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Invisible Images and Indeterminacy: Why we need a Multi-stage account of Photography

Abstract

Some photographs show determinate features of a scene because the photographed scene had those features. This dependency relation is, rightly, a consensus in philosophy of photography. I seek to refute many long-established theories of photography by arguing that they are incompatible with this commitment. In section 2, I classify accounts of photography as either single-stage or multi-stage. In section 3, I analyse the historical basis for single-stage accounts. In section 4, I explain why the single-stage view led scientists to postulate 'latent' photographic images as a technical phenomenon in early chemical photography. In section 5, I discredit the notion of an invisible latent image in chemical photography and, in section 6, extend this objection to the legacy of the latent image in digital photography. In section 7, I appeal to the dependency relation to explain why the notion of a latent image makes the single-stage account untenable. Finally, I use the multi-stage account to advance debate about 'New' versus 'Orthodox' theories of photography.

Key words: Philosophy of Photography; Camera Obscura; Latent Image; Invisible; Digital; Causal Dependence; Indeterminacy; New Theory.

1. Introduction

Some features of photographic images causally depend on the scene in front of the camera: if the scene is a lemon on a plate, the photograph shows a lemon on a plate. An empty plate would cause the photograph to show an empty plate. Visual properties of the photographic image (patterns of dark and light tones) can be causally explained by properties of the lemon and the plate (shapes, textures, colours). Any theory of photography must be able to explain why this dependency relation obtains for at least some photographs. The implausible alternative would be to deny that causal dependency obtains for any photograph at all.

In what follows I assume consensus among theorists that at least in some cases there is a dependency relation between determinate features of a scene and determinate features of a photographic image of that scene. I argue that this commitment is incompatible with many established theories of photography. I appeal to the dependency relation to argue categorically that any 'single-stage' account of photography is untenable and only a 'multi-stage' account of photography is viable. Classifying theories as single- or multi-stage clarifies and contributes to the ongoing discussion of 'Orthodox' and 'New' theories in recent philosophy of photography.

Orthodox theories of photography centre a strong construal of the dependency relation in the definition of a photograph. The paradigm photograph, they claim, has belief-independent counterfactual feature-tracking of the photographed scene because the photograph is the product of an automated process.[i] Such a photograph must acquire its image-bearing properties through an entirely causal process, unmediated by human

beliefs. Orthodox theories can be historically traced to the idea that a photograph is 'nature depicting itself through the agency of light' (Costello 2018: 230). After decades of dominance, the orthodox definition of photographs and the accompanying causal story has been the target of recent criticism. For example: Atencia-Linares (2018), Blanc-Benon (2019), Costello (2017, 2018a), Lopes (2016) and Wilson (Phillips 2009). Criticism of orthodox theory needs to target more than the claim that the photographic image autonomously creates itself through a causal process. It should also challenge the idea that the image is created at the time of exposure. The two ideas are fundamental and related – the former entails the latter – but until now the latter has not received direct or detailed attention.

In section 2, I schematise two competing accounts of the photographic process: the single-stage account and the multi-stage account. In section 3, I analyse the historical basis for the single-stage account, rooted in a collective aspiration to 'capture' a light image. In section 4, I explain why the single-stage view led scientists to postulate 'latent' photographic images as a technical phenomenon in early chemical photography. In section 5, I discredit the notion of an invisible latent image in chemical photography and, in section 6, extend this objection to the legacy of the latent image in digital photography. In section 7, I appeal to the dependency relation to explain why the notion of a latent image makes the single-stage account untenable. Finally, I use this conclusion to advance the debate about 'New' versus 'Orthodox' theories of photography.

2. Single-stage and multi-stage accounts of photography

The two types of account are general: they each encompass chemical and electrical technologies and any kind of production method. 'Single' and 'multi' distinguish alternative assumptions about the status of the exposure stage. A single-stage account supposes that during exposure a photograph comes into existence. A multi-stage account supposes that, subsequent to the exposure stage, a further process stage is necessary before a photograph exists.

Photographic technology is not limited to producing photographs (Maynard 1997, 6), but conventionally the term 'photograph' is reserved for photographically produced visual images and not applied to photographically printed circuit boards. The present discussion is specifically concerned with the production of conventional photographic images that have visible properties and visual content.

