9. What Moves? The Itineraries of Pre-Digital Photography[1]

Michelle Henning

It seems self-evident that photographs are still. The language of fixing, of the freeze and the slice in time has long been used to characterize photographic images. Before digital images, photographs were contrasted with "moving pictures"—with film and television. The tendency to treat photography and film as separate media makes sense from the point of view of consumption, but not when we take into account their shared technology and means of production. Nevertheless, the story goes that in the analog era, photography and film were separate media, one still and one moving, but in the digital era, they converge on the liquid crystal screen. This idea, that the chemical, analog photograph is by nature static, relies not only on a contrast with film but on a comparison to its digital counterpart, which is regarded as mobile, malleable, transitory, virtual and immediate. After all, for most consumers and makers of digital images, the same cameras and platforms are used to make and view still and moving images, and while we might term one "photo" and another "video," the two can be indistinguishable except in that one moves. The introduction of "live" photos makes the distinction even hazier. Furthermore, since they appear and disappear at the touch of a finger, and since the colors on a screen are constantly refreshing, perhaps no digital screen image can really be classified as still. As Ingrid Hoelzl and Remi Marie suggest, "the image is always potentially moving" (2015, 23).

If the digital photograph is never really still, by comparison, the pre-digital, analog or chemical photographic image appears as fixed and static, characteristically immobile, a frozen piece of the real. This portrayal of chemical photography, which can be found across a wide range of writings on the digital image, assumes that what preceded digital was primarily a technology of the photographic print. It neglects the transparency or the negative, or the various ways in which photographs are mediated in order to be reproduced in print media or transmitted across the world. My interest here is in the transitory aspects of the "still" photograph, not its animation (or its relation to cinema) but its lack of fixity as a medium and how this challenges the characterization of photographs as frozen moments and slices through time. In previous writing, I have drawn attention to chemical

photography's role in unleashing images from their fixed place in time and space: through reproduction and circulation, transmission and projection, fragmentation and decontextualization (Henning 2018). I take the view that it matters that we recognize the mobility and liveliness of pre-digital photographs, in order to better acknowledge the diversity of contemporary and historical images and practices and to understand the continuities as well as the breaks between new and old forms of photography. In particular, I want to question overused distinctions between the material and the "virtual," the static and the mobile, that underpin divisions between analog and digital.

The notion of the fixed, still, frozen image is inseparable from other persistent ideas about photography that deserve interrogation. These are specifically about its relation to time and experience. It has often been noted that photography has participated in a historical transformation of experiences of temporality and processes of remembrance (Kracauer 2014, 40). The photograph, conceived as a preserved instant, seems to stop time, prosthetically substituting for and extending our memories, but also to break the continuity of time by slicing it into ever finer pieces. The snapshot's "pastness" becomes its defining characteristic. Even before photography was invented, the photographic image seems to have been anticipated as a snippet of reality, fished from the flow of time (Batchen 1997, 84). The idea of the photograph as a frozen moment seems to suggest a series of moments like beads on a string, each bead corresponding to a photographic exposure. Yet, the length of a photographed moment can vary considerably, from a matter of hours or even days to thousandths of a second. As Chitra Ramalingam points out, "most early photographs were essentially durational in character. Single instants were buried in the aggregation of impressions over time" (2015, 341). There are other temporalities of the photograph, too: to print a positive from a photographic negative requires a second exposure time, and the development of both positive and negative requires various amounts of time for developing and fixing. To treat a photograph as a real moment, grasped, is easy to do if the image represents a younger self, a past event, a now-dead relative. But to make this the defining quality of photography is misleading. So, for example, we might rightly wonder in what sense a photograph is usefully interpreted as a representation of the past, if it has no specifically historical content, or in what sense it represents a "moment" if we cannot know how long the shutter was open, or in what ways it was constructed through the dance of light under an enlarger or the mixing and control of chemicals in trays.

We have continued to regard photography as primarily a means for recording reality, defined by its relationship to the objects in the world that it depicts (so that for some a photograph can never really be abstract, or if it is, it is not a photograph). Cameras are thought of as mechanical eyes, photography as a technology of seeing, a transparent medium that we look "through" to reality (Huhtamo 2018; Henning 2018). The term "fixing" is used to describe both the pinning down of subject matter

by the camera, and the stabilizing of the image on the print or film. These two types of "fixing" do not have any necessary relation to one another: it is not a condition of snatching a moment that it must subsequently be permanently preserved. But through this slippery term, a photograph's stasis is envisaged, both in terms of what is represented in the image (a fleeting moment made to last) and in terms of the characteristics of the print (as something unchanging, of relatively solid and permanent form).

