This article has been accepted for publication in the *Journal of Aesthetics and Art Criticism*. It is a response to an article by Mark Windsor, titled 'Photographic Registers are Latent Images', forthcoming in the *Journal of Aesthetics and Art Criticism*, March 2023.

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What is a Photographic Register?

Photography of any kind involves multiple process stages, but there is little consensus about the nature of the process stages and their relations to each other. In 'Invisible Images and Indeterminacy' (Wilson 2021), I claimed that some nineteenth century pioneers of photography offered characterisations that were influential and misleading. I suggested that their ideas gave rise to a 'single-stage' conception of photography, supposing that one specific process stage – an exposure – is where a photographic image comes into existence, and that other process stages are secondary to this primary event. In opposition, I claim that a photographic image comes into existence only when two primary process stages have ended: first, during a photographic event, light registration causes a photographic register to exist; second, the photographic register is rendered to produce a photographic image. I argue that a multi-stage account of this kind is the correct way to understand photography and that any version of a single-stage view is incoherent.

To refute the single-stage view, I focussed on a crucial detail: the notion of the latent image. This arises for the developing out method of chemical photography, which was a paradigm of photography from the mid-nineteenth century until the advent of digital photography. I claim that a single-stage conception must suppose that dependency relations between the photographic image and the photographed scene are secured by an invisible latent image that comes into existence during an exposure. I argued that such an 'image' could not have determinate features, and that if it were to have indeterminate features, it would be unable to support dependency relations between determinate features of the developed-out image and determinate features of the scene. I reject the notion of an invisible latent image and, with it, the single-stage conception.

In his incisive response, Mark Windsor agrees that the multi-stage account is helpful for understanding neglected aspects of photography but argues that it is compatible with the notion of a latent image; in fact, he says, "Photographic Registers are Latent Images". With this, he claims, the multi-stage view collapses into the single-stage view. He concludes that the single-stage conception of photography is correct.

The primary statement of Windsor's positive position is that:

> The photographic registers described in the multi-stage account just *are* the latent images described in the single stage account. Both possess determinate properties that do the job of securing the dependency relation between visible features of photographs and the scenes they depict to the extent that one should expect that relation to obtain in any given respect." (Windsor 2023, Page #).

There is more of a gulf between our positions than this statement suggests: it contains an equivocal phrase that is key to understanding our disagreement. A photographic register does possess determinate properties that secure the dependency relation, but these are not the same kind of properties that a latent image would need to have. The determinate properties possessed by a latent image would have to be pictorial features, specifically, invisible pictorial features. The determinate properties possessed by a photographic register are not pictorial features of any kind. In the discussion that follows, I make explicit where Windsor is committed to pictorial features and I am committed to non-pictorial properties.[i]

What leads Windsor to claim that a photographic register is the bearer of invisible pictorial features? I think he stands in a long tradition of reading pictorial features of the photographic image backwards into the photographic register. An important step of his argument is where he presents this question:

> If a patent image's pictorial features are not, qua pictorial features that are surely dependent on features of the photographed scene, attributable to the development process, then, *contra* Wilson, surely they must be attributable to determinate [pictorial] features of the latent image. What else could secure the dependency relation between pictorial features of a patent image and features of the scene it depicts? (Windsor 2023 p. #. My insertion in square brackets)

Windsor takes this question to be rhetorical, as if it has been answered by his first point. But I treat it as an open question, and I give a different answer. A dependency relation between pictorial features of the image and the scene can be secured by determinate properties of a photographic register, namely the presence of clusters of silver atoms inside a silver halide emulsion. It is not necessary to suppose that these determinate properties are in themselves pictorial features. In fact, it is a mistake to do so.

