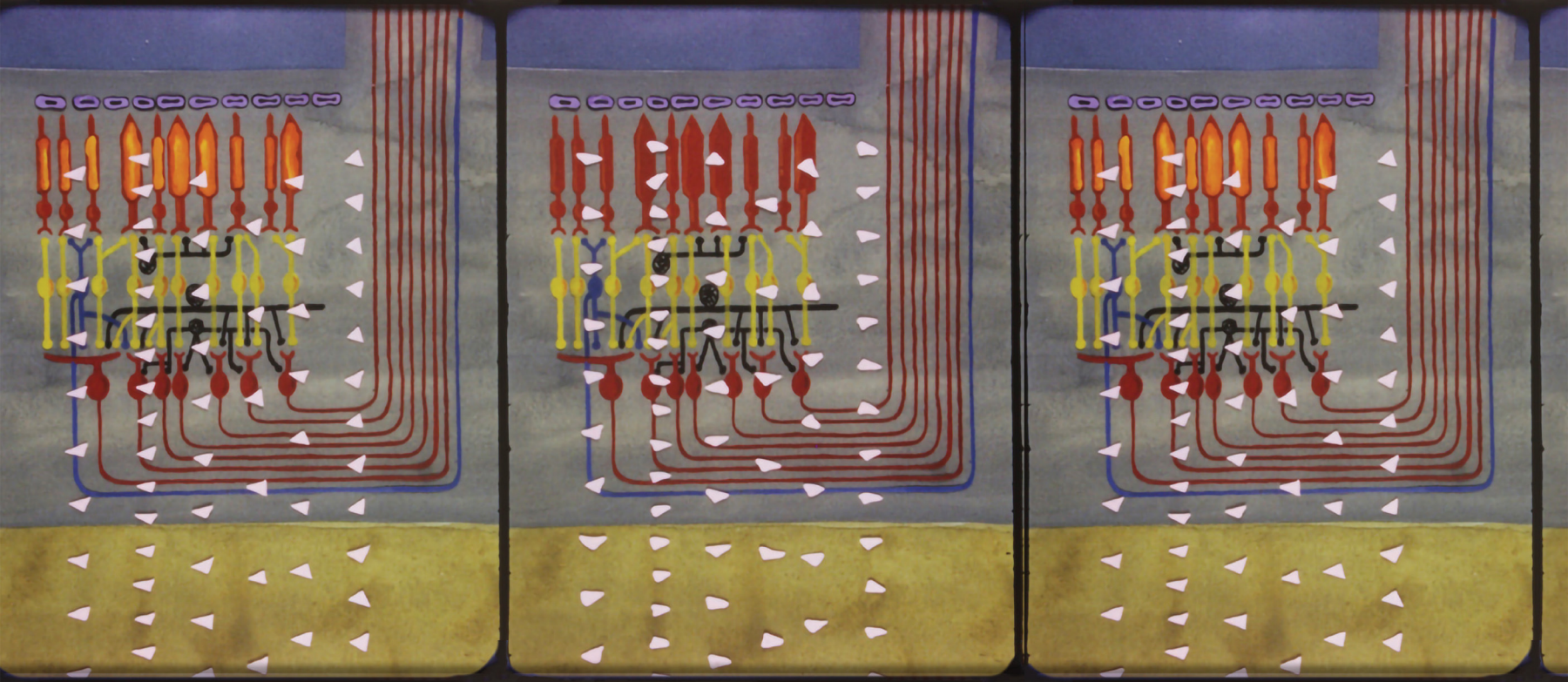
Feeling Colour

Chromatic Embodiment in Film Culture (1950s-1960s)

Bregt Lameris



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The cover combines two images of the film *La perception et l'imaginaire* (FRA 1964, Éric Duvivier). Credit: Image'Est. Photographs of the Kodachrome II camera material by Bregt Lameris, ERC Advanced Grant *FilmColors*, https://filmcolors.org/galleries/la-perception-et-limaginaire-1964-2/#/image/19741 and https://filmcolors.org/galleries/la-perception-et-limaginaire-1964-2/#/image/19742
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Introduction

In 2015 the animation film *Inside Out* (USA 2015, Pete Docter) was released in Western cinemas, telling the story of a young girl, Riley, who moves with her parents from Minnesota to San Francisco. It visualises Riley's inner emotional turmoil for us by personifying her emotions as tiny characters, each related to a specific colour: Joy (yellow/blue), Sadness (blue), Anger (red), Fear (purple) and Disgust (green). The film is interesting in the way the filmmakers have chosen a selection of clearly distinguished emotions and connected each to a specific hue. This rather simplified schematisation of emotions displays the influence of Paul Ekman (the film's advisor), who has also used the supposition that there is a fixed set of clearly definable and recognisable emotions to attempt to trace emotions in facial expressions. Such ideas, however, are not new: they could also be found in the 1960s, when Silvan S. Tomkins introduced his theory on emotions, which claimed that these 'primary affects' are biologically determined and hence unchangeable (Tomkins, 1962; Tomkins and McCarter, 1964). The connection of these emotions to a fixed set of colours, as seen in *Inside Out*, was (and still is) linked to another discourse called 'colour psychology', which was also regarded as founded on biological fact. Yet—as I show in this book—these ideas are actually based on historically contingent cultural conventions related to colours and their connotations.

To understand the underlying structure of this film, therefore, we need to be aware that it is based on the belief that emotions are biologically innate, fixed, and can somehow be connected to specific colours (as in colour therapy), but that this belief is in fact culturally and discursively determined. This becomes even clearer with an analysis of other films using the Tomkins/Ekman framework, which reveals that the question of feeling and colour in film is far too complex for such a limited approach. Connecting these basic emotions to a series of fixed hues ignores the cultural complexity of both cinema and colour; we need to consider colour culture and the history of feelings and emotions if we want to understand both in relation to the cinema of a certain period. This is precisely the focus of this book, in which I tackle the question: In what way are colours and feelings in films entangled in the colour cultures, discourses and beliefs of a particular historical context?

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This question emerged from a larger research project on the history of colour in film, the ERC Advanced Grant project *FilmColors*,[1] which focused on technology, aesthetics and subjectivities. As one of a group of around ten researchers, I participated in analysing a large corpus of colour films. Part of the corpus consisted of canonical films, identified with the help of a social media survey of film historians and colour specialists, concentrating on American mainstream and European art cinema. In addition, each researcher added groups of films related to individual research topics. Overall, the corpus contained a selection of more than 400 film titles from the first 100 years of cinema (1895–1995).

This book focuses on mid-twentieth-century colour cinema, based on the films from this period that were already amongst the 400 films of the project's main corpus. However, I added a further series of films for a more comprehensive overview of the films from this period. The additional films were selected to illustrate the various themes I address in this book, such as extreme haptic effects in relation to the erotic in *Barbarella: Queen of the Galaxy* (FRA / ITA 1968, Roger Vadim, Technicolor V) and *Et Dieu… créa la femme* (FRA 1956, Roger Vadim, Eastmancolor); colourful porn in *Fuses* (USA 1964–1967, Carolee Schneemann) and *Behind the Green Door* (USA 1972 Artie and Jim Mitchell); the dominant presence of food in *Sedmikrásky* (*Daisies*) (ČSSR 1966, Vera Chytilová, Eastmancolor); and hallucinations in Roger Corman's *The Trip* (USA 1967, Eastmancolor). The films *La prisonnière* (FRA 1968, Henri-Georges Clouzot, Eastmancolor), and *Modesty Blaise* (GBR 1965, Joseph Losey, Eastmancolor) were of interest because of their extraordinary use of op art aesthetics, of which *Barbarella* is also a fine example. These films might not immediately spring to mind when we think of the canon of colour film; however, they are indispensable examples that have enabled me to discuss some important questions on colour film and feeling. Finally, experimental films are mentioned and part of the analyses where they are considered pivotal to understand the mid-twentieth-century colour film culture.

History and Theory of Colour in Film

Until the 1980s, film history was mostly written from a teleological perspective that described the early period of cinema as a 'primitive' stage in the development of narrative integration. In a similar way, the advent of colour in early film was generally ignored by film historians, film archives and museums: although the films that date from the period 1895 to the early 1930s were extremely colourful, they were recalled as being black and white, and the industry's use of applied colour systems (such as

1 This project has received funding from the European Research Council (ERC) under the European Union's Horizon 2020 research and innovation programme, grant agreement No. 670446, *FilmColors. Bridging the Gap Between Technology and Aesthetics*. Principal Investigator: Professor Dr. Barbara Flueckiger. Results of this project can also be found on the *Timeline of Historical Film Colors* that can be accessed on filmcolors.org.

hand colouring, tinting, toning and stencilling) was disregarded.[2] Of course, some of the numerous experiments in creating mimetic colour systems were mentioned, but mostly in terms of their relationship to the development of the trichromatic mimetic system, Technicolor IV.[3] However, as the *Timeline of Historical Film Colors* also shows, innumerable mimetic colour film experiments had seen the light of day before Technicolor IV hit the market in 1932, and many of these were not—or only slightly—related to its technology.

Thus, when archives and museums made duplicates of early coloured films, they were mainly in black and white (Lameris, 2015). In the rare instances when early hand-coloured films were shown, they were presented as primitive curiosities intended to evoke amusement (Lameris, 2017: 162). For the most part, however, nitrate prints with tints and tones were projected without paying attention to their colours. These archival practices went hand in hand with a film criticism culture that was largely characterised by its stance against the use of colour in film. This discourse started in the late 1920s with, for example, the *League du noir et blanc* in Paris, which counted Jean Mitry—who later became a famous film historian—among its members. The group wrote polemics railing against the advance of mimetic colour in film and advocating the monochromatic film image (Lameris, 2018: 231–32). This 'chromophobia',[4] that assigned a taste for bright colours to children, women and 'primitive' cultures (Taussig, 2006: 28), seeped into the classical film historical discourse, and as a result colour in early cinema was written out of the larger story. If and when it was mentioned, it was mostly as a subject of ridicule, in the same way as in the archival programming (Lameris, 2017: 64).

The Brighton Conference, organised by the Fédération Internationale des Archives du Film (FIAF) in 1978, however, marked the birth of the New Film History, which sought to bring together film analysis, film history and an increased interest in yet unstudied source materials. Within this new movement, the field of 'colour and film' established itself on the film-scholarly agenda, albeit somewhat later. Although Edward Branigan (1976, 1979), Stephen Neale (1985), John Belton (1990) and Gert Koshofer (1963–2018) were forerunners, entering this field of research relatively early on, it was not until the mid-1990s that an interest in colour in film showed any sustained growth. Around this time, a greater number of colour studies began to appear, including those by Jacques Aumont (1994, 1995), Benoît Noël (1995), Tom Gunning (1994), and Monica Dall'Asta and Guglielmo Pescatore (1995).

2 For a more elaborate explanation of the technologies you can consult the *Timeline of Historical Film Colors*. Hand colouring: https://filmcolors.org/timeline-entry/1212/; tinting: https://filmcolors.org/timeline-entry/1216/; toning: https://filmcolors.org/timeline-entry/1215/ and https://filmcolors.org/timeline-entry/1217/; stencil: https://filmcolors.org/timeline-entry/1218/

3 https://filmcolors.org/timeline-entry/1301/

4 For a fuller discussion of this term, see David Batchelor's *Chromophobia* (2000).

After the 1995 workshop 'Disorderly Order', held at the Film Museum (now EYE Filmmuseum) in Amsterdam, which was predominantly dedicated to colour in silent film, the number of publications—mainly by film archivists and curators—increased rapidly (e.g. Farinelle and Mazzanti, 1994; Hertogs and Klerk, 1996; Fossati, 1996; Berriatúa, 1998; Mazzanti, 1998; Desmet and Read, 1998). The focus of these publications was primarily on early film, and was closely linked to discussions about restoration ethics and practice. The workshop also inspired the restoration of many early colour films, and the Pordenone and Bologna film festivals have been showing these works ever since, ensuring the further distribution of knowledge about early colour film, and contributing to the firm anchoring of colour research in film studies. Thus, colour has become an established research subject, resulting in several important monographs, including those by Susanne Marschall (2005); Christine N. Brinckmann (2015); Scott Higgins (2007a); Richard Misek (2010); Sarah Street (2012, 2019); Federico Pierotti (2012, 2016); Joshua Yumibe (2012, 2019); and James Layton and David Pierce (2015), as well as edited volumes on the subject, such as *Color The Film Reader* (2006), *The Colour Fantastic* (2018) and *Color Mania* (2020).

These studies lie completely outside the tradition of classical film history, with its teleological perspective. By consulting sources that had previously been disregarded, and using alternative research methods, they introduced new and revolutionary perspectives on the history of colour in film. Currently, the possibilities of new, digital research approaches have added to the menu of colour film history. These new studies reflect the fact that technological and aesthetic developments in film history never occur in a vacuum but are always closely linked to cultural contexts and their social patterns and discourses.

Within the New Film History project, a specific theoretical approach and methodology emerged called 'media archaeology'. Although there are many ways of doing media archaeology, they can all be characterised by a shift towards materiality and technology (e.g. Ernst, 2011; Elsaesser, 2002, 2004, 2016; Huhtamo and Parikka, 2011; Zielinski, 2002, 2003). This also surfaces in the strong interest media archaeologists exhibit in Friedrich Kittler's *Grammophon, Film, Typewriter* (1986) and Jonathan Crary's *Techniques of the Observer* (1992), both of which connect the embodiment of the observer to the technologies they describe. This last connection also distinguishes media archaeology as it was further developed by Thomas Elsaesser, who introduced 'apparatus theory' into the field, in order to facilitate inquiry into the various material components of media, placing the spectator/observer/user at the centre of this research.

As such, media archaeology combines formal film analysis, technological and material history, and the history of ideas with a study of the spectator's material position in relation to the senses. Deploying the analytical method of Michel Foucault, media archaeologists often focus on a rather short historical period—one that can

be investigated from multiple perspectives—to discern the discursive constellation of which the subject under investigation is a component. Tom Gunning (1994) and Joshua Yumibe (2012) study colour in early cinema, including ideas on attraction, shock and the senses, from this perspective. Yumibe's book (2012) could be seen as the ultimate combination of Crary's work, early film studies and early discourses on colour, film and the senses.

Over the past 25 years, media studies have also witnessed the development of a variety of methodologies to examine affect, emotion and embodiment in relation to film and other moving images with the help of theoretical perspectives adopted from phenomenology, cognitive psychology and those branches of philosophy concerned with the concept of 'affect'. Scholars engaging in this work include Vivian Sobchack (1992, 2004); Laura Marks (2000, 2002); Jennifer Barker (2009); Carl Plantinga (2009); Julian Hanich (2010, 2018); Eugenie Brinkema (2014); Scott Bukatman (1999); and Steven Shaviro (1993). Nevertheless, the relationship of this research to colour only occasionally surfaces—for example, in a series of essays written over the years by Christine N. Brinckmann that were translated from the German and published by Amsterdam University Press as *Color and Empathy* in 2015, and in Flueckiger's articles, of which 'Color and Subjectivity in Film' (2016) is worth mentioning separately. In addition, Joshua Yumibe's book *Moving Colors* (2012) discusses colour concerning affect and embodiment in nineteenth and early twentieth-century colour theories.[5]

The limited studies of colour film and affect form an important lacuna, specifically considering the strong sensuousness and affective power we generally appoint to colour. All this explains why this study combining affect theory and sensory approaches to colour in mid-century film culture is pivotal.

Colour Film Technology in the Mid-Twentieth Century (1950s and 1960s)

Mid-twentieth-century cinema shifted from predominantly black and white to almost entirely colour. This shift was pushed by important changes in colour in film technology with chromogenic monopack successfully being brought to the market. In addition, during this period, we also see changes in colour film aesthetics, colour culture, and the discourses on colour relating to feelings and emotions. All this makes this period interesting for studying colour film and feelings.

Recently, this period has shown a growing interest from colour film scholars. In 2019, Elena Gipponi and Joshua Yumibe edited a special issue of *Cinema & Cie*, called 'Cinema and Mid-Century Colour Culture'. In this issue, the increased interest

5 Studies on colour and affect in other media are *Reading Colour* (Conquer, 2019) on poetry and *Feeling Photography* (Brown, 2014).

in cinema, colour and the embodied spectator is clear (see, for example, Frederico Pierotti's excellent study on the mid-twentieth-century biopolitical discourses on colour, and film, as well as my article on hallucinating colours and LSD). More importantly, the plain appearance of this special issue also illustrates the increased interest in mid-twentieth-century colour film—something that can also be noticed in the work on Eastmancolor by Sarah Street, Keith Johnston, Paul Frith and Carolyn Rickards (2022) and the elaborate study of the Agfa factory in Wolfen by Josephine Diecke (2021). This book is part of this increased academic interest for mid-twentieth-century chromatic film culture.

To better understand the period's colour film technology, I will take a step back to the 1920s when Leonard Troland, a Harvard psychologist with an impressive knowledge of physics and chemistry, worked for Herbert Kalmus to improve the Technicolor system. During the late 1920s, he transferred the so-called imbibition or dye-transfer process that existed for photography to one that could be used for film. His work first resulted in the two-colour system Technicolor III,[6] which was introduced to the market in 1927. In 1932, with the invention of the beam-split camera, the separate capturing of three colours became possible, and Technicolor IV was introduced. The imbibition or dye-transfer system used matrices prepared by hardening the silver image and washing away the soft gelatin portions. These matrices were then dyed red and green for Technicolor III and cyan, yellow and magenta for Technicolor IV, which were transferred on top of each other onto a blank film, creating an initially two-colour (and, after 1932, full-colour) image.

The beam-split camera used for Technicolor IV was a special camera that enabled the exposure of three black and white negatives capturing green, red and blue light. The camera consisted of a beam-splitter with two prisms forming a cube, splitting the incoming light.[7] One portion of the light was guided through a filter, which transmitted the green light onto the negative for the green record. The second half was transported through a magenta filter, stopping the green light, and letting through blue and red light onto a bi-pack film (two negatives on top of each other). The first negative of the bi-pack recording, the blue, was made of orthochromatic material, which is not sensitive to red light. It also contained a red-orange dye that functioned as a filter, blocking the blue so the red light could be captured on the second film strip, which was panchromatic and hence sensitive to red.[8] In this way, three black and white negatives were produced, containing the colour information of green, blue and red used to produce the Technicolor dye transfer of imbibition projection prints the company was famous for.

6 https://filmcolors.org/timeline-entry/1300/

7 For an explicatory short film illustrating the system and showing the original camera parts, see: https://filmcolors.org/timeline-entry/1301/#/image/9342

8 *Timeline of Historical Film Colors*, entry 1301 (https://filmcolors.org/timeline-entry/1301/).

As mentioned earlier, classic film history generally ignored early film colours, resulting in the long-lasting perception that silent films were predominantly black and white. According to this discourse, the story of film from the early 1930s onwards was one in which cinema turned towards colour following the successful marketing of Technicolor IV[9] in 1932. Interestingly, when looking at what was made and shown at the time, it seems that with the introduction of Technicolor IV, cinema did not turn colour, but instead became predominantly black and white after a rich period of tinting, toning and stencil colouring. Technicolor films from this period might claim pride of place in public memory, but they were not the majority of film productions. Besides this, we tend to remember these films' colours as extremely bright and vivid, which is only partially true.

The dominance of Technicolor in this further overwhelmingly black and white field was challenged in the late 1950s and early 1960s when what we now know as 'chromogenic' (literally 'colour generating') monopack (Heckman, 2015: 47) was successfully brought to the market. Chromogenic systems, such as Eastmancolor,[10] Agfacolor[11] and Fujicolor, made the technological and practical process of producing colour film far more straightforward because colour could now be directly captured on one negative. As a result, the advantage of the chromogenic systems over Technicolor IV was mainly in how the camera captured colours.

