

ANALOGUE/DIGITAL

Referentiality and intermediality

Jens Schröter attacks the notion that analogue photography is more intimately linked to reality than digital photography. He argues that an image's reference to reality cannot be based on strict causal relations or on a refraining from manipulation. Instead, effective reference to reality requires that certain visual elements are brought to the fore and contextualized. This is why for example, physicists and medical scientists developed 'manipulative' digital tools that enhanced otherwise illegible representational images.

Loss of reference?

As far as the history and theory of visual media are concerned, one of the most widely discussed upheavals in recent years has been the spread of so-called digital images.¹ The conceptualization of this transformation has, for about twenty years now, stubbornly revolved around the same topoi. The principal one is the claim that the analogue image's reference to a particular 'reality' is lost through the spread of numerous digital images, images that are visually indistinguishable from photographs. This reference, it is claimed, was guaranteed by the fact that analogue photographs are linked via light indexically, that is, causally, with the object being photographed. Two examples of this rhetoric of loss may suffice. As early as 1990, Fred Ritchin warned that photojournalism and its role in bearing witness to real events would come to an end with the arrival of computers.² And in 1994, Jean Baudrillard claimed that 'reality [has] already disappeared from the synthetic image.'³

Now, it could be assumed that this is an antiquated debate from the early 1990s, but this is not the case at all. In 2004, Bernd Stiegler writes a text on digital photography again presenting the same diagnosis: 'The transition from analog to digital photography has radically transformed photography's discursive as well as ontological status.' With recourse to Friedrich Kittler's dictum that the computer image is 'forgery incarnate'⁴, Stiegler concludes:

'In contrast to analog representation, for which a continuous translation is characteristic, in the case of digital photography the translation of an image occurs within a fixed grid and graticule pattern in which each individual point or pixel is determined

by a numerical value and may accordingly be arbitrarily processed and transformed. [...] We are standing – this is made more than abundantly clear by this pointed characterization – at the end of the photographic era. The pictorial evidence of photography is dead, the presumed authenticity of the photographic image is a chimera [...]. Photography as an authentic document has played out its role.'⁵

Nonetheless, one soon suspects that there is something wrong here, since it remains unexplained why today, and even long ago, doctors, scientists, meteorologists, and soldiers have scarcely relied on analogue images but rather on digitally reworked or produced images in order to analyse, and in some cases transform, a specific reality – be it that of the body, of nature, of the weather, or of the enemy. Stiegler himself writes: 'Today, obviously nearly all professional press photographers who are still concerned about the pictorial documentation of events work with digital equipment in order to be able to transmit images to the editorial department already during an exciting football match or a turbulent party conference.'⁶ And further: 'Of course almost all amateur photographers use their digital camera like a classical Leica [...].'⁷

Yet all these obvious facts hardly challenge Stiegler's postulate of a radical ontological rupture: 'All this is not decisive [...] More decisive are the consequences that have arisen as a result of the digitalization of photography as a whole, without their having been applied in detail and in universal practice.'⁸ Here the argument becomes, in my opinion, truly shaky: how can digital photography actually be nothing but 'forgery incarnate'?

(Kittler) and yet continuously be used as documentation?

In my view, the fundamental problem of this entire discussion lies in the fact that it is haunted by an unquestioned dichotomy in the background; namely, the dichotomy between 'reality' (or reference to reality) and manipulation. First, it is assumed that only a somehow untouched, unchanged, even un-interpreted image could possibly convey 'reference' – as if the very possibility of recording a photochemical image were not in itself already something very artificial.⁹ Second, it is argued that every single intervention in the photographically acquired image automatically and inevitably removes it from 'reality'. Only on the basis of these two assumptions may the claim be formulated that images in the form of digital data represent, merely because they are easier to process, almost automatically the end of 'documentation', of *referentiality*. This notion is defined here as the possibility of signs to point to a fact in the world. Of course this is a difficult topic and there are lots of different theories on how this works. At least two approaches seem helpful. On the one hand, there is the symbol-theoretical approach of Nelson Goodman which was clarified in detail by Catherine Elgin.¹⁰ On the other hand, there are the studies of Bruno Latour who analysed ethnographically how the chains of 'circulating reference' are built in science.¹¹ Both approaches have in common that reference is produced in practice through the *usage* of signs, often *transformed* intermedially into other signs or *combined* intermedially with other signs. Already this description makes clear that the idea that the digital images may lose referentiality because they may be transformed more easily is problematic.

