Ontology and Ontography in Digital Imaging

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Ontology and ontography, the two terms mentioned in the title of this article, make an odd couple. Whereas ontology, the study of being, constitutes a major part of metaphysics and has been at the center of Western philosophy since its beginnings, ontography is a neologism that has only recently garnered attention within philosophy and in neighboring disciplines like Science and Technology Studies. While there is no consensus yet on what exactly the word ›ontography‹ stands for,[1] most authors who use the term would probably agree that ontography should be understood first and foremost in relation to or as a response to ontology. Like ontology, ontography deals with fundamental questions of becoming, existence and reality. Nevertheless, ontography promises to be an alternative to traditional ontological approaches, another way to describe or discuss what *is*. Whatever ›ontography‹ may mean or entail for this author or another, it is safe to assume that it is usually conceived of as some kind of theoretical or methodological opposite to ontology.

The goal of this article is not to discuss in depth particular concepts of ontology or ontography found in the literature, to develop original ideas about either notion or to come up with new definitions. Also, I will not try to ›score points‹ for one side or the other. My intention is to focus on the alleged differences between ontology and ontography or between ontological processes and technologies on the one hand and ontographic processes and technologies on the other hand. My topic is the conceptual dichotomy between the two as it relates to questions of media and mediacy. Specifically, I am interested in the assumed antagonism between ontology and ontography that is marked on the terminological level by the suffixes *-logy* and *-graphy* and their respective associations. Therefore, I will first construct an idealized distinction of the two concepts taking their opposed aspects to extremes so as to accentuate the key differences. I will then apply this idealized distinction to a ›test case‹—the media technology of digital imaging—in order to discuss questions of mediacy, representation and reality. My objective is to show how a study of digital image making and image processing complicates the idea

1 For an instructive overview see Michael W. Stadler: Was heißt Ontographie? Vorarbeit zu einer visuellen Ontologie, Würzburg 2014.

of a simple distinction between ontographic and ontological processes and technologies and of their mutual exclusiveness.

Let us begin our differentiation with a few comments on the most obvious terminological difference between ontology and ontography, the suffixes *-logy* and *-graphy*. Derived from the Greek word λόγος, the suffix *-logy* covers a wide range of meaning, particularly in the history of philosophy. One of the more important semantic fields related to the suffix, however, comprises terms like ›word‹, ›speech‹ and ›discourse‹. Onto*logy*, consequently, may be understood as a way of conveying reality—the becoming and being of entities—through the use of language. Ontology, in this sense, would simply mean ›saying what is‹. The suffix *-graphy*, on the other hand, is derived from the Greek word γράφειν meaning ›to scratch‹, ›to draw‹ or ›to write‹. In analogy to our understanding of ontology, onto*graphy* would then be the act of ›writing what is‹. However, the difference between saying and writing, between spoken and written words appears to small to distinguish ontography and ontology as two radically different modes of philosophical investigation. A more important or fundamental disparity could probably be found in the use of language in general—whether spoken or written—on one side and the use of graphic methods and measures—diagrams, pictures etc.—on the other side. A first key difference between the two concepts would then be the one between linguistic means (in the case of ontology) and graphic, visual, pictorial or, more commonly, non-linguistic processes and technologies (in the case of ontography).

The difference between the linguistic and the non-linguistic leads us to another distinctive aspect of *-graphy*: in semiotic terms, we may distinguish between symbolic, iconic and indexical signs.[2] While symbols are primarily the domain of language (and therefore of ontology), icons and indices are found mostly in non-linguistic spheres. The non-linguistic character of ontography, we may infer, concerns not only icons—graphic signs in general—but indices as well.[3] Whereas symbols are signs for objects by convention, indices are signs because they hold an actual connection to their object;[4] they are signs brought about by an objective causal relation (not by subjective intention or communication). Ontography, accordingly, may mean all processes and technologies by which being ›writes‹ itself, inscribes itself into some suitable physical substance. It is the *-graphy* of photography and phonography, the material self-inscription of reality. In contrast to ontological descriptions of the world, i. e. to linguistic representations, ontogra-

2 See Charles S. Peirce: The Essential Peirce. Selected Philosophical Writings, vol. 2 (1893–1913), Bloomington, IN 1998.

