Did Madame Mao dream in Technicolor? Rethinking Cold War colour cinema through

Technicolor's 'Chinese copy'

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In 1990 Dr Richard Goldberg was invited to give evidence in a legal case brought against Technicolor by former workers, who claimed they had been exposed to hazardous materials in the laboratory in the 1950s.[1] Goldberg had worked as an engineer at Technicolor at that time, improving the company's dye-transfer printing process, and his intimate knowledge of how Technicolor dyed their films was crucial to the investigation. The plaintiff's lawyer quizzed him on dye formulae, chemical components and colourant suppliers, in order to discern if Technicolor's workers had been placed at risk.

After interrogating Goldberg exhaustively on every aspect of Technicolor's process, the lawyer finally asked the engineer if he knew what had happened to the firm's dye-transfer system. Goldberg compliantly explained: 'it's in use in China […] It's a Chinese copy'. Despite the accusatory atmosphere of the interview thus far, Goldberg's answer apparently lightens the mood, causing the stern veneer of the plaintiff's lawyer to crack into laughter. Goldberg continues to assert the veracity of his statement, despite the lawyer's amusement and disbelief, repeating: 'It is. I got you to laugh there. It is.'[2]

As the lawyer's laughter suggests, the notion of Technicolor's 'Chinese copy' implies something comical. Trading upon the perception that Chinese industry manufactures cheap imitations of authentic American goods, Goldberg implies that Technicolor has suffered the same fate as many other American products, whether pirated videos or counterfeit designer goods. Although Technicolor was once a technology associated with the height of Hollywood's global power, Goldberg suggests it has been relegated to a Chinese knock-off. Yet this implies a feat of illicit imitation, a wilful act of technological plagiarism, which as Goldberg explains, was not the case.

Seeking a way to mass produce colour prints of propaganda films during the Cultural Revolution (1966–76), the Chinese government purchased expertise and equipment from Technicolor in the early 1970s to establish the firm's dye-transfer process at the Beijing Film Laboratory. Technicolor representatives subsequently trained Beijing staff and installed machinery manufactured by Technicolor engineers in the UK. The process in Beijing was therefore technologically identical to the other Technicolor laboratories in Hollywood, London and Rome, yet it never operated under the brand name Technicolor, nor did films printed there carry the famous slogan 'Color by Technicolor'. In some regards then, Goldberg's description of the Beijing plant as a 'Chinese copy' is accurate. It was a Chinese replica of Technicolor's system operating outside the corporate constraints of Technicolor's official trademark. The films printed at the Beijing laboratory were therefore unencumbered by the connotations of the American brand, which would have proved problematic during the fraught political climate of China's Cultural Revolution, a period notorious for its extreme condemnation of all foreign influence, especially from the capitalist West.

1

Yet the humour implicit in Technicolor's 'Chinese copy' does not stem only from its association with piracy. Understandably the lawyer found it bizarre that China, when seeking a technology to print Maoist propaganda films to denounce the perils of capitalism, would decide to use a system that was indelibly associated with the gaudiest confections of Classical Hollywood. Technicolor's palette of brilliantly saturated hues was synonymous with the glossy artificiality, idealized glamour and commercial dazzle that characterized Hollywood cinema – an aesthetic that could not seem further from the demands of a socialist film industry.

The incompatibility of Technicolor's brand identity and Maoist filmmaking would have been especially striking in the 1970s, as colour film technologies were ideologically freighted in an explicit manner throughout the Cold War. The distinctions between the colour technologies of East and West were hyperbolized as part of a chromatic Cold War, which saw Technicolor's vivid palette aligned with the capitalist values of consumerism and commercialism. This was particularly the case in Europe, where Technicolor was rhetorically opposed to the subtler, muted hues of chromogenic stocks, based on Germany's Agfacolor patents dispersed after the war, that were used by the socialist countries of the Eastern Bloc.[3] The lawyer's laughter responds to this comical application of capitalist aesthetics to communist content, a humour predicated on the legacy of these simplistic chromatic binaries between the drab colors of socialism and the brilliant hues of capitalism.

In China, however, brilliantly saturated colour was central to the aesthetic programme of socialist propaganda across a host of media, including posters, photographs, stage design and cinema.[4] Particularly during the Cultural Revolution, vivid colour was a vital tool for making propaganda films more immediate, emotive and visually appealing. This is partly why Technicolor was so attractive to Mao's regime. Despite the lawyer's laughter then, Technicolor's aesthetic was not at odds with, but sympathetic to, the aesthetic values of socialist cinema during the Cultural Revolution.

China's purchase of Technicolor's printing system therefore invites two critical interventions, both in our understanding of the history of colour cinema during the Cold War, and in the history of Chinese film technology during the Cultural Revolution. First it poses the questions of how globalizing our understanding of Cold War colour cinema might produce alternative narratives to those established around the West–East binaries of the USA and USSR, and second it demands that we reconsider how porous Chinese film aesthetics were to international influences at this time. Indeed, historians of Chinese cinema have recently argued that approaches to colour cinema in China are often overdetermined by sociocultural interpretations seeking essentialist links between Chinese identity and colour.[5] As Margaret Hillenbrand proposes, 'rather than analyzing what cinematic colour can tell us about so-called "Chineseness" […] we might do better to consider what Chinese cinema can tell us about colour'.[6] In this essay, therefore, we ask what Technicolor's 'Chinese copy' can tell us about colour, specifically the global chromatic networks that characterized colour filmmaking during the Cold War.[7] We examine how this technological exchange forces us to rethink China's connection to larger transnational networks of film technology during the Cultural Revolution – a period typically characterized in Chinese history as one of isolationist self-sufficiency.[8] We also ask how Technicolor's 'Chinese copy' troubles attempts to fix certain aesthetics within singular ideological frameworks. But rather than simply suggesting that colour carried different meanings in different political and national contexts – that the meanings of colour could change as it crossed borders – we contend that the political meaning of colour was produced *in and through* the act of its circulation across capitalist and socialist states.

We begin by tracing this technological transfer from West to East, examining why Technicolor wanted to sell its printing process in the 1970s, and why the Chinese government wanted to buy it. In addition to economic and technological imperatives, we show that formal preferences also encouraged China to adopt Technicolor's process. We contend that this interest in Technicolor aesthetics shaped the design of Chinese cinema during the Cultural Revolution, particularly through the influence of Jiang Qing, the wife of Chairman Mao. We conclude by exploring why Technicolor's Hollywood branch wanted to buy the system back from China after major economic reforms closed Beijing's dye-transfer printing unit in 1993.

To understand China's interest in Technicolor's dye-transfer process, it is crucial to explain how the technology worked and its aesthetic and economic benefits. From 1935 to 1955, a period known as Technicolor's three-strip era, dye-transfer printing was the cornerstone of the company's economic model. At this time Technicolor used a camera fitted with a prism and filters that split light into three separate colour components, with each colour (red, green, blue) recorded on a separate strip of film. These three records were captured on black-and-white negative, which was optically printed to create a gelatin-relief matrix, a shallow-relief printing block that varied in thickness depending on the density of the colour. Each matrix was respectively charged with a dye of a complementary subtractive colour: magenta, cyan, yellow. The dyed matrices were sequentially pressed against a blank strip of film (also coated with gelatin) to reconstruct the three-colour image. The blank and matrix were held in contact by a pin-belt ensuring exact registration. The transfer of dye from matrix to blank was what gave the dye-transfer process its name. That the matrix absorbed, or imbibed, the dye suggested its alterative name of dye-imbibition, or IB. Because of the specialized machinery and skilled labour required for IB printing, it could only be conducted at a Technicolor laboratory.[9]

Laboratory services were part of the standard package studios purchased from Technicolor, including the rental of a Technicolor camera and cameraman, and the counsel of the Color Advisory Service – the team infamously headed by Natalie Kalmus that ensured films

complied with Technicolor's standards.[10] Technicolor bundled its services together in this way both to ensure control over every aspect of the process and for economic reasons. As James Layton and David Pierce note, from 1927, when Technicolor began using the dye-transfer process on two-colour films, the company's laboratory services were the primary source of revenue for the firm, while 'the remainder of the services – colour control, photography, camera rental, and tests – were sold roughly at cost.'[11] By the 1950s all pre-production and production services operated at a loss. As described in a 1950 report from Technicolor 'we lose money on the front end of our operations (everything up to release prints)', but 'our prices for release prints are such as to make up the early losses'.[12] Although the three-strip camera is often privileged as the company's most critical piece of equipment and the linchpin in Technicolor's control of the market, the camera department was evidently an expensive requirement necessary to make the lucrative dye-transfer process possible.[13] Although dye-transfer technology was not invented or patented by Technicolor – this method of printing had been a common means of producing colour photographs for decades – Technicolor refined the system for motion-picture printing to an unprecedented degree of mechanical precision, which was also unparalleled in terms of cost.[14]

IB presented an impressive economy of scale because the only parts of the system that involved costly photochemical processing were the development of the black-and-white negatives, the production of the gelatin matrix, and the printing of the framelines and silver soundtrack. The rest of the process, namely the addition of the colour, involved no chemical or photographic development, just the mechanical transfer of dye from matrix to blank – a process more akin to textile printing than photographic processing.[15] If errors occurred during printing, dyes could be washed off and reprinted, dramatically reducing wastage.[16] As one Technicolor laboratory worker recalled, the process was so economical that 'after the first 25 prints,

everything else was profit'.[17] A recurring phrase used by laboratory staff to describe the IB process was that it seemed to be 'a licence to print money'.[18]

Another benefit of the IB process was colour control. Because each hue was printed individually, and because dyes could be washed off to give different degrees of saturation, each colour could be uniquely fine-tuned. The process was so precise it was even possible to adjust the colour of a single print to compensate for colour bias in the particular screen upon which it would be projected.[19] Some Technicolor cinematographers therefore complained that the IB process gave the laboratory too much power over colour, claiming lab workers removed experimental chromatic effects at the printing stage.[20]

The chromatic control and economy of scale possible with IB were crucial for Technicolor after 1955, when the firm retired its fleet of three-strip cameras, partly in response to the challenges posed by Hollywood's widescreen revolution in the 1950s.[21] However, Kodak's release of a new colour negative film (or chromogenic monopack stock) called Eastmancolor also significantly contributed to three-stip's demise.[22] Eastmancolor negatives could be processed in any laboratory trained to generate colour from the dye-couplers inherent in the stock's emulsion, but the prints could not compete with Technicolor in terms of quality, consistency and colour control.[24] By the mid 1950s, however, Eastmancolor offered a cheaper, more convenient alternative to Technicolor's elaborate system and, most importantly, eradicated the need for a Technicolor camera, thereby liberating studios from Technicolor's controls on shooting and release schedules.[25] At the same time a number of other chromogenic negative stocks emerged across the world, derived from the Agfa patents extracted from Germany after World War II, flooding the market with colour processes that similarly required no special camera equipment.[26]

But far from ruining Technicolor's business, chromogenic stocks enhanced demand for colour prints. It was still possible to produce dye-transfer prints from chromogenic stocks by adding one step into the laboratory workflow (using colour filters to split the camera negative into its three respective colour separations).[27] Laboratory technicians from the London plant remembered the decades after the retirement of the beam-splitting camera as a 'boom' period for dye-transfer printing.[28] As Bernard Happé, the Technical Director of British Technicolor, noted

> [the laboratory] side of the business was in no way diminished by the withdrawal of the three-strip cameras and in fact output increased substantially with the wider use of colour by more production studios […] from 1952 to 1958 the global total of dye-transfer footage sold amounted to more than 4½ billion feet, almost 50% greater than the total for the whole fifteen years preceding.[29]

The in-house publication, *Technicolor News and Views*, reported that 'in 1964 net sales and net income reached an all-time high'.[30]

However, a number of technical and industrial developments contributed to the decline of the IB process in the 1970s. After weathering the challenges of widescreen in the 1950s, (a huge blow to a laboratory system standardized around 35mm, which struggled to produce crisp images in large formats), it was ultimately the declining demand for large print runs that rendered IB printing obsolete.[31] IB printing relied upon an economy of scale, which meant that the smaller the print run, the more expensive the process: the US lab reported it cost them 1.5 cents more per foot to make 30 prints than to make 200.[32] With declining cinema audiences and increased competition from television, the scale of print runs dwindled.[33] Technicolor chose to retire its IB machines in Hollywood in 1975, while the British and Italian laboratories continued using the process until 1978.[34] But during this decade, when Technicolor was winding down its IB

operations, the British laboratory was constructing new IB machinery for export to China. In 1978, the year in which Technicolor dye-transfer printing in Britain ceased, China produced its first IB prints.

