

# Photography: Artist Penny and Machine

Yanai Toister  
Shenkar College of Engineering,  
Design and Art, Ramat Gan,  
Israel  
[yt@yanaitoister.com](mailto:yt@yanaitoister.com)

Through investigation of strategically-chosen terms from the history and theory of photography this paper argues that while photography is traditionally understood as having unsettled definitions of vision it has also, more importantly, put pressure on beliefs and dogmas that pertain to cognition, intentionality and creativity. To that end, the Universal Turing Machine as a conceptual model for photography prompts us to interrogate not images but instead, changing structures of relationship between components that comprise an imaging process. For photography, these are electromagnetic, optical, mechanical, chemical elements and procedures. Only an understanding of these as algorithmic can properly characterize photography as a novel artistic form. Further, this conceptual model of photography integrates the philosophy of photography into a richer philosophical framework, most notably that of media philosophy. Therein photography becomes more than just the contemporary sum of its capturing devices, imprinting processes or depiction traditions. Rather it is archetypal of multiple systems of abstraction and classification and various other symbolic processes of transformation.

*Photography. Vision Machine. Automatic Machine. Turing Machine. Algorithmic Art.*

## 1. NATURE ONWARDS

But an immediate fact about the medium of the photograph (still or in motion) is that it is not painting. (An immediate fact about the *history* of photography is that this was not at first obvious.) (Cavell 1979).

At the core of classic accounts of photography there is always one and the same seed of belief; photography is inherently different from its predecessors in art. A close reading of texts from the early history of photography reveals multiple statements suggesting this. Photography, it was commonly believed, is unique in that it has some privileged connection to nature.

Early accounts on the technology of photography demonstrate an unusually 'high dynamic range' in its deployment of language – with wording that conjures up concepts and metaphors that are, to this day, pivotal in the theory of photography. In them we find a picture of photography that is both active and passive, a medium that draws nature while simultaneously allowing nature to draw itself.

Louis-Jacques-Mandé Daguerre is a close contender for the title of 'inventor of photography.' His carefully considered wordings reveal not only an inventor and entrepreneur but also a man aware of the influence of first decrees. This is a description of the Daguerreotype process he published in

September 1839: 'It consists in the spontaneous reproduction of the images of nature received in the camera obscura...' (in Trachtenberg 1980). An alternative contender for the title of inventor of photography, William Henry Fox Talbot, is responsible for another carefully considered and equally puzzling description: 'Some Account in the Art of Photogenic Drawing, or, The Process by Which Natural Objects may be Made to Delineate Themselves without the Aid of the Artist's Pencil' (in Newhall B. 1980).

For the attentive contemporary reader, such statements ought to prompt questions like; *what* exactly constituted nature in photography then and *where* was it manifested? This unique interdependency was most often articulated with one of three possible identities for 19<sup>th</sup> century nature. These are nature as the sun, nature as an image and, most interestingly, *nature as an object*. Portrayed as such, a photograph was thus believed to reflect its object while *simultaneously* constituting it. Arguably, this articulation blurs the distinction between object and image. To be clear, this idea isn't confined to 19<sup>th</sup> century 'proto-photographic' thinking, it is common throughout most modernist thinking of photography, well into the mid or even late 20<sup>th</sup> century. One notable example is André Bazin:

The photographic image is the object itself, the object freed from the conditions of time and space that govern it. No matter how fuzzy, distorted, or discolored, no matter how lacking, in documentary value the image may be, it shares, by virtue of the very process of its becoming, the being of the model of which it is the reproduction; it is the model (Bazin 2005).

Taken literally, this statement should leave us 'ontologically restless' as Stanley Cavell put it (1979). Nonetheless, it does have several merits. It argues that 'process' (and not resemblance) is what necessitates the form of 'being' an image has. It further alludes to the possibility that some objects can be 'freed' from and un-governed by temporal and spatial constraints. This of course cannot be true to photographs which are tethered to material carriers. It can however be true for newer breeds of photographic images. It probably *is* true for photography in the main, if it could be theorized as an object. Its nature (if it could be said to have ever had just one nature) is contingent upon processual notions. These are, however, prone to change.