3 It must be stressed that icons in the sense of Peirce are not restricted to graphic (or even to pictorial) signs.

4 One of the most prominent examples found in the literature is smoke being an index of fire.

phy proceeds through operations of tracing, mapping and registering the real that produce material ›evidence‹ of the ontic beyond writing in the narrower sense. The second key difference between ontological and ontographic processes and technologies would thus be whether reality is symbolically encoded (by humans) or physically recorded (by machines or non-intentional mechanisms or events).

The distinction between human and non-human agency points at a final and particularly far-reaching difference between ontology and ontography in their idealized interpretation. Because ontographic machines and mechanisms do not rely on the intervention of human subjects and symbolic encodings, they could be said to capture reality in a ›closer‹ or more ›faithful‹ way than linguistic representations. While ontological descriptions submit the ontic to a symbolic or conceptual regime that is external to it and ultimately remains human-centered, ontographic procedures record physical reality ›directly‹ and generate material ›evidence‹ or (self-)›evident‹ traces of the world. Consequently, the third key difference between ontology and ontography would be a qualitative one: in addition to being the more recent philosophical concept, ontography would also mean a ›better‹ way of accessing the world, a ›better‹ mode of describing or depicting it.

As a former linguist and someone trained in the schools of structuralist and so-called poststructuralist thought, I am rather sceptical of the idealized binary opposition of ontography and ontology, which I have just sketched. At the risk of sounding formulaic, my main objection would be that it is not very helpful—at least not from the perspective of a general theory of media and mediality—to distinguish between forms of representation, communication or, more generally, mediacy that would be more ›direct‹, ›faithful‹ and ›close‹ to ›reality‹ and other forms that should be less so. I take it to be a fundamental axiom of media theory that reality is *always* mediated, always one step removed, whether this step involves our eyes, our hands, words, pictures, numbers or any other media. Likewise, separating the linguistic from the non-linguistic, the symbolic or conceptual from the non-symbolic or non-conceptual, the non-evident from the evident looks like a tricky business to me when talking about culture—especially when the two sides are then related to ›reality‹[5] in one case and to advanced technology like phonography, cinematography, television and digital computing in the other.

But, of course, it is also not helpful to categorically deny any and all structural and functional differences across the field of media. Undoubtedly, there are differences that make a difference. And I gladly accept the challenge presented by

5 Let us always be mindful of the fact that while representations of ›reality‹ (whatever the word may mean) can certainly be made in language, language is much more than just a representation of non-linguistic objects and affairs; see, for instance, Roman Jakobson: Closing Statement: Linguistics and Poetics, in: Thomas A. Sebeok (ed.): Style in Language, New York, NY / London 1960, pp. 350–377.

the idealized distinction between ontology and ontography: how best to describe and explain such differences using the example of digital imaging, one of the most significant technological intersections of photography (presumably a paradigmatic case of ontographic mediacy) and computers. I will, therefore, begin by assuming that there are in fact ontological and ontographic media or processes, and then see where the assumption leads.

Starting from this premise, the initial question about digital imaging obviously has to be: is it an ontological process or an ontographic one? Let us first look at a definition of the term found on Wikipedia:

»*Digital imaging* or *digital image acquisition* is the creation of a digitally encoded representation of the visual characteristics of an object, such as a physical scene or the interior structure of an object. The term is often assumed to imply or include the processing, compression, storage, printing, and display of such images. […] In all classes of digital imaging, the information is converted by image sensors into digital signals that are processed by a computer and output as a visible-light image. For example, the medium of visible light allows digital photography (including digital videography) with various kinds of digital cameras (including digital video cameras). X-rays allow digital X-ray imaging (digital radiography, fluoroscopy, and CT), and gamma rays allow digital gamma ray imaging (digital scintigraphy, SPECT, and PET).«[6]

As this quote makes clear, we have to consider at least two kinds of processes when discussing digital imaging: 1) the different sensorial processes generating images, and 2) the various computational processes performed on these images (compressing, transmitting, storing etc.). Processes of the first kind have received quite a lot of scholarly attention in the humanities, processes of the second kind less so.

Restricting, for the sake of simplicity, image generation to photography (i. e. leaving out more exotic cases like computer tomography and digital radiography), we have a hung jury concerning the decision between ontology and ontography. On the one hand, there is a long realist tradition in thinking about photography that runs from William Henry Fox Talbot[7] to André Bazin,[8] Roland

6 Wikipedia: Digital Imaging, under: https://en.wikipedia.org/wiki/Digital_imaging (16 December 2018).

7 »The plates of the present work are impressed by the agency of Light alone[.]« William Henry Fox Talbot: The Pencil of Nature, London 1844, Notice to the reader.