Single- and multi-stage accounts share the same preliminary step: a photographer chooses a scene and sets up the apparatus so that light reflected from or emitted by objects in the scene is channelled to form a light array on a surface. The array may be an indistinct pattern of light, or it can be focussed and filtered to produce an optical light image with image content. The paradigm example appears inside a camera obscura. Early photographers focussed their image on ground glass and some modern cameras have viewfinders that exhibit the light image, such as this example from Thomas Skrlj:[ii]

Fig. 1 The optical light image in a Hasselblad camera viewfinder

The optical light image responds to changes in the scene, light sources, camera position and settings, so it has temporally active visual properties. The image content is accordingly dynamic or static: the clouds move, the hills stay still.[iii]

The next step occurs when light reaches a photosensitive surface and a timed exposure takes place. Single- and multi-stage accounts conceive of the photographic process fundamentally differently. A single-stage account supposes that a photographic image exists from the time of exposure. For example, Guy Rorbaugh (2003: 190) writes that:

> [Photographs] come into existence when they are taken. At the moment the button is pressed, the shutter opens and closes, exposing the film, and we say that we have 'taken a photograph'.

Christy Mag Uidhir (2012: 37-38) details another example:

> I assume here that 'taking a photograph' standardly indicates performing a certain relevant action (for example, tripping a camera's shutter release) initiating a certain relevant process (for example, photochemical, photoelectrical) over a certain relevant base (for example, film, plate, file), onto which some (latent or visible) image is thereby produced (or encoded) and from which further certain relevant products may subsequently be developed or processed (for example, negatives, prints, slides, and so on).

Schematically, a single-stage account conceives of the photographic process like this:

i) A photograph is taken: for a time interval, a photo-sensitive surface is exposed to light from the scene. The photograph exists as soon as it has been taken and it is typically stored as a latent image on undeveloped film, or as a digital file.
ii) The photograph is developed, printed, or screened.

A multi-stage account denies that a photographic image exists from the time of exposure. It requires a subsequent distinct production stage. The account of photography I have previously proposed (Phillips 2009, 338) is one example:

> 1) A light image is formed, using objects and light sources in an ordinary state of affairs; 2) a photographic event occurs – no photograph yet exists; 3) the information recorded and stored undergoes a process to create a visual image (the photograph) or several such images.

Dominic Lopes (2018: 81) provides another formulation:

> A photograph is an image output by a mark-making process taking input from an electro-chemical event that records information from a light image of a pro-photographic scene.

Schematically, a multi-stage account conceives of the photographic process like this:

i) A photographic event occurs: for a time interval, there is causal registration of the light that forms the optical light image. When the photographic event ends, a photographic register exists. No photograph yet exists.
ii) A static visual image is produced using the register from the photographic event. A photographic image now exists.

During the photographic event, a photosensitive surface tallies the quantity and position of light over a time interval and encodes that tally chemically or electrically. I call this encoded information the 'register'. The information has potential to be used to produce photographic images, but the register is not itself an image and does not

encode information imagistically. When the register is used to generate a photographic image, some visual properties will be determined by that separate process stage.[iv] This is the central idea of a multi-stage account: the photographic event does not by itself determine the properties of the photographic image. Variations of this idea have been developed in what has been called the 'New Theory' of photography (Abell 2018. Atencia-Linares 2018. Blanc-Benon 2019. Costello 2017, 2018a, 2018b & 2019. Lopes 2016, 2018 and 2019).

3. 'Capturing' a light image

The idea of 'capturing' images in early 19th century photography led directly to the emergence and dominance of the single-stage account. Pioneers of photography were intrigued by the visible effects of light on surfaces, particularly shadow patterns, mirror reflections, and camera obscura images. Their goal was to arrest these ephemeral phenomena.[v] They claimed to be 'fixing' the camera obscura light image: seizing it, capturing it, or preserving it.[vi] The resultant photographic image, such as a Daguerreotype or Calotype, was supposedly that very image, arrested, stored and displayed.[vii] In 1839 Hippolyte Gaucheraud reported that:

> M. Daguerre has found the way to fix the images which paint themselves within a camera obscura, so that these images are no longer transient reflections of objects, but their fixed and everlasting impress which, like a painting or engraving, can be taken away from the presence of the objects. (Trans. B. Newhall 1980: 17).

Before photography, artists and scientists endeavoured to reproduce camera obscura images by tracing and shading by hand. They used an optical light image as a stencil for directly creating a charcoal or pencil image on a suitable surface. Photography, in aspiration, was preconceived as a technology that could perfect this process. The light image would be traced, transferred, stencilled, impressed, or imprinted, directly onto the surface, but by the reliable hand of nature rather than the unreliable hand of a human agent. This would preserve properties of the optical light image in perfect detail, not merely create an imperfect reproduction. The notion of perfectly reliable retention of the image properties is based on the supposition that the camera obscura image, formed from light, is 'captured' when it imprints itself, through the action of light alone, thereby preserving itself as a photographic image.[viii]

19th century reports of novel photographic processes carefully described a sequence of steps needed to secure such an image. Irrespective of different chemicals and techniques, every process was subject to the same constraint: a surface that is chemically treated to become photo-sensitive must have subsequent chemical treatment to cease being photo-sensitive. Whether the process employs a printing-out technique, such as Talbot's first method, or a developing-out technique, such as Talbot's second method, it can only produce an image that has stable visible properties if it includes subsequent chemical treatment.[ix] Otherwise the photosensitive surface will continue to react to light until it cannot undergo further change, by which time the entire surface has uniform features and no image exists.