Both are truisms only if we accept that photography's social significance rests primarily on this ability to preserve or record reality, bracketing off the ways in which the process encodes and translates its subject-matter, and if we ignore the exceptions, such as the abstract photograph, the long exposure photograph, the projection, the badly fixed and fading print. Even while image stability is desired, it is not easily achieved, as indicated by the efforts made to prevent photographs fading or render them stable—from the Photographic Society's "fading committee" in nineteenth-century London to the experiments of the industrial laboratories of companies such as Ilford, Eastman Kodak, Agfa, and Polaroid, and the ongoing work of archivists (Schwartz 1996, 94; Henisch and Henisch 1994, 92). As Hoelzl and Marie write: "The concept of the photo (or film frame) as an immobile cut through abstract time, does not consider the fact that photographs (as objects in time) are also subordinate to time, even if the change occurring and observable is usually very slow" (2015, 17).

Classic photography theory is born of a particular moment, of the era of snapshot and "instant" industrialized photography, of a particular historical set of practices and genres (family photography, reportage, documentary), and alongside the rise of a specific kind of modernist, humanist and "candid" aesthetic. It is preoccupied with questions of time, realism and memory, in recognition of the ways in which photographic media had dramatically transformed people's relation to their own past and to the visible world, in little more than a century. More recently, this idea of photography as a mnemonic practice has been linked to the vast accumulation of vernacular photographs, which stockpile experience to the point that the sheer volume of the recorded past seems to overwhelm the present (see the discussions in Dvořák and Parikka 2021 and Lewis and Parry 2021, forthcoming). However, a number of recent writers have challenged the dominance of certain key notions in photography theory: of the photograph as a mnemonic and rather melancholic object associated with death; of the photograph as an imprint of the real; of the snapshot as the epitome of photography. For instance, Peter Buse has noted that the emphasis on memory in relation to snapshot photography acted as a useful corrective to the art historical approaches that preceded it but "like any dominant way of thinking, this one has the potential to cut off other areas of investigation" such as "photographic practices that are not in the first instance to do with memory" (2016, 21). Summarizing a wide range of writings preoccupied with

the mnemonic function of snapshots, Buse notes that this is also an emphasis on the partiality and unreliability of photography and a general melancholy in which: "even the most straightforwardly happy of family snaps is shadowed by loss, lack and death" (2016, 28). In my own writing, I have considered how an analogy between photographs and death masks recurs across a number of writings on photography, and emerged out of a particular style of photography, and the specific social and cultural context of interwar Europe (Henning 2017). In *Life After New Media*, Sarah Kember and Joanna Zylinska argue that photography needs to be seen "as more than a series of frozen 'snapshots,'" and they mobilize Bergsonian notions of vitality and ongoing mediation against the more common theoretical association of photography with death (2015, 71).

Attention to the mobility of the photographic image and of photographic practices has been gaining traction recently. The broader recognition that we now experience media on the move, meaning both on devices that we carry with us as well as in temporary instantiations conjured up on a screen, has allowed us to reassess photography as a media-form which had no fixed location even prior to digitization. For Erkki Huhtamo, for example, a consumer box camera such as the Box Brownie, "could well be described as the first true mobile medium" (2011, 27). Rachel Gillies takes the term "mobile photography" to refer both to the use of smartphones, and to photography as an inherently mobile medium, albeit one whose mobility has been radically extended in its transition to digital devices and screens (2020, 213). Hoelzl has argued that we should think of "photography not as a time-less but as a time-based medium" and that movement can be traced "at every stage" in the practice of photography through to its circulation and reception (2011, 2–3). Kember and Zylinska redefine photography in terms of its "potentiality" and its processual, performative nature, treating it as a practice of "cutting," of managing temporality or duration rather than of reducing a (mobile, transient) world to static representations (2015, 71–81). They still regard photography as a means to produce "graspable entities," but these are only temporary stabilizations (Kember and Zylinska 2015, 76, 82–8).

While many of these writers have shaped my thinking about photography as a mobile or kinetic medium, here I want to pick apart the story which posits an old medium as static and fixed and views its replacement as dynamic, dissolving and insubstantial. In particular, I will try to approach the mobility and temporality of the photographic image in terms of its ability to be disassembled and reassembled, its disintegration into particles, its ability to disappear and reappear, moving from one substance or surface to another. This involves attending both to the actual properties of the medium and the cultural frameworks through which we understand it, and it will require situating photography within broader theories of capitalism, modernity and media. In the next section of this chapter, I address how theories about capitalist modernization link a kind of dematerialization to

an acceleration of experience, and how this has affected how photography's own speeding-up has been understood. In the third section, I pay attention to arguments about automation and how the pixels or grain of a photograph are linked to its ability to be dissociated from a specific surface. This is followed by a discussion of noise, as something which results from the movement of images, which connects media with the incorporeal or immaterial (the spirit world) and which at the same time reveals the impossibility of pure communication uncontaminated by the material infrastructure that produces it.