8 Ironically, Bazin called his analysis of photography an ›ontology‹: »We are forced to accept as real the existence of the object reproduced, actually re-presented, set before us, that is to say, in time and space. Photography enjoys a certain advantage in virtue of this transference of reality from the thing to its reproduction.« André Bazin: The Ontology of the Photographic Image, in: Film Quarterly 13/4 (1960), pp. 4–9: 8.

Barthes[9] and beyond. This tradition emphasizes the direct physical link of the photographic process to reality (the light reflected or emitted from objects passing through the lens of the camera) whose material trace the picture (developed from the exposed photographic emulsion hit by the light) is said to be. Speaking in semiotic terminology, it is photography's indexicality and iconicity that support the »truth claim« of the medium.[10] In this perspective, the photographic process and results appear as prime examples of ontographic mediacy.

On the other hand, *digital* processes of image generation have often been suspected and accused of lacking just the physical tie to reality that realists claim as the hallmark of traditional photography. For as the light-sensitive film has been replaced by digital image sensors (such as the charges-coupled devices, or CCDs, in common digital cameras), the photograph, once a ›stable‹ visual inscription of light in a silver halide emulsion, has turned into a transitory and mutable stream of digits with no straightforward connection to the pictured objects. As William J. Mitchell put it: »The referent has come unstuck.«[11] Digital photographs are, according to Peter Lunenfeld, »dubitative« images because the ›directness‹ of their relation to reality is always in doubt.[12] Such rhetoric of loss basically comes in two complementary varieties: 1) the claim that digital images are *not ›really‹ images*;[13] 2) the claim that digital images are *not images of ›reality‹*.[14] Digital images seem to lose their status as ›real pictures‹ precisely because of their digital formation. They

9 »The photograph is literally an emanation of the referent. From a real body, which was there, proceed radiations which ultimately touch me, who am here[.]« Roland Barthes: Camera Lucida: Reflections on Photography, New York, NY 1981, p. 80.

10 Tom Gunning: What's the Point of an Index? Or, Faking Photographs, in: NORDICOM Review 25/1–2 (2004), pp. 39–49: 39.

11 William J. Mitchell: The Reconfigured Eye: Visual Truth in the Post-Photographic Era, Cambridge, MA 1992, p. 31.

12 Peter Lunenfeld: Snap to Grid: A User's Guide to Digital Arts, Media, and Cultures, Cambridge, MA 2000, pp. 55–69.

13 »The digital image does not exist. […] What does exist is countless *analog pictures* displaying *digitally encoded data*: on monitors, TV screens or on paper, on cinema screens, displays and so on. […] There is, thus, something that generates data (information technology) and something that generates pictures (imaging technology) but these things are completely decoupled und utterly heterogeneous.« Claus Pias: Das digitale Bild gibt es nicht. Über das (Nicht-)Wissen der Bilder und die informatische Illusion, in: zeitenblicke 2/1 (2003), p. 50, under: http://www.zeitenblicke.de/2003/01/pias/ (16 December 2018; my translation).

14 »Generating images in silicon chips means nothing else than measuring. […] [T]he given results still only represent chance. […] [I]n games of chance such as the production process of the digital image, every move is a strategic one. […] [N]o one can assure us, that the indexical or iconic signs of whatever we see, are not staged ex post.« Wolfgang Hagen: There Is No Such Thing as a Digital Image: Some Media-Epistemological Remarks on Weak Ontology, University of California, Santa Barbara, CA 2005, under: http://www.

are more aptly described, the argument goes, as abstract or mathematical ›constructions‹, ›models‹ or ›simulations‹[15] rather than as photographic pictures proper. If one accepts this proposition, then the digital generation of photographs probably classifies as an ontological process because it relies on a symbolic (i. e. quasi-linguistic) encoding of information gathered by electronic sensors and not on a ›direct‹ physical tracing and a lasting material inscription of ›reality‹.

Both positions summarized here, the realist understanding of photography as well as the critique of digital images, are contentious and have been intensively discussed and criticized (and rightly so, I think) by various authors.[16] I do not want to elaborate on these discussions here but simply remind the reader that neither the realist nor the simulationist depictions of photographic and digital images remain undisputed and that, by implication, the question of whether photography should be subsumed under ontographic or ontological media is open.[17] For the moment, let us continue under the assumption that traditional (film) photography is an ontographic process and digital (electronic) photography, conversely, an ontological one.