It is worth making a detour into the chemistry of developing-out processes to appreciate why this would be a mistake. When photosensitised silver bromide film is exposed to light, the emulsion undergoes chemical change. Photons of light cause atoms of silver to form inside silver bromide microcrystals. Each stable cluster of reduced silver – which can be as small as four atoms – is a 'development centre'. Development centres are so small that they cannot be detected by direct methods, such as microscopy. Their existence is hypothesised, based on changes that take place in sufficiently exposed crystals (but not in unexposed ones) when chemical development

occurs. Chemical development causes each development centre to grow into a grain of metallic silver. Grains become large enough to be detected by a microscope, then, continuing to grow and occupy more space, they eventually form visual patterns that are visible to the human eye.[ii] Scientists call a single development centre, or collection of development centres, a 'latent image', but an invisible latent image centre is not literally an invisible image. If scientists eventually invent an instrument to directly detect latent image centres, it will not reveal pictorial features that are currently undetectable. The features that constitute an image only emerge through a process of development and fixing, and the magnitude of growth required is huge. A cluster of 10-20 atoms must be amplified by a billion times to become a silver grain (Webb 1950 p. 10). My claim is that exposed but undeveloped film – a photographic register – does not have properties that can reasonably count as pictorial features on any theory of depiction. So-called 'latent image' properties are invisible, but they are not invisible pictorial features.

Imagine an expanse of desert hundreds of miles square. Tens of thousands of isolated grains of sands are marked as 'development centres', but from a satellite or a drone camera, the marked grains are undetectable. Subsequently, each marked grain is replaced by large rock, so that size and location of individual rocks can now be detected by a drone camera. Then each rock is replaced by a concrete building. The buildings are large enough to connect the spaces between them and together form a pattern of pictorial features that can be detected by a satellite, or perhaps viewed by a human in space. This example is not to scale, but it should illustrate that a developing out process involves enormous amplification, which, I believe, cannot simply be conceived of as revealing an existing picture. Although the 'developed out' pattern is dependent on the presence of the development centres, pictorial features of the final image cannot be backwardly attributed to the grains of sand, even though the grains of sand were related to each other in a determinate pattern. Grains of sand could be described as a 'latent image' to signal that they are not yet an image, merely the basis for rendering an image – or multiple different images. It would be a mistake to claim that they are already an invisible image, waiting to be made visible.

A scientifically correct notion of a latent image should not attribute pictorial features to clusters of silver atoms, but the idea that a latent image is an invisible picture is well established and Windsor defends this tradition. An invisible latent image could not be examined directly, but starting from one or more patent images and working backwards, Windsor believes that determinate [pictorial] features can be attributed to a latent image through a process of inference, using the following principle:

> Knowing what [pictorial] features of patent images (or to what extent those [pictorial] features) are determined by the latent image will depend on one's knowledge of the medium the latent image is in and the techniques used to develop it. As a rule, if a [pictorial] feature cannot be attributed to the

> development process, then it must be attributable to the latent image. (Windsor 2023, p. #. My insertions in square brackets).

Windsor does not address digital photography in his response, but it is reasonable to expect that the process of inference described here should also be applicable to digital photography. *Mutatis mutandis*, a digital file would replace the latent image and algorithmic processing would replace chemical development and fixing. However, it quickly becomes apparent that photography is not amenable to this treatment. It is not plausible to attribute determinate pictorial features to a digital file and it would not help to insist that its determinate pictorial features are invisible. My position – the multi-stage account – holds that the determinate properties that enable a digital file to serve as a photographic register are non-pictorial properties. Crucially for the coherence and unity of the multi-stage account, the same is true of a photographic register in chemical methods of developing out and fixing.

If successful, Windsor's argument could only demonstrate that the single-stage view is correct for chemical, developing out processes, not for digital photography. He has not indicated whether he believes that the single-stage account is viable for both, or whether he considers photo-chemical and photo-electrical photography to be distinctly different media. Insofar as the multi-stage account is true for both, it avoids this schism.

I will turn now to Windsor's critique of my argument. He largely sets aside what he calls the first prong of my argument, but I think it contributes more than he acknowledges. In that part of the argument, I claim that a heat-sensitive mug and a water-sensitive painting are examples of genuine latent images. When an ordinary image is temporarily obscured, then made to reappear, the 'latent' image and 'patent' image are not just similar, they are identical: they are a single image. Note that in such cases of a genuine latent image, not only can we attribute determinate properties to the latent image, we can also be certain that those determinate properties are *pictorial features*. This is important in what follows.