In other words, the argument underpinning this paper is that since all aspects of its technical modes of production have been transformed, photography's historical and theoretical lineages can and must change too. Instead of seeking legitimation in terms of a narrow, institutionally sanctioned history of photography, or defining itself as a tradition deriving exclusively from perspectival formulas, optical designs and chemical processes, a rigorous post-photographic enquiry should articulate other networks, operational cultures and contexts of production. These should revolve around more than just conventional products of a lens coupled to image recording and storage technologies.

Such enquiry becomes even more urgent now that we can easily foresee a future where, despite the ever-increasing use of photography, there will be no more photographs. To clarify, photography *will* be there with us in the foreseeable future (although not necessarily in the form we know it) but photographs may *not*, at least not in the strict sense of the word, as permanent markings of light on surfaces.<sup>i</sup>

And so, while still taking our cue from the same protagonist of photography theory, a more creative enquiry may prefer this statement:

For the first time, between the originating object and its reproduction there intervenes only the *instrumentality* of a *nonliving agent*. For the first time an image of the world, is formed automatically, without the creative intervention of man (Bazin 2005).

*Instrument, no-living agent, automatism* – in the context of photography (as well as in other contexts) these three terms can be substituted with one overarching term – *machine*, as indeed they have been,

since the end of the 19<sup>th</sup> century and onwards. And so, to demonstrate that this use of the term machine isn't entirely unwarranted, we ought to first clarify *what kind of machine photography is. What is it a machine for?* I will briefly touch upon historical episodes wherein photography is presented as a vision and inscription machine before I move to the locus of my argument a description of photography as a machine for information processing – a Universal Turing Machine.

## 2. THE MECHANICS OF SEEING

Whether 19<sup>th</sup> century nature was embodied in light, in images or in objects, the early pioneers of photography recognized their challenge vis-à-vis nature as being mostly chemical. Therefore, when the challenge was met and photography was invented (or discovered), photochemical processes came to be seen as that which actually "makes" a picture. Notwithstanding, another technical variable soon proved to be of pivotal importance to the practice and theory of photography – exposure length. Before Eadweard Muybridge's famous photographs depicting animal and human movement this variable was rarely considered important. Up until then exposure times were relatively long: Niépce's heliographs required exposures of approximately eight hours while Daguerre's first processes required 15 to 30 minutes. By the early 1840s Daguerre's process had come down to approximately two minutes and sometimes even less than one. Across the channel, Talbot's first photogenic drawings needed 30 to 60 minutes, though with his subsequent invention of the 'calotype' process, this was quickly reduced to a few. The advent of glass plate photography in the late 1840s and early 1850s accelerated exposures by a comparable factor and brought exposure times down to a matter of a few seconds. Even that, however, is achingly long by today's standards. Exposure times of fractions of a second only became available in the 1870s (Eder 1978).

Thus when a newspaper reported Muybridge's static images of a running horse in Palo Alto, California, it declared: "the grand discovery of an eye which could catch, and a plate which would register the most evanescent of movements" (in Newhall B., 1980). With this statement, and similar others, there emerged, I argue, a new kind of understanding about photography. The eye being celebrated in the quote above could no longer be the photographer's eye but rather his camera (or cameras). With that breakthrough, Muybridge's now-renowned images could not be attributed to nature any more than they could be attributed to a human artist. Arguably, the greatest challenge overcome by photography ('the grand discovery') was not photochemistry but rather mechanics.

As subsequent developments went on to demonstrate, faster exposure times immediately brought about cameras and studios that were much more mobile. Moreover, as human-controlled exposure lengths and camera positions became relevant variables for a viewer to consider, it was only logical that photography would, in viewers' minds, vie with the machine. Thenceforth, viewers of photographs would look back at the earliest works in a different way, one that placed the concept of 'machine' alongside 'nature', or instead of it, as the picture maker in photography. Thus, the nineteenth century distinction between humans and nature would evolve into a modern rivalry for photographic authorship that pits humans against their own technology.