In this essay I'd like to criticize this premise in two ways. First, it can be shown that the development at least of digital image processing procedures, particularly in astronautics and espionage, were precisely intended to bring about greater reference to reality through interventions in the design of photographic images. Therefore, digital processing is not the opposite of reference. Second, referential information is produced by contextualization and through the relation of analogue or digital images to explanatory texts or diagrams. I will show this by using a famous analogue photograph from the history of particle physics. It should

become clear that even the – seemingly given – referential relations between an analogue image and its referent are of course also a product of 'manipulation'. Reference is an effect of intermediality and not dependent on media specific ontological categories like analogue versus digital.¹²

An example from the history of digital image processing

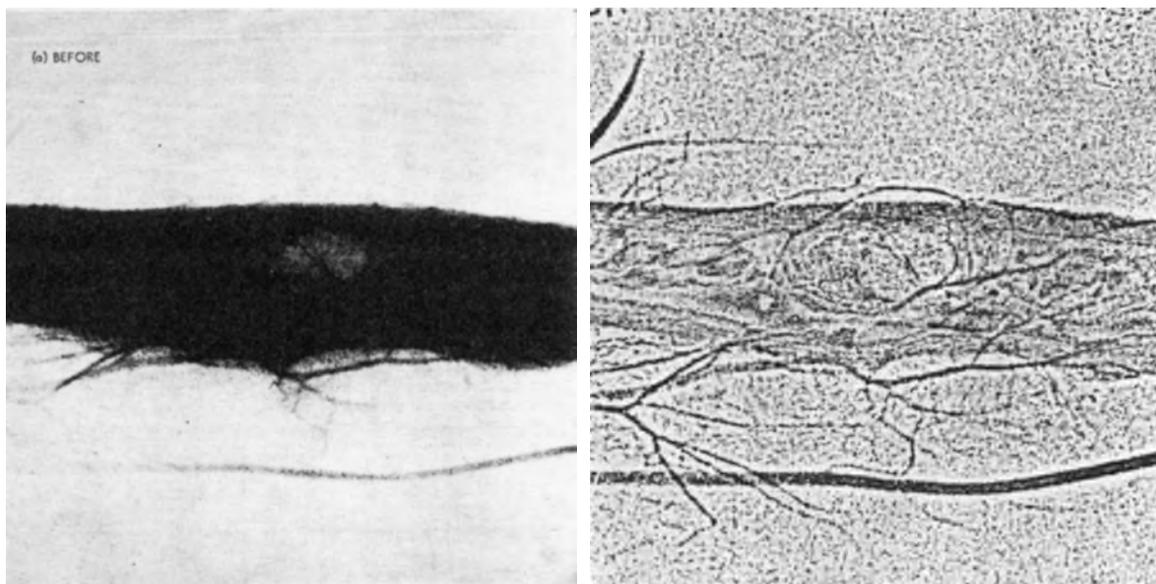
The headword 'digital images' often indiscriminately combines two different types of images. These include on the one hand, scanned (i.e. *digitalized*) images and on the other hand, algorithmically *generated* images (e.g., the 'photorealistic' graphics of Hollywood cinema). Here I would like to deal only with the first type: digitalized images. We are all constantly being confronted with such images: when you place an original on your flatbed scanner and scan it, or when you take a picture using your digital camera, light falls through a lens system onto a photoelectronic sensor. The voltage levels measured pro each pixel are transferred from the sensor to a numerical matrix by means of an analogue-to-digital converter. The digitalized images link up with photographic images insofar that they are based on the scanning of light. Thus it is revealed for the first time why the opposition established between digital (and more precisely: digitalized images) and analogue photography is hardly plausible. For, in the case of the scanner or the digital camera, light also falls – indexically – from the object onto the sensor. Note that the digital sensor does not capture the image in such an entropically irreversible manner as is the case with chemical film – as Wolfgang Hagen has shown – but the term 'photo-graphy' initially means simply 'light-writing'.¹³ Nothing about this concept justifies why this 'writing' should necessarily be chemical rather than photoelectronic in nature. Admittedly, Hagen also emphasizes the fact that the data derived in this way may be more easily transformed. But here my second argument comes in: why is the possibility of change a priori a deviation from the trace of the real? It is rather the case, as I would like to demonstrate, that this trace must be cleared of noise and interference if it is to appear in the first place. To begin with, the possibilities for digitalizing images were only invented in order to process images. And this processing had just one goal, namely to learn more about a particular so-called

reality. At this point, I cannot enter into the numerous precursors and details of this history; they are also unnecessary.¹⁴ I would only like to mention one significant case from the 1960s.