Windsor accepts that a photographic latent image could not have determinate pictorial features in this highly demanding sense. As a variety of patent images are possible, a latent image could not be identical with one such patent image. He objects, though, that the identity standard is too demanding and seeks to establish that a photographic latent image can be determinately related to a patent image, or images, in a different way: through degrees of similarity. Windsor suggests that a single latent image can be considered relevantly similar to a variety of patent images if the determinacy of the latent image admits of degrees.

This has some plausibility. It seems helpful to say that the photographic images produced from a single photographic register have degrees of similarity to one another and that their similarity tells us something about the determinate properties of the

photographic register. However, this does not entitle Windsor to the conclusion that he needs in order to defend the single-stage position, namely that these determinate properties of the photographic register are *pictorial features* of a latent image. As noted above, the determinate properties of genuine latent images are undeniably pictorial features because they are visible at the outset; however, there is no such guarantee in the photographic case, where the supposed 'latent image' is invisible.

This leaves the multi-stage account in a stronger position than Windsor's single-stage account. I can claim that the determinate properties of a photographic register explain why a variety of different photographic images have similar features if they are rendered from a single register. I do not need to appeal to the idea that the photographic register itself has any pictorial features, let alone claim that these features are invisible. Windsor has proposed that the properties of a photographic register are determinate by degree, but he has no further basis to insist that these properties are invisible pictorial features. This means that he has not defended the single-stage view.

In what Windsor calls the second prong of my argument, I acknowledged the possibility of a counterargument based on the idea that a latent image might have indeterminate pictorial features. But I also rejected that position. Windsor objects that I overlooked the possibility that a photographic latent image could have pictorial features that are determinate by degree, rather than indeterminate, and argues that photographic latent images do indeed have such features. He claims that dependency relations between a photographic image and the photographed scene can be secured by the pictorial features of a latent image of this kind. If correct, this would mean I could not use dependency relations as a *reductio* against the existence of latent images.

However, Windsor has not established that a photographic latent image has pictorial features that are determinate by degree. He has taken the traditional route of working backwards from the features of patent images and assumed, without justification, that there exists a latent image with invisible pictorial features. He has established only that a photographic register is relevantly related to a variety of different photographic images – but this is precisely the position that the multi-stage account occupies. I provide an explanation by attributing determinate properties to a photographic register. These properties secure dependency relations between pictorial features of the photographic image and features of the photographed scene without making the mistake of reading back pictorial features from the image into the register.

Windsor offers two characterisations of what he means by determinacy that admits of degrees: a colour case and a tonal case. Both examples are flawed because they project pictorial features of a photographic image backwards into a register. In the first example, Windsor claims that

> A latent photographic image may encode an object as red but no specific shade of red. Depending on how the latent image is processed the object may appear scarlet, crimson, or vermillion. (Windsor 2023 p.#).

This is not possible. When silver halides react to light they cannot have any degree of redness. In colour photography, you must render a silver-image before you can render colour: developed-out patterns of blackened silver serve as stencils, in additive or subtractive, optical or dye methods, to create redness in the final, processed image. The example described here supports a multi-stage account, not the single-stage view.

In the second example, Windsor supposes that exposed but undeveloped film can have tones and tonal contrast. He considers a high-contrast picture produced on a bright day, with areas that are solidly black or white: a description appropriate for the pictorial features of a visible image. But, according to Windsor the tonal contrast of the patent image is a function of the developing process along with *tonal* features of the latent image itself, which, he says, has areas that are determinately absent of detail because they are blacked-out or whited-out from the moment of exposure. However, a latent image with no visible properties could have no dark tones or light tones, and no tonal contrast. In comparison, a photographic register produced on a bright day may have areas with high or low densities of invisible development centres without any detectable tonal difference. A register with such properties could, subject to rendering and subsequent printing on paper, produce solidly white and black areas and a photographic image with high tonal contrast. Areas of total blackness would correspond to regions where no light at all was registered. The multi-stage account can explain degrees of determinacy, including constraints on the potential for image rendering as opposed to retouching, without attributing pictorial features of any kind to the photographic register.

