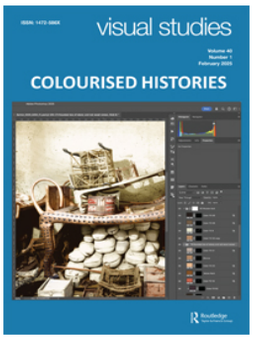

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On AI colourisation: algorithms, ancestry, and colour beyond the black box

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This article investigates the recent fusion of AI colourisation with genealogy and ancestry databases to offer a set of reflections on this nascent technology. Combining humanistic approaches from film and media studies, science and technology studies, critical race studies, and visual and material culture, it attempts to disentangle the political, technical, and aesthetic concerns that arise when the achromatic past becomes the colourised present through machine vision. After tracing the computational origins of colourisation, the article reveals how deep learning-based colourisation tools mark a rupture in the way the machine 'senses' colour, where the logic of pattern recognition and classification overrides epistemologies of sensory perception. The final part of the essay turns to the racialised role colourisation occupies on genealogy platforms, arguing that such databases naturalise the historically fraught relationship between colour as both race and hue. Across these three sections, colour is at the centre of these questions of subjectivity, personhood, and technologically mediated ways of seeing. It remains the vexed and ambivalent site to which meaning adheres.

THREE TO TEN SECONDS

It all seems so suspiciously straightforward.

I click the 'upload' button and select a scanned JPEG from my desktop. The photograph is a black-and-white family portrait from 1946, taken in Tianjin, China, when my father was just a year old. My father, flanked by my paternal grandparents on his left and right, is slightly out of focus, blurring his expression of what could be surprise, confusion, or amazement. Behind him, my aunt glowers slightly, seemingly sceptical of the camera's gaze. She looks the way I feel in this moment: inherently dubious of this AI colourisation tool that I am about to try, one whose tagline is 'See your heritage in color: Upload black & white or faded color photos and be amazed by the results!'[1]

I click 'colorize,' which superimposes a buffering paintbrush icon over the uploaded image that 'paints' swirling arcs of colour as the words 'We are colorizing your photo' appear on the left-hand side of the screen. I watch, rapt, my scepticism slowly turning to wonder as colour floods my grandfather's face. Like most critical media studies scholars, I tend to be sceptical of algorithmic tools that are often riddled with implicit bias but make a claim to ideological neutrality in the service of social betterment (see Benjamin 2019; Noble 2018; and Chun 2021). And yet, prepared as I am to detect implicit bias or error in the result, I find myself surprised at the realism of the colourised image, at the small jolt and flutter in my chest at the instant of chromatic transformation. In three to ten seconds – as promised – the image has been colourised, and convincingly so [Figure 1]. Am I meant to view this as a kind of reincarnation, the world made flesh? A wholesale acceptance of colour's ability to animate the dead, greyscale past?

The technology in question is called DeOldify, which, having learned the most statistically likely data patterns of colour images, colours in black-and-white photographs through a predictive classification process. DeOldify is an example of *deep learning*, a type of artificial intelligence where the word 'deep' describes how the algorithm's circuits 'are typically organized into many layers, which means that computation paths from inputs to outputs have many steps' (Russell and Norvig 2021, 26). Because deep learning uses neural networks which are designed to mimic the human brain and can improve performance based on previous mistakes, it has become widely used for complex operations that include 'visual object recognition, machine translation, speech recognition, speech synthesis, and image synthesis' (750).

The platform is MyHeritage, one of the numerous ancestry sites which have seen an explosion in the past two decades. Though AI colourisation tools can be used for a wide variety of reasons – one of the most publicly

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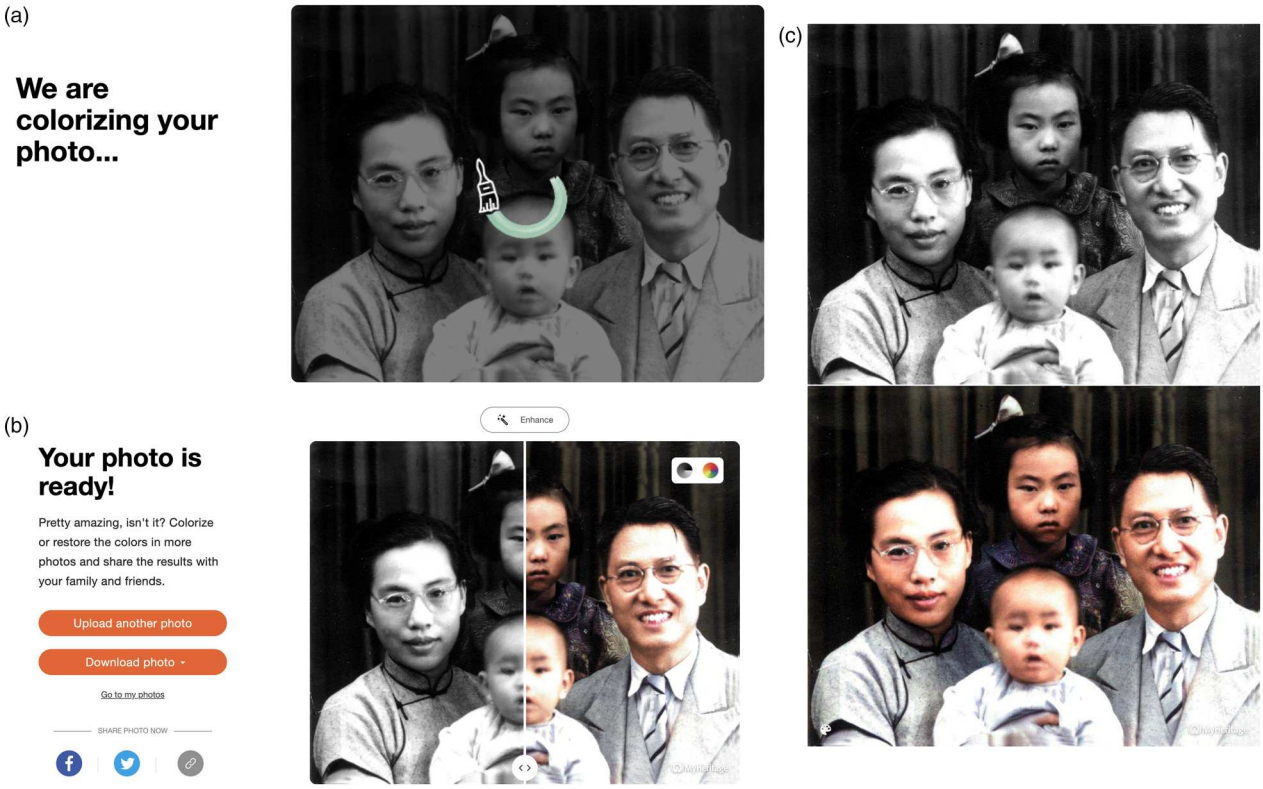

FIGURE 1. (a–c) MyHeritage's colourisation tool with author's family photograph.

circulated examples was a colourised version of Dorothea Lange's *Migrant Mother* (1936) [Figure 2] (Zhang 2017)[2] – the most common and publicly advertised usage is colourising family photos on ancestry and genealogy sites.[3] Platforms like 23andMe, Ancestry, and MyHeritage, which are part of a multibillion dollar industry, are partnering with the programmers who design these algorithms and promoting them in conjunction with DNA testing, 'ethnicity estimates,' and family tree mapping (see Creet 2020). We must therefore view these machine learning colourisation tools as part of a pervasive cultural obsession with heritage, ancestry, and ethnicity in the aftermath of the rise of direct-to-consumer DNA testing, which first emerged in the late 1990s and had reached two million consumers by 2015 (Nelson 2016, 43).