In preparation for the Apollo programme, NASA initiated the Ranger programme. The purpose of the Ranger probe was to send video images of the Moon's surface back to Earth. One had to know, of course, where one wanted to land. The first Ranger missions failed. Only Ranger 7, launched on 28 July 1964, sent analogue video signals to Earth using a new type of vidicon tube.¹⁵ These images were processed and reworked at the Information Processing Laboratory (IPL) which

information is acquired about the reality of the body.

Figure 1 shows a medical image left. Hardly anything can be seen, while right, following the digital processing, considerably more visual information is available. When seen in this way, manipulation is not something artificial that overlays an original trace. Instead, manipulation is the very precondition for being able to make sense of a trace in the first place. It is evident from these examples that digital image processing, the manipulation, was and is the very condition for the referentiality of the images. Intelligence specialist Jeffrey T. Richelson observed: 'However imagery is obtained,



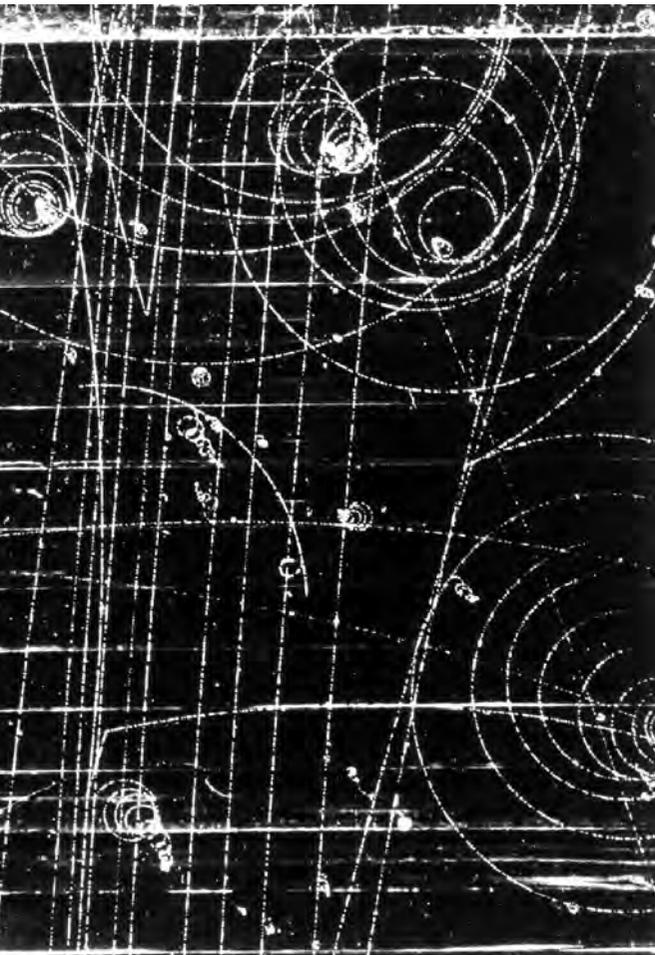
1. Medical image, before and after digital processing. Source: F.C. Billingsley, 'Applications of Digital Image Processing', *Applied Optics* 9 (1970) 2, pp. 289-299 (294).

was founded in 1965 as part of NASA's Jet Propulsion Laboratory. For this purpose, later so-called VICAR (Video Image Communication and Retrieval) software on an IBM 7094 or IBM 360 was used.¹⁶ In this way, knowledge was gained about the reality of the Moon's surface. Very soon the people working at the IPL came up with the idea of also applying the image processing procedures to the enhancement of medical images, initially X-rays. In 1967, the IPL presented their findings to the National Institute of Health where the enthusiasm was so great that the research at the IPL was supported financially.¹⁷ This example of the early medical application of image processing shows how

it requires processing and interpretation to convert it into intelligence data. Computers can be employed to improve the quantity and quality of the information extracted.¹⁸

Interpretation and the intermedial accumulation of referentiality

Manipulation is not the opposite of reference. This ought to be self-evident, since even the most analogue of photos is subject to this principle. Barthes' famous exclamation that every photo tells us 'this has been' presupposes in a quite banal way that the 'this' can be identified in the first place.¹⁹ And this depends at least on two factors. First, certain con-