Windsor's primary objection is that I hold "an implausible view of what a latent photographic image is" (Windsor 2023, p. #). He thinks I endorse a demanding criterion that any latent image is necessarily identical with just one patent image, and says I insist that "the determinate properties of a latent image are just those that are common to any of its possible patent images." My actual view is quite different, understood in the context of my original approach. In the first prong, I did not devise or endorse a demanding criterion for something to count as a genuine latent image, then proceed to apply it to photographic images. On the contrary, I set out to exemplify the kind of claim that others have made on behalf of photography: namely, that an invisible latent image is secured at the time of exposure and remains one and the same image when it is made visible. I sought to show that this could not literally be true, by demonstrating the demands that apply to an image that does live up to this conception. Genuine latent images fulfil this conception only because the latent and patent image is in fact identical. Photographic images cannot possibly be like this. My point is that photography with this self-conception would inevitably fail to live up to its own criteria. This untenable

position awaits anyone who supposes that a photosensitive surface produces invisible pictorial features when it is exposed to light.

The English language lacks a distinct term, a category noun, for a photosensitive surface that has been exposed to light but not yet developed. Terms that more-or-less serve this purpose are unsatisfactory when philosophical clarity is required. 'Undeveloped photograph', 'undeveloped negative' and 'undeveloped print' pre-empt the outcome of a subsequent process stage, giving the impression that that these are already a kind of image. The prefix 'undeveloped' is often casually omitted; for example, returning from the mountains, Ansel Adams reported that his bag held several good negatives, when he was in fact carrying exposed but undeveloped plates. The terminology of 'undeveloped plates', or 'undeveloped film' does not pre-empt the outcome of a subsequent process stage but fails to distinguish between the 'undeveloped plate' that Adams carried up the mountain and the 'undeveloped plate' that he carried down the mountain. The latter is more accurately an 'exposed but undeveloped plate', but this mouthful is specific to a particular substrate. The best candidate is the catchy term 'exposure'. It is functionally neutral about the material substrate and refers to the preceding process stage, rather than a process stage that is yet to come. The drawback is that the same word, 'exposure', is used for the process stage that causes an exposure to exist: a controlled time interval, for example 1/125th of a second, where light is delivered to a photo-sensor. We are obliged to say that an exposure is produced by an exposure: an exposure occurs and an exposure is the result. Consider, also, that it can make sense to say that I made 36 exposures before realising I had forgotten to load film in my camera. It is possible to disambiguate three senses of 'exposure': the period of time that light is allowed to enter the camera; the event of light arriving on a photosensitive surface; and the altered state of a photosensitive surface after light has affected it. I retain exposure in the first sense. I use 'photographic event' for the second sense and 'photographic register' for the third sense.

Windsor remarks that, for the multi-stage account, it is a contradiction to talk about an 'undeveloped photograph'. I can now clarify my view. With an etymology from *photos* + *graphê*, light-drawing, 'photograph' could simply mean any photo-sensitive surface inscribed with the effects of light, including exposed but undeveloped film. Call this 'photograph-1'. In a more everyday sense, 'photograph' typically refers to a stable visible image that is the final product of a photographic process. Call this 'photograph-2'. I would be happy to say that, at the end of a photographic event a photograph-1 exists, while denying that a photograph-2 exists. This means I could accept the notion of an undeveloped photograph-1, but not an undeveloped photograph-2. To escape problems with ambiguity and equivocation, I prefer to avoid the term 'photograph' and instead distinguish between a photographic register and a photographic image (Wilson 2022a and 2022b). In a chemical developing out method, 'undeveloped photographic register' would be closer to a tautology than a contradiction.

I have used up a roll of film. Do I say that I have 36 photos in my camera? Only if 'photo' means photograph-1 not photograph-2. Do I say I have 36 exposures? 36 undeveloped negatives? 36 latent images? One multiply exposed but undeveloped roll of film? Pragmatically, in appropriate contexts, I could say any of these things. But where conceptual clarity matters, it may be more useful to say that I have 36 photographic registers and make it clear that a photographic register is never an invisible latent image.[iii]

References

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[i] In my 2021 article I did not employ the terms 'picture', 'pictorial' or 'depiction'. I am using Windsor's terminology throughout. See Wilson 2022a for discussion of a distinction between image and picture.

[ii] In a printing-out process the grains grow large enough to become visible without chemical development, so there is no 'latent image' stage.

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