Turning now to the second kind of processes mentioned in the Wikipedia article (i. e. digital operations performed on images like storing, transmitting and compressing), it seems only consequential to think of such computational procedures as being ontological. In fact, one of the most influential definitions of digital computation by machine has been that of general ›symbol-manipulation‹,[18] a phrase highlighting the use of signs for algorithmic modelling, problem-solving etc. Even before the first electronic computers were built, Alan Turing had conceptualized the operations of his abstract ›Turing machines‹ as the process of stepwise reading and writing with a fixed set of symbols (numerals and letters from

whagen.de/get.php?page=PDFS/11013_HagenThereisNoSuchThi_2005.pdf (16 December 2018).

15 »These would be the successive phases of the image: 1. It is the reflection of a basic reality. 2. It masks and perverts a basic reality. 3. It masks the *absence* of a basic reality. 4. It bears no relation to any reality whatever: it is its own pure simulacrum […,] no longer of the order of appearance at all, but of simulation.« Jean Baudrillard: Selected Writings, Stanford, CA 1988, p. 170.

16 See, among others, William J. T. Mitchell: Realism and the Digital Image, in: Hilde van Gelder and Jan Baetens (eds.): Critical Realism in Contemporary Art, Leuven 2010, p. 13–27; Jens Schröter: Digitales Bild, in: Image 25 (2017), pp. 89–106.

17 For a theoretical position that seems to cut across the conceptual line separating ontographic and ontological media see Vilém Flusser's description of ›technical images‹—film photography and digital imaging alike—as products of a new kind of imagination; Vilém Flusser: Into the Universe of Technical Images, Minneapolis, MN 2011.

18 See Herbert A. Simon and Allen Newell: Computer Simulation of Human Thinking, in: Science 134/3495 (1961), pp. 2011–2017.

multiple alphabets in Turing's description).[19] Since then, the structural kinship of linguistic and digital operations—the syntactic or quasi-linguistic character of digital computation—has been pointed out again and again by a wide range of authors in various fields of knowledge, among them Noam Chomsky, Jacques Lacan and Charles Petzold.[20] And in media theory, the universal (or ›meta-‹) mediality of digital computers, i. e. the fact that these machines can simulate all processes of technical media through mathematical modelling of their properties, is usually explained by the power of formalized symbol use. The most prominent author advancing this argument is probably Friedrich Kittler—but Alan Kay and Adele Goldberg, pioneers of computer science, said as much already in the 1970s.[21] All of this strongly suggests that digital computation and, accordingly, digital imaging are of ontological nature.

It is all the more surprising, then, that some authors have proposed to study digital objects, devices and processes using the concept of ontography.[22] But exactly how, given the symbolic, formal, algorithmic logic of digital machines, could one argue that computational procedures are ontographic processes rather than ontological ones? A clue to one possible interpretation is offered by what has been called the »miracle of the appropriateness of mathematical language« for physics:[23] the easiest way would be to claim that reality itself *is* a mathematical structure. If this were the case—if nature were, so to speak, made of numbers—, then counting, calculating, computing and related procedures (whether carried out by man or machine) could not be reduced to mere representations of the fabric of being. The rules and results of mathematics would be more than just formalized statements that simply, or amazingly, happen to fit natural regularities and observed phenomena by chance. They would, if ›discovered‹ and applied correctly, give us the one ›real‹ description or script of what ›really‹ is. Mathematics, implemented on

19 See Alan M. Turing: On Computable Numbers, in: Proceedings of the London Mathematical Society 42/2 (1937), pp. 230–265.

20 See Noam Chomsky: On Certain Formal Properties of Grammars, in: Information and Control 2 (1959), pp. 137–167; Jacques Lacan: Psychoanalysis and Cybernetics, or on the Nature of Language, in: Jacques-Alain Miller (ed.): The Seminar of Jacques Lacan, vol. 2: The Ego in Freud's Theory and in the Technique of Psychoanalysis 1954–1955, Cambridge 1988, pp. 294–308; Charles Petzold: Code. The Hidden Language of Computer Hardware and Software, Redmond, WA 1999.

21 See Friedrich Kittler: Gramophone, Film, Typewriter, Stanford, CA 1999, pp. 17–19, 243–263; Alan Kay and Adele Goldberg: Personal Dynamic Media, in: Computer 10/3 (1977), pp. 31–41.