While DeOldify was first released in 2018 as an open-source programme which is still available on the developer platform GitHub, since 2020, MyHeritage has acquired exclusive rights to the most updated version. The corporation encourages consumers to combine it with other proprietary AI features that range from the more innocuous (AI Time Machine for creating custom avatars) to the truly disturbingly uncanny (DeepStory™ 'make[s] your family photos speak' while Deep Nostalgia™ 'Animate[s] the faces in your family photos with amazing technology'). This adoption of deep learning colourisation features on the part of genealogy sites isn't just limited to MyHeritage: most recently, in 2022, Ancestry.com partnered with a digital preservation company called Photomyne to release a new deep learning algorithm that would allow users to automatically colourise and touch up black-and-white family photos. As a June 2022 post on Ancestry's official blog put it, lauding the colourisation software:

> We all love looking at old black and white family photos for a trip down memory lane. But imagine seeing a photo of your great-grandmother with her vibrant red hair and piercing blue eyes. Now that's possible with Ancestry's new colorization feature. You can bring your ancestors to life with color-enhanced images that you can easily share with family. ('Ancestry's New Image Colorization Feature' 2022)

For film and media scholars, this quote will almost certainly recall a long lineage of theorists who have linked both still and moving recorded images to ghostliness or death (see Gunning 2007; Mulvey 2006; and Sconce 2000). But here, the photograph's pastness stems not from any kind of indexical relationship between object and referent – of reflection, light, and shadow created by the photographic imprint – but from

FIGURE 2. Colourised version of Dorothea Lange, *Migrant Mother* (1936) included as an example image for DeOldify on Github. Public domain (open source software).

the automated simulation of colour in the absence of human actors.

The underlying assumption of AI colourisation is that adding colour to black-and-white makes the past more 'real' in the present. It does so by cementing colour's relationship to newness and technological innovation, even as the resulting colourised images often simulate the appearance of older photographic processes like autochrome, thereby embracing what Liz Watkins (2021) calls 'an artifice of deterioration' (139). But AI colourisation tools are also clearly distinct from those used in films such as *They Shall Not Grow Old* (dir. Peter Jackson, 2018), a narrative created entirely out of digitally colourised archival World War I footage, or even the automated colourisation of scanned black-and-white family photographs from individual family history research methodologies. Although *They Shall Not Grow Old* was critiqued for its revisionist approach to history, no one could deny the painstaking labour required to colourise one frame at a time (Murphy 2018). Similarly, family history research methodologies for preservation and restoration require a great deal of cross-referencing and archival work; they are individualised rather than generalisable. By contrast, it takes just a few seconds to colourise a black-and-white photo with a deep learning algorithm that purports to be one-size-fits all.

Tools like DeOldify therefore give users the *sensation* of being in control of the process of colourisation as they experience it in real time, while at the same time experiencing the black box effect of the programme's hidden code. The novelty of these tools thus lies not merely in the final product, but in the process. From the buffering paintbrush icon that adds liveness and harnesses the process of waiting, to the 'ify' suffix that implies intensification, DeOldify builds its platform on that brief moment of unease mixed with wonder that I experienced as I saw my family members transform before my eyes. While it's true the user can adjust the colourised image accordingly by either running the software again or with the aid of digital correction tools, the 'aha' moment arises from that first spectacular 'fall into colour' from black-and-white (Batchelor 2000).

This article investigates the recent fusion of AI colourisation with genealogy and ancestry databases to offer a set of reflections on this nascent technology. Combining humanistic approaches from film and media studies, science and technology studies (STS), critical race studies, and visual and material culture, it attempts to disentangle the political, technical, and aesthetic concerns that arise when the achromatic past becomes the colourised present through machine vision. As many have noted, colourisation's controversy stems from its fraught relationship to questions of archival and historical memory, and as examples like *They Shall Not Grow Old* demonstrate, these concerns about rewriting history through colour are bound up with the politics of nostalgia (Watkins 2021), where, as Tanine Allison (2022) has noted, the film replaces the historic indexical truth value of celluloid with today's ubiquitous logic of digital plasticity.

While it's impossible to discuss colourisation without evoking these debates to some degree, I'm less interested

evaluating these tools on their aesthetics and ethics of authenticity or realism than in what these recent case studies can tell us about cultural anxieties around identity, algorithmic encoding, and the fate of colour in the age of Big Data. This is not to dismiss the very real ethical dilemmas posed by with technologies like deep fakes, which make it increasingly easy to doctor or falsify photos, videos, and sound recordings on an often undetectable level (Rodness 2021). Users and creators of colourisation tools that use deep learning are understandably preoccupied by these concerns: both MyHeritage and Ancestry's FAQ pages for their respective colourisation tools include the question 'Is the color authentic?', and DeOldify adds a watermark that shows the image was colourised with AI (however, users can easily get rid of the watermark by paying for a MyHeritage subscription, rendering this feature somewhat insignificant).

At the same time, I find myself hesitant to embrace the narrative of prominent tech companies that we are in the 'dawn of AI' or on the precipice of a shift to Web 3.0 that will transform life as we know it. My wish is not to feed into techno-utopian *or* dystopian discourses on AI, but instead to explore these emergent technologies through a more speculative or sceptical lens (see the DISCO Network 2025), one that allows for a different kind of insight from the more empirical approaches that are often used in AI-oriented research. Here, I find useful Donna Haraway's confession to her own susceptibility to being seduced by images that use metaphors of blood and kinship to foster an ideology of a shared humanity 'despite decades of critical visual theory.' For Haraway (2004), this susceptibility 'helps, because it is a rule for me not to turn a dissolving eye onto straw problems, not to "deconstruct" that to which I am also emotionally, epistemologically, and politically vulnerable' (262).

Haraway draws our attention to an apparent paradox that scholars thinking critically about media and technology often experience: even when one has a strong grasp of a given apparatus's underlying mechanism or protocols, a lack of transparency can still remain when engaging with these visually seductive objects. In STS, this opaque logic, where accessibility is predicated on obfuscation, goes by the term 'black box' or 'black box effect.' Though originally associated primarily with cybernetics and the history of computing, where 'black box' described 'a unit designed to perform a function before one knew how it functioned,' (Galison 1994, 246), it has come to describe not merely a device, but a particular kind of embodied technological knowledge where 'a great premium is placed on interface, while interiority matters very little' (Galloway 2010). Far from being a tired cliché, the black box remains a potent metaphor for a moment when 'user-friendliness' is predicated on hidden networks of labour and infrastructure.