In the historical reception of photography, the process stages were systematically mischaracterised. The exposure stage was conceived as seizing the image and the subsequent stage was conceived merely as enhancing and preserving the already seized image. In 1859 an anonymous author described how the process was understood:

> The images of the camera obscura were made permanently visible. [...] Silver plates [...] became sensitive to the action of light and received the image, which could be made visible by the fumes of mercury and rendered permanent by a wash of salt and water. (Watson & Rappaport 2013)

The key claims are that the camera obscura image is 'received' by the photosensitive surface, then 'made visible' and 'rendered permanent' by subsequent chemical treatments. Although there are many stages, the image referred to at the start of the process is considered the same as the resultant image: one, single image has persisted from beginning to end. It provides a good example of a single-stage account of photography, but further attention to the history of photography shows that single-stage accounts take more than one form.

'Seizing', 'arresting' and 'capturing' caused confusion because they were not interpreted metaphorically. 'Fixing' is a particularly ambiguous term that can mean generating properties of an image or preventing further change once the image exists. It is true that the developed, photographic image is fixed at the second chemical stage of the process, but not true that the camera obscura image is fixed at the first chemical stage of the process – indeed at any stage of the process. Picturesque descriptions muddled the reception of photographic technology with a fantasy of literal and metaphorical claims.[x] Alongside camera obscura images, photography supposedly made it possible to detain the light ephemera of shadows[xi] and mirrors.[xii] Though false, these descriptions had a lasting influence on how photography was conceived, persisting into the age of digital photography.

In contrast with the ill-conceived notion that a light image, shadow, or reflection could be 'seized', some historical accounts more carefully reported that the camera obscura image was 'copied' and that the aim of photography is to 'reproduce' the light image formed in the camera obscura with a 'copy' or 'recording'. The 1829 partnership agreement signed by Niépce and Daguerre attributed to Niépce the discovery of a new method consisting of the 'spontaneous reproduction of the images of nature received in a camera obscura'. (Fouque 1981: 27). 'Reproduction' sounds plausible and non-metaphorical.[xiii] A charitable presentation of the reception of early photography can dismiss the idea that a light image is literally captured and replace it with the idea that a light image is copied or recorded. It sounds promising, but, like the 'seizing and fixing' model, the 'recording and reproducing model' presents a single-stage account of photography: it supposes that the light image in the camera obscura is initially recorded as an invisible latent image, then reproduced by making the latent image visible. This is single stage because it supposes that a recorded image, being itself a recording of the light image, comes into existence at the time of exposure. When the recorded image is made visible it is then a reproduction of the camera obscura image. In this version the image that persists through time is not the light image, but rather the recorded image: the one that came into existence at the time of exposure.

4. The Invisible Latent Image

Although the 'recording and reproducing' model is more philosophically appealing than the 'seizing and fixing' model, they share a fatal flaw. To explain the phenomenon known as 'developing out', which was a crucial breakthrough in early photography, scientists working with single-stage models postulated the existence of a latent image. The notion of a latent image is a placeholder, facilitating the idea that a captured or

recorded image has persisted over time, even through a period when 'it' is not visible. Supposedly, during exposure the light image is converted into, or produces, a latent image, which is then converted into a printed image, yet throughout the conversions it is the same image. This is the hallmark of a single-stage account of photography: it is true that latent image and patent image are one and the same if and only if there is a photographic image created at the time of exposure.

Daguerre's method, announced in 1839, and Talbot's second, Calotype, method, patented in 1841, are developing-out techniques. The exposure time is not long enough for the photo-sensitive plate to show visible changes and an image only appears when the plate is chemically treated (Newhall 1960: xi). Both include a stage contemporaneously described as an invisible 'latent' image. In 1839 a French newspaper described the phenomenon:

> The image of immobile objects from which the lens receives the light, becomes perfectly imprinted on the plate, although this image is yet invisible and only latent. [...] Before application of the mercury, there does not exist any distinct image, although these images have already been set-down, and set-down for ever. (Wood 1996: 166)[xiv]

Even until recently this material process was not fully understood, but a scientific explanation is available.[xv] A surface is chemically treated with silver halides. When the surface is exposed to light, tiny metallic flecks form in some of the microcrystals, too small to be visible. Chemical development causes each tiny speck to grow into a large grain of silver metal and clusters of these black grains form a visible pattern, which can display an image.