22 See Ian Bogost: Alien Phenomenology, or What It's Like to Be a Thing, Minneapolis, MN 2012, pp. 67–72.

23 Eugene Wigner: The Unreasonable Effectiveness of Mathematics in the Natural Sciences, in: Communications in Pure and Applied Mathematics 13/1 (1960), p. 1–14: 14.

paper or in programmable machines, would be ontography in the truest sense of the word: the ›writing‹ of ›being‹. Although this premise, sometimes called *digital physics* or *digital ontology* (!), is highly speculative, it has been championed for some time by authors like Konrad Zuse, Ed Fredkin and Max Tegmark.[24]

Again, I think it is not easy to decide whether the medium in question is ontographic or ontological. Coming from the background of linguistics and (post-) structural theory, I would argue that digital computing is ontological. But I can see how, proceeding from different premises, one can arrive at the opposite conclusion and qualify it as ontographic. And while I do, as I have said at the beginning, have reservations about the conceptual dichotomy of ontology and ontography by itself, I think the problem becomes acute when we start looking at media in more detail. For I suspect it quickly becomes impossible to keep ontographic and ontological processes apart when dealing with sufficiently advanced technology like photography and digital computers—or with any technology, really. Even if we were to restrict our notion of technology or media to physical artefacts alone, analyses of actual tools, machines and systems would still involve complex objects defying easy characterization. To name just three problems: 1) it is typically very hard to reduce a technology, even a rather rudimentary one, to a single aesthetic or structural (i. e. a mechanical, electrical or electronic) principle that could then be identified as being either ontographic or ontological; 2) technology is the result of, among many other things, physical and conceptual processes of design and fabrication and therefore ›inscribed‹ at once *into* physical reality and *with* concepts; 3) technology, even in the case of embedded, automatic or ›autonomous‹ systems, invariably exists and operates in relation to multiple and heterogeneous contexts which are wholly or partly (but of course not exclusively) affected by conceptual and linguistic processes. Its conditions, applications and effects are always ›contaminated‹ by language.

To briefly illustrate only the first point mentioned with the example of digital photography: it is probably fair to say that an image sensor capturing a scene produces the data giving the corresponding picture according to a conceptually predetermined system of discrete and arbitrary values (the bits representing the detected light intensity conforming to the logic of a particular file format) which have no ›direct‹ reference to reality—and that this process is therefore ontological. It could also be reasoned, however, that the sensor detects, measures and records, even if just for a fraction of a second, a segment of reality (the photons hitting the

24 See Konrad Zuse: Rechnender Raum, Braunschweig 1969; Edward Fredkin: An Introduction to Digital Philosophy, in: International Journal of Theoretical Physics 42/2 (2003), pp. 189–247; Max Tegmark: Our Mathematical Universe: My Quest for the Ultimate Nature of Reality, New York, NY 2014.

exposed light-sensitive capacitors in the CCD) in an ›objective‹ way, according to the laws of physics and independent of any human or linguistic interference—and is therefore ontographic.

We are faced with a dilemma. Either ontology and ontography are both at work in digital image generation at the same time (but then, how could they be mutually exclusive?) or one of the concepts is not valid (and then our conceptual antagonism would disappear altogether). And if we try to resolve this problem by separating the moment of *sensing* the captured light intensity from the moment of *encoding* it, we get ourselves into another paradoxical situation: We would then have identified an ontographic moment (i. e. the detection of photons and their measurement and temporary recording in electrons) linked to an ontological one (i. e. the sampling, quantifying and storing of the electric voltages in the set of digital data comprising the image). We would have to assume that there is one process of—again semiotically speaking—indexical nature with a ›direct‹ reference to the pictured reality, entangled with another process of symbolical nature following a logic devoid of any designation to the ›outside world‹. And the product of these two conflicting but coupled processes (together with even more processes of technical mediacy) would be: the image.

But what if the situation I just described is not a paradox? What if ontography and ontology—taking place as specific technological processes—are not mutually exclusive but do actually complement each other? What if the one does not rule out the other but rather ›integrates‹ or ›enforces‹ it? Let me, to conclude my brief discussion, finally turn to digital image *processing*.