During the 1930s, chromogenic technology was simultaneously developed in Germany (by Agfa) and the USA (Kodak). Other systems, such as Ferraniacolor, Fujicolor or Sovcolor were based on the Agfa patents released after the Second World War (Diecke, 2020; Dootson, 2023). However, when Agfa tried to find a negative-positive system to implement for the professional market, Kodak worked on a reversal system, creating direct positive projection prints for the amateur market. The Second World War had a great impact on Agfa's market position, especially since, in 1945, Agfacolor's formula was opened to the world. As Diecke states: "This laid the foundation for the international and transnational involvement of numerous successors to Agfacolor [...]" (Diecke, 2000: 212). Ferrania, Svema, Gevaert, Ansco and Fuji all based their technology on the Agfa patents, releasing various chromogenic colour systems from the United States to Japan, and Europe. Colour film technology became much more accessible and cheaper over the 1950s and the 1960s (Diecke, 2000; Street, 2018a: 1).

Kodak launched its first chromogenic negative stock in 1950, Eastmancolor type 5247. However, at least until 1953, Eastmancolor was never a replacement for Technicolor (Heckman, 2014: 134–36). On the contrary, Technicolor increased

9 https://filmcolors.org/timeline-entry/1301/
10 https://filmcolors.org/timeline-entry/1310/
11 https://filmcolors.org/timeline-entry/1276/ Although this system had existed since 1939, due to WWII it was not successful on the international market until the 1950s.

its output by 200% during that same period. One of the reasons why Kodak could not compete with Technicolor during the early 1950s was Technicolor's improved sensitivity to ASA 25, whereas Eastmancolor type 5237 only had an ASA of 12. Only Fox, MGM and, specifically, Warner committed to Kodak and its new chromogenic stock at that early stage. Warner, for example, invested in two expensive developing machines, one for Eastmancolor positive and one for its negative film stock development, both of which were ready by 1953. Kodak introduced a new version of its Eastmancolor negative type 5248 that same year. It improved because it was, like Technicolor, of an ASA 25 sensitivity and balanced for tungsten light sources.

In February 1954, Technicolor stopped three-strip shooting technology and sold all the equipment (Heckman, 2014: 194). The firm retired from its three-strip, beam-split technology, letting Kodak take over the Hollywood market with Eastmancolor negative. Although no direct sources explain why the Technicolor firm did this, some assumptions were made. One, defended by Russell Merritt, was that incompatibility between three-strip shooting technology and widescreen technology paved the way for Kodak to take over (Merritt, 2008: 2). Another was the Technicolor scheduling problems due to the restricted supply of beam-split cameras and personnel to handle them. As a result, filming with Eastmancolor negative was much easier to schedule (Heckman, 2014: 148). Furthermore, with Eastmancolor type 5248 being of an ASA 25 sensitivity, Technicolor's advantage with faster negatives was no longer the case (Heckman, 2014: 194).

Technicolor did stay on the market with dye-transfer release prints, launching what is known as Technicolor V in 1954, combining Kodak's chromogenic negative and Technicolor dye-transfer technology (Koshofer, 1965; Pope, 2016; Basten, 1980).[12] Herbert Kalmus already announced this transition in 1953, when he presented it as a new technology:

> An important contribution which Technicolor offers to the motion picture industry, at this time, is the ability to obtain Technicolor dye transfer prints from these single strip negatives, that is, greater flexibility. (Kalmus, 1953)

These technological transitions left traces in colour film production. Over the decade before, the number of films made in colour steadily increased, but between mid-1953 and 1957, there was a consistent decrease in colour film productions (Heckman, 2014: 190). As Sarah Street notes, it was only in the late 1950s and the 1960s that colour increasingly became dominant in Europe and the USA (Street, 2018a: 3). And it would still take until the late 1960s for colour to displace black and white in film. For example, in the UK, at the beginning of the 1960s, most films were still black and white; by 1969, almost all films were shot in colour (Street, 2018b: 470).

12 https://filmcolors.org/timeline-entry/1445/

Simultaneously, a transformation in the appreciation, meaning, aesthetic awareness and effectiveness of colour took place, as Edgar Morin noted in 1956 in *The Cinema, or the Imaginary Man*:

> At the moment it [colour film] is learning how to become as natural as black and white and at the same time to gain an aesthetic effectiveness; it is already capable of sometimes effacing itself behind objects and action, and sometimes effacing objects and action behind it. (Morin, 1956: 138)

Morin was also confident that colour cinema would supersede black and white aesthetics, since it appeared to be more naturally attuned to the senses (142). Along with stereoscopy and widescreen technology, he believed that colour enabled cinema to entice 'all the spectator's senses', turning the movies into the 'feelies' (42).

Morin's predictions seem to bear out: the mid-1950s saw the beginnings of such an aesthetic change. Film scholar Christine Brinckmann, for example, identifies this shift in her article 'Chords of Color' (2015). She describes how, during Technicolor's period of dominance in the 1930s and 1940s, 'a kind of standard, a backdrop against which variations could evolve without infringing on the fundamental validity of the principles' evolved (Brinckmann, 2015: 36). In the second half of the 1950s, however, this more restricted, standardised and controlled use of colour was increasingly challenged by 'a group of films [that] began to push the tried-and-tested system to its limits, or at least to approach color more creatively and excessively' (38–39). Brinckmann believes that the reasons behind this included the emergence of widescreen technology, the need to compete with (colour) television and finally, the appearance of Eastmancolor on the market (39). Russell Merritt, in his article 'Crying in Color' (2008), confirms this by connecting what he calls the 'maturing' of colour film to the fact that filmmakers and cinematographers started experimenting in ways that were not possible for them during the 'Technicolor days' (Merritt, 2008: 1). This, in his opinion, was related to the fact that the emergence of chromogenic monopack gave much more freedom to filmmakers.

Brinckman, on the other hand, also points to a change in film culture that made the new colour film aesthetics possible: 'Mannerisms and parodies were in the air, and light entertainment offered itself as the right field to play with color' (39). And indeed, this perceived liberation of colour in film did not occur in isolation. The 1950s and 1960s were characterised by turns, shifts and revolutions in the form of the sexual revolution, youth culture, pop music, clubbing, decolonisation, and lots of drugs. All this was interrelated with colour culture in and beyond cinema.

Colour Culture of the Mid-Twentieth Century (1950s and 1960s)

From the 1920s until the 1950s, Western colour culture was primarily characterised by the attempt to control society through functional colours, colour conditioning and colour psychology. Faber Birren is known as one of the protagonists in this part of colour history, refining and distributing long-standing ideas on how colour could control the body and mind. He was one of the most important figures in colour culture in the 1950s and into the 1960s, and he will play a large role in this book. Paradoxically, this discourse achieved its maximum international success around the same time as it found itself outstripped by the explosion of colours unleashed by psychedelic culture. As Kirsten Moana Thompson (2015: 62–84) points out, '[w]hereas in Western culture we tried to control colour with the help of colour-cards, colour harmonies, colour consultants, and colour psychology, in the 1960s colour was being unleashed especially in the psychedelic culture'.

Psychedelic colour culture reflected the excitement, anger and fear, as well as the experiments and revolutions, that distinguished this period. The period is also known for the cultural changes introduced by the struggles for women's liberation, the 'sexual revolution', race riots, the civil rights movement, student revolts, the Cold War, and the protests against the Vietnam War. With these revolutions came the liberation of the body and senses, which found its way into art and visual culture.

Besides social and cultural change, technology also underwent revolutionary changes. Space and computer sciences and developments in electronics all influenced daily life and the use of colour. As Carolyn Kane explains, during the 1960s, a chromophobic Western world ended, and an overflow of electronic and synthetic colours emerged. Ever since, our world has been overly colourful:

> Decked from head to toe in electronic hues and digital screens, the cultural landscape abounds with color film, television, fluorescents, op art, billboards, Internet banner ads, screaming neon signs, dazzling fashion displays, postmodern architecture, luminous screen savers, and brightly colored multiscreen installations in pharmacies, shopping malls, airports, airplanes, Gyms and cars. (Kane, 2024: 23)

In all, the mid-twentieth century can be characterised as a social, cultural, technological, and chromatic turning point in Western visual culture.

Simultaneously, a growing interest in B-movies (such as those by Roger Corman), and the birth of the New Hollywood Cinema and European film's New Wave announced a more independent form of filmmaking—one that became increasingly absorbed into the mainstream (Hitchman, 2013). Chromogenic monopack made colour film accessible for these independent filmmakers. This included filmmakers in the global south and southeast, such as India, China and Japan. As Kirsty Sinclair Dootson explains elaborately in her book *The Rainbow's Gravity* (2023), the increasing amount of chromogenic monopack systems on the market and geopolitical shifts and

decolonisation movements that had been going on since World War II also enabled global democratisation of colour film. She writes:

> [...] the 1950s marked a serious erosion of the controlled access to colour that had characterised the preceding decades, held primarily in the hands of fascist, capitalist and Imperial powers (retrospectively Germany, America and Britain). Chromogenic stocks symbolised a range of freedoms for socialist and post-colonial nations, which were now able to begin managing their own colour film productions in a meaningful way for the first time. (Dootson, 2023: 131)

This globalisation of colour film also created a transnational push for new aesthetic forms concerning filmic moods and atmospheres through coloured light or haptic effects with colourful textures and clothing (Street, 2028: 21–22).

The democratising shifts in the colour film industry, the increased access to colour film technology and stock, and an exploded colour culture under the influence of the atmosphere of unrest and revolution make the 1950s and 1960s such a compelling period for the researcher who is interested in studying embodiment and emotions in relation to colour film.

Methodology

With the *FilmColors* team, we analysed the 400 films of the selected corpus with a computer-based method that gave us the possibility of annotating them using highly sophisticated controlled vocabularies and automated video analysis tools.[13] First, we manually analysed each film with the help of a FileMaker database in which we included film analytical concepts, partly based on David Bordwell and Kristin Thompson and Jeff Smith's *Film Art: An Introduction* (2017), and partly on Barabara Flueckiger's investigations on technology and aesthetics in her previous research and teaching (Flueckiger, 2001, 2008, 2016; Halter et al., 2019; Flueckiger and Halter, 2020). These concepts were supplemented with keywords based on narratology, and affect and emotion theories. Other keywords enabled us to indicate more general topics. Finally, we specified various hues, colour schemes and colour contrasts in relation to figure-ground separations. We based the colour contrasts on the ideas of Johannes Itten (1961a), whose work I explore in more depth in the introduction to Part I.

Initially, we annotated the various hues in a particular sequence by hand. Over the course of the project, however, we introduced automated colorimetric analysis, developed by Gaudenz Halter in the Visualization and Multimedia Laboratory at the University of Zurich. To ensure perceptually uniform colour analyses and visualisations, all colour-related computation uses the CIE l*a*b colour space (LAB, for short). This means that hue, chroma and luminance are included in the colorimetry. Visualisations based on

13 The analyses were also used as a ground-truth for the development of the Visual Analysis Tool, VIAN.

the results are enabled on a micro (screenshot), meso (individual film) and macro (film corpus) level (Halter et al., 2019: 124, 126). All of these research instruments—the vocabulary developed in FileMaker, the automated colour analysis and the ability to make segmentations of films by hand or automatically—were brought together in the Visual Analysis and Annotation Tool, VIAN.[14]

The amount of data VIAN contains and the possibility it offers to create visualisations allowed us to find patterns not only in the colours, surfaces, textures, light schemes, composition, and depth of field in relation to specific technologies but also in the feelings, emotions and narrative strategies in the films we analysed. As a result, we could identify recurring themes and patterns in which feelings and colour meet—examples being the representation of alienated or estranged spaces connected to the use of colour or the constantly recurring kaleidoscopes and crystals in coloured moving images. The recurring nature of these aesthetic motifs created a connection between certain films, enabling us to identify visual cultural patterns across time.

A particularly helpful methodological approach to looking at patterns and recurring aesthetic strategies can be found in media archaeology's 'topos studies'. Erkki Huhtamo (2011: 31) has developed a strategy (based on the work of Ernst Robert Curtius) for the investigation of recurring visual tropes and the ways in which they vary depending on the cultural context in which they appear. According to Huhtamo, this implies that the different appearances of a certain topos are never identical; they may be similar—otherwise we would not recognise them as a topos—but their meaning and use always differ, simply because they occur in different cultural contexts.

The computer-based analyses of the 400 films from the canon of colour film history allowed us to thoroughly search for and identify topoi related to embodiment, feelings and colour in the history of film. The next step was to study the particularities of the occurrence of aesthetic topoi as nodes in a network of cultural determinants that are part of the cultural constellation in which they appear. Thus, in my in-depth analyses, I could relate the topoi I identified to the historical context of the colour cultures and the discourses on feelings and embodiment prevalent in the 1950s and 1960s. The book's focus on this period reveals the contemporary popular, scientific and artistic discourses on colour perception, embodiment and emotions. By zooming in on separate films or excerpts, I have discerned the interrelationship between these discourses and their cultural context and film culture. I often return to the same film titles throughout the book to illustrate different themes and thus create a more comprehensive perspective. This also illustrates how the motifs and patterns in which embodiment, feelings and colour are connected in film sit within a culturally determined web of aesthetic practices, and often occur in the same cinematic work.

This book now aims to combine the developments in film history, media archaeology and research on affect and embodiment with the increased interest in mid-century

14 For more details see: https://vian.app/vian

colour culture into a synthesis that will help advance the study of the history of colour in film. To do this, I incorporate ideas from the history of emotions and Fernand Braudel's perspective on historical time. In his renowned trilogy, *La Méditerranée et le monde méditerranéen à l'époque de Philippe II* (1949–1966), Braudel pioneered the notion of 'pluralité des durées' within historical time. Each segment delves into and scrutinises a distinct temporal aspect of Mediterranean history. Drawing inspiration from these concepts, I adopt a similar framework in examining emotion and colour in film, presenting a nuanced variation on historical temporalities. Braudel outlines three temporal layers that I will adopt in this book. The first layer, to Braudel, pertains to the enduring, biological and geological aspects of the environment, which could correspond to the physicality and neurology of human beings in the case of the history of colour film perception and potential emotional responses. The second layer delves into cultural dynamics, characterised by a gradual pace of transformation. Here, emotions are not solely innate but are also influenced by societal norms and cultural contexts. Lastly, Braudel introduces the third layer, focusing on the swift fluctuations of events and individuals, mirroring the rapidity of life itself. In this text, this third layer encapsulates the temporal essence of films as catalysts, facilitating the generation and experience of emotion-driven perception.

These layers are the main tool for recognising and defining patterns and waves in the history of colour film and colour culture regarding affect and emotions. It enables us to ask such questions as: Can a film produce and create feelings (affects and emotions) through the way it is structured and formed, and what meaning does a colour-feeling node produce within the context of the film of which it is a part? Such research needs to be grounded in the close reading, formal analysis and interpretation of excerpts of individual films and their colour schemes. At the same time, the other temporal layers need to be taken into account, as they can give more insight into how films functioned as catalysts and can reveal whether they were following dominant emotional regimes or resisting them as part of a counter-cultural reaction. This study aims to understand the interrelationship between colour in film and feeling-centred emotions through analysing the discursive constellations formed by the ideas on and knowledge about colour and feeling (affect and emotion) current in the 1950s and 1960s.

Colour Film as an Unstable Object of Research

In relation to the analysis and comparison of 400 colour films on DVD and Blu-ray, I would like to lay out one of the biggest challenges in the study of film and colour in film that we have to be aware of: the flexible and unstable nature of the objects under investigation.

First of all, colour and colour perception are highly unstable and subject to change. Commonly held beliefs on the interaction, contrast, perception and feeling

of colours hark back to centuries of writing and thinking about colour, and how to systematise and control it. Colour is indeed a rather complex topic of research. As Anja Hurlbert (2013) explains, even in our everyday lives we often puzzle over its nature, pondering whether, for example, it exists as a physical reality or is simply a construction of the mind. We often disagree about what to call certain hues or tints, and when looking at green grass or a blue sky, we sometimes wonder if we are seeing the same thing as our neighbour (Hurlbert 2013: 369). One of the reasons we ask ourselves such questions is that colours are 'qualia' – something that exists somewhere between 'reality' and perception. Both perspectives on colour (concrete existence and subjective perception) continue to be intensively studied and debated by colour physicalists on the one hand and colour subjectivists on the other. Sometimes the physical theories become dominant, and sometimes the subjective ones. Cultural structures such as language and colour systems also condition our perceptions and beliefs about colour, as Umberto Eco explains in his article 'How Culture Conditions the Colors We See' (1985).

On the other hand, film in itself is an unstable object. As I pointed out in *Film Museum Practice and Film Historiography* (Lameris 2017), films are seen and studied in a wide variety of materialisations that affect how they are perceived and experienced. Scholarly writings on archival film have tried to grasp these problems conceptually in various ways that range from 'film as original' to 'film as text' (as well as many other conceptual forms) (Cherchi Usai, 2000; Fossati, 2009). In her article 'Material Properties of Historical Film in the Digital Age', Barbara Flueckiger (2012: 139) has gathered these disparate reflections into a helpful conceptual toolkit that suggests three main ways of approaching film: film as text (or as a conceptual object); film as token (or as a material object); and film as performance (or as a screened object).

Archivists and film historians have long been interrogating the nature of film. The answers they give are as manifold and fragmentary as the objects at stake, concluding that it is impossible to determine what films actually looked like when they were screened and viewed in the past. A film's title or genre, as defined by the FIAF cataloguing committee, can give us a general idea, but if we consider the subject more closely, we soon realise that it is impossible to know what such a title actually refers to. As Nicholas Hiley (in Hertogs and Klerk, 1996: 22) comments, an 'original film' cannot be anything other than an 'imaginary object'. This is not only because time changes the prints, projectors and audiences, but also because film itself is an ungraspable, ephemeral idea—which is why we call this approach 'film as text' or 'film as a conceptual object'.

The second approach to archival films is that of the 'film as token' or 'film as a material object'. In terms of the history of colour film, this implies a large variety of colour systems, differing in materiality and tangibility, which interact with the materialisations of films as objects (Flueckiger, 2012: 143–45). Since this book focuses on films from the 1950s and 1960s, the corpus, for the most part, reveals three different technologies: the Technicolor IV three-strip negatives with dye-transfer projection

prints that were used until around 1955; chromogenic monopack negative-positive processes such as Eastmancolor and Agfacolor that became the dominant technology after 1955; and Technicolor V chromogenic monopack negative with dye-transfer projection prints.

The much-used chromogenic monopack materials are known for their unstable dye clouds: the cyan and yellow dye molecules are especially susceptible to degradation, leaving only the magenta layer, which means that prints acquire a predominantly pink appearance over time.[15] Restoration and colour grading can attempt to recreate these colours in the newly struck prints of these films; however, information about their 'original' grading and saturation is usually missing, rendering the reconstruction of these colours the result of guesswork. This is what Flueckiger (2012: 142) calls the 'gap in the history of a film', referring to the transformations and interventions such as colour grading that take place during the printing process – the step that mediates between the starting print and the copy. As a consequence, the negative print of a colour film, which could be considered the most 'original' document for the purposes of film restoration or historical research, lacks a large amount of the information needed to reconstruct the colours of a positive print.