2. 'This has been' – but what is it?

ventions or design parameters affecting the taking of photographs and their development have to be met. If the exposure time is set too long, photos become overexposed or motion-blurred to the point of being unrecognizable. This is admittedly banal but shows precisely that referentiality is not something that is ensured simply through the analogue nature of a particular technology. Instead, you simply have to use it, to manipulate it in the right way. Second, even if the design is set up to produce the correct recognisability, it still does not mean that the 'this' automatically comes into play. Even if, for example, people can be recognized, one does not automatically know who they are and in what situation they are. Again, this seems trite but needs to be remembered. It is precisely the contextualization through image captions, et cetera, to which Barthes has explicitly referred in his early, semi-otically oriented works, that is essential.²⁰ And

it is even more important in the case of scientific photographs which often display subjects that are not immediately recognizable.

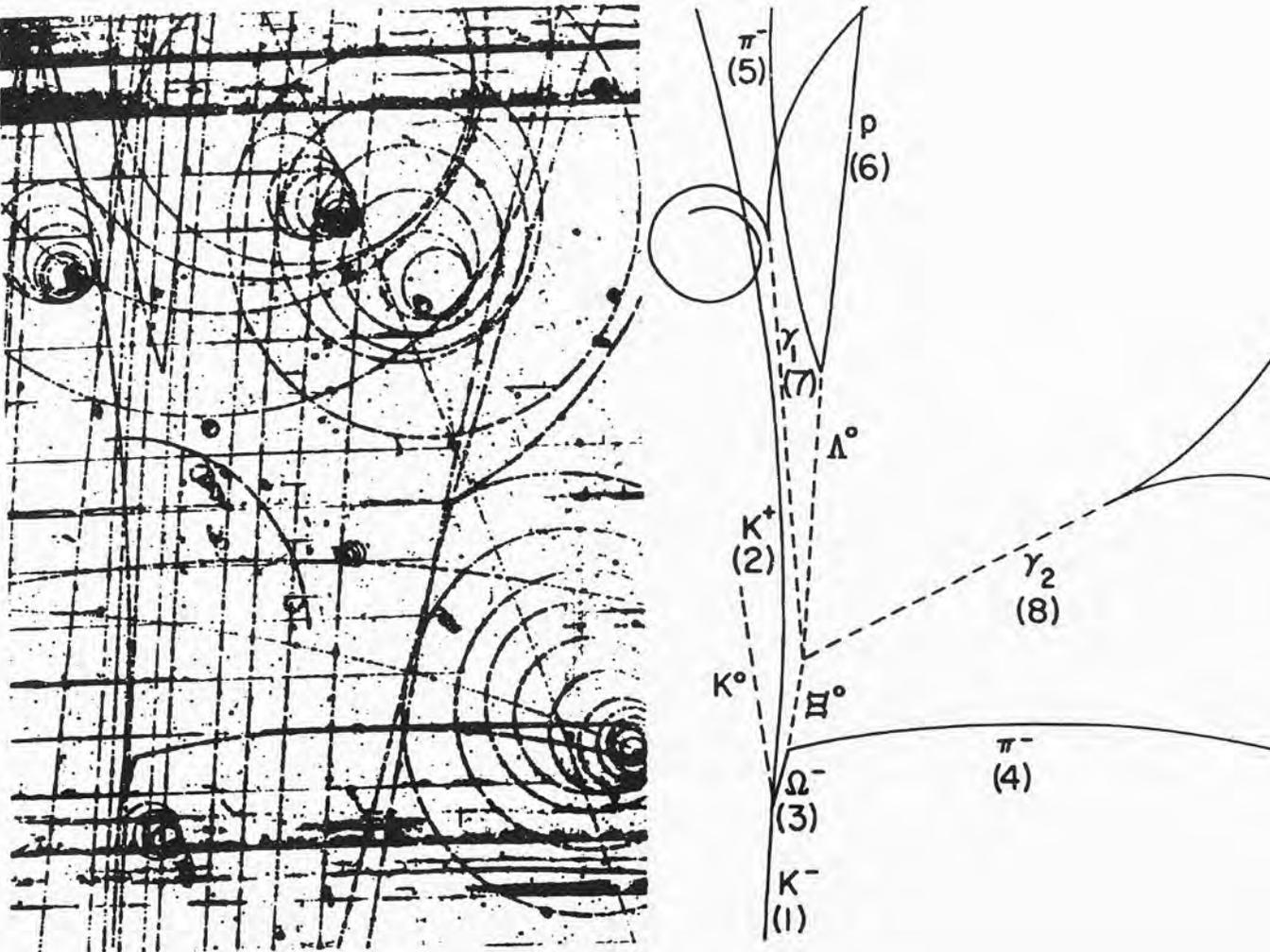
Figure 2 shows one of the most important photos from the history of particle physics; a 'golden event' as Peter Galison has called it. Seen in this decontextualized way, it is unrecognizable. One cannot say what is depicted – although the image is analogue. Its analogue character does not guarantee reference, because reference depends on knowledge (e.g., given through commenting text, that is, intermedially).

