all of their inventors and constructors hoped that they would proliferate on a massive scale. However, they do not possess the ability to achieve intersubjective consensus regarding a work of art, nor the instrumental universality of a musical instrument for very different types of music. For this reason, these hybrid devices remained tied to the performances of their creators for the most part; they often disappeared from the public eye together with their constructors and are only documented in descriptions or photographs. An additional complication is that neither the history of art, music, or technology appears to feel responsible for such hybrid apparatus; therefore, they are excluded from established institutions of conservation. This history of apparatus continues to apply today to the abundance of audiovisual software that has been developed, for which there is also no established context of cultural evaluation or archiving.[28] Yet the success of digital technology does relativize the aforementioned two-hundred-year history of failure. The technical reproducibility and universal functionality of digital interfaces, such as the Lemur by JazzMutant or Pioneer's DVJ-X1, are heralds of instrumental standards for the production of audiovisual artifacts. The same applies to the user interfaces of software of this kind: the computer enables the universality of applications, which are widely distributed as plug-ins and emulations and in their turn influence the aesthetics of production.

In this sense, the history of artistic and technical sound-image linkages can be regarded as an exemplary case for Adorno's proposition that "progress in art must not be denied; nor should it be proclaimed." And Adorno sees the "dual nature" of art—both social and autonomous—as the reason why it is "difficult to talk of progress as both present and non-existent."[29] The dual nature of art can also be confirmed for the dualism of art and technology, which is investigated in this volume. Technological progress is undeniable, yet the history of ideas about sound and image relations contains just as many examples of apparently eternal, recurring motifs, which are as fascinating as they are ultimately not entirely resolvable.

Therefore, the potential antithesis of a history of progress would be the ever-recurring questions, motivations, and aims of the perennial work on image-sound linkages. This could take the form of a conscious and intentional reprise, a historical reference, and new interpretation, as already exist in the history of art and history of music. In the history of image and sound relations, however, there are numerous examples of artists and inventors hitting upon innovative ideas and realizations without being aware that they are in fact part of a long tradition. In the history of art, music, and technology, those concerned tend to overestimate how innovative their work is. Particularly in the case of the color organ, but also in the wider field of audiovisual arts and apparatus, the belief that one is the first and only author of a specific idea is astoundingly pervasive. Adrian Bernard Klein, who invented such apparatus himself and also authored the first in-depth historical account of two centuries of color music, wrote in 1927: "It is an odd fact that almost everyone who develops a colour-organ is under the misapprehension that he, or she, is the first mortal to attempt to do

28 On the hybridity of aims and contexts, see the chapter "Software Art" by Golan Levin in this volume.

29 Theodor W. Adorno, *Aesthetic Theory*, trans. C. Lenhardt (London: Routledge, 1984), 298 and 300.

so."[30] Up until the present day, audiovisual products and software continue to be touted as absolute innovations and "revolutionary fusions of the senses."

One of the main reasons for these permanent reinventions is the fact that a history of audiovisuology does not exist, because due to the fact that image-sound couplings reside in a state of in-between, there has been no development of a specific theory or aesthetics and no canons have been established. In this respect, these reinventions only seem naive from a retrospective point of view; in their particular artistic, aesthetic, and technical situation, they were original and experimental, even when they were created outside any context of historical awareness. The recognition of the deficit of historical situatedness of one's own praxis motivates some of these artist-inventors to undertake retrospective genealogical research and often makes them recognized historians of their respective métiers.[31]