In what follows, I use 'black box' as: 1. a tool to articulate how AI colourisation tools often reinforce existing social biases and 2. as a way of bringing conversations from STS and critical race studies to bear upon visual and material culture and the history of colour film and photography. The black box is, of course, not just an epistemological metaphor but a *chromatic* metaphor, one that equates blackness with inscrutability and opacity. Though we rarely hear this term today, the black box was in fact originally conceived in direct opposition to the white box, a device which 'specified the inner mechanism' (Galison, 246). What happens, then, when we are dealing with a black box logic that is acutely colourful, one that dazzles and entices us through spectacular, auto-generated hues?

I begin this article by excavating the computational origins of colourisation in the 1980s, where 'computational' describes a technique of image manipulation that renders the world as a set of discrete, modular, and numerically labelled objects. Unlike earlier colourisation technologies, however, deep learning marks a rupture in the way the machine 'senses' colour, where the logic of pattern recognition and classification overrides epistemologies of sensory perception. In the final part of the essay, I turn to the racialised role colourisation occupies on genealogy platforms. I argue that while such databases often abstract heritage and pedigree from the human body via tree diagrams and charts, they still rely heavily on skin, hair, and eye colour as ethnic and racial markers, thus naturalising the historically fraught relationship between colour as both race and hue. Across these three sections, colour is at the centre of these questions of subjectivity, personhood, and technologically mediated ways of seeing. It remains the vexed and ambivalent site to which meaning adheres.

THE COMPUTATIONAL ORIGINS OF COLOURISATION

Before delving into the inner workings and aesthetico-political ramifications of tools like DeOldify, we first need to situate them within a longer history of colourisation – which, I contend, has always been computational. By 'computational,' I refer not simply to specific technical processes or hardware, but rather to a visual and philosophical orientation towards numerically inflected object knowledge (Gaboury 2021). In this sense, following W.J.T. Mitchell's 1994 claim that colourisation is an 'updated version of the old practice of

hand-tinting photographs and film frames' (12), one could make the argument that nineteenth-century photographic colour processes like photochrome are analogue ancestors of programmes like DeOldify. At the same time, it's important to distinguish these photographic processes them from colourisation tools that are based on the manipulation of numerical input and output values that are ultimately concealed from the viewer/user, which did not emerge until the late twentieth century.

For the purposes of this essay, then, my starting point for 'colourisation' is the much-maligned electronic technology of the 1980s and early 1990s, during which numerous studios released colour versions of classic Hollywood films such as *Casablanca* (dir. Michael Curtiz, 1942), *It's a Wonderful Life* (dir. Frank Capra, 1946), and *Some Like It Hot* (dir. Billy Wilder, 1959). Importantly, colourised versions of these films were primarily designed to be shown on broadcast television or home video – not in movie theatres. It's difficult to overstate just how reviled colourisation was in its early years. In a 1992 follow-up to his 1988 essay 'In Defense of Colorization' (published the year of *Casablanca*'s release in colour), James O. Young wrote: 'Colorization has been, perhaps, more reviled than any other development affecting the arts since the Visigoths and Vandals visited Rome' (245). A 1988 satirical piece published in the *Los Angeles Times* imagines the characters of *Casablanca* reacting in horror to their own colourisation. 'Who did it, boss, the Germans?', Sascha (Leonard Kinskey) asks Rick (Humphrey Bogart). 'No, this is one atrocity we can't blame on the Nazis,' Rick responds.

The hyperbolic and often humorous language in these pieces encapsulates colourisation's polarising reception by those who embraced its novelty on the one hand (the 'colourisers'), and those who viewed it as a tasteless corruption of cinematic classics on the other (the 'anti-colourisers'). For many who experienced the controversy as it unfolded in real time, colourisation was a flop best forgotten, a gimmick akin to obsolete technologies like Smell-O-Vision which have become part of an archive of so-called dead media. But is colourisation truly dead?

What is often left out of contemporary discussions of colourisation is the ways in which its history is fundamentally inseparable from the emergence of electronic screen colour and its encroachment into the medium of film. From the get-go, colourisation was a process of electronic transcoding, from film to videotape, that used an early computational process known as colour imaging. The first colourisation systems, in the early-to-mid 1980s, were designed for analogue computers – that is to say, they involved the manipulation of electronic signals rather than doctoring the image on a pixel level. Technicians would divide each frame into regions and choose so-called 'memory colours' of common objects (i.e. green grass, blue sky, skin tones) (Lehmann 2016), pointing to how even in its analogue form, colourisation anticipated the discrete and modular logic of the digital image. Processes like those designed by the Canadian company Colorization, Inc. and its American competitor Color Systems Technology were highly laborious, expensive, and time-consuming (it could take hours to colourise a single minute of film). After the original monochrome film was transferred to video, each scene had to be sequenced shot by shot. The first and last frames of each scene then had to be broken down into components (e.g. facial features, background scenery) and assigned a specific colour out of 4,096 possible hues [Figure 3] (Edgerton 2000, 31).

The result of all this labour was a superimposition of colour *over* a black-and-white image that could then be saved to the computer and re-released as a videotape. This additive approach had multiple limitations, most notably a faded or washed out look that stemmed from the greyscale film footage showing through the colourised surface layer (Edgerton 2000, 26). By the late 1980s, the company American Film Technology, under the direction of neuroscientist Barry Sandrew, had come up with an entirely digital colourisation system that scanned the film and broke each frame into pixels, which could then be assigned colour values as numerical code (30).

The history of colourisation thus owes much to the development of computer graphics, or what Jacob Gaboury has traced as the transformation of the computer from a noninteractive calculation tool into an interactive visual medium (7). The analogue colourisation techniques discussed above would not have been possible without the development of early computer paint programmes like SuperPaint, which were designed to emulate the experience of painting or drawing with paint and ink. Developed at Xerox PARC in Palo Alto, California between 1972 and 1973 by Richard Shoup and Alvy Ray Smith (Smith would later go on to found Pixar), what made SuperPaint so unprecedented was its liveness. The user drew with a stylus on a 'canvas' (a tablet) featuring a 'palette' of possible colours, watching hues on the monitor change before their eyes [Figure 4]. Like the film colourisation software of the 1980s, the final product of SuperPaint was a videotape, bridging the technological gap between computing (storage) and video (transmission) (Kane 2014, 116). By the time the digitally colourised version of *Casablanca* was released, in 1988, colourisation software operated by a similar logic of opacity to today's computers, where the Graphical User Interface (GUI)