### 3. VISION MACHINE, AUTOMATIC MACHINE

Peter Henry Emerson was a trained physician who turned to photography, wishing to promote it as an independent art form. Emerson's aesthetic theory, which was based on scientific principles of optics and perception, was a protest and at times direct attack on contemporaries in England which he criticized for denying the connection between art and science.<sup>ii</sup> Emerson's theory, which was called "Naturalistic Photography" (Emerson 1973), held that photographs serve one of two intimately linked but somewhat opposed cognitive purposes: the satisfying of aesthetic interest *and* the delivering of information. He believed that the aim of the artistic photographer was "naturalistic" representation – the imitation of the effects of nature on the eye. For Emerson, a naturalistic representation of a scene was, as much as possible, identical with the visual impression an observer would get should he be standing at the actual spot from which the photograph was made. Emerson, in other words, saw photography (and not only the camera apparatus) as a *vision machine* which the photographer needed to adhere to.

Surprisingly, it was none other than Emerson himself who in 1890 brought his program of naturalism to an abrupt end with the publication of a pamphlet titled 'The Death of Naturalistic Photography.' There he boldly retracted his former view that photography could in principle achieve artistic status, now arguing that photographs could never be works of art on the ground that the photographer's interpretation of subject matter was at the very least inhibited by lacking sufficient control over relevant variables affecting the picture's visual aspect. The best of this spectacular retraction came in 1892 when he declared: "the photographer does not make his picture – A MACHINE DOES IT ALL FOR HIM." In the rest of this published argument, Emerson imagines someone confronting the photographer and summarizing the case against him. This argument is of particular interest:

You selected the view: that was art. You arranged it well, focused it well: that was art.... Then you started a machine, and that machine drew the picture for you; you merely fixed its work by chemicals, which is... not art. You selected some ready-made paper, and the sun printed your picture.... That is photography, with an iota of art in the selection of the paper. We find you have not proved... you are an artist, for you can execute nothing. You cannot even draw a cube fairly.... If you think photography to be an art, you must decide who is the artist in the case of an automatic machine – the penny, the person who drops the penny in the slot, or the automatic machine... (in Newhall N. 1975).

This view, to be clear, still defines the parameter within which photographic discourse occurs. What's more, it also brings rise to an uncompromising belief in *causal* variables as the exclusive formative effect in photography. Wherein (unlike other art forms) 'under the same physical conditions the same results will always follow.'

But is this not a simplistic concept of machine? A machine is set in motion not only because a penny is dropped in a slot. A picture is made not only because a machine is set in motion but because the machine was designed, programmed and built. In other words, such opposition between human and machine is not only superficial but also artificial. Its sole purpose is to serve that which is not machine, or, in this case, to consecrate the human penchant for discrepancy we commonly call creativity.

I posit that the simplistic concept of creativity as autonomously human just isn't particularly useful for thinking about technologically dependent forms of art. Instead, an expansion of the term creativity to include various protocols which are embodied in the technologies and programs where creativity is performed (or in the theory which brought these into being) enables a better understanding of emergent artistic situations which these days are increasingly independent from material.<sup>iii</sup> My contention is that thinking in terms of supervenience will make it possible to theorize photography not only through its typical creative agents but rather through the reciprocal relationships it affords, not only as a history of informed images but rather as a tradition of informative processes which may or may not be sensorially perceivable.

### 4. POST PHOTOGRAPHY

Photography today is difficult to define and cannot be easily encompassed. It seems to be nowhere and everywhere simultaneously, its physicality near to invisible and its practices and uses ever more fluid. Is photography over, as some suggested? Perhaps not, because exact automated depictions are so ubiquitous that we take them for granted. The conundrum, in plain words, is this: "Photography has

all but ceased to exist; yet there is now more 'photography' than ever before."