The Chinese government's interest in Technicolor's IB system was a sound economic and technological choice given the conditions of the film industry in China at that time. In the early 1970s film production was largely, though not entirely, limited to creating cinematic versions of the *yangbanxi*, or revolutionary model stage works.[35] These eight performances, including Beijing opera and ballet, were a new cultural genre intended to dramatize revolutionary ideology in a spectacular and entertaining format. Operas such as *Taking Tiger Mountain by Strategy* or the ballet *The Red Detachment of Women*, showcased the heroic actions of revolutionary figures overcoming the oppressive forces of greed, feudalism and imperialism to inspire revolutionary fervour in the audience. The *yangbanxi* operated as models both in the sense that audiences were meant to copy the behaviours seen on screen and because they were paradigmatic performances to be imitated locally across China, further spreading the revolutionary message of the party.[36]

The cinematic versions of these performances were all shot in colour, undoubtedly to convey the affective potency of the stage versions, which exploited the immediate, visceral and emotive power of colour in their designs.[37] But the decision to shoot in colour is also unsurprising given the long history connecting colour cinema and opera in China.[38] Bright colour was a crucial design element across a host of regional opera styles in China, and however much the revolutionary model stage works ruptured traditional opera practices, as Paul Clark notes, many established conventions were not eradicated but modified in light of the revolutionary ideology of the films.[39] Colour was in fact critical to the Maoist theory of 'three prominences',

the aesthetic code governing visual practice during the Cultural Revolution, which insisted that exceptional emphasis should be put on positive characters in general, heroic figures in particular, and the central heroes above all.[40] In terms of colour, the rule of *hongguangliang* (red, shiny and bright), a particularly vibrant aesthetic already prevalent in the propaganda posters and paintings of the Cultural Revolution, was transplanted into the rendition of these characters in the model stage performances to emphasize their prominence.[41] Saturated colour was therefore a vital aspect of the visual design of the filmed *yangbanxi*, and was key to constructing these model characters and inciting the revolutionary sentiments of the masses.

The cinematic adaptations were intended to fix permanently on film the staged versions of the *yangbanxi* that had been refined constantly since they were first seen in 1967, producing a definitive and standardized record of each work.[42] Jiang Qing, the wife of Chairman Mao and a former film actress, was the leading figure in charge of cultural production, and understood the important role that film could play in rousing the revolutionary consciousness of the Chinese people. The ability to mass produce uniform colour release prints of these films on a huge scale was therefore crucial to disseminating the *yangbanxi* (and by extension, the socialist programme) across China's vast geography.[43]

Dye-transfer printing was the obvious solution to this technological problem, not least because it was already employed in China for mass producing still photographs of the *yangbanxi*.[44] Jiang Qing herself was responsible for several of the most iconic of these photographs, which were printed using a modified version of Kodak's dye-transfer system. In addition to its colour control and consistency, Chinese engineers selected this technology precisely because it could reproduce the vibrancy of the bold hues so crucial to the design of the stage performances. As Zhou Dengyan and Shi Zhimin discuss, it was one of Jiang Qing's

photographs of *The Red Detachment of Women* that engineers used as a test image to develop and calibrate this printing system (figure 1).[45] Kodak's dye-transfer system therefore established a useful precedent of co-opting western chromatic technologies for the mass production of Maoist propaganda.

The drive to adapt dye-transfer printing to cinema was not simply born of practical necessity, however, it also carried symbolic value in the Cold War climate of technological competition between East and West. Historically, China depended upon materials and technologies from Europe and America for producing colour films, which after the establishment of the People's Republic of China (PRC) in 1949 became a reliance upon socialist states such as East Germany, the Soviet Union and Czechoslovakia.[46] But Chairman Mao's call for 'self-reliance' drove efforts to develop indigenous colour processes.[47]

Securing a Chinese colour system was crucial to what Tina Mai Chen calls China's 'socialist modernity'.[48] Like agricultural machinery or military equipment, colour film technologies were critical to China's projected self-image as a modern, socialist state, as new advances underscored the material and scientific benefits of socialism, as well as the regime's ability to drive China towards a utopian, socialist future. PRC rhetoric in particular conflated film technologies with military progress. When Guo Moruo, the director of the Chinese Academy of Science, dedicated the Baoding Film Stock Plant in 1958, he claimed that 'if we were able to produce homegrown film stock, it would be like producing rockets'.[49]

As a technology, film was subjected to the same modernizing logic as other industrial sectors under scrutiny during the Cold War, when productivity and efficiency quantified success.[50] But as an art form with the power to glamorize the socialist cause, colour film carried a certain potency that tractors or weaponry lacked. As Jiang Qing articulated, chromatic film

technologies could cultivate China's international *image* as a thriving modern state: 'the foreigners always say we are the sick man of Asia, don't they? We need to respond with some colours, sending the Chinese dyed Revolutionary Model Operas to the whole world.'[51]

It is telling that Jiang Qing emphasizses 'dyed' colours. While securing an indigenous colour stock was important to China, printing (or dyeing) colour films in high volumes was crucial given the scale of distribution required for the *yangbanxi*.[52] Colour stock was certainly a vital part of Jiang Qing's plan, and China did develop an indigenous colour stock modeled on Agfacolor branded *daidaihong*, meaning 'red from generation to generation'. This brand name resonates with revolutionary sentiments but poignantly indicates the fading suffered by many chromogenic systems that left only the magenta layer of the release print intact, literally leaving films red for subsequent generations. Colour technicians also realized this home-grown stock imperiled the film's original look through chromatic distortion.[53] Although this colour technique was extensively used and saved the cost of importing colour-positive prints, the quality was not comparable to other colour film printing techniques. Securing a high-quality colour printing technology would therefore help demonstrate the pre-eminence of socialist China to the wider world in this chromatic Cold War arms race where colour films and rockets held equal status.

In 1958 the government had already established a research group dedicated to investigating dye-transfer film technologies at the Chinese Research Institute for Film Science and Technology.[54] Due to the close relationship with the Soviet Union, this research was reliant upon assistance from Soviet technicians, not least because the USSR had already developed its own dye-transfer printing system, patented by Mosfilm's Pavel Mershin in 1938.[55] By 1962 the Shanghai film laboratory installed a dye-transfer unit modeled on Mershin's Soviet system, and used this equipment to print copies of the *yangbanxi* from 1975.[56]

Mershin's system, however, should not necessarily be seen as a Soviet alternative to Technicolor. As Philip Cavendish contends, Mershin's machine closely resembled Technicolor's IB system and was probably modeled on the American process.[57] This is unsurprising perhaps given that detailed technical information about Technicolor's process circulated widely in foreign journals and would have been easily accessible to competitors.[58] The only significant difference between the Soviet and American technologies was the use of a large transfer wheel in Mershin's design instead of the flat pin-belt system deployed by Technicolor.[59] The Mershin-style machine in Shanghai was therefore not so much a Soviet *alternative* to an American process, but an *imitation* of it; a Chinese iteration of Technicolor's Soviet copy.

As the 1960s unfolded, the Sino–Soviet split over the nation's respective political doctrines did not leave film laboratories unscathed. The Soviet expertise once welcomed in China was now labeled as *ducao*, a poisonous weed.[60] The Chinese film industry therefore required a new colour printing system free from the taint of Soviet influence; but there were undoubtedly also technical and aesthetic reasons to search for an alternative dye-transfer system, as the yield of the Soviet system was insufficient, and visitors to the Shanghai laboratory noted a high degree of 'negative dirt' on the prints.[61]

By 1969 the conflation of militaristic, technological and artistic advancement was acutely expressed in the *Ranyin Fa Dahuizhan*, or 'The great pitched battle for the dye-transfer process', launched in Beijing under the supervision of Jiang Qing. Drawing factory workers and demobilized soldiers to the 'battlefield' of the Beijing Film Laboratory, the unit redoubled efforts to secure a reliable colour printing technology.[62] Yet technicians struggled to improve upon the existing Soviet designs. In 1971, therefore, a delegation of engineers from Beijing visited

11

Technicolor's London laboratory, and their request for state permission to purchase the laboratory's printing equipment was endorsed by Premier Zhou Enlai.[63]

By 1973, Technicolor Ltd signed a contract promising to manufacture a new IB unit identical to the printers used in London, as well as specialist machinery for producing new pin-belts, at a cost of £3,349,790 to the Beijing Film Lab.[64] Engineers from the British plant, headed by Happé, would oversee installation and training in Beijing.[65] Although blank and matrix stock was initially purchased from Kodak, and subsequently from 3M, the Baoding Film Stock Factory eventually manufactured its own materials.[66] As Happé described, China had 'always had a very good dye and textiles industry so they had no problems at all in making the specialized dyes'.[67]

The reason the Beijing Film Laboratory approached Technicolor's London plant rather than those in Hollywood or Rome is not entirely clear. It is possible that the British laboratory presented a way to ameliorate the potentially inflammatory predicament of collaborating with an American firm. Happé recalled that the Chinese 'weren't prepared to do any business with America whatsoever, but they were prepared to do business with the United Kingdom'.[68] Happé's characterization is undoubtedly exaggerated, as by the 1970s US–China relations were thawing, symbolized by President Nixon's visit to China in 1972; and as we shall discuss, the Chinese government was purchasing American Eastmancolor stock throughout this period. Yet China did have an existing relationship with British Technicolor. In 1956 a delegation of Chinese film technicians, led by Situ Huimin, the vice-director of the Film Bureau, visited the UK plant to learn about processing chromogenic stocks.[69] It is possible the Beijing Film Laboratory wished to exploit this connection while skirting the negative associations of trading with Hollywood.