Unlike in the history of art or music, explicitly historical citations do not refer to a succession of epochs or styles, but often occur across all the historical periods and genres involved. For example, John Whitney, a pioneer of computer animation with his algorithmic visual music, refers explicitly to Pythagoras's doctrine of harmony.[32] On the other hand, there were certainly historical phases of intense concretion in the artistic and technical praxis of image-sound couplings, where the zeitgeist coalesced with available media technology and inspiration from the field of science. This was the case in the 1920s: the artistic Absolute Film, psychological research on color and sound, and the technological advances in radio and sound film were parallel developments, which at first were independent but later came together in spheres of mutual interest. Here, there was already the seed of an audiovisuology that spanned art, technology, and science, for example in Georg Anschütz's color-sound congresses and in the Bauhaus environment.[33] In the 1960s, too, intermedia art, expanded cinema, feedback video techniques, experimenting with drugs, and popular theories—from Marshall McLuhan to Timothy Leary—were all combined in the spirit of psychedelia.[34] In the 1990s, the club culture, analog sampling and scratching, new digital audiovisual software and hardware, and the need for visual additions to electronic music all complemented each other to give birth to live visuals. While it is not possible to offer an exhaustive treatment of these phenomena here, they nevertheless illustrate the permanent return of certain fundamental motifs—some as intentional historical references, some as naive reinventions as mentioned above.

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30 Adrian Bernard Klein, *Colour-Music. The Art of Light* (London: Lockwood, 1926), 21. Kenneth Peacock expressed much the same view: "Nearly every color-organ inventor in the nineteenth and early twentieth centuries was under the delusion that he or she was the first to conceive of color-music. Mary Hallock-Greenewalt is perhaps the extreme example. Her book is a self-panegyric in which she claimed in the opening pages, 'It is I who have conceived it [color-music], originated it, exploited it, developed it, and patented it.'" See Kenneth Peacock, "Instruments to Perform Color-Music: Two centuries of technological experimentation," *Leonardo* 21 (1988): 404.

31 The first standard work about color music is by Adrian Bernard Klein, who performed such experiments himself and only later became aware of the considerable history of the subject; see Adrian Bernard Klein, *Colour-Music.* The same applies today to VJing and audiovisual software, whose development is initially documented by the developers themselves.

32 John Whitney, *Digital Harmony. On the Complementarity of Music and Visual Art* (Peterborough, NH: Byte Books, 1980), especially the chapter "Pythagoras Revisited," 65ff.

33 The second Color and Sound congress held in Hamburg in 1930 was attended by psychologists, scientists, engineers, and artists such as Ludwig Hirschfeld-Mack, Zdeněk Pešánek, and Baron Anatol Vietinghoff-Scheel; see Georg Anschütz, ed., *Farbe-Ton-Forschungen*, vol. 3 (Hamburg: Psychologisch-ästhetische Forschungsgesellschaft, 1931).

34 "To this day, psychedelic art offers a suitable instrument for the analysis of synesthetic-artistic experiences in a world influenced by new technologies." Christoph Grunenberg, ed., *Summer of Love: Psychedelische Kunst der 60er Jahre* (Ostfildern: Hatje Cantz, 2005), 40.

Because such entirely diverse contexts and factors are always linked in audio-visuology, it is very difficult to develop a classification or a chronology for these fields. The cross-connections between the artistic genres and the scientific disciplines create a kind of network. As mentioned above with reference to Bruno Latour's term from science studies, the in-between areas only become visible through these socio-technical networks, which are mostly ignored from the perspectives of the individual disciplines. This complex structure can possibly described by the term "family resemblance"—a philosophical idea proposed by Ludwig Wittgenstein in his critique of language. Family resemblance does not develop in linear sequence like a chronology of progress, rather a unique and original mixture is created through overlapping similarities and differences that enables the determination of a typical similarity for which, however, there are no fixed and unchangeable criteria.

For this reason, the structure of relations in audiovisuology can best be described by the term "semantic network." A semantic network both enables and renders necessary a synchronic and a diachronic viewpoint, but for this reason inevitably eludes classical forms of knowledge representation. It will be achieved for this publication through the parallel forms of book and online platform. The linear history of technological progress and the cyclical history of ideas both have their raison d'être, although one of these alone cannot claim validity without admitting the other perspective. Only then does the more profound reason for the paradox of the perennial and topical nature of the subject mentioned at the outset become clear. This paradox is merely the symptom of the different models of a possible chronology that at once contradict and complement each other. Thus, the audiovisuology presented here is not a new discipline but a meta-level on which the convergence and divergence of audiovisual art forms, methods, and scholarly disciplines become visible.