How has the present condition come about? How have photographic images become fully synthetic? And how did photography's historical devices and processes recently incarnate as computer programs? The answer is deceptively simple. Mathematics and encryption, the inseparable union that for better or worse now governs most human communication is to thank (or blame) for this. On the other hand, Vilém Flusser's philosophy (2000, 2011a, 2011b) suggested that photography was never just another aesthetic or communicative form. Rather it emerged from calculation and so could never founder on it. 'The photographic universe', Flusser's legacy maintains, conditioned human thinking with the categories of *image*, *apparatus*, *program* and *information*, well before other technologies did. It allowed for thinking in a post- historical fashion. Such thinking is arguably *itself* mathematical, thinking in zero dimensions. But to what extent do Flusser's photographic categories hold when arguably it is now post-photography that we want to historicize, theorize and philosophize? Of course, as with photography so too with post- photography very little is ascertainable by means of strict causal discourse. Only programmatic explanations can account for the fact that the majority of all 'photographic' images in existence today is generated, stored, transmitted and displayed fully synthetically, without recourse to materials or material processes. For if, as I argue, the photograph was always the interface to a primitive information technology, then arguably its successor, the fugitive and transient quasi- photograph, as I like to call it, is also part of an ongoing reconfiguration of experience, mediation and signification of the world.

Put differently, the present perspective allows a vantage point from which we can appreciate how much mathematics has always been inseparable from photography. If this is true than photography has always contained (in potential and in effect) an element of *computability*. Therefore, I maintain, computation should be perceived as not only inseparable from photography but rather an integral part of it. Moreover, I will assert that the turning away from the visual towards the mathematical, the algorithmic and the computational, now allows for a new logic for photography. In this arena, the photographic image can no longer participate in the discourse of identity or representation unproblematically because it is now characterized by properties like modulation, transformation and transposition.

## 5. ALGORITHMS

This is why we ought to now consider the possibility that the greatest contribution of photography to art had little to do with depiction, representation, or with imagery for that matter. Instead, we saw, it had everything to do with *how* these goals are achieved. This, to reiterate, is *step by step*.

Think for example about the intricate experiments required for devising the best course of action in concocting photo-chemical solutions. Are these not attempts to determine optimal operativity by way of pre-meditated measures? Consider the motion studies by Eadweard Muybridge or those of Étienne-Jules Marey. The structures of movement they reveal were enabled only by instating clear, unambiguous and *finite* protocols of action. The same goes for Peter Henry Emerson's detailed sets of instructions outlined in his *Naturalistic photography* publications. These are sets of instructions for a sequence of procedures in order to achieve a specified result. The best example of this type of procedure is obviously Ansel Adams and his now famous 'Zone System' which demanded that, at the film exposure stage, accurate measurements and calculations be made to anticipate which future actions would be required in the darkroom (Adams & Baker 1983a, 1983b, 1983c). Adams' process, in short, was such that required a sequence of precise stages and in return guaranteed that the particularities of a pre-visualized photographic image would be realized.

Put differently, 'the nature of photography', the subject of much controversy and debate in the nineteenth and twentieth centuries, is decisively *algorithmic*.

But first, before I take this argument any further, *what is an algorithm?* It is, in very few words, a calculative solution to a problem. In a few more words, an algorithm is a concise description for a finite set of actions for the mathematical solution to a problem (which need not be mathematical). An algorithm does not contain any information, language or signs, other than those necessary for the solution of the problem at hand. However, algorithms, it should be made clear, do not require computers any more than geometry does.<sup>iv</sup>

We should also be thinking about many of photography's technical tropes as algorithmic. For example, the strict regulation called an 18% grey card (corresponding to an agreeably-pleasant tone of grey) or, for that matter, the Kodak color data guides and the sensitometric equations that determine how certain types of human skin tones should appear on certain types of film. In fact, the given proportions of camera apparatuses (always but one proportion per apparatus) is a form of

algorithmic image-disciplining. In photography, I assert, there never was a non-algorithmic form of image synthesis. Three observations may be adduced in support of this assertion. Firstly, strict technical circumstances needed to be emerge in order to yield the expertise required to 'discover' photography. Secondly, photographers learnt how to methodically apply this expertise and its subsequent developments. Thirdly, and perhaps most importantly, the intricacies of this technological expertise are embedded in every aspect of the photographic apparatus – in its mode of production and distribution, and in every amateur or professional manifestation of it.