China was eager to pursue this deal, as Technicolor's system presented an ideal solution to China's technological problem; it was perfect for mass producing large numbers of release prints with unparalleled colour consistency. Thus the systematicity of the IB process was analogous to the political strategy of the model stage works: both were predicated on the creation of one master from which many identical copies were produced, whereby the standardization and consistency of colour translated into a standardization and consistency of experience, cultivating an attempted uniformity of reception, interpretation and instrumentalization across China. Yet despite the suitability of the IB process, Technicolor's system was never used for printing the *yangbanxi*. Following the purchase of Technicolor's equipment in 1973, it took five years to install the machinery and train staff, and by the time the IB unit was operational in 1978 the conditions of filmmaking in China had changed. The Cultural Revolution had concluded with Mao's death in 1976, Jiang Qing was imprisoned, and from 1979 Deng Xiaoping's economic reforms began to reconstitute the landscape of filmmaking in China.

Before discussing Chinese IB printing after 1978, it is crucial to interrogate how the state justified its purchase of Technicolor's equipment during the Cultural Revolution, a period marked by extreme antagonism to all influences from the capitalist West. To exploit a Hollywood mechanism to perpetuate Maoist ideology initially appears irreconcilable (or as noted earlier, laughable). Yet the Cultural Revolution was a period of both ideological and chromatic extremity – a period of intense political fervour matched by what Stephanie Hemelryk Donald characterizes as a 'period of intense colour'.[70] China was interested in Technicolor, then, not simply as a technology but also as an aesthetic and a mode of filmmaking, as these films were unrivalled in their vivid saturation. The ballet film *Hongse Niangzijun*/*The Red Detachment of Women* (Pan Wenzhan, Fu Jie, 1970) presents a crucial case study for demonstrating how the

yangbanxi were informed by Technicolor aesthetics, and how this aesthetic could be ideologically transformed and politicized by the state.

Set in the tropical southern Chinese island of Hainan, *The Red Detachment of Women* shows the political awakening of the slave girl Wu Qinghua (Xue Jinghua). After escaping imprisonment by the cruel landowner Nan Batian (Li Chengxiang), Qinghua joins a detachment of communist soldiers hiding in the mountains, who battle and defeat Nan Batian and his assembled military forces. Based on the real-life experiences of female soldiers during the Chinese Civil War, the story had already been adapted for the screen in 1960 before it was transformed into a ballet as part of the *yangbanxi* programme. This earlier cinematic version, directed by Xie Jin, was also shot in colour, using indigenously developed chromogenic stocks, but demonstrated a much greater interest in chromatic naturalism in line with social-realist aesthetics.[71] The 1970 version, however, indicates an altogether different approach to colour. Filmed entirely in the studio, the ballet unfolds as it would be performed on stage, danced before a series of stylized sets, with simple backdrops and minimal props, and a colour design that relies upon bright and saturated hues, particularly in terms of costume.

At times these colourful costumes serve clear narrative purposes. Wu Qinghua's iconic red clothing, for instance, resonates symbolically, as red is so heavily determined as the colour of the revolution. As Chris Berry describes, its additional symbolism as a bridal colour implies that young women donning red in the *yangbanxi* are presented as 'brides of the revolution'.[72] Elsewhere, however, costumes operate at a more decorative level. In one scene local villagers bring platters of fruit to the soldiers in the mountains to show their support for the regiment. The set exploits the tropical Hainan location, as verdant palm trees frame a bright blue sky, and a

pristine shore is glimpsed in the background, a strip of yellow sand abutting blue water. The local women are divided into two groups: some dressed head-to-toe in turquoise, others in loose-fitting fuchsia trousers and white shirts with yellow sleeves. These unindividuated women form kinetic coloured patterns on the screen: at one moment they are regularly spaced across the stage, with a blue-green figure puncturing the space between each white-and-pink-clad dancer (figure 2), then later the green dancers create a central circle with the soldiers that is intermittently penetrated by white-and-pink dancers rushing in from the periphery.

The coloured costumes enhance the formal qualities of the dance, creating dynamic contrasts between figures, and aestheticizing the different choreographed movements of the two groups. The dancers become parts of a larger formal scheme, each a coloured fragment in a design that forms and reforms in different visually pleasing configurations like a kaleidoscope. At the climax of this number, when the local women are joined by the soldiers clad in grey, an extreme high angle – the only one in the film – presents a birds-eye-view of these twirling, leaping figures as they rotate in concentric circles. This enables the film audience to absorb the complexity of this design, which would be unintelligible from a frontal viewing position before the stage (figure 3).

This tropical setting, the fruit platters, the synchronized female dancers in swirling geometric patterns, the high-angle framing and the colourful costumes beg comparison with the stagecraft of an MGM musical, or a Busby Berkeley number; a revolutionary reinterpretation of the lady in the tutti-frutti hat. But as frivolous as this comparison may seem, it is possible to imagine how the formal strategies of Hollywood musicals mapped neatly onto the political ambitions of the *yangbanxi*. If in this geometric patterning of arms and legs, these 'indissoluble girl clusters' in which Siegfried Kracauer saw the rationalizing forces of capitalism abstracting

bodies into mechanized organs of mass production, then surely such an aesthetic was ideal for the model stage works.[73] If the *yangbanxi* were intended to produce and reproduce uniform, ideal communist citizens by mass producing archetypes for imitation, then the Taylorist impulse identified by Kracauer in these spectacles presented a fitting formal precedent for the Maoist programme to adapt for the socialist cause. This subjugation of individuality to an overriding design, the erosion of singularity in favour of a collectivized schema, characterizes both Kracauer's mass ornament as well as the *yangbanxi*, which Laikwan Pang fittingly dubs 'the art of cloning'.[74] Perhaps it is unsurprising, then, that Hollywood films, and Technicolor productions in particular, were instrumental in film design during the Cultural Revolution.

Access to foreign films was restricted in China at this time, with imports limited to communist allies like North Korea.[75] However Jiang Qing, as the principal force behind the *yangbanxi,* considered Hollywood cinema a benchmark against which China should measure its filmic output. She therefore held screenings of Hollywood films for the cast and crew of *The Red Detachment of Women* to show them how to deploy colour.[76] We know that British and American Technicolor films also appeared as *neicanpian*, or internal reference films, part of the closed screenings of foreign films held for leading members of the Communist Party, including *Gone with the Wind* (Victor Fleming, 1939), *The Magic Box* (John Boulting, 1951) and, allegedly, *Bathing Beauty* (George Sidney, 1944).[77] During the development of *The Red Detachment of Women* Jiang Qing also compulsively screened the 1948 British Technicolor ballet film *The Red Shoes* (Michael Powell and Emeric Pressburger), to learn how to design colour dance sequences.[78] Jiang Qing's fascination with *The Red Shoes* even led her to recruit the acting corps from the *yangbanxi* to dub the film into English to enhance her appreciation of it.[79]

Looking again at *The Red Detachment of Women*, it is difficult not to see the influence of these Technicolor films. The murder of Nan Batian, silhouetted in black against a rosy-amber sunset and framed with a vine-draped tree acting as repoussoir, instantly evokes the iconic view of Tara from *Gone with the Wind* (figures 4 and 5). Wu Qinghua's red costume, framed in a pool of white light against a dark stage, conjures the image of another enslaved ballerina, whose eponymous red shoes are similarly framed in order to vivify their redness (figures 6 and 7). The unusual combination of fuchscia and turquoise costumes in the Berkeleyesque beach sequence of *The Red Detachment of Women* recalls the same palette in the concluding aqua-ballet of *Bathing Beauty*, a resonance further enhanced by the high angles and geometric patterning in both (figure 8). These associations make *The Red Detachment of Women* look less like a socialist propaganda film and more like an homage to glorious Technicolor.

Given Jiang Qing's control over colour in the *yangbanxi*, it is reasonable that her admiration for Technicolor cinema would translate into the design of these films. Jiang Qing exerted rigorous controls over colour during production and intervened if she disliked aspects of the design. She demanded, for instance, that the crew continually re-film a sequence in *Haigang*/*On the Docks* (Fu Chaowu, 1972) because a principal character's scarf was the incorrect shade of red.[80] As a powerful woman issuing chromatic dictates on set, Jiang Qing emerges from these stories as a mirror figure of Natalie Kalmus, the ex-wife of Technicolor's founder, who worked as the colour consultant on hundreds of Technicolor productions. Kalmus rankled directors and crews with her insistence upon colour harmonies, judiciously deployed complementaries, and the tempering of vivid tones with neutral shades.[81] Recollections of Jiang Qing's interference on set suggest that through her repeated viewing of Technicolor films, she had absorbed these regulations and instigated them as chromatic protocol for the *yangbanxi*.

Jiang Qing became notorious for her obsession with the colour green. Possibly because Chinese stocks failed to reproduce green well, a flaw that reflected poorly upon the nation, she insisted on the incorporation of this colour into the *yangbanxi*, which were filmed on expensive, imported Eastmancolor stock that could better reproduce this hue.[82] Yet her tenacity was not intended simply to demonstrate the technological prowess of Chinese cinema, but was also formally motivated. She frequently complained that Chinese crews were unskilled in deploying colour and could not combine shades to their best advantage.[83] While the addition of green lent variety to what might become a monotonous procession of reds, it also enhanced and vivified those reds because these hues are complementary colours, appearing at their most saturated when juxtaposed. A slogan circulating among filmmakers during this period underscores this dualism of ideological and formal concerns: 'it will be a political issue if you do not use red, and it will be an aesthetic issue if you do not use green'.[84]

Perhaps Jiang Qing's compulsive viewing of *The Red Shoes* was because the film repeatedly deploys this red–green binary. Directed by Powell and Pressburger, the film presents the tragic story of British ballerina Vicky Page (Moira Shearer) who must choose between her love of dance and her husband. The ballet that brings her international fame is an adaptation of the Hans Christen Anderson fable 'The Red Shoes', an allegory for Vicky's own fate when she is compelled to dance herself to death. The appeal of *The Red Shoes* in socialist China is clear, (not least the revolutionary associations of the title, which already sounded like a communist ballet), as the central themes of the film resonated with those of the *yangbanxi*: unquestioning commitment to one's destiny, rigorous physical and mental discipline, and the importance of personal sacrifice.

Beyond its plot, however, *The Red Shoes* offered a model for deploying the complementary shades of red and green strategically. Even the title slide displaying Technicolor's brand exploits the resonance of these colours, as the ballet shoes and the word 'Colour' appear in a vivid crimson that visibly pops against the racing green of the grass (figure 9). This establishes a visual motif that is linked with Vicky throughout the film. As Sarah Street notes, even when Vicky does not wear her red shoes, her auburn hair and lipstick are a constant reminder of her dangerous preoccupation with ballet, symbolized by the redness of the shoes.[85] These red tones are enhanced and enlivened by the use of green in costuming and sets. For instance, in the railway carriage where Lermontov once more persuades Vicky to 'put on the red shoes', a scene which betrays her continued compulsion to dance the ballet, the visual field is overwhelmed by green. Both the malachite tones of the walls and the bottle-green shade of her jacket seem to make her scarlet lips, her auburn freckles and her copper hair pulsate with redness through this juxtaposition, underlining the power the red shoes hold over her (figure 10).