In addition, even contemporary projection prints of the same work often differ from one another in terms of colour grading. One example is Alfred Hitchcock's Technicolor V film *Vertigo* (USA 1958). The photographs of this film taken by Barbara Flueckiger, following a semi-standardised method developed for the *FilmColors* project, show how the three-dye transfer prints of this title reveal quite important differences in the rendition of colour. What appears as a purple dress with a blue collar on the Harvard print of the film, for example, changes to a blue dress with a cyan collar on the print kept at the Library of Congress [Figs 0.1–0.2]. Such differences also occurred with Technicolor for 16mm, as the photographs of the academy-award-winning film *Glas* (NDL 1958, Bert Haanstra, Technicolor for 16mm) reveal [Figs 0.3–0.4]. This is even more applicable in the semi-professional field, where films were often shot on reversal film material such as Kodachrome and Ektachrome, after which projection prints were struck on various types of reversal film stocks that differed—often markedly—in quality. These projection prints, therefore, not only differ from the Kodachrome camera material but also from one another [Figs 0.5, 0.6, 0.7]. Occasionally, we also encounter projection prints struck on different materials: from 1955 onwards, when Technicolor started to strike dye-transfer prints based on Eastmancolor negatives, projection prints of the same title could be released both with dye-transfer technology and on chromogenic material. An example of this practice is the film *I tre volti della paura* (ITA 1963, Mario Bava, Technicolor V / Eastmancolor),[16] which was released on Technicolor V projection prints in Europe and on Eastmancolor chromogenic material (under the name Pathé

15 See: https://filmcolors.org/timeline-entry/1310/

16 The film was released in the United States by AIP as *Black Sabbath*.

Color) in the USA (Lucas, 2007: 482). Furthermore, in 2013, Arrow released both the European and American versions of the film title on DVD and Blu-ray, and a comparison of frame shots on DVDbeaver.com reveals interesting colour differences between the two.[17] Of course, it cannot be claimed conclusively that these differences directly refer to the projection prints, since releasing a film on DVD or Blue-ray requires digitisation, grading, compression and duplication, with all the transitions this implies [Figs 0.8–0.9].

Figs 0.1 and 0.2 Example of colour differences between two Technicolor V projection prints from the film *Vertigo* (USA 1958, Alfred Hitchcock).

Fig. 0.1 *Vertigo* (USA 1958, Alfred Hitchcock) Credit: Harvard Film Archive, item no. 246. HDR photograph by Barbara Flueckiger.

Fig. 0.2 *Vertigo* (USA 1958, Alfred Hitchcock) Credit: Library of Congress. Photographs of the Technicolor V dye-transfer safety print by Barbara Flueckiger.

17 See: http://www.dvdbeaver.com/film5/blu-ray_reviews_68/black_sabbath_blu-ray.htm

Figs 0.3 and 0.4 Example of colour differences between two Technicolor 16mm prints of the film *Glas* (NDL 1958, Bert Haanstra).

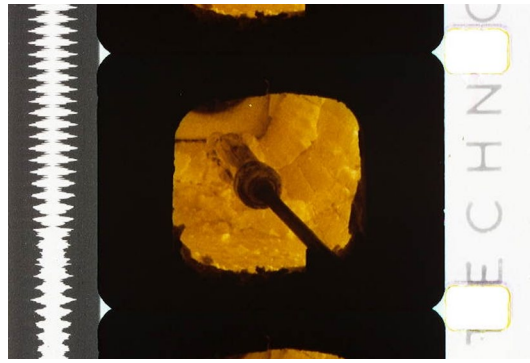

Fig. 0.3 *Glas* (NDL 1958, Bert Haanstra) Credit: Academy Film Archive. Photographs of the Technicolor dye-transfer safety prints (3161-13-1) by Michelle Beutler.

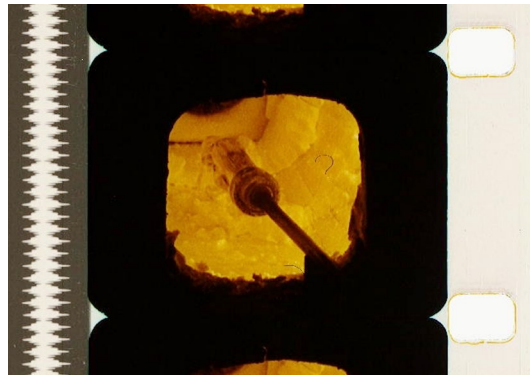

Fig. 0.4 *Glas* (NDL 1958, Bert Haanstra) Credit: Filmarchief: Groningen University. Photographs of the Technicolor dye transfer 16mm print by Bregt Lameris.

Figs 0.5, 0.6 and 0.7 Example of colours differences between Kodachrome camera material (0.5) and projection prints made with various types of 16mm duplication materials (0.6 and 0.7).

Fig. 0.5 *Hallucinations: Images du monde visionnaire* (FRA 1963, Éric Duvivier). Credit: Image'Est. Photographs of the Kodachrome II camera material by Bregt Lameris.

Fig. 0.6 *Hallucinations: Images du monde visionnaire* (FRA 1963, Éric Duvivier). Credit: Image'Est. Photographs of undated Eastman Reversal Color Print Film Type 5269 / 7387 projection print by Bregt Lameris.

Fig. 0.7 *Hallucinations: Images du monde visionnaire* (FRA 1963, Éric Duvivier). Credit: Image'Est. Photographs of the 1985 Gevachrome print by Bregt Lameris.

Figs 0.8 and 0.9 Example of different technologies used for the projection prints and DVD releases of a same film title resulting in colour differences.

Fig. 0.8 *I tre volti della paura* (ITA 1963, Mario Bava), Blue-ray Kino–European version (2013)–Region 'A', http://www.dvdbeaver.com/film5/blu-ray_reviews_68/black_sabbath_blu-ray.htm

Fig. 0.9 *I tre volti della paura* (ITA 1963, Mario Bava), Blue-ray Arrow AIP (2013) -Region 'B', http://www.dvdbeaver.com/film5/blu-ray_rev iews_68/black_sabbath_blu-ray.htm

This brings us to another problem which concerns films that have been translated from archival prints to other, sometimes more accessible formats, such as new projection prints, restorations, distribution duplicates, video-registrations released on VHS, digitisations, DCPs, DVDs, Blue ray, 16mm film library prints, 8mm home movies, and so on. All these various objects have their own (colour) materiality, including digitally coded information translated into pixels and electronic signals; colour information coded into black, white and grey photographic material; and dye clouds and dyes added to the film material. In fact, it could be argued that all these various copies together form the 'original' film title. As Paolo Cherchi Usai (2000: 160) claims, '[t]he "original" version of a film is a multiple object fragmented into a number of different entities equal to the number of surviving copies'. Hence, the 'original' should exist somewhere between all these materialisations as a 'common denominator'.

However, the third approach also influences the formation of the film as an imaginary or conceptual object (as in the first approach). Films do not become cinema

until they are projected, seen, and felt. This brings us to the 'film as performance', which is closely connected to what Giovanna Fossati, in *From Grain to Pixel*, calls 'film as *dispositif*', referring to the fact that films are projected, played or screened with various technologies (VCR, DVD player, DCP, film projector, computer, tablet or mobile phone) in various spaces (screening rooms, living rooms, schools, museums, trains or buses). The technology used usually influences the appearance of a film, including its colouring. The white of the projector lights can vary from a warm yellowish colour to more of a colder bluish one, with the according deviations in the colours projected on the screen (a blue on the film material, for example, can turn green on the screen in the case of a more yellowish projection light). The texture and colour of screens influence how the coloured movements are reflected back to the audience. In the case of 'projecting' screens, such as computers, tablets, mobile phones, or any other modern LED device, the colour rendition can also vary depending on the screen's configurations and settings. As Fossati (2009: 127) explains, this implies that 'a film identity becomes a variable that realizes itself only within a *dispositif*, a situation [...] where the film meets its user'. Not only do the material objects that define a film work differ from one another, but so does each presentation of it. Thus, we can infer that the 'original' colours of a film become even less knowable since we also need to consider all these variations in the *dispositifs*.

To render the analyses of a larger film corpus slightly more comparable, we need to limit the *dispositif* influences of the present moment as much as possible. First of all, it is crucial to use similar circumstances for each of the analyses. For the *FilmColors* project, we ripped the DVDs with the same parameters so we could play them in the VLC player on our Apple computers. Also, we all used BenQ screens, which were calibrated with an X-Rite i1 Display Calibration Colorimeter. Finally, one of the team members constructed small black cardboard boxes with which to cover our workspaces and protect them from light that would otherwise interfere with the colours on our screens. These interventions helped keep the analyses' *dispositif* as neutral as possible.

Figs 0.10 and 0.11 The neon light in *Vertigo* (USA 1958, Alfred Hitchcock) appears blue in the Technicolor projection print and green on the DVD.

Fig. 0.10 *Vertigo* (USA 1958, Alfred Hitchcock). Credit: Academy Film Archive. Photographs of the Technicolor V dye-transfer safety print by Barbara Flueckiger.

Fig. 0.11 *Vertigo* (USA 1958, Alfred Hitchcock) DVD 1999 Universal Studios restoration 1996 by Robert Harris and James Katz

It follows from all this that if we wish to conduct an analysis of patterns in relation to felt emotions in colour cinema, we cannot rely on the detailed refinements of shades and hues in the moving colours on our present-day screens, not least because we usually rely on one specific material manifestation of a film work. This one object should, therefore, be investigated for those facets that define the 'common denominator'. For the *FilmColors* project, we occasionally also captured the archival prints with the Reproset method, allowing us to compare various prints with one another and the DVD or Blu-ray used for the detailed analysis. Such difference in colour between an archival print and a DVD is clearly visible in this hotel room kissing scene from Hitchcock's *Vertigo*: what appears as a green background on the DVD turns out to be a clear blue on the dye-transfer prints in the Harvard and Academy film archives [Figs 0.10–0.11]. These comparisons gave us a better idea of which of the film colours' characteristics could be regarded as common denominators.

This common denominator is most clearly found in the mutual relations between the colours in the film images. Colour contrasts such as saturation, hue, cold-warm and dark-light are part of the common denominator. The stronger the contrast, the more chance that it will be visible in all the material objects that together form the film work and will remain visible in every past, present and future *dispositif* or performance. Another important parameter we can expect to be retained in all the various materialisations and performances of the film is the number of hues used in the film image. Hence, monochrome, hyperchromic or restrictive colour schemes remain recognisable in all the various prints and can also be considered part of the common denominator. The precise hues, however, often vary from print to print, as do the grey tones, which are unreliable because they are susceptible to the workings of simultaneous contrast (see Chapter Four).

We can now add another, final approach to those already mentioned: namely, that of 'film as experience'. This is an essential element for a book that is concerned with interrogating the relationship of the history of emotions, feelings and embodiment to colour film. It also relates to Fossati's (2009) shift of the conception of archival films as an index or 'realism machine' towards what she calls the 'film/mind'—that is, from the idea of archival and historical films as prints and 'originals' that represent the (film-)historical past towards film as it was and is perceived and experienced. To substantiate this, Fossati (2009: 114) quotes Deleuze as stating, '[c]inema not only puts movement in the image, it also puts movement in the mind. [....] The brain is the screen'. Colour film works in a similar way. Cinema not only puts moving colour in the image, it also puts it in the mind: it projects and reflects coloured light into the eyes and brains of the viewers, where the light is processed into moving colours or coloured movements.[18] When approaching archival films from this perspective, the question is no longer what the 'original' film looked like but what effect a

18 For a more in-depth discussion on colour and the mind, see Part I.

film has or had on its audience. Fossati explains this effect with the help of Metz's (1977) idea of the sensation of presence that a film creates. The perception of filmic movement is always in the now; it cannot be experienced as the 'has been there' but always produces a sense of 'there it is' in the viewer. On this level, the film/mind is historically fixed, which implies that our perception of movement as the present is probably deeply embedded in our biological hardware, as is the fact that we perceive colours trichromatically.

However, the experience of cinema may be historically immutable as far as the body's biology is concerned, but other embodied elements of this experience are subject to historical change—although they are constrained to some extent by the viewer's habitus (see Chapter One). So, although I agree with Fossati that the film/mind theory is of utmost importance and needs to be taken into account in any film analysis, nevertheless, for the purposes of this study, we need to go further than the embodied reactions evoked by cinema in general and move into more historical territory, if we are to better understand how a film (and its colours) can be positioned within the emotional context of the time. This should enable us to develop hypotheses on how the film might have been experienced by audiences at a particular time and in a particular cultural milieu.

Structure of the Book

In Chapter One of the book, you find an elaboration on the theoretical framework around emotions, feelings and film, and how we can study this from a historical perspective. To do this, I position the book within the traditions of affect theories, new film history, the history of emotions, and Braudel's ideas on temporalities in cultural history and put them in a historical perspective. The aim is to clarify the underlying theoretical constructs and the origins and uses of the main theoretical concepts this book is built on.

Following this theoretical framework, the book has three parts that each cover one of the various ways in which colour is connected to embodied experiences and feelings in colour theory, perception theory, and popular discourse.

Part I of the book is called 'Stirring up the Eye with Colour' and focuses on colour contrasts and how these were thought to 'stir up' the human organism starting with the eye. Chapter Two lays out a cultural history of the discourses on colour contrasts, from the creation of colour systems to physiological discussions on the eye and the retina, as well as the current knowledge of colour perception, the eye and the nervous system. Part of this history is that of physiological research of the retina, explaining the biological and discursive importance of colour contrasts in Western thought and ideas on colour perception and harmony.

Chapters Three and Four discuss the two main ways to juxtapose and combine (contrasting) colours, known as successive and simultaneous contrasts. Successive

contrasts are created through a rapid succession of contrasting colours, as is often the case in films through the principle of montage. Chapter Three mainly elaborates on two types of successive contrasts. One is extreme dark-light contrasts, which, at the time, were also used to create hypnotic states and imaginary colours in what was known as the Flicker Film. The other type is succeeding contrasting hues, which are complementary or almost complementary. Here, in a nutshell, an afterimage is created that enhances the strength of the following colour. These successive contrasts have an awakening effect, ensuring that the audience does not doze off in the cinema. By zooming in on the cinema of the period, the particularities and connotations that came with the use of these successive contrasts in cinema are made clear.

Simultaneous colour contrasts occur when one colour influences the perception of another colour because they are placed in close vicinity to each other in the same image. This produces instabilities, changes, and fluctuations in the appearances of colours in, for example, painting. During the 1950s and 1960s, there was a high interest in this phenomenon in art-school colour education, colour psychology, and the art movement known as op art or art-cinétique. Chapter Four elaborates on how these ideas and practices can be traced back to popular and art cinema of the period, either as an aesthetic trope or because of the op artworks on display in the pro-filmic space. In those cases where many op artworks are present in the film image, they make the simultaneous contrasts combined with moiré and other effects the core aesthetics of the film image.

Part II, 'Colour Psychologies', delves into the practical applications of colour control, psychology, and therapy. Colour was believed to influence, steer and discipline the human body, a tradition that dates back to the nineteenth century. Several practices emerged from this belief, such as using colour to guide and warn people and steer their behaviour, known as functional colours. Another practice was that of colour psychology, putting into practice beliefs on how colours elicit certain feelings and emotions and can guide attention.

Chapter Five reflects on the biopolitical belief, prevalent in modernity through to the 1950s, that colour profoundly influences the organism. At the time, colour advisors, colour consultants, and colour psychologists used and disseminated this dominant discourse. It was used to control and discipline human behaviour, including the film spectator.

Chapter Six delves into the use of coloured light in films during the 1950s and 1960s, which was strongly connected to the discourses discussed in Chapter Five. Coloured light was also believed to make the human body and its molecules vibrate. It was believed to have healing powers and influence moods. Deviant and non-diegetic uses of coloured light were also used to increase 'ostranenie' or atmospheres of strangeness. This practice is traced back to Nouvelle Vague films, that experimented with the effect of Verfremdung, but also in horror films such as the then very popular Giallo films with their estranging colour palettes. These developments of increasing uses of colour

to create strangeness are investigated for their correlation with the unleashing of colours during the investigation period.

Part III, 'Touching and Tasting in Colour', explores the intersection of colour, film and cross-modal perception, often called 'synaesthesia'. The introduction sets the stage by presenting the historical mid-twentieth-century discourses on the senses and synaesthesia, current knowledge on cross-modal and multisensorial perception, and its importance for film spectatorship concerning affect and feelings. Interesting is the idea that the biological and innate state of the human sensory system is one of connection, which is overlayed by scientific categorisations and separation of the senses. This increases the significance of cross-modal perception and emphasises the importance of its study in a book on colour and feelings in film. Chapters Seven and Eight then delve into the intriguing world of food and touch, exploring how colour and film are linked to these phenomena. They also investigate whether there is a correlation between the growing freedom in the use of colour and the increase in sensuous representation and the activation of the cross-modal systems during the 1960s.

Chapter Seven explores how the rise of colour in film during the 1950s and 1960s has influenced the representation of food and eating. Considering only the fact that we have an impressive palette of food dyes illustrates the strong connection between food and colour. Colour can increase and decrease our appetite and even produce a sensation of disgust, creating aversion towards certain food types. As a result, the way food is coloured can create profound affective reactions in the film spectator.

Chapter Eight pushes the idea of cross-modality by analysing touch and haptic mimicry in film, discussing textures and surfaces in relation to colour. It dives into the discussion of gender and colour, with a focus on tensions created in the representation of the female skin juxtaposed to coloured surfaces of various textures. The chapter ends with an elaboration of pornographic film as the ultimate 'body genre' and the way colour has slowly entered its domain.

Finally, a Coda called 'Hallucinating Colours' takes the reader one step further into the spectator's interior—that is, inside the brain—by discussing the phenomenon of purely subjective colours, their contextual background and their representation in films. In this closing chapter, that has its foundations in my article, 'Hallucinating Colours. Psychedelic Film, Technology, Aesthetics and Affect' (2019), I openly follow the Braudel-induced categorisation of historical time that is present throughout the entire book in less explicit ways. This shows once more the efficacy of the methodology, based on cultural history and the history of emotions, and rounds up the study of how colours and feeling interrelated in films of the 1950s and 1960s.

1. Feeling Film Colours: Theoretical Framework

Emotion, Subjectivity and Affect in Film Analysis

From its earliest days, cinema was seen as a medium that could represent not only subjective perspectives and emotions but also dreams, hallucinations and altered vision. For example, Hugo Münsterberg (1916: 112) wrote a chapter on emotions in his work *The Photoplay: A Psychological Study*, which opened with the words: 'To picture emotions must be the central aim of the photoplay'. And in the 1939 version of his essay 'The Work of Art', Walter Benjamin (2008 [1939]: 37–38) explained that the film camera can present reality in a way that is foreign to our '*normal* sense impressions', enabling a collective experience of the 'individual perceptions of the psychotic or the dreamer'. Maurice Merleau-Ponty (1966 [1948]), on the other hand, claimed in 'Le cinema et la nouvelle psychologie' that interior experiences are best represented not by attempting to reveal a character's 'interior landscape' (for example, the feeling of vertigo) but by showing the exteriorisation of that experience (for example, a body out of balance). He believed that cinema produces affects and emotions by showing the connection between a character and the world in an embodied way which can then be recognised by the viewer due to their own embodied experience of connection to the world (Merleau-Ponty, 1966 [1948]: 104).