Algorithms, we could say, are ways to make a situation explicit, to make it utterly clear and unambiguous. This, I believe, was the purpose of the famous bet between Leland Stanford and his friends.<sup>v</sup> Nonetheless, because explicitly, clarity and unambiguity are rarely qualities we associate with art, when algorithms are used to underwrite the making (or evaluation) of works of art difficult problems arise. Their reduction to an absolute form of determination usurps the place of open interpretation which art theory traditionally consecrates. Interpretation is open to contradiction and debate; determination seems to allow for only one correct case.

## 6. TURING MACHINES

Naturally, a theory of algorithmic image making must necessarily be distributed across manifold technologies. Nonetheless, there is one technology, or rather concept, which plays a protagonist role in narrativizing this theory – this is the Turing Machine. In attempt to establish the relevance of this special apparatus to photography, a short description of its construction is required, which also requires a brief outline of the history of its origin.

The early work of Alan Turing attempted to offer the solution to only one basic problem; How to notate real numbers with other numbers? Technology and engineering have always been dependent upon real numbers but those, as is well known, can be *infinitely* long. Thus, the question was this: Can infinitely long real numbers be notated with whole numbers, which are only *finitely* long? Turing proved that, although this task could not be accomplished for all real numbers, it was achievable for a crucial subset, which he dubbed computable numbers.<sup>vi</sup>

Turing's thesis stated that every computation *expressed as an algorithm* has its equivalent in a hypothetical machine that can be called 'a Turing machine'. Turing machines are deceptively simple. All they consist of is a roll of paper that simultaneously contains commands, data, and

addresses – input and output, a program and results.<sup>vii</sup>

Importantly, being formalistic, mathematics is often a game with empty symbols. The same goes for Turing's concept. It too is part of a tradition that utilizes symbols that precede the distinction between letters and numbers, reference nothing, and, in and of themselves, are completely meaningless. A Turing machine, like a photographic camera, requires for its operation only that which stands at the beginning of Hegel's Logic: pure difference. The only condition for the symbols it reads is that they are distinguishable (and thus translatable to concepts like black and white).

Furthermore, since not only letters and numbers are the same thing for a Turing machine (namely symbols) so too are the differences between numbers, operations with them, and statements about them. This means that for complex computations these machines can be harnessed together, the output of one becoming the input of another, and so on. Thus, Turing postulated the possibility of a universal machine (now known as 'A Universal Turing Machine') that could emulate the behavior of *any* specific Turing machine. A universal computing machine would be one that, given any table of instructions that defined a Turing machine, could carry out those instructions.

A Turing Machine is thus a fundamentally new type of machine because it is no longer a machine that transmits force or energy onto material (as were all machines from antiquity to modernity) but rather a machine that is defined exclusively by a set of logical and *mathematical* structures. It is in that a machine that utilizes, manipulates and transmits pure information, a machine wherein the material and the process it undergoes coexist in the same entity. This, to reiterate, is exactly what Andre Bazin argued about photography.

In and of itself, a Turing Machine is an artefact without properties. Arguably, much like photography it is this virtue of universality – the ability to simulate arbitrary discrete apparatuses – that leads to an absence of characteristics, because any concrete determination would prevent such generality.<sup>viii</sup> Divorced from material substrate, a Turing machine, like contemporary photographic apparatuses, is a technical abstraction. Yet, like photography, it also has applicability wherever it is instantiated.

## 6. REFERENCES

- ADAMS, A. and BAKER, R., 1983. *The Camera*. Little Brown, Boston, MA.  
ADAMS, A. and BAKER, R., 1983. *The Negative*. Little Brown, Boston, MA.