In scientific terms each tiny metallic fleck in a microcrystal is described as a 'latent image speck' because the specks are invisible to the human eye (Slifkin 1972: 153). Although it is true that each speck is not visible, it is wrong to conclude that there exists an invisible latent image, a phenomenon that we imagine to be exactly the same as a visible image, except invisible. The pattern of image-bearing properties produced through development depends on the underlying distribution of specks, but it is a mistake to attribute image-bearing properties to such a distribution while the specks are undeveloped. The pioneers of photography observed the phenomenon of 'developing out' and postulated an explanation: the existence of an invisible latent image. Science has explained the phenomenon of developing out in terms of microscopic catalysts, but the explanation has been received as confirmation of the existence of an invisible latent image.[xvi] Latent image specks carry the term 'latent image' but they can only be used to create an image, they do not already constitute an image. The term 'sensitivity speck' is a preferable alternative.[xvii]

The idea that a light image is captured or recorded led early photographers to the idea that a latent image is generated. The multi-stage account corrects these two mistakes. The optical light image is a phenomenon that persists independent of, though in tandem with, the occurrence of a photographic event. During a photographic event, a photosensitive surface causally reacts to light: sensitivity specks grow in the silver halide microcrystals. The light image is, of course, unaffected by this process. When exposure to light ends, the accumulated registered effects are a tally of the position and quantity of light that arrived during that time interval. The resultant 'register' of the photosensitive changes is recognisable in traditional terms as an exposed but

undeveloped plate or frame of film. It remains sensitive to light and does not display a visible image until it undergoes further processing. The single-stage account wrongly supposes that this register is already a photographic image.
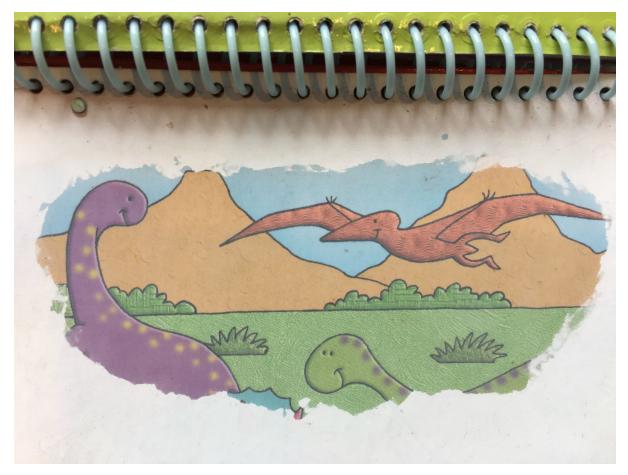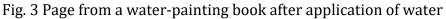
5. Discrediting the Invisible Latent Image

I acknowledge that a type of latent image genuinely exists but argue that there can be no such latent image during the production of a photograph. The single-stage account postulates that the latent image must be a single, invisible image that persists as one and the same image when it becomes a visible patent image. These requirements cannot possibly be satisfied for photographic images and the postulate must be rejected.

Consider what could count as a genuine latent image. Blank coffee mugs can feature latent images which become visible when filled with hot liquid. Water-painting books for children have blank white pages which reveal their colourful latent images when water is applied to the surface.

Fig. 2 Page from a water-painting book before application of water

Fig. 3 Page from a water-painting book after application of water

In these cases, an image with visible properties is produced before it is obscured temporarily under an opaque layer. The, then, latent image can be restored to visibility as a patent image under conditions that make the layer transparent. The patent image disappears when the coffee mug cools down, or when water evaporates from the page. The image reappears when the surface once again has contact with heat or liquid. Although we speak separately of the latent image and the patent image, these do not refer to different images. They refer to a single image under different circumstantial conditions. The terms 'latent' and 'patent' are internally related. We do not call ordinary visual images 'patent' just because we can see them, nor would we call a painting 'latent' just because it is covered by a curtain, though we might do so if it had been over-painted by another picture. In the cases described, the artefact that carries the image, the image-carrier, has some of its properties altered when there is a change from latent to patent state. Nonetheless the determinate properties of the underlying image are unaltered: in Fig. 3 there is a flying dinosaur featured in the latent image even when the image is inaccessible.