First, what is processing? From the perspective of a general theory of media, processing is one of the three basic functions of media, together with storage and transmission.[25] Broadly speaking, processing means transforming what is mediated with the goal of ›improving‹ the mediacy. In the context of electronic media, it means transforming a signal to get a ›better‹ message. Image processing—whether it is implemented digitally or not—is therefore one instance of signal processing. To quote an expert from the field: »Digital image processing takes an original digital image, or an analogue (traditional) photograph that has been converted into digital form, and applies mathematical formulas to the image data to change or enhance the appearance of the image.«[26] Examples of common digital image processing techniques are sharpening by high-pass filters, smoothing by low-pass filters and contrast enhancement by histogram stretching. While some digital meth-

25 See Kittler: Gramophone, Film, Typewriter (as note 21); more recently see Hartmut Winkler: Prozessieren. Die dritte, vernachlässigte Medienfunktion, Paderborn 2015.

26 Jeff Seideman: Digital Image Processing: A Short History, in: Journal of the Photographic Historical Society of New England 157/2 (1999), pp. 8–11, 18: 8.

ods resemble or mimic traditional darkroom techniques from film photography (and in some cases, like dodging and burning, still carry their names), others are unique to computerized processing. A good example is the *Levels* adjustment in Adobe Photoshop which lets you globally redistribute the tonal range of an image while allowing you to control the intensity of shadows and highlights separately.

For the last step in my discussion, let us suppose that photographic processes generating images, digital or not, are ontographic (because what counts is the indexical event of detecting photons reflected from the pictured object in a light-sensitive medium, be it film or a CCD sensor, not a potentially following symbolic encoding of said event). And let us also suppose that digital processing of photographic images is ontological (because it is a quasi-linguistic, formalized manipulation of image data in a system of abstract signs). Essentially, then, my argument is this: digital image processing is not a distortion, a corruption or an obfuscation of the reality shown (or indexically captured) in the ›original‹ picture. Ontological processes do not—at least not by necessity—lessen or negate the ontographic character of a photograph, a sound recording etc. Of course, digital image processing *can* be used to alter pictures in such a way that what was originally depicted becomes unrecognizable or perverted. But the proof or imperative of such a manipulation is neither in the picture nor in the technology. And, more importantly, the opposite is just as true: digital image processing can *reveal* a reality that was not visible in the original picture. Ontology does not have to work ›against‹ ontography. Ontology can substantially increase the ontographic quality of a given media process—or establish it in the first place.

Michael Lynch and Samuel Edgerton have shown how astronomers use digital image processing not simply to produce ›pretty pictures‹ of galaxies and nebulae for the public but also for »composing visible coherences, discriminating differences, consolidating entities, and establishing evident relations« in pictures, i. e. for constructing the representational realism of scientific images showing us the universe ›as it is‹.[27] In a way, my argument is nothing but a generalized reiteration of this basic observation by Lynch and Edgerton in the terms of ontography and ontology. That digital imaging technology—ontological procedures, if you will—can help produce pictorial evidence of reality—its ontographic record—should be obvious in cases where our own eyes fail us because of distance (galaxies far away), scale (sub-micrometer structures) or spectrum (infrared, ultraviolet and

27 Michael Lynch and Samuel Y. Edgerton: Aesthetics and Digital Image Processing: Representational Craft in Contemporary Astronomy, in: Gordon Fyfe and John Law (eds.): Picturing Power: Visual Depiction and Social Relations, London / New York, NY 1988, p. 184–220: 212.

other non-visible electromagnetic waves). But it is also true for ›ordinary‹ photographs of things and scenes visible to the human eye.

In fact, digital image processing was developed for just this reason: to get more ›out‹ of a picture. Again, let us hear from an expert in the field: »The principal idea behind image processing is to make an image more informative, or, in communications jargon, to extract more signal from noise.«[28] It should come as no surprise, then, that the roots of digital image processing are in the American reconnaissance satellite and space imaging programs of the 1960s.[29] The fundamental technologies and procedures—at least the ones we know about—were developed mainly at the Image Processing Lab (IPL) in the Jet Propulsion Laboratory of the California Institute of Technology.[30] Spurred by early successes of the Soviet space program and the first, qualitatively low pictures of the Moon's far side, engineers and scientists at the IPL devised and developed technologies to digitize the pictures sent from their own Ranger spacecraft and enhance them using computers. The images—taken with electronic (not digital) TV cameras and transmitted by radio back to Earth where they were recorded on tape—suffered from various flaws that made them hard to ›read‹. What they showed was not ›evident‹. The ontographic character of the images was never in doubt, of course, but it was far from ›good enough‹ to help the scientists answer their questions. The lesson here is clear: Ontography by itself, the fact that an image is the product of an ontographic procedure, its iconicity and indexicality alone do not guarantee a correct identification and interpretation of the referent that left its traces in the ontographic record[31]—regardless of whether the referent in question is a crater on the Moon, a Soviet missile complex or a tumor.