In the context of the commenting line diagram, as it is printed in the nowadays legendary publication of 1964, the image becomes meaningful [fig. 3].²¹ The photograph is combined with a line diagram that shows which traces are important. Symbols are added to the lines, which make clear (at least for experts) which traces of what particles are represented. The numbers in parentheses point to additional information in the text. More detailed arguments for the interpretation of the traces are given there. So, what exactly is it? The photograph is photograph number 97,205 of a series of experiments conducted at the Brookhaven Laboratory in New York.²² In the American laboratory for particle physics, researchers fired a beam of negatively charged kaons into a bubble chamber with approximately a thousand litres of hydrogen. The collisions of the beam with the hydrogen atoms created numerous new particles to arise which left behind various traces resembling tiny condensation trails. But only one particle interested the researchers, namely the particle of the type Ω^- . Murray Gell-Mann was the first person to assert the existence of this particle as early as 1962. He could predict the particle and its precise characteristics, since he had discovered a new regularity in the previously rather confusing particle zoo, namely the so-called SU(3) symmetry. This theory was confirmed by the 'evidence' of the traces on photo number 97,205 from 1964.

The simple fact that it was the 97,205th image on which the sought-after traces occurred, demonstrates how much media effort had been put into the particle chase. A film was passed at high speed over the bubble chamber in order to capture the countless and disorganized collision events. The resulting images were evaluated one at a time by an entire team of specialists (called scanners). If

any photographic evidence of suspicious traces was found, it had to be interpreted. This was necessary because the few slight and confusing lines that the light had drawn on the film gave no indication on their own of what they represented. In any case, the 97,205th image together with its interpretation became a virtual icon of particle physics. The tiny kink in the lower left of the photo is the all-important trace of the Ω^- . Now we can say with Barthes: *This has been*. The photograph convinced most physicists that Gell-Mann's theory was correct, which in turn has become one of the supporting pillars in the so-called standard model of particle physics under the heading 'quark model'. Nonetheless, at the time of its production in 1964, this image was not yet recognized as definitive evi-

dence. As further indications began to accumulate, the image was recognized as the first photo of an event during which an Ω^- boson is produced and then disintegrates. Only the combination of a) the 'evidence' of the original image (which is produced in retrospect), b) the explaining line diagram, c) the explaining text, and d) a lot of repetitions of similar experiments with respective images, diagrams and texts finally produced the referentiality of the first image. Only the intermedial accumulation of information over time stabilized the referential relation of the photograph. We already saw that digital processing is not necessarily the opposite of referentiality – quite the contrary. Now we see that analogue imagery does not guarantee its relation to the 'real' purely by its analogue cha-



3. Photography of an Ω^- event with an explaining line diagram. Source: V.E. Barnes et al., 'Observation of a Hyperon with Strangeness Minus Three', *Physical Review Letters* 12 (1964) 8, pp. 204-206 (205, processed).

racter, especially in the case of scientific photography where referentiality is so central. Instead, an intermedial accumulation of images, diagrams and texts is necessary (this is of course also true for 'digital images' as used in science).

Nevertheless, it is impossible to derive a 'monotonous finality', as Foucault called it, from all of these examples of analogue and digital photography.²³ It is also not true, that manipulation never represents a problem: there is, citing Alex Soojung-Kim Pang, a limit between 'forbidden intervention and approved correction' which may be exceeded at different rates depending on the practice involved.²⁴ Everyone who has ever produced a book knows that illustrations are nearly always reworked using *Photoshop* in order to make them sharper and give them more contrast. No one would describe this as a falsifying manipulation. According to Luhmann, however, we 'suspect that there is manipulation at work' in the system of the mass media.²⁵ Therefore, it is hardly surprising that particular attention is granted there to the easy workability of digital images, especially in a time of readily accessible personal computers and Adobe software.²⁶ This illustrates again the fact that doubts concerning the credibility of analogue and digital images depend primarily on the type of discursive practice and intermedial configuration in which the images operate.