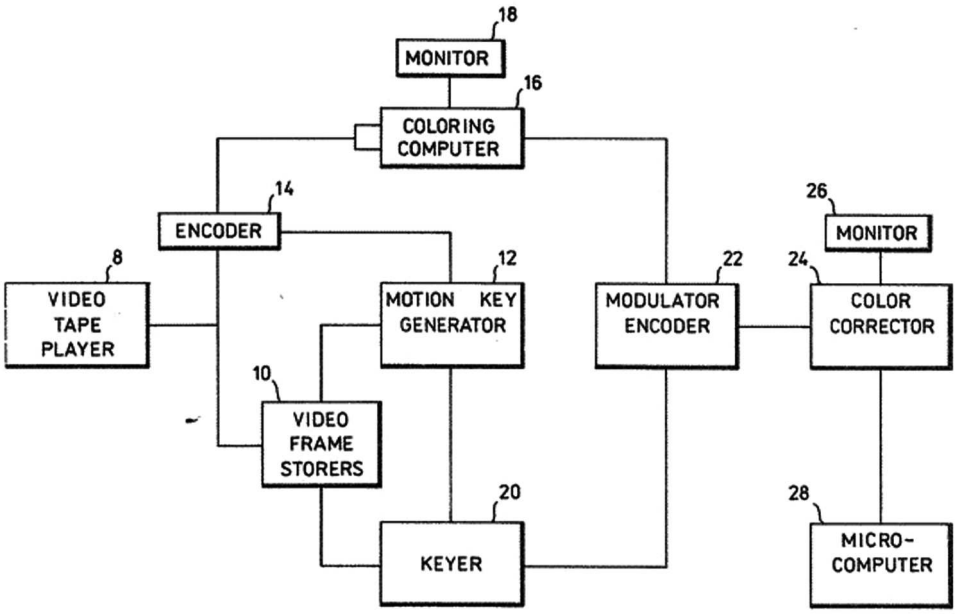

FIGURE 3. Wilson Markle and Brian Hunt (Colorization, Inc.). Canadian Patent 1291260, filed 1 December 1987 and issued 22 October 1991.

has made it possible to doctor and manipulate colour on a pixel level and to effectively decouple colour from object. Encoding colour became a matter of numerical input and visual output, making possible the creation of digital tools which allowed users to manipulate and toggle with numerical colour values with a single click.

In summary, colourisation marked a perceptual shift towards a modular, interactive, and distinctly computational understanding of the image, where individual elements and pixels could be altered with measurable precision. This shift was, intriguingly, already apparent in the film colourisation controversy of the 1980s, which anticipated later debates surrounding digital colour grading. Those who objected to colourised films lamented what they viewed as a superficial, 'unrealistic' manipulation of the image's truth value, often by using painting or dye metaphors. Jimmy Stewart, who was vehemently opposed to the colourisation of *It's a Wonderful Life,* described the

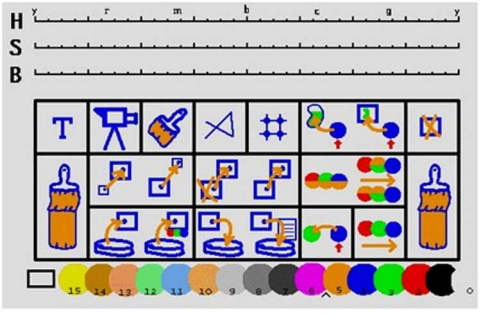

FIGURE 4. SuperPaint menu, circa 1972. Copyright Richard Shoup.

film's scenes as having been 'washed away in a bath of Easter-egg dye' (Rosenfield 1987). The same year, film scholar Arthur Asa Berger (1987) maligned the ways in which with colourisation, 'a film becomes like a huge coloring book and is emptied of its original content' (13). At times, anti-colourisers used highly gendered language: critic Ebert (1988) bitterly decried the process as '[providing] a tarted up imitation of color, like cosmetics on a corpse.' Given how colour has been historically dismissed or othered through gendered and racialised tropes (see Batchelor 2000 and Taussig 2009), it's perhaps unsurprising that these largely white, male critics would be opposed to its encroachment into the alleged purity of the black-and-white image. But what I find especially interesting here is how the language accompanying the 1980s colourisation controversy mirrored the responses that would accompany the rise of computer-generated imagery (CGI) and the digital intermediate (an early form of colour grading)[4] roughly a decade later (Belton 2008) – as when Lev Manovich (2016) declared digital cinema to not be cinema at all, but 'a sub-genre of painting' (22). (And note that DeOldify's iconography – the buffering paintbrush icon and the paint palette watermark – evoke painterly rather than photographic processes.)

From here, it doesn't seem like too much of a leap to claim that digital colour grading is de facto a kind of colourisation. For example, the 1998 film *Pleasantville* (dir. Gary Ross), one of the first feature films to use colour grading throughout, was shot in colour but select sequences were subsequently digitally desaturated to black-and-white – a kind of colourisation in reverse

FIGURE 5. *Pleasantville* (Gary Ross, 1998) was filmed in colour and digitally desaturated to black-and-white – a kind of colourisation in reverse. Fair use.

[Figure 5]. In 2014, Carolyn L. Kane would cite *Pleasantville* as an example of what she called 'The Photoshop Cinema,' or films with a distinctly post-computational aesthetic defined by highly stylised colour grading (243).

Colourisation, then – even if we don't refer it as such – has been absorbed into the fabric of everyday mediated experience. Today on YouTube, one can find numerous tutorials for Adobe programmes like Photoshop and Illustrator to achieve what's sometimes called the '*Pleasantville* effect,' or selective pops of colour within a greyscale image [Figure 6] (Premiere Gal 2018). The ubiquity of user-friendly digital colour filters built-into smartphone cameras and photo – and video-sharing apps like Instagram or TikTok mean that most of us are no strangers to algorithmically enhanced images. We can toggle between black-and-white and colour (as well as a variety of colour palettes) with a single swipe. What once might have been viewed as an act of deception is now commonplace the veracity of an image whose colours have been very obviously tampered with – like the phrase 'bad Photoshop job' indicates – may no longer be threatened. As the word 'enhance' implies, such digital manipulations may only intensify the effect of what was already there.

HOW THE MACHINE 'SENSES' COLOUR

As I've shown so far, colourisation is no longer a novelty technique, but an operational logic of digital images. It has become a ubiquitous component of our media landscape, bringing with it novel ways of sensing both colour and the world at large. But this phenomenological shift is pushed to its limits with deep learning colourisation tools that 'see' with machine vision, where 'perceiving' colour becomes a classification task rather than an act rooted in sensory phenomena.[5] It's accurate to say, as theorists and historians of computing have, that computational imagery – and its ability to simulate qualities such as shading, light, and texture – is based in mathematical simulation rather than optics (see Chun 2006; Gaboury, 38; and Galloway 2012). But until fairly recently, digitally rendering and manipulating colour – as with *They Shall Not Grow Old* – required a great deal of human intervention to vet the accuracy of the hues displayed. By contrast, deep learning-based colourisation tools are based in automated pattern recognition rather than traditional epistemologies of sight, keeping their inner workings largely concealed within the black box. As film scholar Roshaya Rodness insightfully observes,

> What is fascinating about new techniques of colourization is that they can be understood as photography seeing its own image through AI algorithms. DeOldify is photography taking a photograph of itself. The algorithm creates its own automatic representation of the photograph, which was our first attempt to see the world transparently.