In *The Red Detachment of Women* green is used with similar exacting deliberation. For example, when Wu Qinghua arrives at the detachment's camp, she is surrounded by soldiers clad in grey uniforms and locals dressed in white and red. Yet it is Xiao Pang (Li Xinying), one of only two characters wearing green in this sequence, who greets her, clasping her arms as she collapses from exhaustion (figure 11). Xiao Pang's shirt disrupts the ubiquity of red (the flag, the armbands, Wu Qinghua's clothing), and through juxtaposition reinforces Wu Qinghua as our primary subject of interest. A similar strategy is deployed for a second, female figure, who is dressed in a different costume to the rest of the dancing corps, appearing in a teal-green outfit. At various moments she is judiciously positioned in front of the red flag but behind Wu Qinghua, mediating and punctuating these similar shades of red with a streak of green. This both prevents

the principal dancer becoming swamped in a sea of red, but also enriches the redness of both Wu Qinghua's clothing and the flag, through the use of complementary colours.

Given Jiang Qing's admiration for Technicolor aesthetics, the decision to acquire Technicolor's IB process was clearly not only economically motivated, but presented the opportunity to realize the full potential of a Technicolor palette already built into the design of these films. But this invites the question of how the state could ideologically reconcile the adoption of Technicolor as a mechanical and aesthetic system, particularly at this moment of apparent seclusion from the West, when the decision to use a technology so indelibly affiliated with capitalist values would have been highly contentious.

Indeed, Technicolor's affiliation with capitalist aesthetics was concretized during the Cold War, when the deep-rooted associations between bright colours, commerce and consumerism were instrumentalized for political ends.[86] As Alice Lovejoy notes, following World War II, colour film technologies 'became a flashpoint for geopolitical tensions', especially those tensions between the Soviet Union and the West, as nations scrambled to secure Germany's highly prized Agfacolor patents, the only truly viable alternative to Technicolor's three-strip system.[87]

Agfacolor was developed before the war as a German rival to Technicolor (as well as Kodak's emerging Kodachrome process), and was intended to enhance fascist propaganda cinema with the added allure of colour. Unable to reach the level of saturation possible with Technicolor, its muted, subdued, pastel-hued look was celebrated as more tastefully German in its aesthetic than Technicolor's gaudy palette.[88] Following the war, when socialist nations extracted the Agfa patents and began manufacturing their own chromogenic stocks including Sovcolor in the USSR and Orwocolor in the GDR, this chromatic difference between

Technicolor and Agfa was mobilized as an ideological difference between capitalist and socialist values. Dudley Andrew has explored this phenomenon in postwar France, demonstrating how Technicolor's aesthetic was indelibly associated with American cultural values in opposition to Agfa's socialist connotations, an aesthetic difference hyperbolized at the time as 'a cold war battle in the midst of Paris'.[89] The linkage of Agfa's sober palette with moral and political authenticity, in opposition to Technicolor's superficial, tawdry glamour, further entrenched the pervasive trope of the distinction between capitalism and socialism, between West and East, as a distinction between colour and colourlessness.[90]

As Josephine Diecke astutely discusses, these divisions were entirely discursive and artificial – a means for socialist nations to elevate technological limitations into aesthetic preferences by enshrining pastel hues as a socialist aesthetic, rhetorically opposed to the vulgarity of capitalist Technicolor.[91] The speciousness of such a distinction is illuminated by the fact that not only were Agfa-derivatives also used in capitalist nations (including America), but that socialist nations including Czechoslovakia and the USSR consistently imported American Kodak stock throughout the Cold War precisely for its superior colour rendition.[92]

The idea that Technicolor, as an American technology synonymous with bright saturation, was somehow incompatible with socialist cinema is therefore a legacy of these superficial distinctions erected during the Cold War. This chromatic binary, rhetorically erected in relation to the West–East axis of the USA and the USSR, is troubled further by considering what Heonik Kwon has called 'the other Cold War', not the cool stalemate of the Euro-America arena but the 'hot', violent conflicts taking place in Asia.[93] By globalizing our understanding of Cold War chromatism, this relationship between colour, technology and ideology, appears far more complex.

Pang and Jason McGrath have compellingly argued that the use of saturated colour in Maoist cinema was integral to socialist aesthetics, suggesting these films reflect Mao's stipulation that Chinese culture should depart from Soviet models of socialist realism and move toward a combination of 'revolutionary realism and revolutionary romanticism'.[94] Vivid colour was an ideal tool for implementing Mao's demand, as it perfectly embodied this binary.[95] Verisimilitude was certainly enhanced by colour (which is more immediate and visceral than monochrome), but bright colours in particular could offer a spectacularized and glamorized representation of that reality, more fantastical and sensational than black-and-white. Just as colour dominated the Hollywood musical because it enhanced the escapist capacities of the genre, so too in socialist cinema colour presents an idealized, glorified image of a socialist utopia, while evoking the veracity and immanence of such a utopia as a political reality.[96]

The colour design of the *yangbanxi* could therefore be interpreted as distinct either from American or Soviet models, a third way that allowed for the combination of vivid colour and state-sanctioned ideology. However, considering the extreme moments of chromatic stylization in the *yangbanxi*, Pang and McGrath suggest these attempts to reconcile formal and political ambitions failed. McGrath contends that these films present 'such pure spectacle that the ideological content […] threatens to become a mere surface itself, a superficial appearance that in fact reveals nothing'.[97] In Pang's view, through the dazzling colours of the *yangbanxi* 'aesthetics became almost independent from the original political grounds'.[98] For Pang, Jiang Qing's decision to use American technologies to make the *yangbanxi* undermines their ideological foundations, laying bare the prioritization of aesthetics over politics, as she was willing to employ the tools of China's political enemies to enhance the beauty of these films.[99]

But what if this extreme stylization of colour, inspired by Technicolor's particular brand of chromatic excess, was not in conflict with the ideological ambitions of the *yangbanxi* but a deliberate part of their political strategy? What if the use of foreign technologies to shoot and print these films did not undermine their intent but intensify it? That the meaning of colour is relational and contingent is by now a well-established trope in discussions of colour film, but rather than suggesting that the meaning of colours could change as they moved between cultural contexts (suggesting something different in China than America for instance), what if colour accrued meaning in a cumulative manner, gaining new resonances that overlapped and informed one another through the very act of circulation across and between different political regimes?

Such a strategy was not unprecedented in the chromatic Cold War, and Russia presents a useful model for considering China's position. For Russia, Agfa's chromogenic stock was a highly desirable technology but one tainted with fascist associations through its use in Nazi propaganda.[100] To exploit the benefits of the technology, therefore, Russia had to repurpose it as a socialist apparatus. As Cavendish notes, Agfa's process acquired 'symbolic' resonance for Russia once they used the stock to film the documentary *Victory Parade* (1945), which captured the pageant celebrating the USSR's defeat of Germany in World War II.[101] By taking a technology Germany had previously deployed as a propaganda instrument, and using it to chart the ascendancy of Russia's socialist regime, Russia co-opted and redeployed the enemy's cultural weaponry against it, using the aesthetics and technology of fascism in order to overthrow it. The association between Agfa and socialist political power was therefore not contingent on the erasure of its fascist connotations, but upon layering new socialist meanings over the technology's existing ideological implications and producing new political resonances through their interaction.

China's approach to Technicolor displayed a similar rhetoric. While Technicolor may have been ideologically problematic, it was both the ideal technological solution to the demands of filmmaking in China at the time, and it was visually irresistible. As Andrew notes in his discussion of postwar France, 'even left wing critics in this period were fascinated by the richness of Technicolor while they professed to abhor Hollywood's gaudiness'.[102] Similarly the circulation of Technicolor films as *neicanpian* in China underscores the fact that Chinese officials wished to enjoy the lush, chromatic design of Technicolor cinema while simultaneously denouncing its corrupting influence. To use Technicolor's technology to print the model stage works could therefore present an opportunity for the Chinese government to exploit the most appealing visual aspects of American cinema without any political compromise, to hide a love of Hollywood in plain sight by deploying Technicolor aesthetics in service of Mao's ideals.

In order for China to exploit Technicolor's desirable colour system, it had to acquire the technology and then weaponize it against the West; subverting and repurposing the aesthetics of capitalism to mount a counter-attack upon it. The adoption of an American aesthetic would also make these films more legible to the West, a motivation that similarly drove the use of ballet rather than traditional forms of Chinese dance in films like *The Red Detachment of Women* – as Pang notes, western art forms became propaganda instruments for China precisely because the West could easily understand them.[103] The co-option of Technicolor aesthetics performed a similar function. If colour films were like rockets, then China could attack America with weapons of its own design.

In this light the stylization of the *yangbanxi* reveals the complexity of attitudes towards colour during the Cultural Revolution, involving a constant negotiation between ideological and aesthetic forces. It follows that *The Red Detachment of Women* would resemble an MGM

musical because it was designed to do so: it adopts the visual language of Technicolor cinema to articulate a message about the moral vacancy of individualism, greed and capitalism, while also indulging in the aesthetic richness of a cinema indelibly associated with those political values. However, this did not necessarily mean audiences in China responded to these films in the political manner determined by the state. As an embodied and highly subjective sensation, colour is a notoriously difficult phenomenon to control, and despite the state's attempts to harness its effects to ideological ends, the bright colours of the *yangbanxi* resonated in other ways for viewers. For instance, both Pang and McGrath discuss how instead of remembering the political power of the *yangbanxi*, viewers recalled how the use of colour heightened the erotic appeal of these films. By enhancing the sensuality of women's bodies on display, particularly through colourful costumes, the *yangbanxi* in Pang's words, cultivated 'a kind of pleasure on which the state could not keep a tight rein'.[104] However much the state could control colour at the level of production, it was impossible to regulate it at the level of reception, and despite attempts to repurpose Technicolor's appeals for socialist ends, audiences could engage with these films in a host of ways, be they political, aesthetic, or erotic.

China had purchased Technicolor's system under specific circumstances, which had changed appreciably by the time the system was operational in 1978, and yet the technology continued to suit the demands of the Chinese industry even after the Cultural Revolution. The stranglehold on production that characterized the Cultural Revolution began loosening in the late 1970s, even if the full marketization of the industry was some years away. At this time, studios produced films according to quotas set by the centralized China Film Corporation (CFC), receiving a flat fee of 9000 yuan per film irrespective of its quality or popularity.[105] Box office remained an irrelevant

metric until the late 1980s, as tickets were often given away or screenings were unticketed.[106] Therefore, the CFC did not financially reward local distributors based on ticket sales, but the number of prints distributed, incentivizing an inflated scale of print run disconnected from audience demand.[107] As an affordable system of mass producing release prints, Technicolor's IB process was ideally suited to these conditions, producing an average print run of 250 by the early 1980s.[108] Ironically, the closer China moved towards having a commercial film industry, the less useful the IB process became.