All That is Solid

One of the most compelling and much-repeated phrases from *The Communist Manifesto* is "all that is solid melts into air" with its implication that capitalism involves a kind of dematerialization (Marx and Engels 1968). Of course, it is a metaphor: tradition is envisaged as solid and static, while capitalist change and the destruction of tradition is envisaged as dissolution or vaporization. This story of capitalism and of modernity resonated, in the nineteenth century, with certain technological developments and scientific discoveries including the invention of the telegraph and of photography. The vision of capitalism as dynamic, mobile and destructive is shared by one of the early proponents of neoliberal economics, Josef Schumpeter, who conceived of entrepreneurship driving innovation through "gales of creative destruction" (1942). Even today, capitalist economic cycles are described in terms of "growth" and "stagnation" (types of movement and stasis). The dependence of ideas of modern mobility on ideas of stasis-as-stagnation is evident in economic discourse, as is the way that innovation goes hand in hand with the production of obsolescence. Modern capitalism produces casualties—including people and ways of life—which do not disappear altogether but are treated as if outside time, obsolete and outmoded leftovers (Watkins, 1994). Technical obsolescence is grasped in these terms, too: hardly surprising then, if since the 1990s, digital photography has been characterized in terms of dynamic mobility, while the older chemical photography seems to be both about the past and of the past, obsolete but also always inherently backward-looking.

Marx and Engels' phrase captures the sense of destabilization and loss of traditional ties and roots that accompanies rapid social and technical change. This experience is understood by theorists both as the experience of modernity, and the modern experience of historical time (see for example Berman 1983; Harvey 1990). In periods of technical and industrial change, there is a sense of acceleration, of ever more rapid change, of a hastening of time. This experience of acceleration reshapes both the past and the future. It is born of a specific kind of historical consciousness which, writers such as Reinhart Koselleck have argued, developed out

of revolution, globalization and colonialism. It is manifest in the ways in which Europeans mapped their own historical experience onto other cultures, so that nonindustrialized cultures came to be seen as simultaneously contemporary and belonging to the past (1985, 247). The concept of progress is inseparable from the modern experience of acceleration. Time is conceived as a moving forward, and a gulf opens between the present, the past and future (Koselleck 1985, 251). The connection between modernity, accelerated time and movement was made explicit by the Prussian historian Friedrich Ancillon, cited by Koselleck, for whom the experience of modernity was the experience of things being "set in motion" and the love of modernity was "the love of movement in itself, without purpose and without specific end" (Ancillon 1828, cited in Koselleck 1985, 251). This sense of transience induced by modernity, which destroyed an older sense of cyclical time, informed the Romantic attachment to fleeting sensation and ruins, which is linked, by Geoffrey Batchen, to early nineteenth century photographic experiments (1997, 84; 2002).

Most writers on modernity see the nineteenth century as the period in which stability became the exception rather than the rule of social existence (in the West), and many agree, as Bernard Stiegler writes, that "technics, as technology and techno-science, is the chief reason for this reversal" (Stiegler 2009, 1). For Stiegler, accelerating technical innovation means that technical information systems outstrip existing social organization, transforming not only culture but memory and psyche (Stiegler 2009, 3).[2] For Zygmunt Bauman, by the late twentieth-century a newly volatile "fluid modernity" is permeating every aspect of daily experience and social life, disintegrating collectivities and dismantling community, dissolving bonds of family and introducing new nomadisms (1999, 7–13). Bauman links this falling-apart of social relations with a growing disposibility and instantaneity of goods and technologies. Theorists of globalization conceive of the movement and mobility it entails in terms of "flows," that is, "flows of capital, flows of information, flows of technology, flows of organizational interaction, flows of images, sounds and symbols" (Castells 1996, 412). For Bauman, the fluidity of this new phase of modernity means it might only be described in "snapshots, and they need a date at the bottom of the picture" (1999, 2). He evokes the snapshot photograph as a temporary, provisional account of something which we know will have moved on since. Snapshot photography in this sense is the medium born of, and most suited to representing, a new form of experience that does not lend itself to slow, considered representation.

Automation and the spread of electronic media are understood by numerous theorists as contributing to a growing impression (or illusion) of dematerialization. The idea that a movement toward dissolution is characteristic of capitalism is developed by autonomist thinkers such as Franco "Bifo" Berardi, who views computerization as rendering labor increasingly "immaterial," distributing it beyond

the workplace and into everyday affective experience, with devastating effect on human experience—as the limitless speeding-up of information processing meets the limitations of people's capacity to handle and respond to it (2009). New forms of accelerationist theory reverse this, characterizing contemporary global capitalism as depleted, flagging and stagnating, and seeing emancipatory potential in acceleration (Gardiner 2017, 33).[3] Despite significant differences, most of these theorists concur in their diagnosis of late capitalism and liquid modernity as both accelerating and destructive. Contemporary theory diagnoses a speeding-up of transport and communication, and of the pace of life in general, alongside increased productivity and increasingly fast cycles of fashion and cultural change, even while it also diagnoses an underlying inertia and repetition (Rosa and Scheuerman 2013, 5–7). The sense of accelerated time is invariably linked to fragmentation, liquefaction, dissolution or disintegration: things fall apart.