- ADAMS, A. and BAKER, R., 1983. *The Print*. Little Brown, Boston, MA.
- BAZIN, A., 2005. *What is Cinema?* Univ. of California Press, Berkeley.
- BURGIN, V. (ed.), 1982. *Thinking photography* Palgrave Macmillan, London.
- CAVELL, S., 1979. *The World Viewed: Reflections on the Ontology of Film*. Harvard Univ. Press, Cambridge MA.
- EDER, J.M., 1978. *History of photography*. Dover Publications, New York.
- EMERSON, P.H., 1973. *Naturalistic Photography for Students of the Art & The Death of Naturalistic Photography*. Arno Press, New York.
- FLUSSER, V., 2000. *Towards a Philosophy of Photography*. Reaktion, London.
- FLUSSER, V., 2011. *Does Writing Have a Future?* Univ. of Minnesota Press, Minneapolis.
- FLUSSER, V., 2011. *Into the Universe of Technical Images*. Univ. of Minnesota Press, Minneapolis.
- FRANKE, H.W., 1988. The Computer - A New Tool for Visual Art. *The Visual Computer: International Journal of Computer Graphics* 4, 35-39.
- NAKE, F., 2010. Paragraphs on Computer Art, Past and Present. In *'Ideas Before Their Time: Connecting Past and Present in Computer Art' conference*, N. LAMBERT, J. GARDINER and F. FRANCO Eds. BCS, London, 55-63.
- NAKE, F., 2012. Construction and Intuition: Creativity in Early Computer Art. In *Computers and Creativity*, J. MCCORMACK and M. D'INVENTRO Eds. Springer, Heidelberg.
- NEWHALL, B. (ed.), 1980. *Photography: Essays & Images: Illustrated Readings in the History of Photography* The Museum of Modern Art, New York.
- NEWHALL, N., 1975. *P.H. Emerson: The Fight for Photography as a Fine Art*. Aperture, New York.
- TRACHTENBERG, A. (ed.), 1980. *Classic Essays on Photography* Leete's Island Books, New Haven.

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<sup>i</sup> Strictly speaking the historical difference between the camera obscura and the photographic camera was the ability to offer a *permanent* image (given the fulfilment of other requirements of course). The future, as it is emerging, will include fewer and fewer permanent photographs (that is photographs with material support) and many more photographic projections which are, by default, *not* permanent.

<sup>ii</sup> Notably Henry Peach Robinson, an English Pictorialist photographer who was best known for his use of combination printing - joining multiple negatives or prints to form a single photographic image (other examples for uses of such technique are Gustave Le Gray's seascapes or Oscar Gustave Reilander's *The Two ways of Life* from 1857).

<sup>iii</sup> On that note it may be worth recalling this provocative statement by Herbert Franke: 'The application of technical means in art is very old; it is remarkable that in music it has led to insertion of complicated physical precision machines, whereas visual art has long remained true to methods used since the stone-age: the application of colour by means of pencil and brush.' To be clear, by "methods" Franke is also referring to theoretical methods (Franke 1988).

<sup>iv</sup> Notably, the term algorithm is phonetically derived from the name al-Khwarizmi (Muhammad ibn Musa al-Khwarizmi), a 9th century Persian mathematician. In other words, algorithms *predate* computers by at least a millennium (depending on whether we take Charles Babbage or Alan Turing to be the father of the modern computer).

<sup>v</sup> The bet was whether a horse's four hooves ever lift off the ground simultaneously.

<sup>vi</sup> Turing machines do not need the many letters, figures, and signs found on today's computer keyboards. They make do, loosely following Boolean algebra, with one sign and its absence: one and zero. By sampling this binary information on the basis of an IF-THEN specification that constitutes the entirety of their artificial intelligence, they operate automatically – the roll of paper moves just a bit to the left, a bit to the right or not at all. Most importantly, the manner in which they read determines what is subsequently written. It depends on the sign (or as the case may be, its absence), whether Turing machines leave the mark standing or delete it – or conversely, whether they leave the empty space standing or replace it with the sign. After this simple operation, the program loop jumps back to reading, and so on, etc., etc., ad infinitum. That is the whole of it.

<sup>vii</sup> Such a universal machine would thus become programmable. Turing's hypothetical machine therefore provides the formal basis for the modern computer. In a computer, to be sure, different instructions, or sets of instructions called programs, allow the same machine to do a variety of tasks.

<sup>viii</sup> "Water" is not the same theoretical object in chemistry as it is in hydraulics - an observation which in no way denies that chemists and engineers alike drink, and shower in, the same substance. By much the same token, "photography" is not the same object in photography theory as it is when it appears in a general theory of the social formation' (Burgin 1982).