Berry describes how in the 1980s Deng Xiaoping's economic reforms placed a burgeoning emphasis on commercialism and competition between studios.[109] These shifts instigated an industry-wide revolution in terms of themes and genres, with IB printing playing a crucial role in distributing a new form of popular cinema. The Beijing IB unit printed films that relied upon conventional generic uses of colour for spectacle, exoticism and pageantry, including the China-Hong Kong co-productions *Chuilian Tingzheng*/*The Reign Behind the Curtain* (Li Hanxiang, 1983) and *Huoshao Yuanmingyuan*/*The Burning of Yuan Ming Yuan* (Li Hanxiang, 1983), which spectacularly reconstructed the sumptuous image of the Qing Dynasty's imperial courts, and *Kongque Gongzhu*/*The Peacock Princess* (Zhu Jinming, Fei Su and Zing Rong, 1982), a fantastical representation of a folkloric tale, exploiting the exoticism of the Dai ethnicity in southwestern China.[110]

This increasingly commercial attitude in the studios was mirrored in the subject matter of Chinese films, with Berry noting how: 'in place of the worker-peasant-soldier heroes of yore, we now have the sort of technocrats and yuppies Mr. Reagan and Mrs Thatcher would have been proud of'.[111] For instance, in *Zhuanta Yiqianwan*/*Make Ten Million* (Li Chensheng and Wang Haowei, 1992) a window cleaner inherits both an enormous fortune in foreign currency and a

related set of romantic problems, as a result of his entanglement with a materialistic admirer (figure 12). It seems especially fitting that Technicolor's IB system, routinely described as a 'licence to print money', should be used to mass produce prints of a film about the transformative power of financial capital, and that the technology would participate in the transformation of the Chinese film industry from a state-run sector towards a more economically motivated and competitive free market.

American critics and scholars sometimes claim that Fifth Generation filmmakers, and in particular the famed colourist Zhang Yimou, exploited the chromatic richness of Beijing's dye-transfer unit to deliver the sumptuous, radiant colour of films like *Ju Dou* (1990).[112] It is certainly tempting to imagine that a film about a dye-works was printed using the dye-transfer method, particularly as *Ju Dou* showcases strips of fabric run through dye-baths in the same manner the matrix is dyed in the Technicolor laboratory. Although we have found no evidence to suggest any Fifth Generation films were printed using the Beijing lab's IB process, it is telling that American critics alighted upon the Fifth Generation as part of Technicolor's lineage. Roger Ebert for instance, traces the chromatic intensity of *Ju Dou* back to China's acquisition of Technicolor's equipment in the 1970s, suggesting that this is why *Ju Dou* exhibits 'a brilliance not seen in Hollywood films since the golden age of the MGM musicals'.[113] Yet he overlooks the *yangbanxi*, with their aesthetics modeled on Technicolor precedents, as crucial interlocutors. While the Fifth Generation are often conceived as a rupture with the cinema of the Cultural Revolution, this shared interest in saturated colour suggests a greater degree of continuity than is typically acknowledged, and problematizes the periodization of Chinese cinema along exclusively political rather than aesthetic lines.[114]

Just as declining print runs catalysed the closure of the IB units in Hollywood, Italy and London, so too in China did industrial transformations cause dwindling print numbers, signaling the end of the dye-transfer system's economic viability. From the mid 1980s, with studios negotiating profit sharing schemes and performance related pay, the industry began moving gradually towards a market economy that would be more fully realized in the 1990s, when local distributors began selecting the films they wished to distribute (rather than having titles mandated by the state).[115] Combined with competition from television and imported foreign films, these factors caused a dramatic 50 per cent drop in print orders at the Beijing Film Laboratory in 1993, forcing the lab to abandon the costly dye-transfer system that year.[116] However, just as a Chinese buyer had emerged in the 1970s as Technicolor wound-down its dye-transfer system, now in the 1990s an American buyer arrived to salvage the Chinese system, as Technicolor's US branch decided to revive its dye-transfer system.

There were numerous factors driving Technicolor's renewed interest in the IB process in the 1990s. Despite the dip in print runs seen from the late 1960s, by the late 1970s enormously popular films including *Jaws* (Steven Spielberg, 1975) and *Star Wars* (George Lucas, 1977) signaled a renewed demand for large numbers of prints. Ironically these were two of the last films printed using Technicolor's IB system in Britain, suggesting Technicolor perhaps retired its IB machines prematurely.[117] As the culture of the blockbuster thrived in the 1980s, the economics of IB printing seemed viable once again. It is also possible that Martin Scorsese's campaign against colour fade in Eastmancolor prints in the 1980s drew attention to the stability of IB prints, revitalizing interest in the process.[118]

By the 1990s the emergence of digital printing technologies also presented new possibilities for colour manipulation that could be combined with Technicolor's IB system. Frank Ricotta, former Technical Director at Technicolor, recalled it was the firm's president Ron Jarvis who imagined that 'if the Technicolor dye-transfer process could be resurrected, with high quality, that might raise the bar for digital cinema to match'.[120] But as filmmaker John Akomfrah notes, there were other political possibilities imagined for the dye-transfer process in the digital age among black American filmmakers including Julie Dash and Arthur Jafa, who he recalls 'talked about a "return to Technicolor", about going to China […] in order not simply to retrieve an archaic technique but also, in a digital, default-redefining attempt, to reinscribe the black figure in the photochemical matrix, to revisit cinema's analogue history with a new (digital) promise'.[122] As Akomfrah describes, the delicate colour calibration possible with IB printing held a utopian promise for black filmmakers, as it could potentially be refined to present the correct rendition of black skin, which was so often distorted by the laboratory to privilege the accuracy of white flesh tones.[123] Technicolor's motivations for returning to China were undoubtedly commercial and economic rather than social and political, particularly in light of the firm's deeply problematic relationship to racial politics, yet Akomfrah reminds us of the other political potentialities embedded in the technology and the alternative histories this technological transfer might have generated.[124]

It was not long after Richard Goldberg delivered his deposition regarding Technicolor's 'Chinese copy' in 1990 that he was re-employed by Technicolor to investigate the possibility of using the Beijing laboratory to produce release prints for the American firm, a scheme codenamed 'Project 10'.[125] Technicolor initially approached the Chinese government about purchasing processing chemicals, but then broached the idea that the Beijing plant might become

a captive laboratory for Technicolor, thereby harnessing their existing technology and eliminating the Beijing laboratory as a competitor should dye-transfer once again became a dominant method of film printing.[126] Technicolor also planned to 'lock up' the Number 1 Film Factory in Baoding, which manufactured blank and matrix stock for the Beijing lab, both to prevent supply to any potential competitors and to avoid dependency on Kodak.[127]

It was made clear that Technicolor would not officially license the laboratory to operate with any independence under the Technicolor brand, in the manner of the Italian and British affiliate labs, but that the American firm would retain control over the label 'Color by Technicolor' while using the Beijing facilities to cheaply mass produce release prints using its iconic IB process.[128] Technicolor understood this to be a mutually beneficial arrangement. It would give the Beijing Film Laboratory access to global markets and a consistent flow of work in addition to greater technological expertise, while it would also ensure Technicolor retained its monopoly on dye-transfer printing should it ascend to its previous position of market dominance, as well as ensuring access to cheap labour and resources in East Asia.[129]

Initial tests were made at the Beijing lab to gauge the functionality of this equipment, with viability studies continuing throughout the early 1990s. Initially Goldberg's team struck an experimental IB print of *Duel in the Sun* (King Vidor, 1946), a poignant choice given its depiction of Chinese workers constructing American railroads, a historical echo of American technological progress predicated on East Asian labour.[130] Goldberg's team experimented with various matrix and blank materials as well as dye solutions.[131] But in 1993 the Beijing laboratory suddenly announced it had ceased IB printing due to the drop in print orders caused by the marketization of the Chinese film industry described above.[132] The American team had to act swiftly to decide whether they should ask the Chinese government to keep the lab open, salvage

equipment and return it to America, or start an entirely new operation in Hollywood.[133] Negotiations continued for two years and although the Beijing laboratory offered to sell a range of machinery back to Technicolor, eventually the American company only purchased pin-belt related machinery equipment that was integrated into Technicolor's North Hollywood facility, where a new IB production line was under construction.[134]

These years in the early 1990s mark a fascinating moment of collaboration between Technicolor and the Beijing Film Lab, a collaboration that could have seen Beijing become a global hub for printing and distributing Hollywood cinema. Just as Goldberg had found humour in China developing a 'Chinese copy' of Technicolor, so too did the press see the irony in Hollywood's desire to buy this technology back from China. As an article in *The New Scientist* described with a smirking tone: 'Red China is all set to start selling the West a lost art that the West has only just finished teaching to China […] Hollywood may have to forget its deep-seated political prejudices and do business with Communists.'[135]

By the early 1990s and the conclusion of the Cold War, Technicolor's IB process had circled the globe: it had been imitated by the Soviets and then copied by Chinese technicians in Shanghai; it had been franchised to Britain and then exported to China, only to be studied by American technicians and reinstated in Hollywood. If the meaning of Technicolor's system transformed with each new iteration, each border crossing and political appropriation, then the Cold War legacies of Technicolor's IB process cannot but inflect the meaning of the films printed in Hollywood from the 1990s. In a film like *Apocalypse Now Redux* (Francis Ford Coppola, 1979/2001), printed using the revived version of Technicolor's IB process in Hollywood, colour is explicitly weaponized as part of the Cold War conflict. Throughout Copolla's vision of the

Vietnam war, soldiers continually deploy M18 smoke grenades – a chromatic technology used to signal landing zones to aircraft, or as an obfuscatory tactic to disguise military manoeuvres (figure 13). Yet these scorching orange and searing purple clouds of smoke, hues selected strategically for their stark contrast against jungle foliage, take on an aesthetic quality in Copolla's film, producing sublime effects of sumptuous beauty.

We are reminded that during the Cold War colour was simultaneously a strategic tool, a logistical weapon and a source of pure visual delight – capacities that did not undermine or negate one another but were inextricably linked. That this film was printed using a technology sold to a socialist state to mount an attack upon capitalism, which was then re-appropriated by the West to make a film about a failed war against communism, illuminates the nature of chromatic meaning in cinema. It is not just mobile and protean, not simply changeable, but contingent upon the existing social, political and historical resonances that already adhere in the technology, creating an accretion of fresh meanings with each new iteration.

Thus Goldberg's reference to Technicolor's 'Chinese copy', although intended as a joke, illuminates a global history of colour cinema. This technological exchange between America and China presents a new framework for conceptualizing the relationship between colour, technology, ideology and aesthetics during the postwar period. It suggests we should not lock colour palettes into particular ideological frameworks, but instead consider how the circulation, translation, imitation and appropriation of technologies and aesthetics can compound, inflect and transform the meanings of colour. By globalizing Cold War narratives to include China's connection to transnational chromatic networks, particularly during a period conventionally imagined as a moment of absolute seclusionism, Technicolor's 'Chinese copy' presents a compelling case for the contingency of chromatic meaning during the Cold War, demonstrating

that the meaning of colour was not eradicated by, but produced *through*, the act of its global circulation.

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[1] 'Deposition of Richard J. Goldberg,' 5 April 1990, Richard J. Goldberg Collection, George Eastman Museum, Rochester, NY (hereafter GEM).

[2] Ibid.

[3] On the rhetorical distinction between colour technologies during the Cold War, see Dudley Andrew, 'The postwar struggle for color', *Cinema Journal*, vol. 18, no. 2 (1979), pp. 41–52. On the dispersal of the Agfa patents, see Alice Lovejoy, 'Celluloid geopolitics: film stock and the war economy, 1939–47', *Screen*, vol. 60, no. 2 (2019), pp. 224–41; and Josephine Diecke, 'Agfacolor in (inter)national competition', in Barbara Flueckiger, Eva Hielscher and Nadine Wietlisbach (eds), *Color Mania: The Materiality of Color in Photography and Film* (Zurich: Lars Müller Publishers), pp. 211–22.