It seems likely that theories of modernity as accelerated temporal experience follow modern science in linking movement and speed with disintegration or liquefaction. In physics, the movement of atoms and molecules is linked to a change in state from a solid to a liquid or gas, or from cold to hot, and the theory of entropy suggests an inexorable movement toward disorder over time. However, when the acceleration we are describing is the experience of historical time, the movement from "solid" to "liquid" or even from "material" to "immaterial" is largely metaphorical ("immaterial labor," for example, does not imply that labor is not embodied or does not have material effects). The solids that melt into air, or liquify, are traditions, ways of life, values and beliefs, institutions and hierarchy, things that are not tangible objects, but were felt to be "solid" because they were long lasting or seemed indestructible. Metaphors of liquefaction, disintegration, dissolution or evaporation are a means to make sense of periods of rapid change, and the loss of familiar anchors and routines.

In the case of electromagnetic media, the connection between speed and increased intangibility is literal. To accelerate information flow, from the nineteenth century, media began to harness forms of radiation that could permeate solid walls and cross national borders. By the 1870s, this mediated flow of information was speeding up capitalism, via the ticker tape telegraph system used in finance houses and stock exchanges. During the twentieth century, as media became increasingly computational, their temporality came to depend on processing time: thus, the human experience of an accelerated modernity is dependent on the micro-temporalities of "time-critical" digital and electronic media, the workings of which were increasingly black-boxed, and which rely on invisible and intangible forms of transmission (Ernst 2005; Parikka 2011). Fast information flow, whether analog or digital, appears to be accompanied by a relative dematerialization insofar as the dissolution of the image into signal, wave and particle is what allows it to travel.

The familiar narrative of modernization as acceleration also plays out in theories of digital photography, which emphasize the speeding-up of the taking and viewing of photographs facilitated by digital processing. However, in everyday experience, digital photography actually introduced a new slowness, in the form of a frustrating delay, noticeable in early and lower-priced digital cameras, between the pressing of the shutter release button and the taking of the photograph. It is the case, though, that photography (both digital and analog) became faster over the course of its history, in the sense that increased film sensitivity, finer lenses, and electronic shutters made possible ever-shorter exposure times, supporting the impression that the photograph itself was a slice of time. As early as the 1850s, London photographic studios were advertising "instantaneous photographs," a phrase which emphasized the convenience to customers (since the whole process would be quick) but also the modernity of a technology characterized by speed (Skaife 1860, 9). The attraction of the instantaneous as characteristically modern was linked to developments in other technologies, particularly electricity and telegraphy, and to studies of the human nervous system (Henning 2018, 46; Canales 2009, 25–26; Morus 2000, 459).[4] By the early twentieth century, the shortening of photographic exposure times and processing times was being driven by a combination of commercial and military incentives, including state-funded research into sensitizing dyes during the Great War.[5] In other words, the speeding up of photography was not a technical inevitability but was overdetermined by the larger narratives and practices of capitalist modernity and consumer culture, in which acceleration, innovation and instantaneity were central concepts.

The Discrete and the Grainy

Even those theorists of photography who challenge simple divides between analog and digital tend to view photography as moving inexorably towards a kind of dematerialization. In some accounts this is associated with the black-boxing of the technology, for example in Kaja Silverman's account of photographic history as a move away from the "wet" chemical technology of early photography towards a "dry" photography (in a reversal of Bauman's increasing liquidity). Photography's dry spell begins with the commercial dry plate and the factory-processed film and continues into the black box of the digital camera. As Silverman summarizes, through a reading of Jeff Wall's seminal essay "Photography and Liquid Intelligence," chemical photography's reliance on fluids, its "liquid intelligence," makes it seem unpredictable and uncontrollable, whereas ever "drier" photographic technologies appear to drive towards a "cool," more rational and controlled image (Silverman 2015). This is not a simple opposition between analog and digital; dryness is associated here with a growing gap between production and consumption, an increasing automa-

tion and, from the photographer's point of view, a more "hands-off" and ocular approach, in which the material resistance and messiness involved in "making" a photograph is replaced by the quick, clean act of "taking" a photograph.