If photography is compared with genuine latent images, we might imagine that a light image with visible properties is captured or recorded on a photosensitive surface, but it is temporarily inaccessible. In the right developing conditions, that latent image can be made visible. The comparison fails. It is true that the optical light image has visible properties – it has size, colour and can feature sharply focussed recognisable forms (Fig 1) – but despite the hyperbole of historical reports, the light image is never actually 'captured', so it cannot constitute the initial visible state of a genuine latent image which

must be made temporarily 'invisible', then visible again. The single-stage account cannot claim that a photograph has a visible-but-obscured initial state. It instead conceives a different kind of latent image: a photographic image that is invisible at the outset.

This idea makes it feasible to compare the photographic latent image with invisible ink. We can inscribe a message onto a surface with invisible ink: for precision we could use a stencil, trace a template, or make an impression from a stamp. When chemicals are applied, the inscription becomes visible and legible. Here what typically matters is that the invisible inscription has content that is retrieved or disclosed. The content persists through time, one and the same, even though it is stored in different forms. We could check by matching the visible outcome with the stencil, template, or stamp.

But consider the example more carefully. If we treat half the page with one chemical the invisible ink may turn blue; the other half treated with a different chemical may turn red.[xviii] Different dilutions of the chemical solution may produce darker or lighter results. Which has identical content to the invisible inscription? It does not seem to matter. So long as we can read the disclosed message, we can say that it has the same content as the inscribed message. But if red and blue colour, or dark and light tones, are properties that make a difference to the content, we could no longer confidently answer the question. Of course, we might specify in advance that the invisible inscription is to be developed in accordance with strict guidelines: stipulating that the result must be a dark blue inscription, otherwise the outcome is incorrect. This instruction could even be the content of the inscribed message. The technical development to produce that result can be fully standardised and fully automated.[xix] But the fact remains that the invisible ink inscription does not by itself determine those properties: it is not intrinsically, or invisibly, dark blue.

For the coffee mug and painting book, it is right to say that a single latent image exists and persists under different conditions: the 'invisible', because obscured, image remains one and the same image when it again becomes visible.[xx] The invisible ink inscription is different: it cannot persist unchanged through different conditions. The invisible inscription is not one and the same as the visible inscription, even if some properties of the visible inscription match the properties of a template, for example matching copies of a signature. If it makes sense to say that the surface carries a latent inscription, it makes equal sense to say that it simultaneously carries numerous latent inscriptions: a latent red inscription, a latent blue inscription, a latent dark inscription, a latent faint inscription etc. We can, through stipulation and standardisation, prescribe that one of these is the correct outcome for our purposes. But this does not eradicate the potential for the other outcomes.

The photographic 'latent image' is the same. When exposure to light has caused a photosensitive surface to register effects, but those effects are not visible, it does not carry a singular image that persists through different conditions. The register, carrying a distribution of invisible sensitivity specks, could be used to inform the production of numerous images under a range of different conditions, leading those different images to possess different visual properties. In this example, by Vincent Duault, a light image is exposed to photosensitive paper in a dark room. Rather than standardly develop the entire sheet, the artist finger-paints a drawing onto the sheet with developing fluid before stopping development and fixing the result. [xxi]

Fig. 4 Fragmentary silver halide development

If the fluid had been applied to different areas, in different quantities, with different dilution, or left to act for longer or shorter duration, the determinate visual properties of this image would be different. The image has contour effects: patches of different tonal contrast are visible where fluid has been layered. We could imagine an alternative image produced by standard development: immersing the whole sheet in a bath of fluid may have produced an image without contour lines and without blank areas. Although the undeveloped sheet held a distribution of sensitivity specks available to generate each of these images it did not hold an invisible standard image, nor did it invisibly hold this actual image.

It is not legitimate to work backwards from any one developed visible image and claim that it is the same image as an undeveloped invisible image, because that supposition could be repeated for every different version of a visible image that can be produced. Rather than there being one latent image, it would only make sense to say that there are multiple or innumerable latent images. My view is that under this pressure 'image' and 'images' are concepts that become incoherent and in the context of philosophical inquiry it is better to avoid these terms.

The multi-stage account distinguishes two process stages that are fused in the single-stage account: it separates the photographic register from the photographic image and reserves the term 'photograph' for the latter, because only the latter is a visible image. It supposes that a photograph does not exist until it has visible image-bearing properties. This does not deny that a photograph can exist with determinate visible properties not yet accessible to a perceiver. After an exposure, a Land camera triggers an automated sequence of chemical stages which develop a register into a negative image and use it to generate a positive print. The entire process must be shielded from light, so an opaque layer provisionally obscures the visible properties of the finished photograph. Peeling apart the protective layers reveals the visible properties of the newly created photographic image; but providing access for a viewer does not create those visible properties or bring the photograph into existence.