[4] On the role of vibrant colour in posters, see Harriet Evans, '"Comrade sisters": gendered bodies and spaces', in Stephanie Hemelryk Donald and Harriet Evans (eds), *Picturing Power in the People's Republic of China: Posters of the Cultural Revolution* (Lanham, MD: Rowman and Littlefield, 1999), pp. 63–78; on their remediation in film, see Stephanie Hemelryk Donald, 'Red aesthetics, intermediality and the use of posters in Chinese Cinema after 1949', *Asian Studies Review*, vol. 38, no. 4 (2014), pp. 658–75; in photography, see Zhou Dengyan and Shi Zhimin, '*Ranyin fa*: photography and the appropriation of Kodak Dye-transfer in socialist China', *Trans Asia Photography Review*, vol. 7, no. 2 (2017),

<http://hdl.handle.net/2027/spo.7977573.0007.202> accessed 21 June 2020; on stage design and film, see Laikwan Pang, *The Art of Cloning* (London: Verso, 2017).

[5] An argument articulated across a range of essays in *Journal of Chinese Cinemas*, vol. 6, no. 3 (2012), Special Issue on the Colour of Chinese Cinemas.

[6] Margaret Hillenbrand, 'Chromatic expressionism in contemporary Chinese-language cinema', *Journal of Chinese Cinemas*, vol. 6, no. 3 (2012), p. 216.

[7] Sarah Street's insistence on the necessity of a global approach to colour in the postwar period has established a formative methodological framework for this project. Sarah Street, 'The monopack revolution, global cinema and *Jigokumon/Gate of Hell* (Kinugasa Teinosuke, 1953)', *Open Screens*, vol. 1, no. 1 (2018), <https://doi.org/10.16995/os.2> accessed 21 June 2020.

[8] The rupture of the Cultural Revolution and the subsequent Economic Reform has usually been underscored as a shift from 'isolationism' to 'openness'. See, for example, Michael B. Yahuda, *Towards the End of Isolationism: China's Foreign Policy After Mao* (London: Macmillan, 1983); Harish Kapur (ed.), *The End of an Isolation: China After Mao* (Dordrecht: Martinus Nijhoff, 1986). This stereotypical discourse has been contested by some contemporary scholars; for a summary, see Richard Curt Klaus, *The Cultural Revolution: A Very Short Introduction* (Oxford: Oxford University Press, 2012).

[9] For a more detailed explanation of the process by the Technical Director of Technicolor Ltd., see Bernard Happé, *80 Years of Colour Cinematography* (London: British Kinematograph, Sound and Television Society, 1984), pp. 11–18.

[10] For details of the standard Technicolor package, see Scott Higgins, *Harnessing the Technicolor Rainbow: Color Design in the 1930s* (Austin, TX: University of Texas Press, 2007), pp. 87–88.

[11] James Layton and David Pierce, *The Dawn of Technicolor, 1915–1935* (Rochester, NY: George Eastman House, 2015), p. 221.

[12] 'Report to the Board of Directors of Technicolor Limited', 5 June 1950, Technicolor Corporate Archives, GEM. Technicolor Ltd. was the British counterpart to the American parent company Technicolor Inc.

[13] The laboratory has historically been overlooked in most histories of Technicolor cinema, but a number of recent publications have increasingly attended to the importance of the lab. See Layton and Pierce, *Dawn of Technicolor*, pp. 135–58; Simon Brown, Sarah Street and Liz Watkins (eds), *British Colour Cinema: Practices and Theories* (Basingstoke: Palgrave Macmillan/BFI, 2013).

[14] For a useful history of dye-transfer printing before Technicolor and a summary of Technicolor's proprietary patents, see John Huntley, *British Technicolor Films* (London: S. Robinson, 1949), pp. 183–84.

[15] On the economy of dye-transfer printing, see Layton and Pierce, *Dawn of Technicolor*, p. 155.

[16] Bernard Happé, interview by Frank Littlejohn, Alan Lawson and Alf Cooper, 13 June 1989, transcript of cassette recording made by the Broadcasting, Entertainment, Communications and Theatre Union Oral History Project, British Film Institute (hereafter BECTU, BFI).

[17] Paddy O'Gorman worked in the transfer department of the lab (where the IB machines were referred to as 'transfer' machines). Paddy O'Gorman, interview by Alan Sapper, 31 July 1992, BECTU, BFI.

[18] This exact phrase appears in three separate BECTU interviews: O'Gorman; Wilfred Brandt, interview by Alan Lawson, Len Runkel and Alf Cooper, 11 November 1991; Len Runkel, interview by Alf Cooper, 9 November 1988, BECTU, BFI.

[19] Jim Gorrie, a projectionist at the British laboratory recalled that 'all the screens in London were different colours, some were green, some were yellow, some were brown [… so] when we had to do a master print for the opening, for premiers […] we'd say, well [the screens at this cinema] they're green there so we'd take a little bit of green out.' Jim Gorrie, interview by Alan Lawson and Alf Cooper, 28 November 1988, BECTU, BFI.

[20] For various accounts of the friction between the camera department and the laboratory, see Jack Cardiff and Justin Bowyer, *Conversations with Jack Cardiff: Art, Light and Direction in Cinema* (London: Batsford, 2003), p. 61; Chris Challis interview, in Brown, Street and Watkins (eds), *British Colour Cinema*, p. 24; Huntley, *British Technicolor Films*, p. 114.

[21] On Technicolor's initial incompatibility with widescreen see Heather Heckman, 'Undervalued stock: Eastman Color's innovation and diffusion, 1900–1957', (PhD thesis: University of Wisconsin–Madison, 2014), pp. 192–200.

[22] It is often claimed that Kodak released Eastmancolor to destroy Technicolor's market dominance. However, as the sole supplier of Technicolor's blank and matrix stock, Kodak profited enormously from this monopoly. The release of Eastmancolor was instead precipitated by a 1947 antitrust suit brought by the American government against Technicolor and Kodak for their collusion in withholding chromogenic monopack from the open market. See Heather Heckman, 'We've got bigger problems: preservation during Eastman Color's innovation and early diffusion', *Moving Image*, vol. 15, no. 1 (2015), pp. 44–61.

[24] Heckman, 'We've got bigger problems', p. 46.

[25] Ibid. As Heckman notes, few of these qualities were true of Eastmancolor in the early 1950s, as initially the process was more expensive and less flexible than Technicolor, especially at the printing stage.

[26] On the wider political context of the extraction of the Agfa patents, see Lovejoy, 'Celluloid geopolitics', pp. 237–39; on the various brands competing with Eastmancolor, see Diecke, 'Agfacolor in (inter)national competition'; on the truly global quality of this technology's dispersal, see Street, 'The monopack revolution'.

[27] For greater technical detail of how Technicolor manufactured IB prints from Eastmancolor negatives, see Richard Haines *Technicolor Movies: The History of Dye Transfer Printing* (Jefferson, NC: McFarland, 1993), p. 28.

[28] Syd Wilson, who worked in a variety of printing roles at Technicolor Ltd., described how 'the 1960s was a boom period for us, the whole of the sixties'. Syd Wilson, interview by Jack Household, 18 June 1991, BECTU, BFI. Happé noted that 'from the middle of the 1960s […] Technicolor as a process reached its peak'. Happé interview, BECTU, BFI. Runkel also noted that in terms of footage, the 1960s was the busiest time for the laboratory. Runkel interview, BECTU, BFI.

[29] Happé, *80 Years of Colour Cinematography*, p. 15.

[30] '50 Golden Years of Technicolor', Special Edition, *Technicolor News and Views* (1965).

[31] John Belton, 'Getting it right: Robert Harris on colour restoration', and Richard W. Haines, 'Technicolor revival', both *Film History*, vol. 12, no. 4 (2000), pp. 405, 410.

[32] 'Report to the Board Of Directors of Technicolor Limited 8 October 1956', Technicolor Corporate Archives, GEM.

[33] Haines, 'Technicolor revival', p. 410.

[34] On the closure of the plants, see Bill O'Connell, 'Fade out', *Film Comment*, vol. 15, no. 5 (1979), p. 17; Henry Gilmer Wilhelm and Carol Brower, *The Permanence and Care of Color*

Photographs: Traditional and Digital Color Prints, Color Negatives, Slides and Motion Pictures (Grinnell: Preservation, 1993), p. 348.

[35] As Paul Clark notes, the limited nature of cultural production during this period is often overstated; for instance, documentary films and newsreel production did not cease production. Paul Clark, *The Chinese Cultural Revolution: A History* (Cambridge: Cambridge University Press, 2008), p. 90.

[36] Clark, *The Chinese Cultural Revolution*, p. 57–59. This topos of copying and imitation is explored at length in Pang, *The Art of Cloning*.

[37] On the 'affective characteristics' of colour, see Chris Berry, 'Every colour red? Colour in the films of the Cultural Revolution model stage works', *Journal of Chinese Cinemas*, vol. 6, no. 3 (2012), p. 243. Pang also discusses the idea the capacity of colour to 'agitate' the audience politically and emotionally, in *The Art of Cloning,* p. 243.

[38] Key shifts in colour technology were marked with screen adaptations of operas: from early 16mm experiments in colour with *Xianhui Xifu/The Virtuous Daughter in Law* (Yan Heming, 1938) and China's first live-action colour feature film, Fei Mu's *Sheng Sihen/Remorse at Death* (1948), to the first colour film made in communist China, *Liangshanbo yu Zhuyingtai/The Butterfly Lovers* (Sang Hu, 1954). On the intertwined history of opera and colour cinema in China, see Hillenbrand, 'Chromatic expressionism', p. 213; Jason McGrath, 'Cultural Revolution model opera films and the realist tradition in Chinese cinema', *The Opera Quarterly*, vol. 26, no. 2/3 (2010), p. 358.

[39] Clark, *The Chinese Cultural Revolution*, p. 49.

[40] On the 'three prominences' in Maoist aesthetics, see ibid., p. 46; Pang, *The Art of Cloning*, pp. 29–31.

[41] Donald, 'Red aesthetics', p. 670; Zhou and Shi, '*Ranyin fa*'.

[42] On the modification and refinement of these performances, see Clark, *The Chinese Cultural Revolution*, p. 91.

[43] Ti Shih-Chiek noted that the installation of the plant in Beijing was 'intended for mass production' as there were 'more than 100,000 projection teams providing facilities for 35mm cinemas'. Ti Shih-Chiek, 'The People's Republic of China: addendum to the Progress Committee Report', *SMPTE Journal*, vol. 88, no. 6 (1979), pp. 431–32.

[44] The modification of Kodak's system presents a further fascinating instance of China's adoption of American technology in order to mass produce Maoist propaganda materials. Zhou and Shi, 'Ranyin fa'.

[45] The crucial distinction between the American and Chinese processes was that in China the system involved the complex *colourization* of black-and-white photographs. On this fascinating history, see Zhou and Shi, '*Ranyin fa*'.

[46] Gary G. Xu, 'Chinese cinema and technology', in Yingjin Zhang (ed.), *A Companion to Chinese Cinema* (Malden, MA: Wiley-Blackwell, 2012), p. 8.