Wall/Silverman's wet-dry distinction alludes to the way in which, even in digital, photography's messy physicality is not entirely expurgated but rather displaced to an elsewhere: to manufacturing plants and mines that are not visible to the photographer. But the assumption that digital represents a step toward greater rationalization and control underestimates (for example) the technical complexity of photographic film manufacturing which makes use of very refined automated processes of precipitation and ultrafiltration to precisely control the grain of the image. To see the "dry" image as more rationalized reinforces one of the key fallacies of the analog-digital distinction in photography: the tendency to view analog as less automated and less industrialized.[6]

Vilém Flusser, writing in the 1980s, understood changes in automation and the rise of an information economy as producing a new mobility in images, which disassociated them from specific material surfaces. He argues that the automation of work, and the transformation of human labor into the labor of machine programming (characteristic of what he called post-industrial society), means the end of cultural objects. This is because cultural objects, as he defines them (in a mix of Heideggerian and Marxist thinking), are objects given value through human labor; and in the context of post-industrial information society such objects "become almost 'value-less' supports for programmed information" (Flusser 1986, 330). Flusser's prime example of a post-industrial object is a photograph which carries its information "on its surface and not within its body," and this information "may be transferred easily from one worthless surface to another" (1986, 330). The camera, in turn, is not simply a machine but an apparatus which "elaborates information." In this way, Flusser sees photography as a key medium in the shift toward an information-based, post-industrial society, suggesting that this is merely consolidated in the move from chemical to electromagnetized photos (Flusser 1986, 331).

According to Flusser, photographic images have a relative independence from the physical surface on which they appear, which distinguishes them (and all other technical images) from traditional (i.e. handmade) images. Technically, this is not strictly the case with photographic prints, the visual characteristics of which are determined not only by the negative and enlarger but by the type of paper and the qualities of the photographic emulsion. The image does not sit on the surface, as Flusser seems to imply, but as Ramalingam points out, the photograph is "laminar," made up of different "strata" which determine the appearance of the image and how it changes over time and in different environmental conditions (2015, 319–320).

For Flusser, the break between chemical and electromagnetic images is not as significant as the break of both from traditional images. He emphasizes the particle-based nature of technical images: from the grains on a chemical photograph to

the points of light and color on a television, "all technical images have the same basic character: on close inspection, they all prove to be envisioned surfaces computed from particles" (Flusser 2011, 33).[7] However, early theorists of the digital image see a key difference at the particle level, between the grain of the chemical image and the pixels making up a digital image. They distinguish the irregular grain of photosensitive emulsion, with its infinite tones, from the pixels of the digital sensor, all of identical scale and countable (Mitchell 1992).[8] The difference in these photosensitive surfaces, and how they store information is a foundational distinction between analog and digital cameras, since the process by which light enters the camera remains the same. Bernard Stiegler suggests that the key difference is that digital images can be disassembled and reassembled, while the chemical or analog photographs cannot, even though they too are "always already discrete" (Stiegler 2002, 155–158).

Some writers have suggested that technologies predating digital photography can be seen to increase the discreteness of photography, for example, the half-tone system required for the "mass circulation of photographs . . . imposed for the first time a grid structuring the grain of the image" (Cubitt, Palmer, and Tkacz 2015, 9). However, this kind of explanation of the birth of photography as a mass reproducible and standardized medium, first via the half-tone screen and eventually through the pixel array, with its distinction between random particles and rationalized grid, retains the misleading impression that analog photography is craft-based rather than something that itself becomes highly industrialized and standardized.

In information theory a discrete process is simply defined as having a limited set of symbols or values and a finite range of allowable sequences, a set of rules that allows for encoding and compression (Shannon and Weaver, 1964, 34–6). The particulate nature of the technical image is key to its mobility (its reproducibility, its transmitting ability). Discreteness, manifested in the regular grid of the half-tone screen or pixel array, enables greater encoding and compression, key factors in the transmissibility of images. However, the grains of a technical image do not necessarily point to a separation of information from material support. Insofar as they also act as indices of "noise," they suggest contamination or damage to the image or its material limitations. For example, across both pixel and crystal-based photographic technologies, low light affects the appearance of grain.[9] Generally and very broadly speaking, the lower the light, the more visible the grain of the image and potentially the more noise (drop-out or "artefacts" in digital images). Noise becomes an indicator of the physical constraints of the medium itself.

Snap and Crackle

Noise in the image also reveals that it has travelled. It is the accumulated dirt of the traveller. As Hito Steyerl famously argues in her "In Defense of the Poor Image," the poor-quality digital images that circulate on the internet are a product or side effect of the fetishization of high-resolution (rich) images, the privatization of intellectual property and the commercial market for media. Noise, like dirt, accrues to the devalued, but it also gathers with speed, as Steyerl asserts in her opening sentence, "The poor image is a copy in motion. Its quality is bad, its resolution substandard. As it accelerates, it deteriorates" (2009). Acceleration, for Steyerl as for others, is associated with dematerialization: "Poor images are poor because they are heavily compressed and travel quickly. They lose matter and gain speed" (2009). If Steyerl seems to agree that poor images take to the extreme the tendency Flusser identified in photography—to detach information from its material support—she also suggests that in the process they encounter a different kind of materiality in the form of noise.