6. The digital legacy of the latent image

The invisible latent image is not a feature of every method of chemical photography. It is absent from printing-out techniques such as Niépce's Heliograph method and Talbot's first method of 'Photogenic Drawing'.[xxii] As soon as developing-out techniques became dominant, because they allowed far faster exposure times, the latent image became part of photography's *imaginaire* for the next 150 years. The arrival of digital technology has added a new twist. When a light image is exposed to an electronic sensor, no-one imagines that the sensor directly retains an invisible imprint of the light image.[xxiii] There is no latent image stored on the sensor surface, waiting to be made visible. Although digital photography abandons the invisible latent image, it does not thereby abandon the single-stage account of photography. In fact, it reinforces the preconceptions that inform single-stage orthodoxy because it creates a strong, yet false, impression that a photograph exists as soon as an exposure has occurred.

Digital photography appears to fulfil the fantasy of immediately securing an image. A smartphone screen displays a dynamically changing image reminiscent of the image in a camera obscura, or the Hasselblad viewfinder illustrated in Fig. 1.

Fig. 5 Photography with a smartphone camera

Smartphone cameras encourage users to feel they directly capture an image precisely when they press the button. One moment the image on the screen is changing in real time, the next moment 'that' image is frozen. The user has the impression of looking at the very same image. Unlike chemical photography, the process seems to have no intermediary gap, equivalent to the latent image stage, between the moment of exposure and the production of the image. But, unlike the Hasselblad viewfinder, the image moving on the screen is not a light image, as that, instead, is being channelled out of sight on a tiny sensor. The impression of immediacy is granted by a multi-stage process executed at high speed, with sophisticated automation. Digital photography massively reduces the time between the photographic event and the production of the photographic image but cannot eliminate the intermediary gap. The sensor registers light during the photographic event by accumulating charge, quantifying electrical signals and storing the data as a digital file. The registered information must be digitally processed before a photographic image can be screened or printed. Although the latent image might seem a relic of chemical photography, made obsolete by digital photography, its role as a placeholder has not been eliminated. The digital file is treated as a substitute for the latent image and sustains the same preconceptions.[xxiv] While no-one would go to the length of claiming that the digital file is an invisible image, it is treated as a photographic image that is made visible when it is screened or printed.

Consideration of RAW and JPEG files can dislodge this idea.[xxv] A RAW file is not a photograph: it is a matrix of data from which it is possible to generate numerous images with a wide range of different properties. No single visible image can be 'the' RAW image, even if the file is used to generate a visible image on one occasion only. This is a parallel for the invisible ink argument against the notion of the photographic latent image: the RAW file stores neither a single image nor a numerous collection of images.

Rather, stored data can be extracted to generate images. In effect, a JPEG image file carries a set of instructions for generating one of the many images that the RAW file could generate, using a subset of the RAW data. To save memory space cameras often save a compressed JPEG without a RAW file, whereas a RAW file contains the full information the sensor registered during the photographic event. [xxvi] However, like RAW files, a JPEG is not a photograph. It is called an 'image' file because it can be used to produce an image, not because it already constitutes an image.

If single-stage accounts are correct, a digital file must secure continuous existence of a photographic image from exposure to display. This is not possible because a digital file is not an image. In a multi-stage account, a digital file is an intermediary carrying information between two separate process stages. After a photographic event, an intermediary must store information about the quantity and position of light non-imagistically, then inform the production of a photographic image. It cannot carry that information imagistically unless it is already a photographic image. In my multi-stage account, I call the intermediary a 'register' and distinguish it from the photographic image, although it is evident that the term 'photograph' is colloquially used for both types of artefact. Using the same term obscures relevant differences and creates the impression that a 'photograph' we 'take' and the photograph we display are one and the same. It also feeds the idea that the register is a kind of image. I have argued that a register, whether chemical or electrical, consists of neither one nor multiple images. Philosophical enquirers can avoid misunderstandings by adopting the multi-stage distinction between the photographic register and the photographic image.

7. A refutation of the single-stage account

A dependency relation between a photograph and the photographed scene is a keystone of most discussions in analytic philosophy of photography. [xxvii] When an image is produced photographically the causal relation between the source of light and the photograph is of great significance: it is thought that we can derive from the effect some characteristics of the cause, which is not true of all causal relations. A single-stage account apparently fits this idea perfectly: during exposure, a source of light causes an image to come into existence and subsequently that image can be examined to yield unmediated visual information about its causal source. The perfect fit is no coincidence. The single-stage account is the tradition from which this idea emerged.