What does it mean for a photograph to take a photograph of itself, and what does this kind of

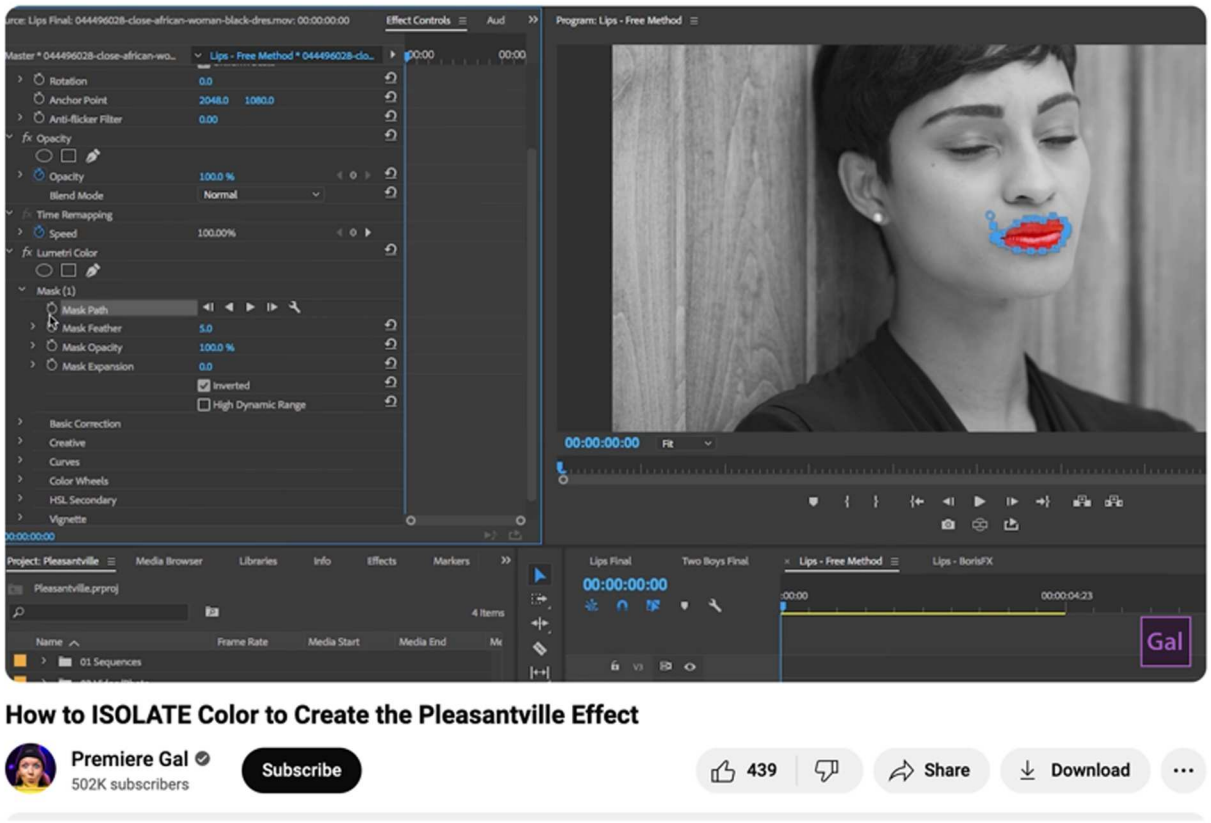

FIGURE 6. Premiere Gal, 'How to ISOLATE Color to Create the Pleasantville Effect,' YouTube, 30 March 2018. Fair use.

self-reflexive representation mean for the fate of colour in the age of Big Data? To explore this, we need to understand on a basic level how these colourisation tools work. While there are minor differences between them, here I focus on DeOldify, the technology that forms the basis for MyHeritage's colourisation feature, for a few key reasons. First, as of this writing, DeOldify is widely considered to be the most 'advanced' colourisation algorithm that incorporates the 'newest' and most 'innovative' techniques of deep learning (though we should always take this technologically deterministic rhetoric with a grain of salt). Second, because the original open-source version of DeOldify is still available, alongside an in-depth explanation of how it works, it eliminates some of the obstacles that typically accompany the analysis of propriety algorithms. In contrast with schemes that depend on humans for colourisation like the above-mentioned *They Shall Not Grow Old,* what these deep learning-based colourisation tools make manifest is a fundamental incompatibility between human and machine scales of knowledge and styles of interpretation (Burrell 2016, 3).

DeOldify, whose slogan is 'Bringing back color since 2018,' was founded by software engineer Jason Antic with the support of California startup Fast.ai. Antic has been very vocal about where the technology still needs to be ironed out and documenting the development process (2019). DeOldify offers options for both restoration and colourisation: two fundamentally different tasks, with the latter proving much more challenging.[6] While restoration involves touching up faded or damaged photos already taken in colour, colourisation is much trickier because there is no single correct colour that can be surmised from the black-and-white image alone. Some basic colour theory here helps explain why this chromatic ambiguity exists: greyscale images eliminate *hue* (dominant colour family, like red, blue, green, etc.) and *saturation* (intensity of hue), replacing these two with a single category of *lightness* (the relative luminance of an object). As Figure 7 illustrates, multiple colours can have the same lightness value. Historically, this means that there can be often surprising discrepancies between viewer expectations and behind-the-scenes production: to take one publicised example, many *Addams Family* (1965–1966) viewers were shocked to discover decades later that the set for the house in the show was painted a lurid pink, because this hue provided the best visual contrast for the final televised image [Figure 8] (Brownlee 2013).

In this sense, colourisation – whether automated or not – paradoxically involves reversing something that is fundamentally irreversible. A 2021 post on X (formerly

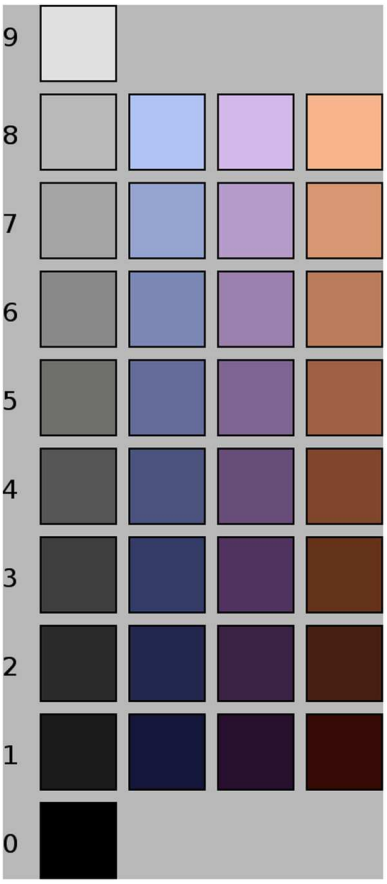

FIGURE 7. The same three hues with differing degrees of lightness as represented by the Munsell Color System. Public domain (Wikimedia Commons).

Twitter) puts this succinctly: 'There is a fundamental issue with colorising [*sic*]: Colorising is kind of like unscrambling eggs' (Wyss @pdfguru 2021). Reverting already scrambled eggs to unbroken whites and yolks is inherently impossible – much like returning colour to an image that was never in colour to begin with. But whereas colourists working on films like *Casablanca* and *They Shall Not Grow Old* conducted extensive research on what the colours of historical costumes and clothing might have been, hence using profilmic space as a referent for the digital recolouring of a greyscale image, DeOldify automatically assigns colours to an image in a near-instantaneous predictive process. Lacking sufficient contextual information to determine the original colours in a black-and-white image, AI colourisation becomes a mode of identifying different types of objects and surfaces (skin, sky, ground, fabric) and pairing them with a statistically likely colour based on stochastic patterns detected in other images within the data set (McCarty 2021).