[47] Yang Mingda, former Beijing Film Laboratory worker, recalled this dependence on foreign stocks in an interview with Zhaoyu Zhu, August 2017. China's dependence upon (or independence from) Soviet states is tackled extensively in Zhu's in-progress PhD project currently titled 'A critical history of film technology in Maoist China, 1949-1979' (King's College London). Mao's call for 'self-reliance' originated in Mao Zedong, 'We must learn to do economic work', *Selected Works of Mao Tse-Tung: Volume 3* (Oxford: Pergamon Press, 1965), p. 191, but became an unwritten economic policy implemented after the Sino–Soviet Split. For a rigorous historical account of China's development of indigenous colour stocks, see Laikwan

Pang, 'Colour and Utopia: The Filmic Portrayal of Harvest in Late Cultural Revolution Narrative Films' *Journal of Chinese Cinemas* vol. 6, no. 3 (January 2012): 263–82.

[48] Tina Mai Chen, 'Socialist geographies, internationalist temporalities and travelling film technologies: Sino-Soviet film exchange in the 1950s and 1960s', in Olivia Khoo and Sean Metzger (eds), *Futures of Chinese Cinema: Technologies and Temporalities in Chinese Screen Cultures* (Bristol: Intellect, 2009), p. 76.

[49] Qu Geping, '*Jiaopian gongye de zuoyong yu yiyi*' ('The effects and meaning of the film stock industry'), *Dianying jishu*, vol. 7 (1958), pp. 4–5. Pang discusses Guo Moruo's speech in her insightful article on Chinese colour stocks. Pang, 'Colour and Utopia', p. 271. The conflation of colour film and rockets was not simply rhetorical however. As Lovejoy notes, there were crucial material and technical overlaps between the development of film stocks and war economies. Lovejoy, 'Celluloid Geopolitics'.

[50] Our thanks to Vincent Bohlinger for his insights into the Soviet parallels regarding the importance of industrialization, efficiency and productivity in relation to colour film, in 'Discussions of innovations in sound and color in Soviet Cinema of the 1930s', paper delivered at SCMS annual conference, Chicago, March 2017.

[51] '*Zhou zongli deng guankan dianying ranyinfa yingpian "zhongguo gongchandang dijiuci quanguo daibiao dahui" de jianghua*', ('Premier Zhou, Jiang Qing, and Yao Wenyuan's remarks on the dye-transfer film, the CCP's Ninth Congress) (October 1969), in *Zhongguo dianying wuzi chanye xitong lishi wenjian huibian* (*The Anthology for the Historical Documents in Chinese Cinema Material Industrial System*), in Liu Naizhong (ed.), (Beijing: Zhongguo dianying chubanshe, 1995), pp. 332–34.

[52] In his report on film technology in China in the 1970s, Donald Kennedy notes that China would print between 3000 and 6000 copies of films of 'national importance'. Donald D. Kennedy, 'The film industry in the People's Republic of China', *SMPTE Journal*, vol. 85, no. 11 (1976), p. 864. For comparison, the average print-run at the British Technicolor lab was 50. O'Gorman interview, BECTU, BFI.

[53] The unsatisfactory quality of *Daidaihong* was described in Zhang Chi, '*Kanfa he xiangfaping daidaihong caidi*'('Opinions and thoughts: criticisms on colour negatives of Daidaihong'), *Dianying jishu* (*Film Technology*), vol. 3 (1979), pp. 32–33.

[54] Huang Mingzhi, Miao Jinkang and Zhang Jian, *Caise dianying ranyin fa* (*Colour Film Dye-Transfer Process*) (Beijing: Zhongguo Dianying chubanshe, 1981), p. 8.

[55] On the development of Mershin's system, see Mayorov, 'Soviet colours', pp. 241–55.

[56] Yang Haizhou and Feng Shulan, *Zhongguo dianying wuzi chanye xitong lishi biannianji* (*Chronicle of Chinese Cinema Material Industrial System*) (Beijing: Zhongguo Dianying chubanshe, 1998), p. 199; 'Woguo zili gengsheng zhicheng ranyin fa caise yingpian' ('China can produce dye-imbibition prints by the homegrown technology'), *Renmin Ribao* (*People's Daily*), 21 May 1975, sec. 1.

[57] Philip Cavendish, 'Ideology, technology, aesthetics, early experiments in Soviet color film, 1931–1945', in Birgit Beumers (ed.), *A Companion to Russian Cinema* (Chichester: John Wiley, 2016), pp. 270–291; Philip Cavendish, 'The political imperative of color: Stalin, Disney and the Soviet pursuit of color film, 1931–45', *The Russian Review*, vol. 78, no. 4 (2019), pp. 569–94.

[58] Herbert Kalmus, the founder of Technicolor, insisted (undoubtedly in light of the 1947 antitrust suit) that Technicolor's patents were not strong enough to prevent competitors from imitating its process, and that it was Technicolor's superior craftsmanship, rather than technological secrets, that gave the firm its monopoly. Herbert T. Kalmus and Eleanore King Kalmus, *Mr Technicolor* (Absecon, NJ: MagicImage Filmbooks, 1993), pp. 152–54.

[59] Other differences are discussed in D. W. Samuelson, 'Filming in China', *American Cinematographer*, vol. 64, no. 5 (1983), p. 29.

[60] Xu Qianlin, *Zhongguo dianying jishu fazhan jianshi* (*The Brief History of Chinese Film Technology*) (Beijing: China Film Press, 2005), p. 96.

[61] On 'negative dirt', see W. D. Hedden, F. M. Remley and R. M. Smith, 'Motion-picture and television technology in the People's Republic of China: a report', *SMPTE Journal*, vol. 88, no. 9 (1979), p. 615. By the late 1970s the Shanghai lab could produce around 13 million feet of IB footage per year, whereas by 1983 the Beijing lab could produce 100 million feet annually. Editorial Committee of Shanghai Film Gazette, *Shanghai dianying zhi* (Shanghai: Shanghai Social Academy Press, 1999) p. 533; Samuelson, 'Filming in China', pp. 25–26.

[62] Chen Bo, *Zhongguo dianying biannian jishi* (*Chronicle of Chinese Cinema: Comprehensive Volume*) (Beijing: Zhongyang wenshi chubanshe, 2005), p. 816.

[63] Happé discusses the visit by the Chinese delegation to Britain. Happé interview BECTU, BFI. On Zhou Enlai's endorsement, see Yang and Feng, *Zhongguo dianying wuzi chanye xitong lishi biannianji*, p. 316.

[64] Ibid., p. 333.

[65] This process is discussed at length in Happé interview, BECTU, BFI.

[66] Yang and Feng, *Zhongguo dianying wuzi chanye xitong lishi biannianji*, pp. 264–65. Information regarding Kodak's role comes from Happé interview, BECTU, BFI. Frank Ricotta, former Technical Director at Technicolor discusses 3M's role in his interview with James Layton, Shannon Fitzpatrick and Almudena Escobar López, 26 April 2013. Our thanks to James Layton for sharing this interview with us.

[67] Happé interview, BECTU, BFI.

[68] Ibid.

[69] Situ Huimin, 'Guowai dianying jishu jianwen lu' ('Witness reports of foreign film technology'), *Dianying Jishu*, no. 5 (1957), p. 28.

[70] Donald, 'Red aesthetics', p. 671

[71] On the 1960 version, see Tian Jingqing, *Beijing dianyingye shiji 1949-1990* (*The Historical Account of Beijing Film Industry 1949–1990*) (Beijing: Zhongguo dianying chubanshe, 1999), p. 168.

[72] Berry, 'Every colour red?', p. 234.

[73] Siegfried Kracauer, 'The mass ornament', in *The Mass Ornament: Weimar Essays*, ed. and trans. Thomas Y. Levin (Cambridge, MA: Harvard University Press, 1995), p. 78

[74] Pang, *The Art of Cloning*.

[75] Clark, *The Chinese Cultural Revolution*, p. 151.

[76] Pang, 'Colour and utopia', p. 273.

[77] Zhai Jiannong, *Hongsewangshi:1966-1976 nian de Zhongguo dianying* (*The Red Memories: The Chinese Films from 1966 to 1976*) (Beijing: Taihai Press, 2001), pp.70, 106; Zhong Dianfei, 'Lun shehui guannian yu Dianying guannian de gengxin' ('On the renewal of social consciousness and cinema consciousness'), *Dianyingxue: shoujie dianyingxue nianhui*

lunwenxuan (*Film studies: The Essay Anthology of the First Annual Film Studies Conference*) (Beijing: Zhongguo dianying chubanshe, 1988), p.3.

[78] Jiang Qing's fascination with *The Red Shoes* is recounted in Qi Benyu's memoirs, published online in 2016, Qi Benyu, 'Jiangqing lingdao de jingju geming' ('The revolution of Peking Opera led by Jiang Qing'), *Qi Benyu huiyi lu* (*The Memoirs of Qi Benyu*)(Hong Kong: Zhongguo wenge lishi chubanshe, 2016).

[79] The tricky dubbing process is discussed in Pan Zheng, *Pengneipengwai: Shanghai Dianying Yizhichang De Huihuang Yu Beichuang* (*Inside and Outside the Stages: The Story of Shanghai Dubbing Studio*) (Shanghai: Sanlian Bookstore, 2017), pp. 119–29.

[80] Pang, 'Colour and utopia', p. 273.

[81] The technical workers' distrust of Kalmus reflected a deep animosity towards women exerting influence on the studio floor. As Sarah Street notes, Technicolor cameramen frequently cited Kalmus's physical appearance, particularly the colours of her clothing, as evidence she had little technical expertise and was unqualified to advise on-set. See Brown, Street and Watkins (eds), *British Colour Cinema*, p. 16.

[82] On the inability of Chinese stocks to reproduce green well, see Ding Yaping, *Zhongguo dianying lishi tuzhi, 1896–2015* (*The Pictorial Chronicle of Chinese Film History*) (Beijing: Wenhua yishu chubanshe, 2015), p. 637. On Jiang Qing's interest in the colour green and her use of Eastmancolor stock, see Pang, 'Colour and utopia', p. 273.

[83] Pang, 'Colour and utopia', p. 273.

[84] Zhai, *Hongsewangshi:1966–1976*, p. 105.

[85] Sarah Street, *Colour Films in Britain: The Negotiation of Innovation, 1900–1955* (London: Palgrave Macmillan/BFI, 2012), pp. 190–93.

[86] On the associations between colour and consumerism, particularly since the nineteenth century, see Regina Lee Blaszczyk and Uwe Spiekermann (eds), *Bright Modernity: Colour, Commerce and Consumer Culture* (London: Palgrave MacMillan, 2017); Laura Anne Kalba, *Color in the Age of Impressionism: Commerce, Technology, and Art* (University Park, PA: Pennsylvania State University Press, 2017); Sarah Street and Joshua Yumibe, *Chromatic Modernity: Color, Cinema, and the Media of the 1920s* (New York, NY: Columbia University Press, 2019), pp. 66–103.

[87] Alice Lovejoy, 'Celluloid geopolitics', p. 238. Although other systems were available none could rival Agfacolor or Technicolor in terms of colour fidelity and release print quantity.