However, the second half of the twentieth century saw a shift from a focus on the embodiment of the viewer towards neo-formalism, structuralism and semiotics, which increasingly focused on the film form as text. The emotional components of a film were analysed from a psychoanalytical perspective. Christian Metz (1977) is a clear example of this combination of structuralism, semiotics and psychoanalytic theory. For example, he turned to psychoanalysis to conceptualise the question of the viewer's identification with a film (Dymek and Lowy, 2018: 70): his aim was to use psychoanalytical tools to understand why we watch film. In this, his ideas were in line with those of Jean-Louis Baudry (1978), particularly in his seminal chapters on the viewer of classical Hollywood films in the 1970s, whom he describes as entering a state of regression that closely resembles the experience of the Freudian unconscious. This approach produced many interesting studies on the way the mechanisms of voyeurism are

 https://doi.org/10.11647/OBP.0380.01

related to power, including Laura Mulvey's work on the male gaze, which represented an important contribution to feminist film theory (1975). However, as Franziska Heller (2010: 33–34) explains, semiotics and psychoanalytical theory reduced perception for the most part to vision and the eye, emphasising the importance of concepts such as scopophilia and voyeurism, and neglected the role of the body in both perceiving and experiencing film.

We encounter a similar focus on the eye in the first edition of *Film Art* (Bordwell and Thompson, 1979), which became one of the most important sources for formal film analysis. In a paragraph headed 'Form and Feeling', the authors explain in a general way how emotions function in film. They make a distinction between the emotions represented in a film and those experienced by its audience, and explain that the latter is always the result of the entirety of the film form's elements and the full film text. They conclude that the relationship between the two types of emotions is rather complex and advise the film scholar to analyse as many elements of a film as possible so as to achieve a nuanced understanding of its functions and effects (Bordwell and Thompson, 1979: 32–34). Thus, they clearly separate the film text and what a viewer might 'feel'. This does not mean that Bordwell and Thompson exclude the spectator from their theories entirely; rather, their theoretical spectator is a structural prediction of how they might (or ought) to use the cues given in the film to cognitively puzzle out its meaning.

If the viewer's embodied potential is omitted, this creates a lacuna in our understanding of how film works. The viewer and the film are closely—almost organically—connected. For example, the fundamentals of film technology are predicated on knowledge of the biology of our perceptions. We can see this in the way trichromatic vision inspired the 'invention' of colour photography and cinematography, or the way camera movements express our automatic embodied reactions, fooling us into experiencing dizziness or muscle tension. Yet these embodied connections between film and viewer, implied in Münsterberg's, Benjamin's and Merleau-Ponty's psycho-physical/phenomenological writings on film, were only rarely included in semiotics and formalist film theory.

This is evident in a short paragraph in *Film Art* called 'The Subjective Shot', in which Bordwell and Thompson explain how film form can create an impression of subjectivity. Their main focus here is on the use of optical point-of-view shots. After giving a very brief historical overview, complemented by a series of examples, they end with the question of whether the point-of-view shot does indeed increase subjectivity, referencing contemporary film theorists such as Metz and François Truffaut, and conclude that the subject needs to be studied more seriously (Bordwell and Thompson, 1979: 147–48). Their focus on the point-of-view shot once again privileges the eye over the body. Even when discussing camera movements, which they claim 'provide several powerful cues for a convincing substitute movement', they quickly shift the attention

back to the eye instead of elaborating on how camera movements implicate the body in film spectatorship:

> Narratively subjective or not, the moving camera *eye*, the mobile framing of the shot, acts as a surrogate for our *eye* and our attention. Camera movement illustrates very well how the image frame defines our *view* of a scene. (Bordwell and Thompson, 1979: 123 [my emphasis])

In the second edition of *Film Art*, Bordwell and Thompson (1986: 94–95) added a paragraph called 'Depth of Story Information', referring to 'how "deeply" the plot plunges into the character's psychological states'. They consider the point-of-view shot or sound as strategies intended to create a greater degree of 'perceptual subjectivity'. Perceptual or mental subjectivity, they state, is created when the plot 'plunges' into a character's mind, revealing 'inner images' such as memories, fantasies, dreams or hallucinations. These parts of the text remained almost unchanged in subsequent editions of the book, and became predominant conceptual themes in the practice of film analysis.

Film Art has remained an influential resource, not only guiding the teaching of formal film analysis, but also determining the way it is used in research. Formal film analysis is thus embedded in Bordwell and Thompson's concepts, which have dominated the field since the late 1970s and early 1980s. Indeed, many of these concepts still work very well, which makes them a perfect starting point for the categories used by the film analysis tool VIAN. Nevertheless, if we wish to analyse the more embodied characteristics of emotions, subjectivity and affects in relation to film, they remain rather limited.

In the mid-1990s Murray Smith, taking Bordwell and Thompson's ideas as a starting point, introduced several useful concepts with which to analyse a film's 'structure of sympathy'. For example, in his article 'Altered States' (1994), Smith distinguishes 'sympathy', a feeling projected onto a character from the outside, from 'empathy', feeling *with* a character. He links this to Noël Carroll's distinction between 'a-central imagining', which he relates to sympathy, and 'central imagining', which is more connected to empathy (Smith, 1994: 38). Central imagining depends on stylistic forms such as emotional simulation, motor and affective mimicry, and the startle response (38–39). Smith focuses on affective mimicry, which he defines as 'our capacity to gauge the affective states of others through facial and bodily cues, rapidly and with little or no knowledge of context' (47). This allows us to mimic these cues as they are enacted on screen and thus intuitively identify with a film character's emotional state. He explains that the viewer is further placed in *alignment* with the characters when 'provided with visual and aural information more or less congruent with that available to [the] characters' (35). This is very similar to Bordwell and Thompson's (1986: 94–95) concept of 'perceptual subjectivity', created by the point-of-view shot or

sound, which is connected to the viewer's access to the character's actions, and to what they know and feel themselves.[1]

However, an increasing shift towards the embodied spectator occurred in media studies from the early 1990s onward, with the import of theoretical perspectives from phenomenology and those branches of philosophy concerned with the concept of 'affect', in particular the work of Gilles Deleuze and Félix Guattari.[2] Film scholars also began to theoretically separate the terms 'affect' and 'emotion'. Smith explains that this distinction is based on the following ideas borrowed from emotion theory:

> [E]motions proper have a cognitive component and an affective component; fear, for example, is characterized as a judgment or 'cognition' that something endangers the interests of the subject, held in an intentional relationship with a state of affective arousal in the subject. Different emotions are thus discriminable according to the specific cognitive component, or identificatory evaluation. (Smith, 1994: 42)

In their introduction to the 'Emotions' issue of the journal *Necsus*, Jens Eder, Julian Hanich and Jane Stadler (2019: 94) explain that these scholars saw affects as 'physical-neuronal precursors of conscious emotions that are felt but not yet cognitively classified'. This dichotomy between affect and emotion is an analytical difference. According to this perspective, the notion of affect as a more embodied and less cognitive instance remains a useful way to differentiate between various states in the emotional process: affect occurs at a moment that can and will be corrected and/or influenced later by the cognitive part of the process. However, the idea of this dichotomy as a direct description of physiological, emotional and affective processes was increasingly subject to criticism, including in the realm of film and media studies.

In the early 1990s, Vivian Sobchack published *The Address of the Eye* (1992), which reintroduced phenomenological thinking into film theory. Sobchack activated an interest in the audience's embodied (pre-reflective) reactions that went beyond Bordwell and Thompson's cognitive approach. She refers in her book to Merleau-Ponty's writings, explaining that perception and expression are not separate but part of our existence as a whole:

> [They exist] in the simultaneity of subjective embodiment and objective enworldedness [sic]. Using the term *chiasmus* to name this reversibility ('the ultimate truth'), Merleau-Ponty characterizes it as that 'unique space which separates and reunites, which sustains every cohesion.' That unique space is both the lived-body and the experienced world. (Sobchack, 1992: 4)

1 As such it is related to Gérard Genette's narratological concept of 'focalisation' and what Bordwell and Thompson described as 'depth of knowledge'.

2 Scholars engaging in this work include Vivian Sobchack (1992, 2004); Steven Shaviro (1993); Torben Grodal (1997); Laura Marks (2000, 2002); Jennifer Barker (2009); Carl Plantinga (2009); Julian Hanich (2010, 2018); Franziska Heller (2010); Jens Eder (2016); Eugenie Brinkema (2014); Linda Williams (1989); Jonathan Crary (1992) and Steven Shaviro (1993).

This intertwinement of the lived-body and the experienced is the foundation of all phenomenological thinking in film studies, which is in many ways characterised by the reflection upon how the two occupants of that 'unique space' are related, connected, or united. Jennifer Barker has even gone so far as to bring film and the human body closely together using the various types of the flesh as metaphors for the film projection. As a result, when reading her book *The Tactile Eye* (2009), one can imagine the feel of the film experience as one very close to the experience of the own flesh.

The increasing realisation that the embodied spectator is pivotal to an understanding of film as a performance art changed the field of film studies. Adopting Merleau-Ponty's idea that we need to describe the experience of the thing and not the thing itself, film scholars began to build a conceptual framework that allowed for the inclusion of embodied, pre-reflective reactions and emotions in film analytical practice. A pioneer in this domain was Ed Tan, author of *Emotion and the Structure of Narrative Film. Film as an Emotion Machine* (1996). In this work, he distinguishes between two types of film experience: the 'experience fiction' and the 'experience artefact'. Whereas the first type of experience might give a viewer a feeling of 'safety' and 'imaginary sojourn' in the fictional world of the film, the second type refers to the experience of the artefact, which influences the appreciation of the film as an object (35–36). Although Tan does not say in so many words that the 'experience artefact' is an embodied reaction to the film's form, he does refer to it as aesthetic emotion. He describes this as '[...] the aesthetic emotion that flows from the formal characteristics of a work of art, as opposed to its contents' (Tan, 1996: 34).

Carl Plantinga (2009: 114) has introduced a series of concepts with which to analyse these embodied ways of addressing the viewer's 'more or less universal perceptual skills and in other cases skills that are socially dependent but also relatively direct and automatic, that is, not mediated by language or conscious thought'. Films that particularly address the spectator in this way are what Linda Williams categorised as body genre films or texts with '[...] a sense of over-involvement in sensation and emotion' (Williams, 1991: 5). The most poignant examples of the body genres to Williams are horror, pornography and melodrama. Indeed, earlier studies of film and cinema that took embodiment into account were generally focused on pornography and horror (Williams, 1989; Carroll, 1990). Still, as Plantinga rightly claims, 'all films appeal to the corporeality of the viewer'.

Plantinga uses the term 'direct affect' to describe viewers' automatic, pre-reflective responses to what they see on the silver screen, be it movements, sounds, colours, textures or places. In addition, he argues that the cinema *dispositif*, as introduced by Baudry (1975, 1978) and further developed by Metz (1977, 1995), is in fact designed to enable such direct and automated responses optimally. A powerful and much-used form of direct affect is the 'startle effect', which Plantinga (2009: 118) describes as 'a response to any sudden and intense stimulus such as a loud noise or a potentially threatening sudden movement'. Examples of these visceral reactions are a rapid blinking

of the eyes, jumpy or jerky movements, and cries or shrieks. 'Technical movements', produced with the help of camera movements, editing or special effects, also create embodied effects in the audience. Sobchack (1993) refers to this when discussing Merleau-Ponty's *chiasmus* as a space connecting and separating the lived-body and the experienced world. The viewer's body resonates with the filmic movement, be it a fluid camera movement or jerky editing that rhythmically cuts up time and space. It is this embodied connection that Heller (2010) discusses in her work on fluidity in film, noting that it creates strong physiological effects, such as dizziness, nausea and the feeling of movement, through what is known as 'cross-modal perception' (see Part III). The movement of objects or figures in the diegesis can also affect the spectator's embodiment: for example, objects or characters moving away from the camera create affective responses that differ from those created by objects or characters moving towards it (Plantinga, 2009: 120).

A further concept introduced by Plantinga is mimicry, which is related to the fact that the viewer hears and sees the physical bodies of the film's characters. This concept is based on the idea that humans communicate emotions through body language (facial expression, posture and gesture), and that these emotions are recognisable as such when actors replicate the accompanying body language on the silver screen. The embodied recognition of emotions through body language or the timbre of the voice is called 'motor mimicry', which Plantinga (2009: 124) defines as 'the tendency of an observer to outwardly mimic the facial and body movements of another person'. What is interesting here is that motor mimicry can lead to 'affective mimicry' and 'emotional contagion', which, as Plantinga explains, happens when we laugh on hearing others laugh or cry when seeing tears roll down another's face. Plantinga does not explain affective mimicry in detail; however, based on Smith's description (above), it does not seem so different from emotional contagion. Both concepts describe more or less automatic and unconscious (affective) reactions to what we see and hear real people or characters in a film doing or saying (Plantinga, 2009: 127). As a result, we not only mimic expressions, postures and gestures, we also experience them as we perceive them. Plantinga refers to Béla Balász, who explained this phenomenon in relation to film in 1924 in *Der sichtbare Mensch*.[3] As I discuss later, direct affect and motor mimicry are both strongly connected to cross-modal perception (Part III).

To avoid confusion, the terms 'emotional contagion' and 'motor mimicry' were included as keywords in VIAN, but not 'affective mimicry', which seemed too close to motor mimicry as a concept and too similar to emotional contagion in meaning. Motor mimicry was used for the more unconscious, affective and embodied processes, while emotional contagion followed motor mimicry as a more emotional reaction to the unconscious reflex underlying laughter or tears.

3 Another keyword used in VIAN is 'mimicry'. However, I do not work with this particular concept here.

Similar phenomena have been studied from the perspective of neuroscience and neurophysiology. In 1992, at the University of Parma, neurophysiologists discovered what in 1996 would become known as mirror neurons in macaques (Pellegrino, et al. 1992; Rizzolatti et al., 1996). Public opinion received their discovery as a revolution, and mirror neurons were seen as the answer to many questions about civilisation and social behaviour. Research, however, showed that mirror neurons were much more limited and did not provide an understanding of every remaining question in psychology. Neuroscientific research provided proof of the role of neurons in (low-level) action understanding and imitation, defined as 'copying the topography of body movement' (Heyes and Catmur, 2022).

This renewed a neuroscientific interest in an embodied approach to imitation and simulation—for example, in the work of Rizzolatti's colleague Vittorio Gallese (Gallese, 2016). Gallese started to study the 'aesthetic experience' from an experimental perspective, using physiological methods to study the sensorimotor and affective features of perceptual experiences. However, instead of reducing this complex phenomenon to (mirror) neurons only, he now approaches it from a manifold perspective, connecting perception, action, and cognition to sociocultural influences in what he calls the 'mind-body'. Turning to phenomenology and 'embodied cognition', he searches for new insights into the relationship between the body and the mind. Recently, together with Michele Guerra, he also started studying the movie spectator and the experience of film as an embodied experience (Gallese and Guerra, 2022).

The History of Emotions

Many studies on affect and emotion in cinema tend to adopt a mainly ahistorical approach.[4] This is problematic because, like every other element of culture, visual representations (including representations of feelings, affects and emotions) are historically determined. However, this approach basically follows the long-dominant idea in psychology that emotions are fixed, biologically innate phenomena,[5] a perspective propagated by psychologist Silvan S. Tomkins during the 1960s and currently upheld by his follower Paul Ekman (Tomkins, 1962; Ekman and Rosenberg, 2005; Leys, 2011: 437). Ekman is still an influential figure: he works as a trainer and consultant for some of the most powerful international organisations and has

4 Eugenie Brinkema (2014) does give general historical overviews of the concept at the beginning of each of her chapters in *The Forms of the Affects*. However, the film analyses themselves are rather ahistorical in nature.

5 The cognitive method also takes an ahistorical perspective, since the way in which our cognition works is considered to be an unchanging, innate particularity of the human species. Notable exceptions to this way of thinking are Maarten Coëgnarts and Peter Kravanja (2014), who distinguish the physiological from the cultural in relation to cognition and cinema in their book *Embodied Cognition and Cinema.*

recently developed a computer program that supposedly reads emotions from digital representations of the face.[6]

Nevertheless, this more or less ahistorical approach to affect and emotions has been challenged over the past decade, particularly in the field of the history of emotions.[7] Theoretically, historians of emotions consider them to be biologically, culturally and historically flexible and subject to change (Stearns and Stearns, 1986; Reddy, 2002; Rosenwein, 2006; Scheer, 2012; Gammerl, 2012; Plamper, 2015; Boddice, 2018). They argue that emotions are not simply biological and free of cultural influences, but are learned embodied practices that (may) have become automatic. They are, as cultural scientist Monique Scheer (2012: 202) states in her groundbreaking article 'Are Emotions a Kind of Practice?', 'habits emerging where bodily capacities and cultural requirements meet'. These learned automatisms can affect the materiality of the human body, such as the muscles, nerves and bones, as well as the brain tissue.[8] Hence, historians of emotions endorse the concept of neurological plasticity, which entails re-evaluating essentialist and reductionist ideas of the human brain. This stance has been validated by the new insights emerging from the neurosciences (much of the recent research in this discipline is focused on the brain's plasticity), enhancing our understanding of the interconnections between the world we live in and our embodied ways of experiencing and expressing emotions.[9]

Aligned with these ideas, Rob Boddice calls emotions 'biocultural' phenomena, meaning that they combine the biological and the cultural (Boddice, 2018: 69). The term 'biocultural', however, should be used with care due to manyfold and varied uses in different disciplines. For example, the term was used in anthropology for studies concerning biological and cultural influences on human health and well-being, and biocultural diversity studies connections between biological, cultural and linguistic diversities (Franco, 2022: 2 of 10). Because of the confusion that these very different uses of the same concept might produce, Franco suggests no longer using the term

6 See: https://www.paulekman.com/

7 The idea that emotions are historically determined can be traced back to the early twentieth century. For example, in France, Lucien Febvre of the Annales school considered emotions to be historical, and the work of Norbert Elias could be seen as a history of emotions (Boddice, 2018: 27–29). Emotions also found their way as a topic of research into the historical discipline in the 1980s with the work of Susan and Peter Stearns: first, in their study on the history of anger (1986), and two years later, in their study of emotion and social change (1988). This is usually seen as the starting point of what is now known as the 'history of emotions'. The history of emotions has gained in scholarly influence over the past decades: for example, centres for emotion studies have been established, including the History of Emotions Research Center at the Max Planck Institute for Human Development in Berlin (2007), The Queen Mary Centre for the History of Emotions in London (2008), and the interdisciplinary platform ACCESS at the Free University of Amsterdam.

8 Scheer substantiates this with several references to neuroscientific studies which currently consider plasticity of the brain as a key focus of research into the connections between the world we live in and our embodied ways of experiencing and expressing emotions.

9 Ruth Leys (2011) contends that by defining affects as embodied and emotions as cognitive, affect theorists have reintroduced Cartesian dualistic logic into the debate through the backdoor.

'biocultural' to study biological and cultural diversity, but instead turning to the concept of 'eco-cultural diversity' (Franco, 2022: 5 of 10).

In the history of emotions, as described and analysed by Rob Boddice, the concept of 'biocultural' explains how emotions can be studied as historical practices. Boddice writes:

> When we interact, emotionally communicate or emote in our cultural context, we are practicing emotional behaviour that is learnt, situated, shared and, when emotive processes work well, feels *as if* it is natural. (Boddice, 2018: 124)

This notion of biocultural could also shed some light on the constructed dichotomy between emotions and affects, and their separation into two individual entities, with affect characterised as the more automatic and embodied (biological) reaction to stimuli and emotion as the (conscious) cognitive act of processing these stimuli (cultural). Interestingly, the late-nineteenth-century philosopher John Dewey, who studied experience as both a concept and practice, had already criticised this way of thinking. According to him, this split between sensation and idea (or affect and emotion) was closely connected to the Cartesian dualism of body and soul: 'The older dualism between sensation and idea is repeated in the current dualism of peripheral and central structures and functions; the older dualism of body and soul finds a distinct echo of stimulus and response' (Dewey, 1896: 257–58). Scheer (2012: 206–07) has taken up Dewey's argument, proposing that emotions are actually circular processes that involve the physiological, intellectual, cognitive, neurological and motor functions of the body. Consequently, affects can only theoretically be separated from emotions. According to this perspective, emotions are embodied processes, combining cognitive *and* immediate affective processes that are difficult—if not impossible—to untangle; hence, the biological and the cultural are two inseparable elements of an emotional, biocultural practice.