As the following quote on the reasons for the digital processing of satellite imagery illustrates, the potential pictorial pitfalls of imaging technology are many: »Typical corrections were for optical flare, atmospheric diffusion, sensor discontinuities, geometric distortion resulting from satellite images taken at non-perpendicular angles to the target, size matching for the creation of mosaic maps, blur created by the lateral movement of the satellite, and to eliminate ›noise‹ from

28 Jeffrey L. Star: Introduction to Image Processing, in: Byte 10/2 (1985), pp. 163–170.

29 Although experiments at the National Bureau of Standards in optical character recognition also played an important part; see Kenneth R. Castleman: Digital Image Processing, Englewood Cliffs, NJ 1979, appendix I.

30 See Jens Schröter: Das Ende der Welt. Analoge vs. digitale Bilder – mehr und weniger ›Realität‹?, in: Alexander Böhnke and Jens Schröter (eds.): Analog/Digital – Opposition oder Kontinuum? Zur Theorie und Geschichte einer Unterscheidung, Bielefeld 2004, pp. 335–354; Peter J. Westwick: Into the Black: JPL and the American Space Program, 1976–2004, New Haven, CT 2007, pp. 112–117.

31 For the example of particle physics and images from bubble chambers see Peter Galison: Image and Logic: A Material Culture of Microphysics, Chicago, IL 1997, pp. 370–384.

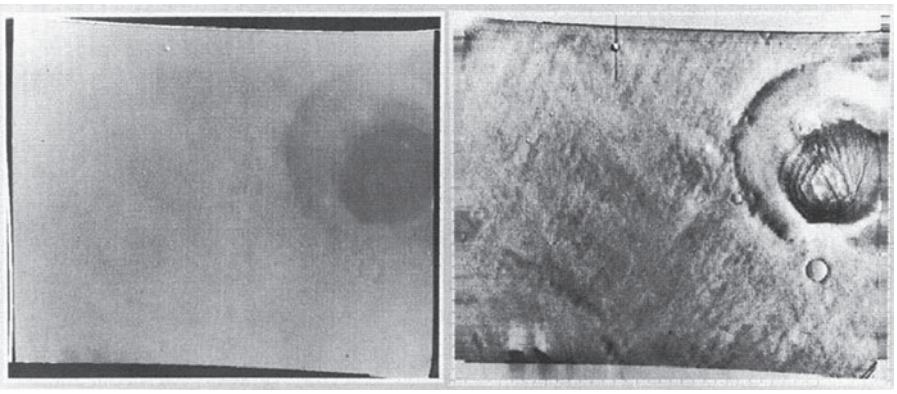

Fig. 1: Image of Mars surface with and without increased contrast

transmitted images.«[32] In cases like these—and in other scenarios like medical applications—, ontological procedures of image processing ›bring out‹ what ontographic imaging processes have captured so that the reality represented in the resulting pictures will show itself clearly. The examples of an unprocessed ›original‹ image of the Mars surface taken by a robotic Mariner space probe and its digitally processed copy (see figure 1) demonstrate this well.[33] The ›prettiness‹ of the processed picture is only the aesthetic flipside of its epistemic—or ›enhanced‹ ontographic—quality.

It is worth noting here that in many cases digital image processing will correct flaws that are not extrinsic to the act of image generation (like the atmospheric diffusion, motion blur or channel ›noise‹ mentioned in the quote above) but that are intrinsic ›defects‹ of the original imaging technology itself. Put the other way around, ontographic processes often ›distort‹ reality by the very act of imaging, i. e. by the mechanism used to produce the image. In photography, perhaps the best known examples are the lens distortion (barrel and pincushion distortion) and the perspective distortion (converging lines).[34] And there are many more potential ontographic quirks of imaging processes that one has to deal with when trying to get a ›good‹ picture ›faithful‹ to the represented segment of reality. In digital

32 Seideman: Digital Image Processing (as note 26), p. 10.

33 What kind of a picture is this? To greatly simplify matters: it is a (minimally) edited digital copy of a digital image file generated by a digital scan of a lithographic half-tone reproduction of a computer printed hard copy of a digitally processed copy of a digital image which was received by radio signal from a Mariner spacecraft that captured it with a TV camera and recorded it on digital tape before it transmitted it to Earth.