[88] On the development of Agfacolor and the technological reasons behind its 'muted pastel look' in relation to Technicolor's saturation, see Michelle Beutler, 'Standardizing color film: Technicolor No. IV and Agfacolor during the 1940s', in Flueckiger, Hielscher and Wietlisbach (eds), *Color Mania*, pp. 197–203. On American Kodak's superiority in terms of 'colour reproduction', see Diecke, 'Agfacolor in (inter)national competition', p. 213.

[89] Andrew, 'The postwar struggle for color', 50.

[90] This stereotyped opposition of the 'drab' colourless Eastern Bloc and the chromatic brilliance of the capitalist West is explored and challenged in Krisztina Fehérváry, *Politics in Color and Concrete: Socialist Materialities and the Middle-Class in Hungary* (Bloomington, IN: Indiana University Press, 2013), pp. 1–8; David Crowley and Susan E. Reid (eds), *Pleasures in Socialism: Leisure and Luxury in the Eastern Bloc* (Chicago, IL: Northwestern University Press, 2010), p. 10.

[91] Josephine Diecke, 'Socialist identity in the making – *Lea aus dem Süden* (Gottfried Kolditz, GDR 1963) between French chic, socialist values and consumer culture', paper presented at the Third International Colour in Film Conference, BFI, March 2018.

[92] Diecke, 'Agfacolor in (inter)national competition'; Anna Batistová, 'Glorious Agfacolor, breathtaking totalvision and monophonic sound: colour and "scope" in Czechoslovakia', in Brown, Street and Watkins (eds), *Colour and the Moving Image*, pp. 47–55; Tereza Frodlová, 'In the colours of Agfacolor: introduction of colour to Czechoslovak Cinema of the 1940s and 1950s', paper presented at the Fourth International Colour in Film Conference, BFI, February 2019; Richard Misek, 'Last of the Kodak: Andrei Tarkovsky's struggle with colour, in Wendy Everett (ed.), *Questions of Colour in Cinema: From Paintbrush to Pixel* (Oxford: Peter Lang, 2007), 161–178.

[93] Heonik Kwon, *The other Cold War* (New York, NY: Columbia University Press, 2010). Kwon's work is part of a broader movement to globalize studies of the Cold War. On the global and visual turn in Cold War studies, see *Visual Studies*, vol. 30, no. 2 (2015), Special Issue on Cold War Visual Alliances, ed. Sarah Bassnett, Andrea Noble and Thy Phu.

[94] Pang, 'Colour and utopia', p. 265–69; McGrath, 'Cultural Revolution model opera films', pp. 343–76.

[95] Colour's capacity to simultaneously enhance naturalism and evoke the fantastical has been a key trope of criticism on colour cinema since the late nineteenth century. For a shrewd assessment of these tropes, see Joshua Yumibe, *Moving Color: Early Film, Mass Culture, Modernism* (New Brunswick, NJ: Rutgers University Press, 2012), pp. 5–9.

[96] The affective power of colour further bolster's Richard Taylor's argument that the utopian impulse of the musical was uniquely suited to the demands of socialist ideology (albeit in the

Soviet context). See Richard Taylor, 'The Stalinist musical: socialist realism and revolutionary romanticism', in Birgit Beumers (ed.), *A Companion to Russian Cinema* (Chichester: John Wiley, 2016), pp. 139–57.

[97] McGrath, 'Cultural Revolution model opera films', p. 370.

[98] Pang, 'Colour and utopia', p. 274.

[99] Batistová makes a similar case regarding the adoption of Eastmancolor by the Czech film industry, claiming that 'where colour film stock was concerned, political issues ceased to be important'. Batistová, 'Glorious Agfacolor', p. 53.

[100] Agfa was also made by IG Farben, a chemical giant that worked complicitly with the Third Reich. See Esther Leslie, *Synthetic Worlds: Nature, Art and the Chemical Industry* (London: Reaktion, 2005), pp. 167–215.

[101] Cavendish, 'Ideology, technology, aesthetics', p. 287. Cavendish develops this argument in dialogue with the work of I. G. Germanova, 'Tsvetnoe kino: Zametki na poliakh arkhivnoi stenogrammy' ('Color cinema: notes on the margins of archival minutes'), *Kinovedcheskie zapiski* (*Film Scholars' Notes*), no. 12 (1991), pp. 112–60.

[102] Andrew, 'The post-war struggle for color', p. 47.

[103] Pang, *The Art of Cloning*, p. 169

[104] Ibid., p. 173. The eroticism of the *yangbanxi* is also discussed in McGrath, 'Cultural Revolution model opera films', p.344, where, following Xiaomei Chen, he imagines that sexiness and ideological efficacy are not necessary mutually exclusive.

[105] On the 'flat-rate purchase system', see Ying Zhu and Seio Nakajima, 'The evolution of Chinese film as an industry', in Ying Zhu and Stanley Rosen (eds), *Art, Politics and Commerce in Chinese Cinema* (Hong Kong: Hong Kong University Press, 2010), pp. 25–28.

[105] Ibid. See also Emilie Yueh-yu Yeh and Darrell William Davis, 'Re-nationalizing China's film industry: case study on the China Film Group and film marketization', *Journal of Chinese Cinemas*, vol. 2, no. 1 (2008), p. 37–51.

[106] Our thanks to Wesley Jacks for sharing his research into Chinese distribution and box office during this period, both in conversation and through his paper 'High hopes and flat fees: an analysis of film import distribution in China between 1978–1993', delivered at the SCMS annual conference, Chicago, March 2017.

[107] Zhu and Nakajima, 'The evolution of Chinese film as an industry', p. 26. Zhu and Nakajima have compared this Chinese system of production and distribution to the block-booking practices of Classical Hollywood, which presents a poignant observation for our consideration of Technicolor's IB system: a technology perhaps best suited not to a free-market economy, but to a monopoly masquerading as a market.

[108] Samuelson, 'Filming in China', p. 25.

[109] Chris Berry, 'Market forces: China's Fifth Generation faces the bottom line', in Berry (ed.), *Perspectives on Chinese Cinema* (London: BFI, 1991), p. 114. See also Zhu and Nakajima, 'The evolution of Chinese film as an industry', p. 25.

[110] Our thanks to Heather Heckman for sharing information about Chinese IB prints held in the collections of the University of South Carolina.

[111] Berry, 'Market forces', p. 114. On industrial shifts in Chinese cinema during this period, see Yeh and Davis, 'Re-nationalizing China's film industry', pp. 37–51.

[112] See, for instance, Vincent Brook, 'To live and dye in China: the personal and the political in Zhang Yimou's *Judou*', *Cinéaction*, February 2003, p. 25.

[113] Ebert suggests that China's acquisition of Technicolor equipment in the 1970s inculcated a love of vivid colour among the Fifth Generation, although he mistakenly asserts that the technology transfer from West to East included three-strip cameras that were used for filming titles such as *Raise the Red Lantern* (1991), which was certainly not the case. Roger Ebert, 'Raise the Red Lantern: review', *Chicago Sun Times*, 27 March 1992.

[114] Among scholars of Chinese cinema, the question of the Fifth Generation's relationship to Chinese film history, and the degree to which is marks a radical departure, is keenly debated. For a measured assessment of these debates, see Chris Berry, *Postsocialist Cinema in Post-Mao China: The Cultural Revolution after the Cultural Revolution* (London: Routledge, 2004), pp. 2–3.

[115] Ibid. See also Yeh and Davis, 'Re-nationalizing China's film industry', p. 37–51.

[116] Fax from Wang Peifang to Richard Goldberg, 29 October 1993, Richard J. Goldberg Collection, GEM.

[117] This point is raised in Grant Lobban, 'The return of dye-transfer colour prints: Technicolor's best kept secret', *Cinema Technology*, vol. 15, no. 3 (2002), p. 30.

[118] Martin Scorsese, 'Letters', *Film Comment*, vol. 16, no. 1 (1980), pp. 79–79.

[120] Frank Ricotta interview. The idea of combining IB printing with digital technology was also explored in Edward Delvers, Bruce Richardson, and Thomas White, 'Imbibition release prints utilizing digital technology', *SMPTE Journal*, vol. 104, no. 8 (1995), pp. 534–36.

[122] John Akomfrah, 'Digitopia and the spectres of diaspora', *Journal of Media Practice*, vol. 11, no. 1 (2010), p. 23.

[123] For a discussion of Akomfrah's essay and its reflection upon how "anti-black racism inheres in the film apparatus", particularly in relation to digital technologies and skin colour, see Kara Keeling, *Queer Times, Black Futures* (New York: Columbia University Press, 2019), pp.117-124

[124] In particular Technicolor's *Gone with the Wind* (Victor Fleming, 1939) has come under increased scrutiny for its racism and anti-blackness in light of the gathering momentum around the Black Lives Matter movement. On the recent controversy surrounding the film's removal from HBO see Jacqueline Stewart, 'Why we can't turn away from 'Gone with the Wind', CNN Opinion, 25 June 2020 <https://edition.cnn.com/2020/06/12/opinions/gone-with-the-wind-illuminates-white-supremacy-stewart/index.html> accessed June 29 2020

[125] There had been contact between Technicolor and the Beijing lab throughout the 1980s in fact, as the Beijing Film lab had exhibited IB prints at the SMPTE conference in Los Angeles in 1980, and then developed a correspondence with Technicolor regarding the possibility of purchasing research into non-silver soundtracks (a technology that would have economized the IB process even further). John M. Andreas Collection, GEM.

[126] On the purchase of chemicals, see the letter from Ron Jarvis to Madame Xu Lixin, Deputy Director, Ministry of Chemical Industry, Beijing, 18 February 1993, Richard J. Goldberg Collection, GEM. The details of the larger plan are found in 'Preliminary plan summary of Technicolor Project 10. Meeting in PRC', September/October 1992, Richard J. Goldberg Collection, GEM.

[127] As one memo stated, 'Technicolor should not depend for raw material upon [a] company who is [our] largest competitor'. 'Notes from Project 10 meeting, Wednesday 2 September 1992', Richard J. Goldberg Collection, GEM.

[128] Lawyers advised that the brand name 'Technicolor' should be removed from several contracts in order to prevent the Beijing Lab operating as 'a licensee of our trademark.' See fax from John H. Oliphant to Richard Goldberg, 9 October 1992. Richard J. Goldberg Collection, GEM.

[129] 'Preliminary plan summary of Technicolor Project 10'.

[130] On *Duel in the Sun* see Belton, 'Getting it right', pp. 393–409. This was perhaps an extension of the restoration project begun by MoMA to try and reprint all of Selznick's colour films from the original Technicolor colour separations. See O'Connell, 'Fade out', p. 15.

[131] Goldberg's team trialed an experimental Agfa-Gevart blank and matrix stock in addition to materials from Kodak and Baoding. 'Agfa-Gevaert Project 10', Richard J. Goldberg Collection, GEM.

[132] Fax from Wang Peifang to Richard Goldberg.

[133] 'Meeting notes: Thursday 9 December 1993: Future considerations for Project 10', Richard J. Goldberg Collection, GEM.

[134] See 'Chinese pinbelt purchase', Richard J. Goldberg Collection, GEM.

[135] Barry Fox, 'Fading Film Business', *New Scientist*, vol. 100, no. 1380 (October 20, 1983), p. 215.