Should we therefore conclude that there is no difference between analogue and digital photography, to use these simplistic generic terms? Not at all. Digital data have to be archived in a different way. They can circulate in a different way and be processed in an entirely different way. Different forms of technology have different potentials, which in my opinion may not however be negotiated abstractly from a *macrological* – 'ontological' – standpoint. Rather, it can only be a question of investigating in detail concrete discursive practices and their respective application of analogue and/or digital visual media – as would, say, a history of science informed by Bruno Latour. Through detailed studies of scientific practices, Latour has examined the particular ways in which referentiality, 'reality', is produced. And in the very same *micrological* way, one ought to study the practices of analogue and/or digital photography.²⁷ Referentiality is not ontologically given (i.e. analogue) or not-given (i.e. digital). It is a product of specific and

contingent intermedial constellations and in that sense, always already political. Everything that is not unchangeable is political insofar as it could be otherwise, and its being a specific way is a product of historical and social conditions. That is the case for 'analogue' and 'digital' too. The analysis of concrete analogue and digital practices is therefore a contribution to the research on the politics of intermediality.²⁸

- 1 There are some discussions about the question if the notion 'digital image' is self-contradictory or problematic, which I will ignore here. See: B. Schneider, 'Wissenschafterbilder zwischen digitaler Transformation und Manipulation. Einige Anmerkungen zur Diskussion des 'digitalen Bildes'', in: M. Heßler, D. Mersch (eds.), *Logik des Bildlichen. Zur Kritik der ikonischen Vernunft*, Bielefeld 2009, pp. 188-200.
- 2 Cf. F. Ritchin, *In Our Image: The Coming Revolution in Photography. How Computer Technology is Changing Our View of the World*, New York 1990; idem, 'Photjournalism in the Age of Computers', in: C. Squiers (ed.), *The Critical Image. Essays on Contemporary Photography*, Seattle 1990, pp. 28-37.
- 3 J. Baudrillard, 'Das perfekte Verbrechen', in: H. von Amelunxen (ed.), *Theorie der Fotografie IV 1980-1995*, Munich 2000, pp. 256-260 (258). It is not clear to me what Baudrillard means by 'synthetic image' since in my view all images have to be called synthetic (with the possible exception of mirror images – but are those really images? Cf. U. Eco, 'Über Spiegel', in: U. Eco, *Über Spiegel und andere Phänomene*, Munich/Vienna 1993, pp. 26-61). In the context of the quote, it is likely that Baudrillard has computer-generated images in mind (see below) which still does not make sense however, since it can be shown that the real has in no way disappeared even from generated images, cf. J. Schröter, 'Das Ende der Welt. Analoge vs. digitale Bilder – mehr und weniger 'Realität'?', in: J. Schröter, A. Böhnke (eds.), *Analog/Digital – Opposition oder Kontinuum? Zur Theorie und Geschichte einer Unterscheidung*, Bielefeld 2004, pp. 335-354.
- 4 F. Kittler, 'Computer Graphics: A Semi-Technical Introduction', in: *Grey Room* 2 (2001) 1, pp. 30-45 (31).
- 5 B. Stiegler, 'Digitale Photographie als epistemologischer Bruch und historische Wende', in: L. Engell, B. Neitzel (eds.), *Das Gesicht der Welt. Medien in der digitalen Kultur*, München 2004, pp. 105-126 (108, 109, 110).
- 6 Idem, pp. 106-107.
- 7 Idem, p. 107.
- 8 Ibidem.
- 9 Cf. L. Daston, P. Galison, 'The Image of Objectivity', *Representations* 10 (1992) 4, pp. 81-128.
- 10 See C. Elgin, *With Reference to Reference*, Indianapolis 1983.