Against this tradition, I have argued that no image comes into existence at exposure. Information about the pro-photographic scene is stored, but not stored imagistically. I concluded that the purported invisible latent image is not genuinely an image. However, advocates of the single-stage account might not accept this conclusion. A counterargument is available even if it is conceded that an invisible image could not determine all the visible properties of multiple different images. It is possible for a single-stage account to argue that an image does come into existence at exposure, but that it is an image with indeterminate properties.

Indeterminacy is commonplace for many images. The black-on-white image-bearing properties of a charcoal sketch are indeterminate with respect to colour. A charcoal sketch of a lemon on a plate cannot make it a matter of fact that the lemon is yellow: the sketch is also compatible with the lemon being red or blue. The sketch may nonetheless be determinate with respect to tonal contrast: the pattern of light and dark shapes can

make it a matter of fact that the lemon is lighter than the plate. This characteristic of images can be a basis for defending the single-stage account.

Indeterminacy would allow a single latent image to be compatible with multiple patent images, even if it does not fully determine their properties. The variety of different images that could be produced from a single exposure would plausibly share properties in common, for example the position of lines, shapes and blank regions; despite featuring differences, for example details, tonal contrast and sharpness. From this, the available counterargument is that the latent image is determinate with respect to the invariable properties – meaning any patent image produced from the latent image would have these properties – but indeterminate with respect to the variable properties. If the determinate properties are modest and indeterminacy is generous, the latent image produced at exposure could be compatible with every variation of the patent image.

A charcoal sketch of a lemon on a plate need not bear any dependency relation with an actual lemon on a plate. Drawings are not expected to carry information about the determinate features of a real-world scene, although they sometimes do so. Expectations are different for photographs. If the photograph features a lemon on a plate, we expect it acquired its image-properties because the photographed scene featured a lemon on a plate. In practice, this dependency relation is evident in most photographs, including the examples illustrating this argument. Any theory of photography must be able to explain why a dependency relation, between determinate features of a photographic image and determinate features of the photographed scene, holds for at least some photographs.[xxviii] A multi-stage account can satisfy this test, but a single-stage account cannot. This shows that the counterargument can be defeated.

Single-stage accounts cannot claim that all types of features of a patent image have a dependency relation with the photographed scene. Causal dependence only obtains for the modest collection of determinate properties that are common to every different variation of the patent image. This is a problem because it is usual to find causal dependence in many more properties of a photograph. Yet in many crucial respects it seems the latent image is indeterminate, so carries no information from the scene to the final image.

Consider an example concerning tonal properties: tonal contrast in an image comprises the darkness of the darkest tones, the brightness of the lightest tones and differentiation of the range of tones in between. If the pro-photographic scene has bright light and strong shadows, it is a challenge to produce a photograph showing details of a figure standing in shadow. Following exposure, we could develop out an image featuring an area of undifferentiated darkness with no details of the figure. If, instead, an image was developed out differently, for example, left motionless in developing fluid rather than agitated, the developing chemicals would act differently on the sensitivity specks and produce different visible properties across the same area.[xxix] With increased tonal contrast, details of the figure can be distinguished within the area of shadow. These are two images with significantly different visual properties that are alternative outcomes from a single exposure. A single-stage account could not claim that tonal contrast is a determinate property of the latent image, because tonal contrast is different in the two images. To be compatible with both images, the latent image must be indeterminate

with respect to tonal contrast. Indeterminacy with respect to tonal contrast would impact on many other significant image-properties, including sharpness and detail.

If the latent image is indeterminate with respect to tonal contrast, it carries no information about the tonal contrast of the photographed scene. It is not possible for there to be a dependency relation between tonal contrast of the final photograph and tonal contrast of the photographed scene. This would be incompatible with the fact that many photographs have tonal contrast that causally depends upon the photographed scene. Similar examples involving other properties such as sharpness and detail could be considered. The counterargument defending the single-stage account cannot accommodate these significant image properties in an account of causal dependency, so it must be rejected.

The multi-stage account can explain the dependency relation and at the same time dislodge the traditional paradigm that a photograph is an effect that delivers unmediated visual information about its cause. During a photographic event, a photosensitive surface is exposed to light channelled from the pro-photographic scene, causing the photosensitive surface to register information about the determinate position and quantity of light arriving during that time interval. The resultant register stores this information non-imagistically but the information can be subsequently rendered imagistically. When information in the register is used to produce an image, determinate properties of the photographic image causally depend on determinate features of the scene, taken together with the nature of the image production process. Note that data registered during the photographic event cannot be accessed as a visual image without intervention and any intervention to render the data imagistically, contributes properties to the image. There is a dependence relation between image and scene, but it is necessarily mediated by the conditions of image-production. This conclusion invites a re-examination of how we understand causal dependence in photography, with implications for concepts in art theory, such as indexicality and trace.