34 Go take a picture of your loved one with a smartphone, holding the device very close to the person's face: that is not how they ›really‹ look!

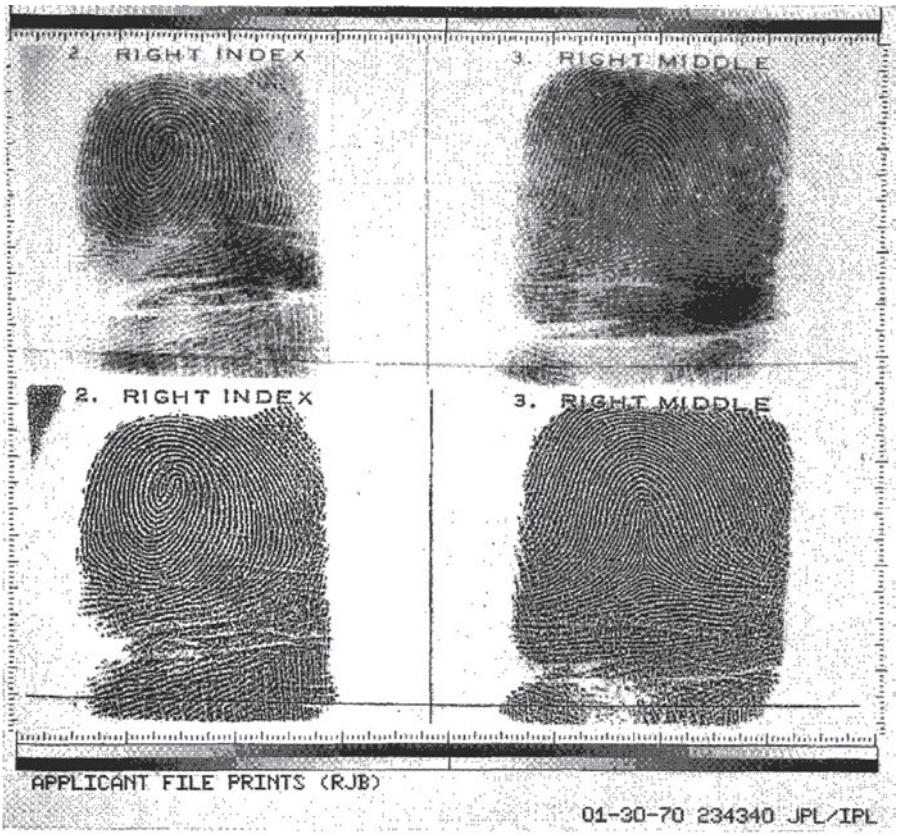

Fig. 2: Restoration of fingerprint by image processing

imaging, ontological processes routinely ›rectify‹ ontographic processes so we get a better picture of the world.

Which brings me to my final point: I suggest that we try to think ontography and ontology not as antagonistic forces or modes of knowledge but as two generative moments complementing each other in an ongoing series of intertwined aesthetic and epistemic processes, a tangled, twisted ›chain of operations‹[35] producing, storing, processing, distributing and reproducing representations of reality which may—or may not—ultimately lead to the referent that has left its trace (see figure 2).

35 See André Leroi-Gourhan: Le geste et la parole, Paris 1964, pp. 163–164; see also my critique of the concept in Till A. Heilmann: Zur Vorgängigkeit der Operationskette in der Medienwissenschaft und bei Leroi-Gourhan, in: Internationales Jahrbuch für Medienphilosophie 2: Techne / Mechane (2016), pp. 7–29.

Picture Credits:

Figure 1: Image of Mars surface with and without increased contrast (Source: James E. Tomayko: Computers in Spaceflight: The NASA Experience, NASA contractor report no. 182505, NASA, March 1988, p. 293; Courtesy NASA/JPL-Caltech)

Figure 2: Restoration of fingerprint by image processing (Source: Fred C. Billingsley: Digital Image Processing for Information Extraction, in: International Journal of Man-Machine Studies 5 (1973), pp. 203–214; Courtesy NASA/JPL-Caltech)