The belief that media might provide a means to communicate with ghosts or aliens often relies on the ambiguity of noise. In the twentieth century, the "snow" in analog television and the crackle of radio both seemed to suggest that it was possible to see or hear beyond the channel, to access other worlds—an idea dramatized in the film *Static* (Romanek 1986), in which the principal character is convinced he can see Heaven in the white noise of television. Similar esoteric understandings even gained a scientific basis after the 1965 announcement of the discovery of the "cosmic microwave background" (CMB), which was picked up by radio and television antennae as "noise" and considered by cosmologists to be radiation produced by the Big Bang.[10] The idea that in looking at television static or "snow" we are witnessing the beginning of the universe, feeds into a fascination with the accidental and nonhuman elements of media. Beliefs and practices centring on cosmic or spectral communication through media are sometimes seen as the consequence of a misunderstanding of technology and science, or a human response to the unsettling pace of change in modernity. However, Bernard Geoghegan argues that our willingness to perceive ghosts in the machine is linked to the failure of the technological promise to provide smooth and uninterrupted communication (2016, 900). He argues that nineteenth-century spiritualism emerged as a practice of building connections in the gaps, delays and noise characteristic of emergent and unstable media.

Noise goes hand in hand with mobility, it lurks in channels, and thrives in transmission, it haunts any kind of communication. The technical problem of how to enable a message to emerge unscathed from transmission is the focus of cybernetic information theory. Claude Shannon's 1948 *Mathematical Theory of Communication* addresses the technical imperative of getting a message (including an image)

to survive intact through a noisy channel. Shannon was primarily concerned with how a message gets "*selected from a set* of possible messages" and how information can be retrieved or reconstructed from a message (or image) that has been altered by mediation, including through encoding and compression (Shannon and Weaver 1964, 31, his emphasis; Hayles 1987, 126).

Shannon insisted that the meaning of the message was irrelevant to the engineering problem of encoding and decoding information, yet his own examples reveal how false the separation is. His example of a text with low "redundancy" (meaning also low predictability) is James Joyce's modernist masterpiece *Finnegans Wake*. Texts like this prove a challenge to communication systems that rely on encoding and compression, since relatively little can be removed from the text without it being impossible to reconstruct at the other end.[11] In a high redundancy symbolic system—Shannon's example is that favorite of 1930s and 1940s proponents of language rationalization, C.K. Ogden's Basic English with its 850 word vocabulary—not only can the text be compressed, but in a noisy channel, "a sizable fraction of the letters can be received incorrectly and still reconstructed by the context" (Shannon and Weaver 1964, 75).[12] These examples are a give-away regarding the non-neutrality of what appears as principally a technical problem, since *Finnegans Wake*'s complexity as a text cannot be separated from its meaning, nor can Basic English's simplicity be separated from its ideological purpose. The formal and linguistic experimentation of Joyce's writing is part of the content of the text, while Basic English represents a different pole of modernism, one informed by logical positivism and the universal language and Unity of Science movements of the 1930s, and concerned with "debabelization"—the "purification, simplification and systematization" of language (Morris 1938, 81). Indeed, the 1949 introduction to Shannon's essay, written by Warren Weaver, connects information theory to universal language theories, arguing that Shannon's engineering theory should be used to inform the ways in which language is "designed" (Shannon and Weaver 1964, 27).

Geoghegan describes what Weaver was proposing as a "massive assimilation of the humanities, social sciences, and nature into a technocratic framework whose orderliness reflected the design of the machine systems from which it had been abstracted" (2012, 93). It is no surprise that these machine systems accommodate themselves more easily to the simplified and rationalized Basic English than to *Finnegans Wake*, despite Joyce's text more accurately representing the fate of language in the world of communication technology—as Donald Theall describes it, it is a "self-reflexive book about the role of the book in the electro-machinic world of the new technology" (Theall 1992, n.p.). While Shannon reads *Finnegans Wake* as difficult to disentangle from noise, a text that will not fare well in a noisy channel, it is also a text that mobilizes and anticipates noise as a central part of communication.

Shannon does not conceive of noise as a property of the original text but as a property of the channel (or the medium), and also as an outsider that invades the

system and perturbs or jams the signal during transmission. Examples of this from telecommunications include the noise generated in underwater cables by snapping shrimps, or the appearance of CMB in television "snow." Such intrusions seem to confirm a preexisting sense of a third presence between sender and receiver, which Michel Serres names the parasite (Serres 2007). Indeed, Serres argues that this "excluded middle term" is actually key to the functioning of media. For him, every channel once opened is opened up to interference, and media by definition must be "noisy." Serres argued that communication depends on "background noise, white noise, jamming, static, synchronic breaks" (Serres 1982, 40). Noise draws attention to the process of mediation itself; as Sybille Krämer writes, "only noise, dysfunction and disturbance make the medium itself noticeable" (Krämer 2015, 21). But also, and more radically, Serres viewed noise as the essential ground of mediation: "We see only because we see badly. It works only because it works badly. . . . I understand the message only because of the noise" (2007, 70).