Colour has always had a slippery relationship to objecthood – do colours 'belong' to objects or are they free-floating qualia? – but programmes like DeOldify push this tension to its limits. On the one hand, their central conceit seems to be that black-and-white images are missing some essential experiential truth that colour embodies. On the other hand, because there are multiple correct colours that the algorithm can match to a specific image, then colours don't seem to belong to these objects because they can be swapped out at will. There is no intrinsic meaning to these colours, where, following a long history beginning with nineteenth-century psychophysics and culminating with contemporary digital encoding, colour has become an abstract stimulus represented as an array of mathematical values (see Kane 2014; Rossi 2019; Murray 2018; Montaña 2019; and Sterne and Mulvin 2014).

So, how does this chromatic predictive process work in practice? As I already mentioned, developers have described AI colourisation as a classification task, where the algorithm uses data (that is, the thousands of sample images it was trained on) as *input* to produce *output* in the form of a colour designation. Deep learning tools (which include DeOldify as well as Google Images and chatbots like the controversial ChatGPT), as mentioned earlier, use *neural networks,* models which mimic how neurons signal to each other in the human brain and make it possible for algorithms to make predictions and correct errors. Yet despite the ways in which these models emulate neural pathways, the resulting processes, as DeOldify reveals, are fundamentally incompatible with human ways of knowing and sensing colour.

DeOldify uses a form of deep learning called a General Adversarial Network, or GAN, which consists of two components: the *generator* and the *discriminator*. These two networks, as the name would suggest, have an adversarial relationship, or what is sometimes called a zero-sum game. Put simply, the generator generates new data, and the discriminator predicts whether the data is 'real' or 'fake.' When it comes to colourisation specifically, this means that the generator's job is to produce colourised images from black-and-white outputs, while the discriminator is then tasked with evaluating these images against the 'real' colour images from the training data. With training, the generator gets better at fooling the discriminator by producing increasingly 'realistic' AI-generated colourisations, while the discriminator learns to get better at distinguishing generated images from real ones. This adversarial process continues until the generator produces colourised images that are indistinguishable from real colour images to the discriminator.

Yet, sophisticated as GANs may be, this kind of self-reflexive perceptual mode can have troubling implications. It creates an enclosed feedback loop in

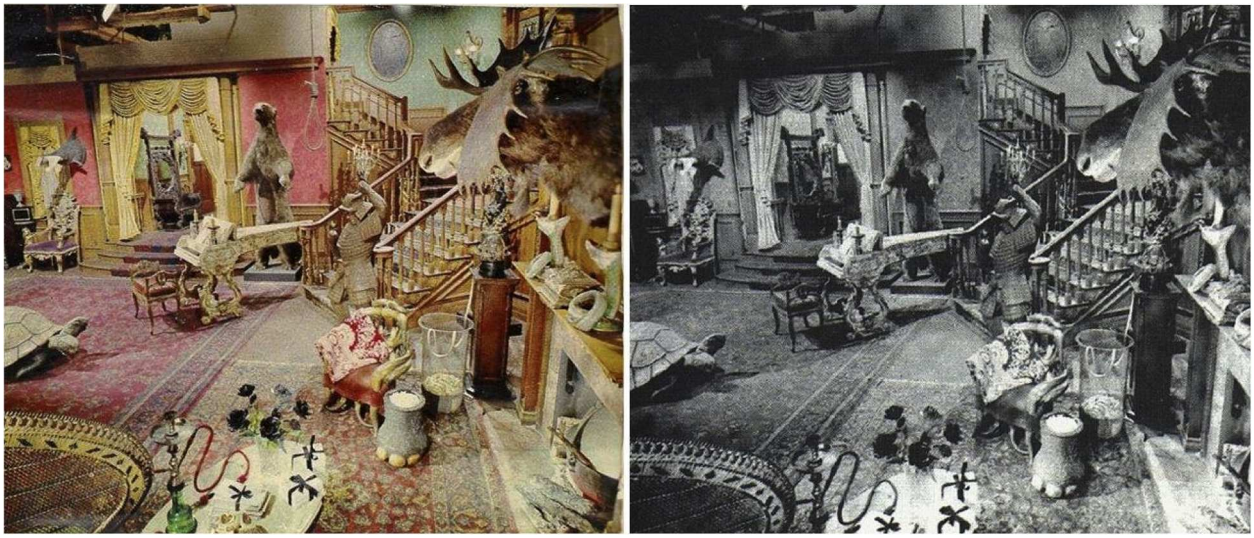

FIGURE 8. The colourful set for *The Addams Family* versus the final televised black-and-white image. Public domain.

which the only way for the algorithm to 'sense' colour is by detecting existing patterns within the training data that link objects to specific colours (the memory colours mentioned in the previous section). DeOldify often leverages pretrained models, particularly for the discriminator, meaning that its colours have been preselected for and already established as 'natural' or 'realistic.' Furthermore, unless the software is open-source, users are typically unable to access the training images for generative AI, making it exceptionally difficult to pinpoint existing biases in the data or potential issues of privacy and consent. What results is the creation of a set of normative criteria for the types of images that are knowable to the machine's gaze – even when the inputs (in this case, colour) are unknown.

As critical media scholars have shown time and again, datasets are by no means 'raw' or neutral but make political statements about what is considered normal, natural, or common-sense. They are built on a set of assumptions about how labelling and representation operate, and that categories such as colour – which are notoriously slippery and resistant to categorisation – are fixed and universal (Crawford and Paglen 2019). Wendy Chun (2021) has described the historical power relations bound up in algorithmic pattern recognition, where, because 'nothing ever stays the same and no two things are identical, every recognition is also a misidentification' (228). With AI colourisation, these instances of misrecognition are sometimes apparent and even humorous: one of its most cited errors is 'zombie hands,' or when the algorithm renders human flesh the same colour as the image's background. In another instance, one Reddit user described showing their grandfather a colourised image of him in a suit when he was younger. Upon seeing the image, the grandfather 'laughed for a solid two minutes because he said it made him look like a movie theater usher. His suit in real life was light gray with a maroon bow-tie and the colorized version turned it into stark white with a bright red bow-tie' (@Y-do-u-kare 2022). Faced with an ambiguous colour input based on uniform brightness levels, the algorithm opted for what amounted to a historical cliché.

But instances where misrecognition can be identified in real-time are relatively rare, because they require living agents and/or historical memory to intervene. Other times, misrecognition by AI colourisation can be more insidious, as when data scientist Sam Goree (2021) revealed that DeOldify often lightens darker skin tones in the absence of colour context. Goree took a 1943 historical colour photograph of a Black female worker drilling into a military aircraft, desaturated it to greyscale, and then re-colourised it using DeOldify. The resulting colourised image featured duller, more washed-out colours, rendering the subject of the photo paler than she was in the original image [Figure 9a-c]. While the logical assumption here – following many instances of algorithmic racial bias – might be that the data set contained a disproportionate number of images of white people, Goree explains that there is another explanation at play: the problem of norms or averages. Because of the way DeOldify must guess at an image's colour, the algorithm will sometimes select a hue that falls in between the two most likely colours – hence resulting in increasingly dull colour. The often lack of transparency behind how these classification decisions are made – even when software is open-source – means that there is ample space for bias, which, as I now turn to in the final section of this essay, manifests in the complex relationship between colour and race on ancestry platforms.