In 2011, film scholar Tarja Laine redefined the concepts of emotion and affect in her book *Feeling Cinema: Emotional Dynamics in Film Studies*, in which she describes affects as an implicit quality of the stream of emotion. Laine (2011: 2) considers cinematic emotion to be 'an umbrella term [covering] affective appraisals and emotional evaluations'.[10] John Deigh, in *The Oxford Handbook of Philosophy of Emotion* (2009), also presents affect as part of the emotional process. Instead of separating affects from emotions, Deigh tells us that the study of emotions in general has been divided into two more specific categories:

> On one, emotions are conceived of as principally affective states. The concept on which this line proceeds is feeling-centered. On the other, emotions are conceived of

10 Interestingly, Laine describes this umbrella term using the 'old' ideas of unconscious affects as opposed to the evaluative emotions. This underlines the difficulty of redefining these concepts without referring to their 'old' meanings, which have been etched into the consciousness of media scholars.

> as principally cognitive states. The concept on which this line proceeds is thought-centered. (Deigh, 2009)[11]

Laine and Scheer see emotions as embodied acts that include the affective realm. From this point of view, it is interesting to include Deigh's 'first line' of emotion research, conceiving of emotions as affective and more feeling-centred states. However, this raises another question: how can the concept 'feeling' be usefully defined?

In their article 'Affect—or Feeling (After Leys)', John Cromby and Martin Willis (2016) give an overview of the ways in which 'feeling' has been conceived and defined. Their first reference is to Susanne Langer's work, which argues that feeling is more of an activity or a process than something we 'have'. Feeling as a concept is a verbal noun: 'to have a feeling' implies 'feeling something' (Langer, 1967: 20). This corresponds with Scheer's view of emotions as a kind of practice. 'Doing' emotions in this sense corresponds to the understanding of 'feeling' as an act of the dynamic body:

> [F]eeling is not simply the same as affect or emotion [...] it also includes the felt aspects of many other processes: both those we conventionally describe as embodied or affective, and those we conventionally categorise as mental or cognitive. Its dynamics therefore incorporate all of the intensities and valences attributed to affect within the affective turn, but without erecting boundaries between these and other aspects of experience. (Cromby and Willis, 2016: 485)

Therefore, we can conclude that feeling has connotations or aspects similar to Scheer's and Laine's redefinition of emotions.

Colour can strike us in similar ways to affect or emotion (feelings). In 1956, for example, psychologist Rudolf Arnheim wrote:

> Schachtel [...] has pointed out that the experience of color resembles that of affect or emotion. In both cases we tend to be passive receivers of stimulation. An emotion is not the product of the actively organizing mind. [...] It strikes us as color does. (Arnheim, 1956: 274)

This idea is echoed by Cromby and Willis (2016: 484) in their assertion that the connection between feelings and perception is an embodied practice: there can be no human experience without the body because '[w]e see with our eyes, taste with our tongue, smell with our nose, touch with our skin, and so forth'. Colour perception is likewise an embodied process that takes place in the eye, the nervous system and the brain (Hurlbert, 2013). So, even before we begin to think about colour as a sensuous medium in a more metaphorical way, we must first acknowledge it as embodied and thus sensuous in a very literal way.

11 See: https://www.oxfordhandbooks.com/view/10.1093/oxfordhb/9780199235018.001.0001/oxfordhb-9780199235018-e-2

Besides the fact that we cannot feel without our senses, there are other similarities between feeling-centred emotions and colour perception. For example, as with feeling-centred emotions, colour perception involves a circular process that includes the senses, brain and neurons, cognition and intellect. Furthermore, sensuous perception has also been recognised as culturally malleable, rather than biologically fixed. Constance Classen's *Worlds of Sense: Exploring the Senses in History and Across Cultures* (1993) is an early example of a study confirming the flexibility of sensuous perception.[12]

The body is neurologically plastic, and can be influenced by experience and training. Thus, feeling-centred emotion and the experience of colour are embodied phenomena partly subject to historical and cultural change. Laura Marks (2000: 22) introduced this idea into film studies with her book *The Skin of Film*, in which she discusses the possibility that the senses can learn and memorise, and thus become 'vehicles for cultural knowledge'. On the one hand, this implies that the connections between colours and emotions are also fluid, and we can, therefore, formulate hypotheses that historicise these embodied, corporeal processes. On the other hand, however, it cannot be denied that the colours produced in our minds as a result of brain activity are constrained by our bodies' slowly changing biological realities. Cones in the retina of the eye, for example, are only sensitive to certain light frequencies, which translate into certain colours that combine to create further colours. These frequencies are limited to a wavelength range of 380–780 nm. Both the experiences of feeling-centred emotions and of colour perception are subject to change at differing paces, and these changes in historical perceptions problematise the task of researching colour in film as a sensuous, embodied phenomenon.

Layers of Embodied History and Colour Film

From the 1980s on, film historiography began to be dominated by what is now known as 'new film history' and 'media archaeology', which aimed to avoid the old chronological, teleological way of writing film history. This resulted in film historical studies focusing on shorter periods, such as the popular period of silent cinema (1895-ca.1930) or the even shorter period of the 'cinema of attractions' (1895–1914). In media archaeology, reflections on historical time were based on Michel Foucault's archaeological approach to history. In addition to his ideas on power and discourse, Foucault also reflected on

12 Classen illustrates this insight with the nineteenth-century story of Kaspar Hauser, which she considers to be a very clear example of the flexibility of sensuous perception. Hauser apparently grew up in a dark cell in complete isolation until he was discovered at the age of 16. It appeared that his senses had developed quite differently to those of people who grow up in a 'normal' social environment. He had very acute hearing and his eyesight was highly developed for seeing in the dark, whereas in daylight, it was poor and 'a summer landscape appeared a repulsive blur of colours to him' (Classen, 1993: 41). However, after he was reintegrated into society, his senses readapted and the way he perceived the world changed. Classen's conclusion is that our senses develop in various ways, depending on the surroundings and the context.

historical time and periodisation, integrating the idea of ruptures and discontinuities into historical research, distinct from the modernist teleological idea of history as a continuous flow towards perfection.

Foucault's ideas on temporality in historiography are laid out in *Les mots et les choses* (1966), *Archéologie du savoir* (1969) and *L'ordre du discours* (1971). In these works, he attempts to define and structure the way meaning and knowledge is produced on various levels and within different social groups by introducing a series of concepts such as the 'episteme', 'discourse' and 'discursive formations'. An episteme is a slowly changing constellation of discourses that 'defines the conditions of possibility of all knowledge, whether expressed in a theory or silently invested in practice' (Foucault, 1970 [1966]: 167). For example, up to around 1800, the episteme in Western culture was dominated by the idea that human perception was mechanical and objective. Siegfried Zielinski (2003: 164) calls this the episteme of the Cartesian 'objective' observer, who is positioned outside the observed in a way that is comparable to a camera obscura, whose perspective emanates from a single, mathematically definable point.

However, an epistemic shift took place around 1800, towards the idea that knowledge production is largely subjective. This change can be traced back to Immanuel Kant's conceptualisation of transcendental idealism in *Kritik der reinen Vernunft* (1781): all knowledge of the empirical world, filled with '*Dinge an sich*' ('things in themselves'), is and can only be produced by the perceiving and categorising subject structuring experiences and perceptions (Leezenberg, 2007: 114).[13] Within the philosophy, thinkers such as René Descartes, Robert Boyle and John Lock also already discussed the nature of colour: did it exist as a phenomenon of the physical world, as a production of the mind, or as a combination of the two (Rossi, 2019: 5)? Interestingly, the distinctions between these epistemes of knowledge production are often illustrated by their different approaches to colour. The first episteme—characterised by the belief that the world can be known in an absolute and objective way—is said to mirror the Newtonian scientific approach to investigating colour as light. Isaac Newton defined colour through his theory of light, using mathematics to explain its existence as wavelengths in real life. Then, during the nineteenth century, the focus shifted more towards the perceiving subject, and the idea of colour perception came to the fore in studies by, for example, Thomas Young (1802), Johann Wolfgang von Goethe (1810), Arthur Schopenhauer (1816) and Michel Eugène Chevreul (1839).

This approach towards the study of colours as a subjective experience, created by and within the human body, bled into more spiritual or psychological assumptions about colour. Goethe was the master of this discourse, arguing that

13 Ironically, Foucault's episteme is itself representative of these structures that constrain the way knowledge is produced by the transcendental subject, indicating that Foucault's own ideas on knowledge production could not have been shaped within the context of any other Western episteme.

colour and emotions were physiologically connected.[14] This idea was taken up by the anthroposophist and founder of the Waldorf schools, Rudolf Steiner, in his lectures on colour ('Das Wesen der Farben') at the beginning of the twentieth century, as well as by those who used colour for more commercial purposes, such as Matthew Luckiesh and Loyd A. Jones, who a priori presumed that colour perception influenced the experiencing of emotions (Luckiesh, 1918; Jones and Townsend, 1925; Jones, 1929). It was also widely disseminated by 'colour consultant' Faber Birren (1950), who did not shy away from using colour in a highly commercial way; he gratefully adopted the pseudo-scientific discourse and continued to spread the idea that colours were connected to specific emotions or affects. Even now, a quick Google search on the subject will turn up numerous websites discussing the connection between colour and emotions, moods, feelings and behaviour. At the beginning of the twentieth century, this more immaterial discourse resonated with the scientific writings of such figures as psychologists Hugo Münsterberg (1916) and Leonard Troland (1927), both working at Harvard, who assumed that colour introduced atmosphere and mood into a film. In fact, we can safely state that this discourse, which included beliefs in colour psychology, chromotherapy and the healing powers of colours, is still present in our Western way of thinking. These connections between colours and emotions are often presented as if they were innate and unchangeable; however, they are, in fact, part of the modernist episteme that we (partially) continue to live in, and as such, are still changing and developing, albeit slowly.[15]

As we have seen, media archaeologists, who place themselves within the Foucauldian tradition, think of time in relation to epistemes, discursive constructions and discourses that are defined by the constraints of the research question. When exploring the way in which colours and feelings were defined and perceived during a particular moment in film history, it is imperative to focus on how these ideas about feelings, colour, and film constrain the distinctions of time and periodisation. To approach this problem, I build on the work of cultural historian Fernand Braudel of the French Annales School. In his acclaimed three-part work, *La Méditerranée et le monde méditerranéen à l'époque de Philippe II* (1949–1966), Braudel introduced the concept of a '*pluralité des durée*s' in historical time. Each part (or book) describes and analyses a specific temporal dimension in the history of the Mediterranean. I use these ideas as a template for my study of affect and colour in film, introducing a similar but slightly modified distinction between historical temporalities.

The first temporal layer Braudel defines is that of the almost unchanging (quasi-immobile) milieu. In his study of the Mediterranean, this is related to nature and the way natural environments influence human behaviour (Braudel, 1990 [1949]: 16).

14 More specifically, in the part 'Didaktischer Teil. Sechste Abteilung: Sinnlich-sittliche Wirkung der Farbe'.

15 In his book *Moving Colors*, Joshua Yumibe (2012: 19) confirms this when he states that in modernism, including in mass culture and cinema, colour 'has been understood to be significantly sensuous in nature'.

When transferred to the level of the sensuous and embodied experience of cinema, this historical layer can logically be related to the physical structure or biology of the human body and its nervous system. The idea of taking into consideration the role of the quasi-immobile infrastructure of the body is not new to film studies. For example, when Plantinga (2009: 117) explains the concept 'direct affect', referring to the automatic and pre-reflective reactions of spectators, he adds that these reactions are partly rooted in 'natural perceptual responses that have developed over long periods of human history'. In other words, these more physiological reactions change at a quasi-immobile pace.

In the case of colour, the clearest example of such a quasi-immobile factor can be found in the retina and its photoreceptors that both enable and constrain colour vision. As already mentioned, the human retina is sensitive to light frequencies limited to a wavelength range of 380–780 nm. In addition to its overall sensitivity range, the retina also contains three types of cones, each corresponding to peaks in sensitivity in the blue, red and green colour ranges. This trichromacy is one of the quasi-immobile biological constraints determining human colour vision's potential.[16] An interesting question is the way in which the biological limits of the human body surface in cultural forms and objects, and whether the manifestations of the quasi-immobile emerge under the influence of the contemporary state of knowledge about these biological constraints and possibilities at a particular moment in time (see the introduction to Part I for more detailed information on the biology of the retina).

The second temporal layer concerns cultural contexts. Braudel (1990 [1949]: 17) defines this as the history of groups and groupings, which is characterised by a slow rhythm ('lentement rythmée') of change. These slowly changing cultural and discursive histories are pivotal to a study such as this one, dedicated to investigating the relation of feeling-centred emotions to colour in film. For example, Plantinga states that the aforementioned 'direct affects' are not only biological and innate but are also steered by social conventions and cultural constraints.[17] It is precisely the incorporation of this cultural layer as 'second nature' that enables these 'direct affects' or 'automations' at a physiological level, or at the level that sociologist Pierre Bourdieu called the 'habitus'. Scheer introduces the concept of habitus as a theoretical anchor in the history of emotions, bringing the cultural context and the body together as an

16 The biology of human colour vision has not always been trichromatic. Rather, the human retina has slowly evolved from dichromatic vision. The dichromatic retina is believed to have had two types of cones, one sensitive to the short wavelengths (S-cone, 430 nm) or blues, and the other (L/M-cone) to longer wavelengths or greens. Our current L-cones (560–590 nm) and M-cones (530–540 nm) evolved out of this earlier L/M-cone, which developed over time into two separate cones (Gordon and Abramov, 2005 [2001]: 117). The various current hypotheses explaining this change mostly describe contextual constraints, such as the need to recognise the most nutritious food, which was supposedly red. This implies that this quasi-immobile evolutionary change also had a biocultural character.

17 Coëgnarts and Kravanja (2014: 28), in turn, call this the 'stage of culture', complementing the 'stage of the body', for the purposes of their analysis of cognition and film.

inseparable whole. In many of Bourdieu's definitions of the concept, the habitus is considered to be closely related to history:

> The *habitus*, a product of history, produces individual and collective practices—more history—in accordance with the schemes generated by history. It ensures the active presence of past experiences, which, deposited in each organism in the form of schemes of perception, thought and action, tend to guarantee the 'correctness' of practices and their constancy over time, more reliably than all formal rules and explicit norms. (Bourdieu, 1990: 54)

As a result, perception, thought and action are all unconsciously regulated by the habitus, which incorporates cultural schemata, thus guaranteeing their 'correctness'. As mentioned above, Scheer considers emotions to be just such embodied practices. She also explains what this implies for our approach to the history of emotions: 'Conceiving of emotions as practices means understanding them as emerging from bodily dispositions conditioned by a social context, which always has cultural and historical specificity' (Scheer, 2012: 193).

In other words, since certain emotions (feelings) are potentially the practices of a certain period, they can be studied in a hypothetical manner through the cultural and historical specificity of the bodily dispositions from which they emerged. I explicitly use the words 'potential' and 'hypothetical' to clarify that I do not—by any means—wish to claim that the actual emotions experienced in the past can be known, felt or experienced by today's historian or reader of an historical study. However, what we can do is sketch out the cultural context of a specific period and its potential to condition the bodily dispositions, and hence constrain or enable the practice of emotions and feelings at that moment in time. As such, the contemporary episteme of modernism forms a discursive baseline of thinking about subjectivity and embodiment running underneath all the variations in the theme of colour, subjectivity and emotions in film which form the subject of this study. However, the way this baseline surfaces in ideas and cultural forms can change even within a decade under the influence of fast-changing cultural contexts and discourses.

This brings us to Braudel's (1990 [1949]: 16–17) final temporal layer of events and individuals, which change as rapidly as life itself. This third layer covers the temporality of films as catalysts, helping us create and experience feeling-centred emotions through the act of perception. On the one hand, Scheer (2012: 210) considers the use of audiovisual media as an emotional practice in itself, since objects such as films function as emotional regulators, educating us in how to express and experience emotions that might occur in particular situations according to the norms of the contemporary cultural context (for example, when looking at a particular colour or colour combination). On the other hand, moving images can also challenge and stretch these norms, revealing other possible ways of expressing and experiencing feeling-centred emotions. Of course, there are differences in how moving images create, regulate and educate feelings depending on the emotional regimes within which they

function. The way media objects produce different forms of feeling-centred emotions is interrelated with the emotional regimes of the times and places in which they are made or shown. An analysis of moving images from a particular period opens up the potential to hypothesise about the feeling-centred emotional regimes and contexts of that period.

In all, embodied experiences are always a combination of all of these temporal layers. First, the sediments from distant times change according to an often-imperceptible evolutionary rhythm and emerge in cultural expressions as quasi-immobile patterns. Secondly, there are the contexts of colour cultures, such as the slowly changing belief that colours have a psychological and physiological influence on the human organism, leading to the association of colour in film with strong emotionally affective moments that supposedly produce a similar organic reaction in the audience. And thirdly, there is the more mercurial, ever-changing actuality of the event, in which the sediments of quasi-immobile patterns and visual cultures are drawn together in shorter periods, each with their own specific film culture in which technological constraints combine with temporary interpretations of the effects of colour in film.[18]

18 In my article 'Die Ästhetik der Zwei-Farben-Verfahren' from 2020, I refer to media archaeologist Erkki Huhtamo, who introduced the concept of 'topos' into media studies to enable the investigation of such cultural reiterations. Even though aesthetic patterns, such as the recurrence of two-colour aesthetics throughout film history, is not a topos in the strict sense of the word, Huhtamo's reflections help in understanding how to approach diachronically occurring patterns and motifs when exploring the use of colour in cinema. Huhtamo's (2011: 31) most important argument is that the various appearances of topoi are never identical simply because their manifestations in different periods are constrained by the variations in cultural contexts. This brings us to Braudel's second and third layers of historical time. Recognising topoi, motifs and patterns is one thing, but we must analyse the various manifestations in depth if we are to come to a more profound understanding of the way they function at particular moments in time.

PART I
STIRRING UP THE EYE WITH COLOUR

In their impressive book *Color Vision*, James Gordon and Israel Abramov describe the starting point of colour perception as: 'wavelengths [of light] entering the eye and how they *stir up* the nervous system' (2001: 93, my emphasis). This implies that, to them, colour perception is related to the activity and energy of the retina. Indeed, when light hits the retina it activates special cells called photoreceptors. This sets off a chemical process that turns the light into electrical signals, which are then transported by the optic nerves to the brain. In the brain, these signals are processed into images or colour experiences such as the perception of colour contrasts.

The question is in what way these light waves stir up the nervous system, and what neuronal activity results from this. A closer look at the physiognomy of the eye and its neuronal structures teaches us that one of the main functions here is the production and increase of the perception and impression of colour contrasts. To clarify how this knowledge influenced Western perspectives on the eye and the perception of contrasts, I will elaborate on the historical development of discourses on and uses of colour contrasts, from a variety of perspectives and positions in the Western colour tradition.