The initial impact of cybernetics on the humanities was not at all what Weaver had in mind. In photography theory, it was used (albeit ironically) by Roland Barthes to challenge humanist theories of photography as a universal language.[13] Barthes argued that the press photograph's appearance of uncodedness reinforced a sense of its neutrality, and was made possible by the apparently irrelevant details of the real that cluttered the image (Barthes 1977, 27). If "noise" names the uninvited intruder that threatens the hierarchy and clarity of the message, the indiscriminate photograph is "noisy' even prior to any electromagnetic transmission. Barthes own "punctum" describes a kind of noise, an unintended detail, or incidental inclusion, that attracts the attention of a reader regardless of the intentions of the photographer (Barthes 1981).

Indeed, in photography, "noise" might describe a wide range of intrusions and interruptions in the image. As with radio and television antennae and the microwaves they pick up, light and photographic emulsion are highly sensitive to atmospheric interference, from water vapor, gases and visible light and other kinds of radiation. Photography is plagued with animal and plant interference too, from fungi in lenses, to flies and other creatures invading the darkroom. In a digital photograph, "noise" includes the artefacts resulting from compression, as in Steyerl's poor image. In a chemical photograph, it might describe the graininess of an image, which limits the amount it can be enlarged, or forms of contamination, corruption or interruption by outside entities. Such disruptions could include, for instance, the sulphurated hydrogen emissions from the Ilford gasworks that ruined 25,000 sensitized glass plates at the Ilford photographic factory on one day in 1899 (Catford n.d., 49–50). They might include the effects of extreme temperatures and moisture, but also of the beetles and lizards that invade the darkrooms of photographers in hot countries. Noise might even describe the people and animals that accidentally "photobomb" wedding portraits and holiday snapshots. Noise is part of

the appeal of chemical photography in a postdigital culture, hence the tendency of social media photo "filters" to mimic chemical flaws, including inconsistent grain, light leaks and contamination marks.

This noisiness is linked to the mechanical nature of photography, which, in the mid-nineteenth century, contributed to the sense that photography allowed the sun, or nature, to directly picture itself. In the early years of photography, a certain kind of noise also signified that time passed inexorably and could not be arrested. In a period characterized by growing anxieties about the loss of all fast-fixed certainties, religious and moral certainty was attached to the inevitability of decay and decline. To the natural theologists of 1830s and 1840s Scotland, for example, signs of material decay and traces of dirt and disorder that appeared incidentally in daguerreotypes supported the belief that the world would come to an end, and that it therefore began in an act of creation (Smith 1979; Morell 1971). Early photographic practice was informed by a Romantic aesthetic of the ruin: Louis Daguerre himself presaged his own invention with an 1824 photo-realistic painting of the ruins of Holyrood chapel (now in the Walker Art Gallery, Liverpool). John Ruskin was pleased to find that in his 1845 daguerreotypes of Venice "every chip of stone & stain is there" (Ruskin cited in Fawcett 1986, 187). Anxieties about decay, decomposition and environmental degradation motivated the times as much as a sense of rapid technical progress, and in this context, photographic "noise" appeared as a revelation, not of the past preserved, but of time passing and a world beyond the visible one.

Shapeshifting

The question of how we characterize different photographic technologies has consequences for what we do with photographs, how we read them and what we exchange for them. It is unlikely that any history or theory of photography could dislodge our dogged attachment to photographic realism (especially in reportage and documentary photography), or our tendency to treat photographs nostalgically (especially in photographs of family and friends). More narrowly, however, the emphasis on the photograph as a frozen moment has led to a neglect of certain kinds of photographic technologies and practices, an overvaluing of others, and a narrow understanding of the myriad connections and disconnections between chemical and digital photography.

The history of photography, told as a series of transitions—from daguerreotype to the negative-positive processes, from wet plate to mass-produced dry plate, from unique print to half-tone reproduction and to wire photo, from analog to digital or wet to dry photography—seems to support arguments that photography moved from a messy physicality and objecthood to an increasingly virtual, imma-

terial state. Certainly, it may be true that photography is largely experienced (by the majority of photographers and their subjects) as a less materially demanding and more automated, fleeting and transient practice than it once was. It is also generally true that photography became technically faster—faster shutter speeds, more sensitive films, faster lenses—over the course of the twentieth century, a speeding-up that was driven by ideological, commercial and military imperatives, including a prior commitment to the modernity of the instantaneous. Cameras too have broadly become more transportable (when miniaturized in mobile phones for example).