8. Conclusion

The single-stage account is rooted in the historical reception of photography and needs to become a relic of the past. It can only explain the phenomenon of developing out by postulating that there exists an intermediary invisible image. If an invisible image has indeterminate image-bearing properties, many significant properties of the visible image will not depend on determinate properties of the photographed scene. The single-stage account is thus incompatible with the fact that, in practice, most photographs have a dependency relation with the photographed scene.

My argument has been presented as a contest between single and multi-stage accounts, but my conclusion advances critical debate about 'Orthodox' and 'New' theories in recent philosophy of photography (Costello 2019, Lopes 2019 and Walden 2019). The aspirational preconception of photography was that the image produces itself, without assistance or intervention: the light image must impress itself onto a surface. Over time this became the orthodox definition of a photograph. According to the New Theory this is a fantasy that cannot be realised, because after there has been exposure to light, to secure a stable, visual image, it is essential to perform a secondary stage of production. The secondary stage may be randomised, standardised, manual, or automated, but it

inescapably determines properties of the visible image and those properties are contingent on that stage.

I propose that orthodox theories should be classified as single-stage accounts of photography because it is only possible that a photographic image creates itself autonomously if it comes into existence at exposure. I have offered a refutation that applies to any single-stage account of photography. Assuming my argument is successful, a multi-stage account of photography is the only coherent option.

Single stage accounts of photography fulfil the aspirational fantasy of a self-creating image by supposing that a photographic image is created in its entirety at the time of exposure. Accordingly, they misrepresent the subsequent stage as making visible the image that has already created itself. I have argued that we should reject this and reconceive photography as a multi-stage process. A photographic event produces a photographic register. Subsequent rendering of a photographic register is necessary to produce a photographic image. The term 'register' has the benefit that it applies to chemical and electrical photography and the account rightfully acknowledges that a photographer who uses a register to produce a photograph is doing more than making visible a pre-existing image.[xxx]

Image Credits

Fig. 1 © Thomas Skrlj/@tskrlj

Fig. 2 © Dawn Wilson

Fig. 3 © Dawn Wilson

Fig. 4 © Vincent Duault

Fig. 5 © Jonathan Wilson

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[i] See Costello & Phillips (2009) for a critical survey.

[ii] Thomas Skrlj, 12th September 2018. The image shows the viewfinder of a Hasselblad 500cm medium format camera.

[iii] Like any visual image, descriptions can pick out visible properties of the image display (patches of colour with tonal contrast) and interrelated visible properties of the image content (distant hills are pale silhouettes, midground hills are grassy with dark areas of heather).

[iv] Following Catharine Abell (2018), the multi-stage account can specify that registered information be channelled from register to image *'through a communication channel of a type that is effective at carrying such information.'*

[v] 'How charming it would be if it were possible to cause these natural images to imprint themselves durably, and remain fixed upon the paper!' William Henry Fox Talbot (1980: 29).

[vi] 'I have captured the light and arrested its flight! The sun itself shall draw my pictures!' Louis Jacques Mandé Daguerre in a letter to Charles Chevalier, 1839. Quoted as an epigraph in Watson & Rappaport (2013).

[vii] I use 'photograph' for these examples and images resulting from other technical processes.

[viii] In 1839 Talbot wrote that 'the fixing of the images of the camera obscura' was one of two principal points of his invention (Watson & Rappaport 2013: 129). In a letter to John Herschel he described it as 'fixing upon paper the image formed by the Camera Obscura; or rather, I should say, causing it to *fix itself*' (ibid.)

[ix] An image is printed out when the exposure time is sufficient for chemical changes on the sensitised surface to become visible. An image is developed out when the exposure time is too short for chemical changes to be visible on the sensitised surface.

[x] In 1859 Oliver Wendall Holmes claimed that, '[The Daguerreotype] has fixed the most fleeting of our illusions, that which the apostle and the philosopher and the poet alike used as the type of instability and unreality. The photograph has completed the triumph, by making a sheet of paper reflect images like a mirror and hold them as a picture.' (1981:101).

[xi] 'The most transitory of things, a shadow, the proverbial emblem of all that is fleeting and momentary, may be fettered by the spells of our "natural magic," and may be fixed forever in the position which it seemed only destined for a single instant to occupy'. (Talbot 1981: 41).

[xii] In 1840 Alphonse Eugène Hubert claimed to have discovered a process 'for obtaining the most perfect of portraits, by means of a chemical composition which fixes them in the mirror at the moment one looks at oneself!' (Watson & Rappaport 2013: 117).