We distinguish two ways in which contrasting colours can be juxtaposed: either following each other in succession or occurring simultaneously in a single image. These two ways are enclosed in the concepts of successive and simultaneous contrasts. Successive contrasts arise from the rapid alternation of shots containing contrasting colours, a technique often employed in films through the principle of montage. The two main colour contrasts used successively are extreme dark-light contrasts, which were for example used to induce hypnotic states and produce colours in the eye. The second type involves succeeding colours that are complementary or nearly complementary, creating an afterimage that intensifies the impact of the following color. These successive contrasts can have a stimulating effect, preventing the audience from drifting off during a film.

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Simultaneous colour contrasts occur when one colour affects the perception of another due to their close proximity within the same image. This interaction leads to instabilities, changes, and fluctuations in the appearance of colours, as seen in painting, for instance. During the 1950s and 1960s, there was significant interest in this phenomenon within art-school colour education, colour psychology, and the op art or art-cinétique movements. These ideas and practices were reflected in the popular and art cinema of the time, either as an aesthetic motif or through the presence of op artworks in the pro-filmic space. In cases where numerous op artworks appear within the film image, they emphasise the simultaneous contrasts, along with moiré and other effects, making these elements central to the film's visual aesthetic.

Successive and simultaneous contrasts can be defined as the twin overarching concepts explaining colour contrasts in Western thought; all other contrasts occur either because colours follow each other successively or because they are juxtaposed in one image. Both types of contrast occur in cinema, including in the films from the 1950s and 1960s.

2. Colour Contrasts, Culture and Perception

Quasi-Immobile Physiognomy of the Perception of Colour Contrasts

I wish to start the debate on how colour contrasts were and are believed to stir up the human organism, by laying out the physiognomy of the retina in relation to the perception of colour contrasts. In this way I wish to give an insight in the temporal layer of quasi-immobility, hence, colour perception from a biological point of view. Since I am not specialised in this field, I will heavily rely on more or less recent textbook explanations.

Current physiological literature alerts us to the biological complexity of the retina, with its multi-layered structure, covering more than half of the eye's inner surface. It consists of various different kinds of neurons and fibres, which can be divided into three layers: (1) the layer of photoreceptor cells; (2) the layer of intermediate neurons; and (3) the layer of ganglion cells. The cells of the three layers are connected to each other through synaptic layers (Wyszecki and Stiles, 2001 [1982]: 86). Figure 2.1 shows a drawing of the physiology of the eye. The layer of photoreceptor cells (1) contains the so-called rods and cones, and is represented in the top section of this drawing. It is positioned on the outer part of the retina, which means that the photons that activate them have to pass through all the other layers of cells first. The rods and cones are connected to so-called bipolar cells in the first synaptic layer. These form the layer of intermediate neurons (2) and are connected to other cells on both sides. The bipolar cells (indicated by 'RB' in the diagram) are rod bipolar cells, where the information supplied by the rods is collected and transmitted (Müller et al., 2019: 611). 'MB' stands for midget bipolar cells, which collect and transmit the information gathered in the cones. The rods show converging patterns of up to 130 connecting to one rod-bipolar cell. Conversely, cone signals remain separated, and each cone is connected to its own midget bipolar cell (Wyszecki and Stiles, 2001 [1982]: 87). In the second synaptic layer, bipolar cells transmit the collected signals to the layer of ganglion cells (3). Ganglion cells are divided into two types: midget ganglion cells, collecting the signals of the

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cones via the midget bipolar cells, and diffuse ganglion cells that receive the collected rod signals as transmitted by the rod bipolar cells.

Fig. 2.1 Schematic representation of the retina (Dowling and Boycott 1966: 104).
Used as illustration in Wyszecki and Stiles, 1982: 86

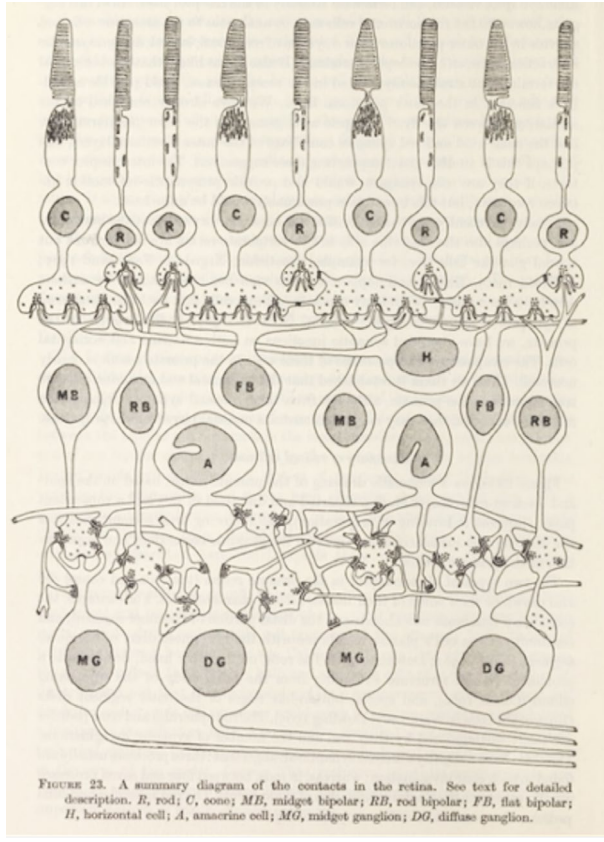


FIGURE 23. A summary diagram of the contacts in the retina. See text for detailed description. *R*, rod; *C*, cone; *MB*, midget bipolar; *RB*, rod bipolar; *FB*, flat bipolar; *H*, horizontal cell; *A*, amacrine cell; *MG*, midget ganglion; *DG*, diffuse ganglion.

Interestingly, the retina is a developmental derivative of the brain and performs similar operations (Frings, 2012: 14). This means that it already processes a large amount of the information before the neural signals are sent to the brain. For example, in the first synaptic layer, where photoreceptor cells (1) are connected to bipolar cells (2), so-called horizontal cells connect rods and cones of all types to one another. These horizontal cells enable lateral processes between photoreceptors through this first synaptic layer. This indicates that rods and cones do not function separately but interact and communicate with each other. Furthermore, rods are also directly linked to cones through connections at the level of the synaptic bodies of both types of cells. In the second synaptic layer, amacrine cells have a similar function to horizontal cells in that they allow for lateral processes to occur in this part of the retina. Gunther Wyszecki and W.S. Stiles (2001 [1982]: 88) summarise the potential interactions between rods and cones, thus:

i. direct contact between rod spherules and cone pedicles;
ii. indirect connections between rods and cones through horizontal cells;
iii. indirect connections between rod-bipolars and cone-bipolars through amacrine and ganglion cells.

This suggests that there are connections between cells in both the first and second synaptic layers, meaning that information can be exchanged between rods and cones, between rod-bipolars and midget-bipolars, and between various ganglion cells.

In the layer of photoreceptors, this direct and indirect contact between cones and rods creates a process called 'lateral inhibition', which increases the perception of contrast. Practically speaking, this means that 'the activated photoreceptors send an inhibitory signal to the less active ones in their vicinity, suppressing their residual activity and, hence, increase the perception of contrast' (Frings, 2012: 15). This increase of contrast occurs on both the levels of dark-light and colour contrasts. These processes of lateral inhibition are the biologically defined starting point of what is recognised as simultaneous colour contrasts:

> The cone responses at any one point in the retina, at any one time, are also influenced by the responses of surrounding cones and by their preceding responses. These spatial and temporal interactions, which are only the first of similar modulations that occur at further stages of neural processing, underpin the core phenomena of color perception: simultaneous color contrast. (Hurlbert, 2013: 372)

Another possible result is that the layer of ganglion cells processes not three but four different signals, corresponding to green, red, blue and yellow, whereas colour-sensitive photoreceptors usually exist as short, middle and long wavelength cones (loosely related to blue, green and red). Since there is no knowledge of yellow-sensitive cones, the question arises of whether and how the yellow signals are constructed and increased through lateral inhibition, or otherwise. An explanation might be that a neural signal of yellow is produced by combining readings of the activation of M (green) and L (red) cones. 'When LW- and MW-sensors are being activated equally, we see yellow' (Müller et al., 2019: 627).[1] Instead of a direct activity of 'yellow' in the photoreceptors, a yellow signal is read out of red and green signals. This explanation of the creation of a yellow signal indicates that the eye mixes colours in an additive way.

In addition to this, Müller et al. (2019: 640) explain that the perception of colour contrasts is not only produced in the layer of the photoreceptors, but also in the layer of ganglion cells. These are complex information-processing systems—for example, they analyse information signals concerning local differences in luminance, and

1 'Werden LW- und MW-Sensor gleich stark aktiviert, sehen wir Gelb'.

communicate this to the brain. Furthermore, they also process information on colour differences: 'Some retinal ganglion cells are particularly activated by small spots of red, of green or of blue light. [...] Some retinal ganglion cells compare locally the relative amounts of red and green light or blue and yellow light' (Krug, 2012: 46).

There are four types of ganglion cells, all answering in their own way to the information that comes from the photoreceptor layer. Interestingly, they react in different ways: type 1 increases its firing frequency with red and decreases with green; type 2 increases with green and decreases with red; type 3 increases with yellow and decreases with blue; and type 4 increases with blue and decreases with yellow. This means that ganglion cells process and increase the contrasts between the four different colour signals, which are then sent to the brain, where they are further processed into the coloured images we perceive (Müller et al., 2019: 640).

In a way, this means that Hering's opponent colour theory—as explained later in this introduction, in which he hypothesised that colour vision is based on four colours instead of three—might also find physiological and biological substantiation in the working of the ganglion cells. However, according to Barry B. Lee (2008: 13), these four colours as produced in the eye deviate from Hering's opponent axes. Kuehni and Schwarz (2008: 101) confirm this, saying that, although psychological and neurophysiological support for Hering's system has been attempted, 'to date, there is no generally accepted neurophysiological mechanism for unique hues'.

In summary, when light enters the eye, it is processed, broken up and transformed into neural signals that are caused by—but differ materially from—light waves. The colours we see when we view an object are the result of the relationship between stimuli in the form of physical light spectra (that are not themselves colours) and the embodied way in which our neural responses and visual perceptions are created.[2] This implies that colours as we see them are pure perception, created inside the eye and the nervous system. Light waves prompt the eye to start this activity, and the body then processes and digests these stimuli. Since one of the retina's main activities is to increase or decrease the intensity of some of these signals in order to strengthen or abate the effect of colour contrasts, this can also be seen as the result of neural activity in the human eye.

This quasi-immobile biological hardware of the eye and retina, explain the existence of simultaneous contrasts and colour constancy as physiologically produced phenomena. This suggests there is a physiological, quasi-immobile biological basis for our centuries-long tendency to focus on contrasts when studying colour perception, and for the importance they appear to hold for us when regulating the use of colour in art and design.

2 The body also creates the experience of colours deviating from or independent of the stimuli of light spectra in the form of after-images and hallucinations.

Colour Systems for Colour Harmony

Traditionally, the perception of colour and colour contrasts has been studied from a variety of perspectives—optical, aesthetical, psychological or phenomenological, and physiological. Although they all have different starting points and fundaments, they often get mixed up. In this chapter I will lay out the history of colour contrasts from these various perspectives, explaining the importance of colour contrasts in human perception and in the way we use colour.

The aesthetic or artistic tradition adopted a normative approach, prescribing which colour contrasts were in good taste and which were not. These norms and regulations were rooted in, but did not necessarily contribute to, theories of perception; rather, they were used to explain what was known as 'colour harmony' or 'colour consciousness'. Phillip Otto Runge, Wilhelm Ostwald, Adolf Hölzel, Faber Birren, Johannes Itten and Hans Albers are all examples of authors who wished to educate the general public on how colours should be, for example, positioned in relation to one another—and this list should of course include Goethe, the polymath. Some 'colour specialists', following in Goethe's footsteps, connected this prescriptive discourse to more spiritual ways of thinking, using the discourses of colour therapy and psychological theories to substantiate the need for 'colour harmony', which will be the topic of Part II.

These different types of knowledge were illustrated with colour circles, spheres and trees to help visualise how colours related to and contrasted with each other. The circles and spheres would vary according to the system they were intended to represent. I will elaborate later on these various perspectives, and explain how colour theories, norms and standards concerned with the function and use of colour contrasts in the 1950s and 1960s were the result of a specific form of knowledge production (which included ideas, rules and regulations regarding the use of colour) that developed within the modernist episteme.

Although it is almost impossible to systematise such a fluid and elusive topic as colour, it has been studied and described from a wide variety of disciplinary perspectives, which have given rise to an equally wide variety of systems, codes, categories, and other attempts to control or organise the phenomenon. In ancient Greece, for example, colours were schematically categorised in a two-dimensional, linear way. These linear systems—which were transmitted in writing and contained sometimes five, sometimes seven names for hues—persisted into the seventeenth century.

During the seventeenth century, however, other ideas began to take root, based on the colour-mixing experiments of artists over the preceding 50 years of the Baroque period. Scientist Robert Boyle, in his 1664 *Experiments and Considerations Touching Colours*, determined that the basic colours of an artist's palette were black, white, yellow, red and blue (Boyle, 1664; Gage, 1999: 26 and 136; Kuehni and Schwarz, 2006: 54). In response to Boyle's ideas, a number of systems of primary and secondary colours were

created that visualised how these colours could be related to one another in a logical way. In 1776, entomologist and engraver Moses Harris invented his 'colour wheel', a circular representation of a symmetrical, complementary colour system, displaying the primary colours (red, blue and yellow) and the results of their combinations (green, orange and purple) (Gage, 1999: 137), as well as their chromatic grades. Harris's circle represented what became known as the subtractive system. Most colour circles created around this period corresponded to the subtractive colour system, offering a visualisation of how various colours could be created by mixing pigments and dyes (Spillmann, 2009: 20–23, 36–43).

Earlier in the eighteenth century, Newton conducted his extensive studies of light—and consequently of colour. His scientific work on colour and light is of an empirical nature, observing and describing light and colours (and the way they produce contrasts) as phenomena that take place outside the human body. However, although Newton was mainly interested in light and colour stimuli, he was also aware that colour was, in the final analysis, a phenomenon of perception. He published the results of his experiments in *Opticks* in 1704, describing how white light can be prismatically decomposed into various wavelengths that appear to us as different colours. Newton illustrated his findings with a circular diagram 'in which he graphically represented the results of the mixture of spectral lights' (Kuehni and Schwarz, 2008: 54). He further noticed that some colours appeared as each other's opposite or complementary colour (Gage, 1999: 142). Following these findings, Newton hypothesised that if these colours were re-combined, they should turn back into white light, and (logically) combinations of opposite or complementary colours should yield the same result. This is what we know as the 'additive colour system'. As a result, Newton's colour circle, representing the refraction of white light into colours and back again, related to additive colour mixing, which was different from the circles representing the effect of pigments and dyes mixed together as in the subtractive system.

We now understand the significance of the difference between additive and subtractive colour systems. However, it took some time before the implications of this distinction were generally known or accepted: for example, although the practice of painting and mixing pigments is rooted in subtractive systems, artists adopted Newton's theories of colour, finding in them a theoretical basis for what they were already doing in practice—that is, working with colour and colour contrasts. It would take until the mid-nineteenth century before the confusion over the difference between light mixtures and colourant mixtures was clarified by Hermann von Helmholtz. Helmholtz explained that just as the combination of colours ultimately results in white light, so pigments absorb (or subtract) part of that white light and reflect what remains, resulting in colour stimuli (Kuehni and Schwartz, 2008: 133; Gage, 1999: 219).

One factor that had an extremely important bearing on colour systems of the time was the availability of pigments and dyes. Harris and others had difficulties

representing the 'ideal' colours they wished to make visible through their systems because they lacked the right pigments. A solution appeared in the nineteenth century with the 'invention' of synthetic dyes, which transformed the dye industry. These dyes enabled post-impressionist painter Georges Seurat, for example, to use a palette that came very close to representing the colours of the spectrum. It also enabled the standardisation of hues according to their colorimetric measurements, decreasing the reliance on language and interpretative association. Nevertheless, these pigments still were not entirely stable, and could not be relied upon for future use (Gage, 1999: 244).

During the second half of the nineteenth century, physiologist Ewald Hering introduced an interesting third system of so-called 'opponent colours'. Rolf Kuehni and Andreas Schwarz (2008: 98) call Hering's work a 'paradigm shift in color order' because 'Hering recognized that perceptual color order was a world unto itself, complexly related to physical stimulus description'. The result was a system with four fundamental perceptions of colour (which Hering called '*Urfarben*'), representing yellow, red, blue and green. Since he observed that 'a color perception cannot simultaneously be yellowish and blueish, or reddish and greenish', he called these colours 'opponent color pairs' (Kuehni and Schwarz, 2008: 100) and illustrated his ideas by means of a colour circle, in which they were represented as opposites. The closest to a biological explanation of the perceptual phenomenon that Hering described as 'opponent' colours can be seen in the way stimuli are processed as colour signals transmitted by the eye's ganglion cells as explained at the beginning of this chapter.

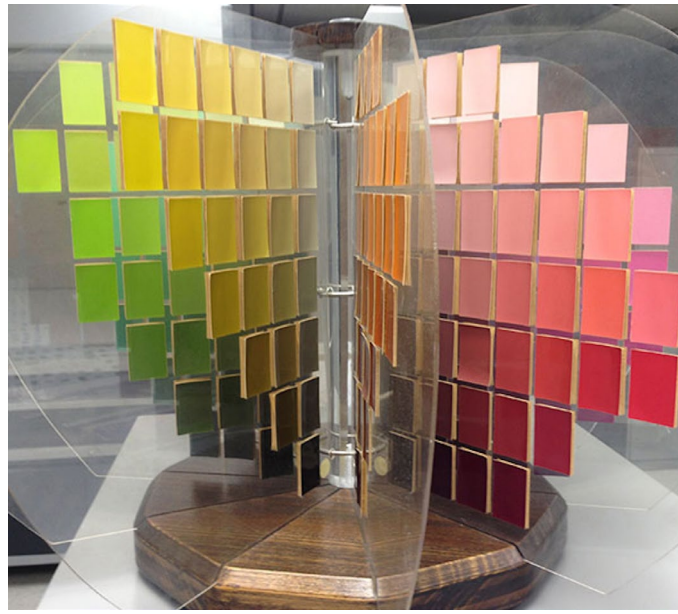
These two-dimensional colour circles proved very effective in illustrating colour theories such as those of Newton and Hering. However, to visualise the more complicated ways we perceive the world around us in colour, colour had to be systematised in three dimensions: hue, saturation/chroma and lightness. Hence, the continuing search for other potential models, such as triangles combined into three-dimensional cones which painter Phillip Otto Runge then integrated into a colour sphere in 1810 (Kuehni and Schwarz, 2008: 70–80). The equator of Runge's sphere represented the hues organized as primary and secondary colours, as in the Harris colour circle. White was placed on the top of the sphere, black on the bottom, turning the vertical meridian into a scale of lightness. At the centre of the sphere was grey, obtained by mixing not only black and white, but also red and green, blue and orange, and yellow and purple. As a result, the horizontal axes of the sphere represented a colour's degree of chroma or 'purity' (Kuehni and Schwarz, 2008: 79).

In 1919, Alfred Henry Munsell developed a system that followed this idea to symbolise three dimensions of colour—hue, value and chroma. In addition, Munsell tried to represent all the colours as we perceive them, not as a sphere but in the form of a 'colour tree'. As such, he visualised that a purple or blue at its highest saturation level had to be located close to the black at the bottom of the tree, whereas a saturated yellow would be close to the white at the top. In this way, he tilted the equator of the sphere, while stretching and turning it into a tree-shaped form [Fig. 2.2]. In all, '[i]ts

open-ended scale brought an end to the idea that a perceptually uniform color solid can fit into a simple geometric solid' (Kuehni and Schwarz, 2008: 115).