FIGURE 9. (a–c) Left: original of Alfred T. Palmer, 'Operating a hand drill at Vultee-Nashville, woman is working on a "Vengeance" dive bomber' (1943) via the Library of Congress; centre: the same photo, converted to grayscale by the author; right: the grayscale image colorised by the DeOldify AI colorisation algorithm. Originally published in Sam Goree, 'The Limits of Colorization by AI'.

COLOUR, RACE, AND KINSHIP ON ANCESTRY PLATFORMS

AI colourisation tools, as we have seen, are both new and not new. Colourisation is a technique that long predates the rise of deep learning, but algorithms like DeOldify have also ushered in several epistemological shifts, ultimately reducing colour to an automatic classification process that negates interpretation. Furthermore, novel technologies don't exist in a vacuum, but emerge from longstanding cultural dominants such as capitalism, colonialism, and white supremacy. Genealogy platforms like Ancestry and MyHeritage operate on the assumption that users have an intrinsic desire to connect with their genetic roots by 're-colouring' the past. Several visualisation tools on these platforms (many of which are crowdsourced), such as tree diagrams and the 'Find a Grave' feature, abstract heritage from the human body. By contrast, colourisation tools indicate a return to physiology that has troubling echoes of turn-of-the-century 'racial scientific' discourses on pedigree and phenotypical colour.

Since the discovery of DNA's molecular structure in the 1950s and the sequencing of the human genome between 1990 and 2003, genetics have become a central aspect of contemporary technoscientific culture. Scholarly coinages like 'the DNA mystique' (Nelkin and Susan Lindee 2004), 'the genealogical sublime' (Creet 2020), and 'the genomic gaze' (Hogan 2016) illustrate the ways in which emergent genetic technologies have fostered distinctly modern understandings of selfhood, kinship, and belonging. As some have argued, the contemporary obsession with genealogy platforms stems from a collective desire to locate the infinite or sublime within vast quantities of data – and the Internet proves the ideal medium through which to realise this desire (Creet, 20). Self-discovery via genetics is an integral promise of the information economy, prompting Alondra Nelson to conclude that 'DNA is the original Big Data' (8) and 'the most essentialist and socially anemic conception of human identity' (6).

Nelson is one of several scholars, such as Donna Haraway, Kim Tallbear (2013), and Catherine Nash (2015), who have been critical about genetics as the primary determinant of self-determination and kinship. Collectively, these critics contend that it is impossible to talk about genetics and ancestry in the twentieth and twenty-first centuries without talking about race, where DNA's privileged status of verification – of 'discovering one's roots' – has become a way of monitoring and reifying engrained ideas of racial purity. On the surface, contemporary digital databases that celebrate geographical diversity may seem a far cry from the late-nineteenth and early-twentieth century eugenicist project to document, categorise and rank individuals based on their proximity to Aryan whiteness, as in the work of Frances Galton (Charles Darwin's cousin who coined the term 'eugenics' in 1883) (Gould 1981, 75) or the concentration camps of Nazi Germany. And yet, DNA databases, as Tallbear argues in *Native American DNA,* actually reinforce the concept of racial purity by design, where the very concept of mixed heritage reaffirms set racial categories by dividing humans into percentages [Figure 10] (75). The multicultural and 'post-racial' paradigms of the late twentieth century espoused the neoliberal idea that 'we are all related,' though passing decades have revealed that this political project of human sameness was only ever aspirational (Melamed 2011). Technologies designed to be antiracist ironically have the opposite effect, harkening back to the turn-of-the-century notion that clear delineations exist between human populations and that race is biological, eternal, and ultimately quantifiable.

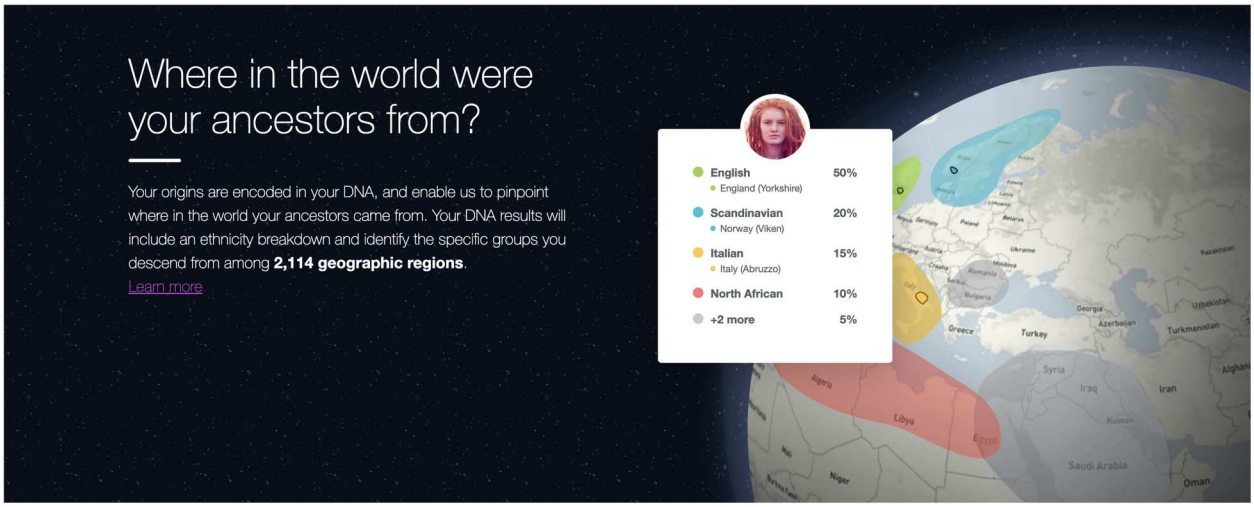

FIGURE 10. MyHeritage's 'Ethnicity Estimate'.

Colourisation tools on ancestry platforms therefore crystalise anxieties about mass migration, intergenerational mixing, and mortality, which manifest via the elusive promise of reanimating the past through automated bodily colour. Despite the enormous variation in skin, hair, and eye pigmentation across human populations, grouping these colour differences under the nebulous categories of 'ethnicity' or 'race' blurs culture and biology. 'Eye color is just the beginning,' somewhat sinisterly reads an ad for AncestryDNA® + Traits, whose Pigmentation Traits Prediction feature estimates a user's physical traits based on their genetic results [Figure 11]. While Ancestry is careful to avoid any mention of race or ethnicity here, opting instead for terms like 'inherited skin tone,' online forums such as the r/AncestryDNA subreddit reveal the chromatic encodings of race at the heart of these predictive features. In a sub-thread between two users who identify as African American, they concur that Ancestry's categories fail to map onto the complex colour taxonomies within the Black community, where

> We have different complexion categories, we got the high yellow (the lightest) we got the light skin (same as high yellow just slightly darker and tanner) we got the brown skinned (the medium complexion like a dark skin an light skin made a baby) we have the dark skin (anyone darker than a Hershey bar imo) and we have the deep skin (those who actually have black skin color like really dark). (@supermnnovaa95 2021)

Historically racist and derogatory terms like 'high yellow' reveal the painful history of the 'one-drop rule' in the United States, where having a single Black ancestor would 'contaminate' one's so-called racial purity, or whiteness. We don't have to dig too deep, then, to uncover the legacies of colourism and eugenics scaffolding these chromatic taxonomies (Kane and Zeitlin-Wu 2025; Keevak 2011, forthcoming).