Digital theorists have increasingly recognized the dependence of the "virtual" on material infrastructure, and the misleading nature of terms like "dematerialization."[14] Possibly, these were never intended to signify a literal loss of materiality, but rather to describe a shift from pictures experienced as solid and tangible to images that flicker before us and vanish again, that can be switched off, that proliferate and multiply. They capture how the digital image is variable and malleable, capable of innumerable temporary and potentially simultaneous instantiations, as against an analog image imagined as a stable print. However, I have suggested here that, the replacement in photography of chemical technologies with electronic technologies is not explicable in these terms. This story of a move from stable to unstable, fixed to fluid, material to virtual could even be inverted. We could instead describe liquid (wet, chemical) photography as constituted of environmentally hypersensitive, shapeshifting and alterable substances, its images held in suspension as only latent possibilities prior to the development of a film or the printing of a negative. Rather than regarding digital photography as existing in the realm of the virtual, we could emphasize its hardware, recognizing its dependence on a fairly solid set of technologies, a massive material infrastructure or an orderly and rigid pixel grid. That neither of these is sufficient demonstrates how reductive such oppositions of stasis and mobility, or materiality and virtuality, can be. Even so, I hope that our cultural attachment to linked narratives of technical acceleration and dematerialization might be challenged by the project of attending to the mobility and the fluidity of pre-digital photography.

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Notes

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2 Stiegler shares what Buse calls "the melancholic consensus" (Buse 2016, 28; Stiegler 2009, 18; Crogan 2010).

3 Notably Williams and Srnicek suggest that the dynamism of contemporary capitalist societies is fraudulent, but continue to regard the rapid exchanges of information involved in financial speculation as a model for a new kind of algorithmically planned economy, and continue to associate speed with futurity (Williams and Srnicek 2014, 358). As Michael Gardiner says, they envisage a "gleamingly turbocharged future" in which "capitalist infrastructures can be repurposed to emancipatory ends." Gardiner contrasts this with Bifo Berardi's less hubristic vision of a slowing down, a "postenergetic" society, linked to an ageing population (Gardiner 2017, 45 and 49; Berardi 2009, 21).

4 The dependence of ideas of media speed and instantaneity on the temporality and rhythms of the human body is evident in the writing of Paul Virilio, who sees photography increasing in sensitivity and speed in inverse proportion to the human eye (Virilio 1994, 13). For Virilio, not only does the speed associated with technical modernity outstrip that of the human body, it produces a slowing-down and desensitization of the body.

5 In Britain, as the archives of Boots the Chemist reveal, the "photography season" for retailers lasted from only April to September (Boots the Chemist, 1927, 438). Over the darker winter months, the photography department of the high street store had to transform itself into a diverse department selling lamps, torches, electric toasters and picture frames.

6 Far from being haphazard, liquid, chemical technologies are, as anyone who has visited a photographic film manufacturing plant may be able to attest, highly controlled and predictable. I am thinking of my own visit, in 2019, to the factory of Harman Technologies, producers of Ilford black and white films.

7 For Flusser, a technical image responds to a particulate reality, "something invisible that has blindly become visible" (Flusser 2011, 16). It is an image "brought forth by an apparatus" (Flusser 2000, 13).

8 As Stephen Jones explains, the concept of the digital refers to elements that are discrete and countable (on our fingers or digits), in contrast to the apparent continuity of much of what we perceive (Jones 2015, 87).

9 For example, in silver halide black and white photography, the surface area of the crystals affects the sensitivity of the emulsion and therefore the available shutter speed and aperture, and correspondingly, the speeds of moving objects that can be photographed. Thus, the seeming ability of the camera to slice time into ever finer moments (thousandths of a second) depends on the mechanical and optical qualities of the camera and lens, the amount of light available, but also on the gelatin, the film base, the sensitizing dyes used, and on a high degree of technical control over the size, shape, surface area and regularity of these grains of silver halide.

10 First identified by radio astronomers Arno Penzias and Robert Wilson, at Bell Telephone Laboratories (the research arm of AT&T and also the employer of Claude Shannon), CMB came to have a significant impact on cosmology, supporting the theory of the Big Bang over theories of a "steady-state" cosmos (Oliver 2019).

11 Shannon describes Finnegans Wake as a text high in relative entropy, where entropy measures the number of possible configurations or variables, or how much freedom there is within the system, and how much choice is possible. The higher the entropy, the more information (Shannon 1964).

12 Weaver explains that an increase in noise appears to be an increase in uncertainty, such that "if the uncertainty is increased, the information is increased, and this sounds as though the noise were beneficial!" (Shannon and Weaver 1964, 19). He goes on to make a distinction between types of uncertainty that Shannon does not explicitly make: "Uncertainty which arises by virtue of freedom of choice on the part of the sender is desirable uncertainty. Uncertainty which arises because of errors or because of the influence of noise is undesirable uncertainty" (Shannon and Weaver, 1964, 19; see also Hayles 1987, 119–42).

13 Barthes' cybernetically informed writings on photography, from the 1960s to the 1980s, are, as Bernard Geoghegan has argued, in many ways an ironic reworking of Shannon and Weaver's theories (Geoghegan 2011, 227).

14 See for example the work of writers such as Shannon Mattern, Lisa Parks, Jussi Parikka and Sy Taffel, among many others.