Currently one of the main standards of colour representation is the CIE L*a*b colour space. This system was introduced in 1931 and was standardised by using colorimetric measurements, the accepted definition of a 'standard observer', and by taking into account object reflectance and the spectral differences of light sources such as tungsten and daylight. The result is 'a technological system for accurately defining color stimuli in three dimensions, related to average human cone sensitivities' (Kuehni and Schwarz, 2008: 126).[3]

Fig. 2.2 Example of a vintage Munsell Colour Tree.
https://munsell.com/color-blog/color-tree/



What is interesting now is that a tension exists between scientific and artistic colour schemes. The twentieth century saw artists returning to older systems, such as circles, spheres and trees, that were not (yet) considered reliable models in more scientific circles. Wilhelm Ostwald, for example, who collaborated closely with the dye industry, relied on Hering's four *Urfarben*, which he built into a system of colour mixtures, even creating a 'colour organ' for painters. His ideas were adopted by the artists from De Stijl, Mondrian, van Doesburg, Rietveld and Huszár (Gage, 1999: 244).

Itten, as a representative of the Bauhaus, however, refuted Ostwald's ideas and returned to Runge's colour circle as the reference point for his system of colour contrasts:

3 CIA l*a*b is the colour space used for the *FilmColors* project's annotation tool VIAN.

> [This sphere is] the elementary shape of universal symmetry. It serves to visualize the rule of complementaries, illustrates all fundamental relationships among colors, and between chromatic colors and black and white. If we imagine the sphere to be a transparent body, each point within which corresponds to a particular value, then all conceivable colors have a place. (Itten, 1970b: 66)

Clearly, Itten chose Runge's circle as it allowed him to explain his ideas on the use of colour in art and how to work with colour contrasts in a more explicit way than, for example, Munsell's colour tree. To make his point even more explicit, Itten (1970b: 66) projected the circle onto a flat surface, turning it into a 'colour star'.

Thus, colour circles and colour systems were developed to define and visualise ideas on how colour values were related in systems of colour contrasts. Colour contrasts, such as complementary contrasts, contrasts of hue and saturation, and light-dark contrasts, all found their place in the systematic value systems (circles, spheres and trees) described above. The fact that they play such a big role in almost all these systems, shows the importance of contrasts in our interpretation, systematisation, and use of colours over centuries.

Studying the Physiology of the Eye

From 1800 onwards, an increased focus on the perceiver entailed a heightened interest in the physiology of the eye and the retina. This was encouraged by the emergence of scientific technologies such as the microscope. As early as the seventeenth century, a well-known pioneer in microscopy, Anthonie van Leeuwenhoek, had managed to enlarge the view of the retina, enabling its detailed study. However, despite this breakthrough, the development and use of the microscope as a scientific and medical instrument stagnated (La Berge, 1999: 112) until the mid-nineteenth century ushered in a new era of scientific interest in microscopy. This coincided with an increased interest in the perceiving subject and in phenomena such as simultaneous colour contrasts, as I will discuss below. At this stage, however, the study of the eye moved more in the direction of investigating its physical 'hardware'.

The developments in microscopic technology and the shift in focus towards the interiority of the perceiver prompted further investigations into the eye and the retina. During the eighteenth century, a start was made on constructing theories of the retina relating to human colour vision, challenging contemporary ideas of the retina as a simple extension of the optic nerve set in vibration by the direct stimulation of light (Polyak, 1941: 151). Thomas Young rethought these assumptions by referring to Newton's theories on light. In his text 'On the Theory of Light and Colors' (1802), Young concluded:

> [As it seems] almost impossible to conceive each sensitive point of the retina to contain an infinite number of particles, each capable of vibrating in perfect unison

> with every possible undulation, it becomes necessary to suppose the number limited, for instance, to the three principal colours, red, yellow, and blue. (Young, 1802: 21)

Young based his hypothesis that the sensitivity of the retina was limited to three colours on Newton's experiments with prisms and his findings that three colours could be recombined to make white.[4] This was in line with the early seventeenth-century discovery in painting that a similar law applied to the mixing of colours: '[A]ll colors could be made from just three, the painters' primaries—red, yellow, and blue—together with white and black' (Shapiro, 1994: 600–01). In short, Young fused his (limited) physiological knowledge of the eye with theories of colour mixing to form the hypothesis that the optic nerve might consist of three types of fibres corresponding to the three basic colours defined at that time—those of the subtractive system. As Clerk Maxwell (in Mollon, 2003: 14) later commented, Young was the first to search for a solution to the fact that there are three primary colours 'not in the nature of light, but in the constitution of man'.

In the 1850s, Young's ideas on the existence of the optic nerve's three fibres would become the starting point for Maxwell's and Helmholtz's theories of colour vision.[5] As Helmholtz's *Handbuch der physiologischen Optik* (1867) became a classic textbook, the theory suggesting the existence of three different colour receptors in the retina soon became relatively well known. Nevertheless, for a long period of time, the idea that the retina was only sensitive to a limited number of colours remained open to debate. Schopenhauer, for example, considered the retina to be one large sensory organ that was activated as a whole even after Young, Maxwell and Helmholtz had introduced their theories on trichromatic vision and the three types of photoreceptors.[6] Even in 1941, Stephen Polyak was still querying if cones (the photoreceptor cells in the retina) could be of one type or several:

> [T]here may be perhaps several [cones]—for example, three different kinds of cones—existing side by side, in which case the perception of colors could easily be explained, particularly in accordance with the three-component theory of Young and Helmholtz. (Polyak, 1941: 250)

Nevertheless, Polyak subsequently decided that there was no palpable anatomical evidence to support this assumption.

4 'Auf der Newtonschen Farbenlehre und dem darin enthaltenen additiven Mischungssystem beruht die Young-Helmholtz-Theorie des menschlichen Farbsehvermögens' (Welsch and Liebmann, 2004: 129).

5 Helmholtz, who clearly was the cannier of the two, launched the theory as his own in the *Handbuch der physiologischen Optik* (1860), 'forgetting' to recognise the work Maxwell had published five years earlier (Heesen, 2015: 10).

6 As explained above, it would take until the 1960s for scientists to find anatomical evidence to support this idea. Until then, scientists clearly were not uniformly convinced its validity. Therefore, Schopenhauer should not be blamed for dismissing an assumption that was, at the time, still highly speculative.

Indeed, the still-limited capacities of microscopes made it difficult to truly distinguish between the various layers of the retina. However, as mentioned above, microscopes began to improve during the nineteenth century. Even more revolutionary was the way in which specimens were prepared for microscopic investigation. Around 1830, Adolph Hannover started experimenting with the use of chromic acid to harden tissue (of the retina, for example), enabling him to cut it into sections, making observations far easier (Shepherd, 2015: 20). As a result, the following decade was characterised by extensive studies of the structure of the retina and the search for the exact location of the photoreceptors. In 1850, Heinrich Müller and Rudolph Kölliker, for instance, suggested a new conceptualisation of the retinal structure, in which the photoreceptors were placed on the outside of the retina, not—as it was commonly believed until then—on the inside (Polyak, 1941: 161–64).

It would take until well into the 1960s, however, for conclusive evidence to be produced establishing that the retina was indeed sensitive to a limited number of colours. W.A.H. Rushton achieved measurements for the M and L opsins (photoreceptor molecules), based on the light spectra reflected back from the retina after bleaching a cone pigment. Investigations into the differences between the measurements of normal and colour-blind eyes allowed him to calculate the spectra of the opsins of the various cones. However, these results were not yet accepted as physiological evidence. As Barry Lee explains:

> [Gathering real evidence] first became possible with measurement technique[s] that permitted estimation of light absorption (Bowmaker and Darnall 1980) or electrical responses (Baylor, Nunn and Schnapf 1987) of single cones. The Young-Helmholtz view received final confirmation. (Lee, 2008: 13–20)

Physiological investigations began to emerge, with a shift in focus from outside to inside the body, as we saw in Chapter One with regard to Goethe and the modernist episteme. Already, at the beginning of the nineteenth century, Thomas Young (1802) was adopting this line of enquiry in his study of the eye and the retina. Indeed, throughout the nineteenth and twentieth centuries, physiological biologists and neurologists continued to study the biological hardware of the eye and the physiological functions of its wide variety of cells.

Experimental Psychology and Early Phenomenology

Experimental psychology represented another approach to investigating the perception of colour and colour contrasts. Experimental psychologists—or, as some of them called themselves, 'phenomenologists'[7]—explored how the subjects in their experiments perceived colours and colour contrasts, and how the manipulation of stimuli could influence these perceptions. In some respects, Johann Wolfgang von

7 The term was not yet exclusively linked to philosophy at that time.

Goethe could be considered an experimental phenomenologist *avant la lettre*; taking himself as a test subject, he started to investigate and describe the subjective phenomena of colour perception, such as the after-image. In 1810 Goethe published his findings and ideas on colour in the book *Farbenlehre*. This work marked an important moment in the colour debate, pushing it towards the study of how colour stimuli and colour perception interact. Goethe was already famed as the author of the wildly successful novel, *Die Leiden des jungen Werthers* (2006 [1774]), and his romantic disposition is discernible in *Farbenlehre*'s highly subjective form. For example, he uses a personal anecdote to explain the subjectivity of colour perception: he describes himself watching a beautiful girl in a scarlet dress, which leaves him with an impression of sea-green after she disappears from view (Goethe, 1840: V.52).[8] The green image is one that, as he phrased it, 'belongs to the eye'. Thus, Goethe used a very personal experience to position the production of perceived colours inside the body of the observer.[9]

Of course, Goethe was not a natural scientist, but an amateur at best, and his method to do an introspective investigation of his own experiences was critiqued a century later. Wilhelm Wundt, known as the father of experimental psychology, would explain why this approach is problematic:

> The only form of introspection which experimental psychology seeks to banish from the science is that professing self-observation which thinks it can arrive directly, without further assistance, at an exact characterization of mental facts, and which is therefore inevitably exposed to the grossest self-deception. (Wundt, 1910: 7)

Wundt characterized this type of introspection as unscientific, even resulting on occasion in metaphysical hypotheses. He stated that introspection can only be scientific if used with an experimental method, which implies that the object of observation—the 'psychical process'—should be disconnected from and independent of the observer. He dismissed self-observation as a method (in the way that Goethe applied it) since the act of observation would automatically influence the psychic process under observation. As he observed, '[t]he endeavor to observe oneself must inevitably introduce changes into the course of mental events' (Wundt, 1910: 5).[10]

8 Referring to the fact that he uses the example of seeing an attractive young woman when explaining the after-image, Joshua Yumibe (2012: 21) argues that Goethe not only added a subjective note to colour theory, but also directly connected it to feelings in another way.

9 However, as John Gage points out in 'Colours Ordered and Disordered' (2012), Goethe was not the first to study the effect of the after-image: the phenomenon had in fact been noted in antiquity, and it became the object of serious scientific study in the late eighteenth century when Robert Waring Darwin turned to a more systematic enquiry into its properties. Robert Waring Darwin was the father of Charles Darwin. Other subjective phenomena, such as simultaneous contrast and colour constancy, were also studied before 1800 (Gage, 2012: 302–303).

10 Large parts of Goethe's *Farbenlehre* were also of a highly speculative nature, partly taking colour theory into the spiritual and esoteric domain. In addition to describing how he thought colour perception came about within the body, he also ascribed certain emotional effects to colours. These speculations have been, and still are, used in more spiritual ways, such as in colour psychology and colour therapy, practices that are the topic of Part II.

The epistemic shift around the beginning of the nineteenth century towards an increased interest in the perceiver also saw the emergence of several somewhat more hypothetical theories on the physiological workings of the eye and the retina. An interesting and fairly influential discourse described the activity of the retina when excited by light stimuli. For example, Arthur Schopenhauer, who was Goethe's pupil at the time, used the idea of light activating the retina as the basis of the argument he laid out in his treatise on vision and colour, *Ueber das Sehn und die Farben* (1816). Schopenhauer's aim was to gain an understanding of visual perception and colour vision with the help of philosophical hypotheses on what might take place inside the eye when stimulated by light. He speculated on the role of what he called 'ergänzende' (complementary) colours (so actually a type of colour contrast) in colour vision, and not only referred to the after-image as a perceived phenomenon, but also tried to explain it by hypothesising about the type of activity light provoked in the retina. For example, he stated that if white light activated spots on the retina, these would afterwards be 'exhausted' or suffer from 'fatigue', meaning they would be less functional for a while, creating only the colour black (Schopenhauer, 2010 [1816]: 62). According to Schopenhauer, something similar also happens with the various colours, albeit at different energy levels and with variations in the amount of activity.

After explaining why yellow and violet complement each other, and if combined together form white (as in Newton's theory), Schopenhauer (2010 [1816]: 64–65) immediately added that they were not, however, equal parts of the full retinal activity. In his opinion, 'the yellow color is a much larger qualitative part of that activity than is its complement, violet'. As an explanation, he referred to Runge's colour sphere,[11] which positioned colours of maximum saturation on the equator, indicating that they do not contain any black or white. Schopenhauer stated that these colours were full of 'energy', which supposedly decreased with the addition of more black or white. In order to build his theory, he focused on the hues of maximum saturation, but despite the saturation levels, he explained that they did not all have the same levels of energy: for example, as violet is the darkest and yellow the lightest colour, violet has a lower level of energy. In a simple way, Schopenhauer described what Munsell introduced into his colour system by tilting the equator in 1913, moving the saturated yellow closer to white and the saturated blue closer to black. As I will explain below, Munsell based his system on how colour is experienced, dividing and classifying colours in a way that correlates to the experience of the similarities or differences between them.

Schopenhauer called his theoretical hypothesis the 'intensive divisibility of the activity of the retina'. He was of the opinion that the full activity of the retina (white) equalled a whole. This was reflected in his more or less mathematical analysis of the

11 Like Goethe's *Farbenlehre*, Runge's sphere dates from 1810, and is based on the subtractive colour system. Nevertheless, Schopenhauer's use of this sphere is effective since his concern is not the complementary hues but how a colour's saturation is equal to the level of energy it produces in the retina.

eye's activity when excited by light: he gave white the numerical symbol '1' (signifying the full presence of light and activity), and its opposite, black, '0' (signifying the total absence of light and activity), embedding these ideas in his philosophical system and formulating hypotheses on how the eye worked and the way light activated the retina (Stahl, 2010: 13). Schopenhauer (2010 [1816]: 58–59) explained that '[i]t follows from my previous observations that brightness, darkness, and color are conditions in the strictest sense: modifications of the eye which are experienced instantaneously'. This implied that in addition to the function of transforming light stimuli into visual perceptions, he was convinced that modifications in the eye provoked an immediate experience, directly creating embodied activities and stimulating energy in the retina. Interestingly, the differences in retinal energy and activity aligned with various colour contrasts, such as complementary contrasts, contrast of saturation and dark-light contrast.

How to (Not) Move the Eye with Colour

After accepting the idea that colour and the eye interacted, the hypothesis that light and colour might even violate the eye was not far away. For example, Goethe (1840 [1810]: V.55) commented that '[e]very decided color does a certain violence to the eye, and forces the organ to opposition', as well as describing the role of 'pathological colours' and the ways in which they could damage the eye in extreme situations. We later find these ideas echoed in the work of colour consultant Faber Birren (1950, 1956, 1961a), who approached it as a pathological problem in his writings in the 1950s and 1960s. As many researchers have pointed out, the danger of eyestrain was considered an important factor in both colour and cinema cultures (Yumibe, 2012: 20).

Despite the widespread criticism of Goethe's *Farbenlehre* during the nineteenth century, and the relative obscurity of Schopenhauer's work, their ideas nevertheless became fundamental to the thinking on colour in the twentieth century. This was partly due to a rekindled interest in their studies in Germany during the century's first decades. Goethe's *Farbenlehre* became popular across a broad field of colour specialists, from the more academic circle around natural scientist Arnold Brass to the expressionist painter Ernst Ludwig Kirchner (Gage, 1999: 194) and Adolf Hölzel, a professor at the art academy in Stuttgart from 1905 until 1919, where he taught future Bauhaus teachers and theorists Johannes Itten and Oskar Schlemmer. During a lecture at the first German 'colour day', held in Stuttgart on 9 September 1919, Hölzel explained that he and his students stood on 'Goetheschem Fundamente', claiming that 'Goethe is eternal to us, at least as long as human eyes exist' (my translation).[12]

12 'Goethe ist für uns ewig, wenigstens so lange es menschliche Augen gibt.' This return to Goethe implied the continuation of a more spiritual, occult discourse on colour's supposed impact on the human organism.

Hölzel also referred to Schopenhauer, especially his theory of the bipartition of the retina. As a result, even though his treatise was not nearly as well known as Goethe's, Schopenhauer's ideas also found their way into twentieth-century normative discourses on colour. Hölzel (1919) described how '[t]he bipartition, as Schopenhauer calls the required division with regard to colour in the eye, has to be taken into account continuously for images' (my translation).[13] He fully embraced Schopenhauer's theory that light stimuli produce both 'strain' and 'relaxation', regarding it as a little-known fact that has a disproportionately large influence on daily life. Hölzel even pushed this idea to its limits: in his opinion, colour harmony and complementary colours were not based on mathematical science but on the way perception and after-images functioned, and he claimed that the human eye was perfectly capable of judging the accuracy of this type of contrast.

Of course, Hölzel and Itten leaned towards a more occult and spiritual way of thinking about colour, as instigated by Goethe and continued in the tradition of colour psychology and colour therapy that I discuss further in Part II. However, those figures who had a more scientific, mathematical and psychophysical perspective on colour, such as Helmholtz, Munsell, Ostwald, and artists such as Delaunay, Moholy-Nagy and Mondrian, also considered contrast in an embodied way. Helmholtz (1995 [1881]: 298), for example, discussed partial fatigue of the retina, which—even though he did not refer to it—closely resembled Schopenhauer's 'division of the activity of the retina'.

Artists of the time also took up the aesthetic theory of 'Einfühlung', which can be translated as 'feeling into'. One element that was considered essential in this theoretical approach was 'the affective, and more precisely qualitative (i.e. qualia-like), effects' of colour (Ganczarek et al., 2018: 142). Even László Moholy-Nagy, who was not known as a fan of emotionalism, interpreted the notion of Einfühlung as the 'primal' states of tension created by colour perception, which he considered crucial to any artist. In his book *Malerei, Photography, Film* (1925), he commented:

> We must assume that there are conditions of colour relationships and tensions, light values, forms, positions, directions which are common to all men and determined by our physiological mechanisms. [...] [T]he paintings of every age must have been formed from these primal states of tension grounded in man. The observable variations between the painting of different periods can be explained only as periodic formal variations of the same phenomenon. (Moholy-Nagy, 1967 [1925]: 13)

Moholy-Nagy considered these elements to be biological, slow to change and fundamental to the art of (abstract) painting. The way these tensions were made visible in artworks was subject to variation, but the 'biological' principle was the same. That

13 'Der Bipartition, wie Schopenhauer die geforderte Zweiteilung hinsichtlich der Farbe im Auge nennt, ist im Bilde fortgesetzt Rechnung zu tragen. Der Spannung und Entspannung, jenem Geheimnis, das so sehr in unser Leben im allgemeinen eingreift' (vergl. Goethe, Maximen und Reflexionen Nr. 1079).

principle was precisely the notion of tension that Goethe and Schopenhauer described as a need for balance.