- 11 See B. Latour, *Pandora's Hope: Essays on the Reality of Science Studies*, Cambridge MA 1999, pp. 24-80.
- 12 I cannot delve into the vexed questions how to define intermediality, cf. J. Schröter, 'Intermedialität. Facetten und Probleme eines aktuellen medienwissenschaftlichen Begriffs', *montage/AV* 7 (1998) 2, pp. 127-154. In the context of my approach I'm talking here about different forms of 'synthetic intermediality'.
- 13 Cf. W. Hagen, 'Die Entropie der Fotografie. Skizzen zu einer Genealogie der digital-elektronischen Bildaufzeichnung', in: H. Wolf (ed.), *Paradigma Fotografie. Fotokritik am Ende des fotografischen Zeitalters*, Frankfurt a.M. 2002, pp. 195-235.
- 14 Cf. Schröter, op. cit. (note 3).
- 15 On the vidicon tube, cf. G. Wolberg, *Digital Image Warping*, Los Alamitos 1990, pp. 33-34.
- 16 Cf. F.C. Billingsley, 'Processing Ranger and Mariner Photography', *Journal [of the] Society of Photo-Optical Instrumentation Engineers*, 4 (1966) 4, pp. 147-155. Billingsley mentions the IBM 7094 (p. 147), while Ken Sheldon maintains that an IBM 360/44 was used at the IPL, see: K. Sheldon, 'Probing Space by Camera. The Development of Image Processing at NASA's Jet Propulsion Laboratory', *Byte* 12 (1987) March, pp. 143-148 (145). For later developments with the Mariner-Probes, see: J.A. Dunne et al., 'Digital Processing of the Mariner 6 and 7 Pictures', *Journal of Geophysical Research*, 76 (1971) 2, pp. 394-417.
- 17 Cf. Sheldon, op.cit. (note 16), pp. 145-147. See also: NASA, *Astronautics and Aeronautics, 1967. Chronology on Science, Technology and Policy*, Washington, D.C. 1968, p. 104.
- 18 J.T. Richelson, *U.S. Satellite Imagery, 1960-1999. Archive Electronic Briefing Book No. 13*, s.l. s.a., retrieved 19 July 2011 via www.gwu.edu/~nsarchiv/NSAEBB/NSAEBB13. Cf. F.C. Billingsley, 'Applications of Digital Image Processing', *Applied Optics* 9 (1970) 2, pp. 289-299 (289).
- 19 Cf. R. Barthes, *Camera Lucida. Reflections on Photography*, New York 1981.
- 20 Cf. idem, 'The Photographic Message', in: S. Heath (ed. and trans.), *Image. Music. Text*, London 1977, pp. 15-31.
- 21 Cf. V.E. Barnes et al., 'Observation of a Hyperon with Strangeness Minus Three', in: *Physical Review Letters* 12 (1964) 8, pp. 204-206.
- 22 Cf. N. Samios, *Early Baryon and Meson Spectroscopy Culminating in the Discovery of the Omega Minus. SU(3) and Quarks*, retrieved 13 February 2011 via www.osti.gov/bridge/servlets/purl/10162083-fAD7aQ/10162083.pdf.
- 23 M. Foucault, 'Nietzsche, Genealogy, History', in: idem, *Language, Counter-Memory, Practice: Selected Essays and Interviews*, Ithaca 1977, pp. 139-164 (139).
- 24 A. Soojung-Kim Pang, 'Technologie und Ästhetik der Astrofotografie', in: P. Geimer (ed.), *Ordnungen der Sichtbarkeit. Fotografie in Wissenschaft, Kunst und Technologie*, Frankfurt a.M. 2002, pp. 100-141 (104). See also: M. Lynch, S. Edgerton, 'Aesthetics and Digital Image Processing', in: G. Fyfe, J. Law (eds.), *Picturing Power: Visual Depiction and Social Relations*, London 1988, pp. 184-220.
- 25 N. Luhmann, *The Reality of the Mass Media*, Stanford 2000, p. 1.
- 26 Some examples of these are cited in M. Rosler, 'Image Simulations, Computer Manipulations: Some Considerations', in: *Afterimage*, 17 (1989) 4, pp. 7-11. The commotion about digital reworkings is also surprising because – as Rosler has also stressed – manipulation and processing have in the same way been part of the history of photochemical photography from the very outset.
- 27 See: Latour, op.cit. (note 11).
- 28 Cf. J. Schröter, 'The Politics of Intermediality', *Intermedialities: Theory, History, Practice (Acta Universitatis Sapientiae. Film and Media Studies)* 2 (2010) 1, pp. 107-124.