Regardless of intent, we can see how datasets risk reaffirming and perpetuating these same epistemological

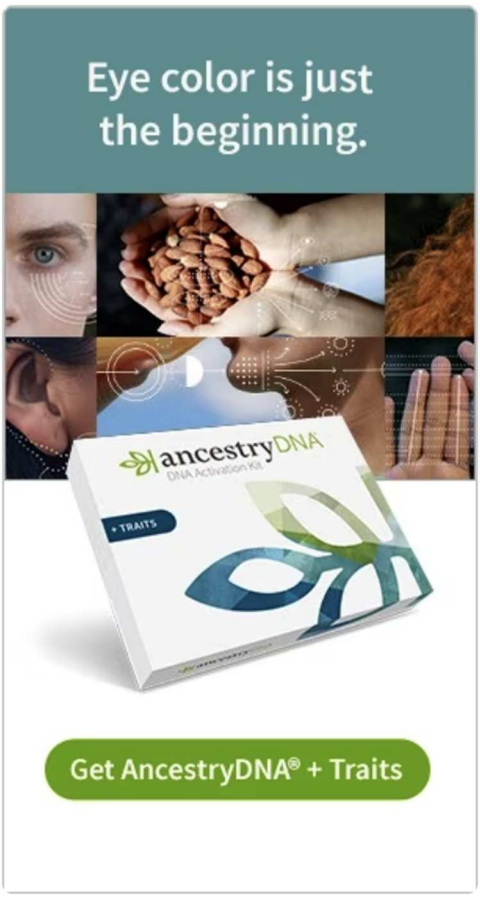

FIGURE 11. An ad for AncestryDNA® + Traits, whose Pigmentation Traits Prediction feature estimates a user's physical traits based on their genetic results.

assumptions about the so-called science of race, which the photographic medium renders palpable or evidentiary (Crawford and Paglen 2019). It's well established at this point that photography played a key role in the histories of colonialism and white supremacy, where it operated as a highly efficient ethnographic technology for capturing and categorising those deemed as Other (Hochman 2014). Deep learning colourisation tools, in their emphasis on colour's ability to bring black-and-white photos to life, therefore merge racial scientific discourses about phenotype with the history of colour media, which coalesce in the politics of reproducing accurate 'flesh tones.' An article on AI colourisation tools published in *Family Tree Magazine* promises 'rosier tones in your black-and-white or sepia images' with a 'technology [that] now exists to put the bloom back in the cheeks of your ancestors in family photos' (Morton n.d.). Terms like 'rosy' and 'bloom' imply a pinkish flush that is only visible with a fair complexion, betraying an assumed whiteness at the heart of these colourised family ties (Dyer 1997). As Kirsty Sinclair Dootson (2023) thoughtfully reveals, the introduction of colour into black-and-white screen media – from film and photography to television – carries with it a racialised charge and legacy (16). Calibrating so-called flesh tones (that is, white or 'Caucasian' skin) correctly was a priority for novel colour technologies, rendering the visibility of darker skin tones a chronic issue throughout their long and tenuous history. Whiteness remains the ground zero from which other 'coloured' categories depart.

As a case in point, let's briefly return to the satirical *LA Times* piece spoofing the colourisation of *Casablanca* I quoted earlier, which recounts the characters of the film reacting in horror to their chromatic transformation. Recall that the film has a single Black character: Sam the piano player (played by Dooley Wilson). In the parody, all characters except Sam marvel at their newly colourised skin, making remarks like 'My face is pale orange, or is it pink? My finger looks like a flesh-colored crayon.' As all turn to face Sam, Sam says: 'I don't know what color this is … But it definitely isn't pink.' The 'flesh-coloured' (that is, white) characters offer descriptors like 'dark mauve,' 'the same color as Rick's hair,' and 'the same color as our bourbon' – all language which avoids the words 'black' or 'brown' and points to the arbitrariness of racialised colour terms (Mathews 1988). This is not to give the parody too much credit – after all, it normalises whiteness as 'flesh-coloured' by seemingly accepting at face value the now infamous Crayola example.[7] Still, it cleverly points to the ways in which chromatic media and technologies such as colourisation are irrevocably linked to race, and vice versa. Racial power dynamics are baked into colourisation techniques, whether analogue or algorithmic.

In this essay, I have offered some preliminary thoughts on the nascent technology of AI colourisation, focusing on deep learning algorithms such as DeOldify. From colourisation's computational worldview to the damning histories of so-called scientific racial thought that manifest on ancestry databases, it's clear that colourisation has gone from a novelty technique to a ubiquitous aspect of contemporary image manipulation. Today, it's common to hear that we live in a 'post-optic' or 'post-visual' era, where algorithms make deductions about who we are by tracking patterns in our behaviours, both on and offline. Yet, if tools like DeOldify show us anything, it's that the spectre of visuality continues to haunt digital spaces in the form of colour. Endlessly seductive, colour bears the elusive promise of the real, the ability to touch and recover the past – even if what underlies it is a matrix of ones and zeroes. There has never been, and will never be, a 'real' colour technology that opens a transparent window onto unmediated experience. Could a focus on colour be a way of cracking open the black box, of revealing that its darkness and opacity need not be achromatic? Colour may well be a privileged space to talk about the persistence of visuality in the wake of AI and Big Data. Seeing, for many of us, it seems, is still believing – however sceptical we aspire to be.

Notes

[1] Throughout this article, I default to the British spellings of 'colour' and 'colourise.' The exception is when I quote directly from sources that utilise the U.S. 'color' and 'colorize,' in which case I retain the original spelling.

[2] As Zhang et al. point out using Lange's 'Migrant Mother' as an example, there are multiple variations in skin tone and clothing colour that can occur within a single image, of which the final AI colourised result is only one 'plausible outcome.'

[3] DeOldify has the capability to colourise film and video footage as well, but these are less frequently used and less immediately relevant to the genealogy platforms I explore in this essay.

[4] The Digital Intermediate, or DI, originally referred to the intermediate step when movies were shot on film, scanned digitally, and edited, then printed back onto film stock for theatrical release. However, given that most films today are filmed, edited, and screened digitally, it has come to refer primarily to colour grading rather than an intermediate step.

[5] One could write a whole separate article regarding the situated, distributed agency of deep learning-based colourisation tools. For these reasons, I place scare-quotes around verbs such as 'perceive' and 'sense' as shorthand for these complex questions of agency when it comes to AI. For a more thorough exploration of agency and machine learning, see Smits and Wevers 2022.

[6] DeOldify offers three colourisation modes: 'artistic' (prioritising vibrant colour and aesthetics over spatial stability), 'video' (for moving

images; prioritises spatial and temporal stability), and 'stable' (more vibrant colour than video, but more spatial stability than artistic). All three of these modes involve minor differences in how the algorithm is trained that are beyond the scope of this article.

[7] Although Crayola changed 'Flesh' to 'Peach' in 1962 during the American Civil Rights Movement, 'flesh' continued to be used colloquially through the 1990s. In the mid-to-late 1990s, the company released a 'multicultural' pack intended to represent a more diverse array of skin tones, but which conflated the difference between race, ethnicity, and culture.

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