During the 1950s and 1960s, colour contrasts again were at the centre of attention in the field of colour theory. In 1954 perceptual psychologist Rudolf Arnheim published *Kunst und Sehen*—translated as *Art and Visual Perception* (1956)—which contained a chapter discussing how colour contrasts and perceptions of colour interact. Later, in 1961, colour theorist and former Bauhaus teacher Johannes Itten published *Kunst der Farbe*, a systematic study of colour contrasts and their influence on the perceiver, and followed this in 1970 with a shortened version, a 'Studienausgabe' ('study guide'), that was translated into several languages and is still in print today. This text contained Itten's ideas on the different colour contrasts and how they could be used to create 'colour harmony'. He defined seven types of contrast: (1) contrasts of hue; (2) light-dark contrasts; (3) cold-warm contrasts; (4) complementary contrasts; (5) simultaneous contrasts; (6) contrasts of saturation; and (7) contrasts of extension (Itten, 1970).[14] These contrasts also formed the basis of Hans Albers' later work (see Chapter Four). Itten was building on the ideas of his former tutor, Adolf Hölzel, who had already systematized various types of colour contrast in 1904 (Röthke, 2013: 7).[15] The added value of Itten's work lay in the fact that he systematically worked through the seven contrasts, providing a practical introduction to each and suggesting ways in which artists could use them. For Itten, colour contrasts could not appear without the active eye and mind of the perceiver:

> The color agent is the physically or chemically definable and analyzable pigment, the colorant. It acquires human meaning and content by optic and cerebral perception. The eye and the mind achieve distinct perception through comparison and contrast. (Itten, 1973 [1961]: 19)

Thus, from the nineteenth century until deep into the twentieth, the discourse on colour was interspersed with an understanding of colour perception as an embodied phenomenon, based on the presumption that the eye and the nervous system played a crucial role in its creation, most noticeable in the perception of colour contrasts. This implies that, from the very beginning, the idea that colour contrasts were determined by embodied processes formed part of the cultural context of colour film, also determining ideas and discourses of the 1950s and the 1960s.

14 Because Itten's contrasts are still considered standard in colour theory, we used them for our film analyses in the *FilmColors* project, and integrated them into VIAN.

15 'In Bezug auf die Farbe haben wir folgende Gegensätze, die so wichtig sind, dass Sie sich dieselben sehr merken u. besonders notieren müssen. 1. Farbgegensätze an und für sich (etwa Gelb und Blau) 2. Kalt u. warm, 3. Hell u. dunkel (Dunkelbau u. Hellgelb) 4. Die complementären Gegensätze, 5. Quantitätsgegensätze (viel Blau, wenig Gelb u. umgekehrt) 6. Intensitätsgegensätze (scharfes Gelb zu mattem Blau) mit 7. der Steigerung des Satzes 6 in farbig u. neutral (gelb z.B. als Farbe auf blaugrauem Fond).'

3. Shocking, Shifting, Straining

> The freeing-up of color and image to motion and mutability was an important conceptual move that permitted greater experimental variability: color became dynamic. (Street and Yumibe, 2019: 114)

Films set colours in motion and can use successive contrasts to produce physiological reactions in audiences. Successive contrasts describe how colours that follow each other in a temporal sequence influence their appearance. All types of contrasts, be they complementary, light-dark, or saturation, can occur in this way. Traditionally, however, these effects are more often related to the after-image, and the assumed production of a complementary by the retina:

> The successive contrast of colours includes all the phenomena which are observed when the eyes, having looked at one or more coloured objects for a certain length of time, perceive, upon turning them away, images of these objects, having the colour complementary to that which belongs to each of them. (Chevreul, 1839: 30)

This, again, seems to originate with Goethe, who was convinced that after-images (or, as he called them, 'Spektra' or 'Scheingestalt') were similar to the complementary pairs of the subtractive colour circle (Gage, 2012: 302).[1] Consequently, he related their appearance to what he believed to be the eye's urge to find harmony. Furthermore, he stated that the sum of the remaining primaries comprised a hue's complementary colour, directly connecting the after-image to complementary colour contrasts. Goethe (1840 [1810]: V.60) wrote that after-images 'show that the eye especially demands completeness and seeks to eke out the colorific circle in itself'.[2] It is interesting to note, however, that the colours he used in his colour circle were based on the primaries, red, yellow and blue, with orange, purple and green as secondary colours. Goethe here explained his ideas on colour harmony using a normative discourse while substantiating his argument with the help of a biological framework.

As mentioned in the previous chapter, Goethe was not the only one to confound ideas on colour and approach their study in a somewhat unsystematic way. According

1 Charles Lock Eastlake, who translated Goethe's text in 1840, does use the term 'complemental' (e.g. VI.66). He also uses 'complementary colours' in the notes he added to the text.

2 'Das Auge verlangt dabei ganz eigentlich Totalität und schließt sich selbst den Farbenkreis ab' (Goethe, 1810: V.60).

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to Gage (1999), a conformity emerged among colour theorists after 1800 that the after-image of red was green, rather than the blue-green that we actually see. The presumed symmetry with colour systems can be explained by the urge for balance and harmony, as visualised in the colour circles created by Harris and others. In addition, it reflects the contemporary cultural belief that the complementary colours of the subtractive system are similar to the perception of after-images. This belief was extremely powerful: it continued to hold sway '[e]ven when colour studies were based on perceptual phenomena of colour such as *Interaction of Color* (Albers 1963)' (Gage, 1999: 22)—and it still exerts an influence today.

Helmholtz, in 1881, expanded the definition of successive contrast with the contrast between light and dark. He also describes the idea that successive contrasts depend on the eye's movements from one object or surface to the other (297–98). Cornwell-Clyne (1951) related successive contrast to cinema writing that '[…] every colour stimulus affect[s] the response to the stimulus which follows, by means of what has been called successive contrast, or fatigue […]' (636). In all, successive contrast is to be considered a temporal effect where what is previously perceived affects the activity of the eye, and influences the succeeding perception.

There are various ways in which films apply successive contrasts: some, for example, alternate black and white and 'natural' colours, producing a physiological effect in the eye by alternately activating and deactivating cones and rods. This often indicates a transition in time, emotion or affect within the narrative of the film. A famous example of this type of successive contrast can be seen in *Der Himmel über Berlin* (GER/FRA 1987, Wim Wenders). Wenders uses colour to refer to the physical (as opposed to the spiritual) world—a world that is also characterised by the ability of the characters to feel and touch—and the contrast between black and white and colour produces a narrative and structural opposition between the world of humans and the world of angels (Misek, 2010: 33). Another example is *Pleasantville* (USA 1998, Gary Ross), where colour is associated with the feminine, and with emotions and feelings. Other, less well-known examples from the 1960s include *Shock Corridor* (1963), which uses Kodachrome to visualize hallucinations, and [昆虫大戦争] (*Konchu Daisenso*/ *Genocide*) (JAP 1968, Kazui Nihonmatsu, Fujicolor), in which memories of war are represented in black and white and inserted into a film otherwise shot in colour. Films often introduce inserts containing colour schemes that differ from the rest of the film as a narrative device to signal a shift in perspective to what David Bordwell and Kristin Thompson call the 'mental subjectivity' of a memory, hallucination or dream as explained in Chapter One.

During the 1920s, many experimental two-colour mimetic colour systems, such as Prizma or Technicolor II, were also inserted into monochrome (either black and white, tinted or toned) films. These inserts often referred to situations that evoke sensory experiences, such as fairgrounds, neon city lights, fashion shows, young women bathing, or firework displays (D'Haeyere, 2018: 127). The alternation between colour

and monochrome remained even after mimetic colour systems such as Technicolor and later Eastmancolor became the dominant technologies. Films alternated mimetic colours with monochrome shots made with filters or tinting and toning. Examples of these types of successive colour changes in the 1950s and 1960s include Alfred Hitchcock's *Marnie* (USA 1964, Alfred Hitchcock, Technicolor V): whenever Marnie is afraid or has flashbacks of her past trauma, the image turns red; *Funny Face* (USA 1957, Stanley Donen, Technicolor V): the darkroom scene with the red light contrasts with the surrounding scenes in 'natural' colours; *To Catch a Thief* (USA 1955, Alfred Hitchcock, Technicolor V): green-lit shots alternate with 'natural'-colour shots; and the Japanese monster film [吸血鬼ゴケミドロ] (*Kyuketsuki Gokemidoro/Goke, Body Snatcher from Hell*) (JAP 1968, Hajime Sato, Fujicolor): still images of war in monochrome red and moving images of an atomic explosion in orange alternate with shots in mimetic colours. Roger Corman also used this aesthetic strategy in *The Pit and the Pendulum* (USA 1961, Roger Corman, Eastmancolor) and *House of Usher* (USA 1960, Roger Corman, Eastmancolor) to represent traumatic dreams or memories. Interestingly, Corman partly used pre-tinted film stock in combination with toning for these particular scenes (Lightman 1961: 624). It was thought at the time that tinting and toning had become obsolete after sound was introduced in the 1930s, because the colours were thought to interfere with the sound (Mitchell, 1963, 1964).[3] As a result, these older colour techniques might have had a historical connotation and may have been deployed to deliberately create a nostalgic effect or a sense of the 'long-ago'. Interestingly, Antony L'Abbate showed that Eastman-Kodak had already solved the problem of tinted sound film, introducing a brand of pre-tinted sound stock called Sonochrome in 1929. L'Abbate gathered around 400 sound films from the late 1920s and the 1930s that used pre-tinted film stock (L'Abbate, 2013). Further, Agfa produced pre-tinted film stock that could be used for sound films, making this technology also easily accessible for German filmmakers (Ruedel, 2020: 135–36).

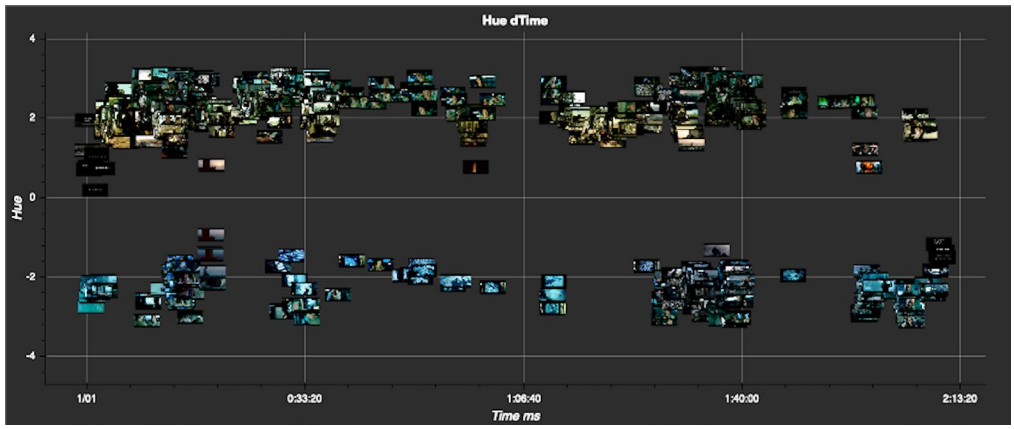
Another aesthetic strategy frequently seen in films of the 1950s and 1960s was the use of a series of various coloured monochrome images for the title sequences—for instance, those designed by Saul Bass for *Spartacus* (USA 1960, Stanley Kubrick, Technicolor V) and *West Side Story* (USA 1961, Jerome Robbins and Robert Wise, Technicolor V) (Horak 2014). Another example—not designed by Bass—is François Truffaut's *Fahrenheit 451* (GBR 1966, François Truffaut, Technicolor V). Of course, alternating monochrome shots of different colours occurred in many early tinted or toned films, and even much later films used similar alternating patterns—*Black Hawk Down* (USA / GBR 2001, Ridley Scott), for example. The alternation of two colour schemes becomes visible in a VIAN colour plot of Hue dTime,[4] in which two horizontal lines appear, one of a more greenish tone, the other bluish [Fig. 3.1]. The VIAN visualisation shows that the two dominant colours alternate throughout the

3 Anthony L'Abbate explains in his *Ulrich Ruedel* (2020).

4 This means that the visualisation is based on the hues present in the film taken over time.

film. Also, the blues appear darker than the greens, implying a dark-light contrast. The increase of monochrome aesthetics in digital film practice has meant that these types of alternations now occur more frequently. It is clear, then, that successive colour contrasts form a recognisable pattern throughout the history of cinema, although they occur in different ways and in different forms depending on their role within the specific film and on its cultural context. The question we are concerned with here relates to the types of successive colours used during the 1950s and 1960s and how we can interpret them within the cultural context of that period.

Fig. 3.1 VIAN colour plot of Hue dTime in which we see how the dominant hues in the film's images alternate over time. Image obtained through VIAN webapp based on the analysis of the DVD (Universum Film, 2010) of *Black Hawk Down* (USA / GBR 2001, Ridley Scott).



Successive Dark-Light Contrasts: Shocking the Eyes

One of the contrasts that is mentioned by Itten is the dark-light contrast. When we move from a brightly lit situation into one with moderate light, we are temporarily blinded to the objects around us. Goethe had already described this phenomenon in the first chapter of *Farbenlehre*, called 'Licht und Finsternis zum Auge' or 'Effects of Light and Darkness on the Eye'. According to Goethe (1840 [1810]: I.I.10), this was an indication of weak eyes. The current explanation is that when the eye is bombarded with an abundance of light, the photoreceptors become bleached out and are temporarily deactivated. This effect is often used in film to simultaneously blind both the viewer in the screening room and the characters in the diegetic world. It is a very subtle, directly embodied way of playing with the alignment between audience and characters.

Similarly, when our eyes have become adapted to darkness but are then suddenly confronted with an extremely bright light, it temporarily blinds us.[5] One reason is that

5 'This effect is strongest when going from a very dark environment into a very bright one. In darkness, the rods become activated to provide the scarce visual information available in dark

a sudden change of light means the pupil does not have time to adjust its size to the amount of light entering the eye. In a dark environment, the pupil becomes relatively large, enabling as much light as possible to enter, but when more light hits the eye, the pupil closes to protect the retina. However, in the case of a sudden, extreme transition from dark to light or from black to white, the pupil does not have enough time to close, and the rods and cones get overexposed and bleached out, and therefore need time to recover. Such changes from dark to light create a 'startle effect', and can even hurt the eyes.[6] Indeed, we have already encountered in Chapter One, the idea of light 'violating' the eye and causing eyestrain, or in the most extreme situations, a 'shock' to the eye.

In the fourth chapter of *Farbenlehre*, Goethe describes how such a sudden light flash can create the impression of colours. He described how he perceived a reddish colour which at the beginning only formed the perimeter of a circle, and then moved towards the centre of the circle slowly. In the end the red covered the entire circle, blocking his view entirely. In Goethe's observation, the red was then replaced by blue, after which it disappeared from the outside of the circle to the inside (1840 [1810]: IV.40).

This type of dazzling visual shock became an important filmic element. For example, in 1921 W.E. Story published an article on colour and cinema called 'Tentative Report of the Optics Committee' in *Transactions of the Society of Motion Picture Engineers*. Story mainly referred to Hermann von Helmholtz when explaining the retinal reaction to a stimulus. One of the first effects he mentions is precisely that of bright light on the functionality of the eye: 'To one emerging suddenly from a dark room ordinary daylight is dazzling to such a degree as to deprive one temporarily of the entire use of his eyes' (Story, 1921: 28). It should be no surprise that filmmakers occasionally experiment with this effect. The following examples describe some of the ways this perceptual shock effect has been used in film to achieve certain embodied effects and affective reactions.

When examining the films analysed by the *FilmColors* project, several excerpts emerge that clearly show the use of blinding lights. Often, the light source is diegetic: for example, spotlights or searchlights that shine straight into the camera can create a blinding effect. Two examples are the opening scenes of the films *A Star is Born* (USA 1954, George Cukor, Technicolor V) and *Singin' in the Rain* (USA 1952, Stanley Donen; Gene Kelly, Technicolor IV), both of which take place in front of a theatre as the stars arrive for a glamorous premiere. The spotlights swivel and dance around,

situations. However, rods recover rather slowly from a light shock. The extrafoveal area of the retina, where the cones are located, needs around forty minutes to approach full adaptation to darkness, whereas the cones only need two' (Wyszecki and Stiles, 2001: 519).

6 When I was watching *Star Wars: Episode V—The Empire Strikes Back* (USA 1980, Irvin Kershner) with my nine-year-old daughter, she complained that her eyes were hurting because of the sudden change from soft to bright white light that accompanied the change of scene from the friendly planet with Yoda to the bright, white surroundings of Bespin, where Leila and Solo will soon be betrayed to the empire.

and occasionally shine their extremely bright light right into the camera. Combined with the stereotypical flashing cameras of the photographers as they jostle to take pictures of the stars, they create a dazzling, even startling effect. Another diegetic source frequently used in films, usually alongside lashing rain and stormy winds, is lightning. And occasionally the sun is also used as a source of blinding light, as in Corman's *The Trip* (1967), when the main character Paul, who is experiencing LSD-induced hallucinations, sees himself making contact with the sun that seems to swallow him. Here, the sun's light blinds the spectator with its brightness. Gazing into the sun was (and is) seen as a healthy meditative practice in alternative circles,[7] and was also practised in LSD-induced 'therapeutic' trips. There was even an apocryphal account of four students who suffered eye damage because they were sungazing 'to hold a religious conversation with the sun' while on a hallucinogenic trip.[8]

From the late 1950s until the early 1970s, blinding lights and the physiological effects they can produce were used to the extreme in what is known as 'flicker film' in experimental cinema. Flicker film might sound superfluous since every analogue film projector uses flicker to create a moving image. Blocking the projector's light 24 times a second enables the transportation from one to the next film image without producing a blur. To avoid a visible flicker effect, the projected light is blocked twice for each frame, once when it is being transported and once when it is standing still. In this way, a flicker of 48 Hertz is created, which remains more or less unperceived, so the illusion of movement is complete. Flicker films, however, create an extra flicker effect by alternating black and white images on top of the usual 'invisible' flicker of the film projection. This produces a much lower frequency flicker, perceived as a rapid alternation of black and white images. Since such a flicker effect creates all kinds of phantom images (shapes, patterns, colours), Malcolm Le Grice also called these types of experiments 'perceptual film' (1977: 105).

The interest in phenomena of altered perception through various types of techniques, such as the flicker film, shows in the film *La perception et l'imaginaire* (FRA Duvivier 1964), which is an exploration of altering perception through different methods such as sensorial isolation, hallucinogenic drugs, and exposure to flickering light. The last experiment is the most prevalent in the film, showing a test person exposed to flickering lights, followed by experimental film images of what she supposedly perceived after the intense bombardment of light stimuli. The cover of this book is an image from this film, representing an illustration of how flicker enters and stirs up the nervous system of the eye. The film, produced by the pharmaceutical company Sandoz, illustrates a broad interest in such experiments that go far beyond experimental cinema. As a result, experimenting with altering the perception of the film spectator in flicker films is part of this larger context that also includes the use of

7 See, for example: https://www.blockbluelight.co.uk/blogs/news/what-is-sun-gazing or https://eu.boncharge.com/blogs/news/what-is-sun-gazing.

8 See: https://www.snopes.com/fact-check/blinded-by-the-light/

hallucinogenics and the emergence of 'visual LSD' in the 1960s. This will be discussed more in depth in the Coda of this book.

According to Edward Small and Joseph Anderson, flicker films were meant to make '[...] the brain cells of the audience members 'synch up' with the flicker frequency' (1976: 30). Experimental filmmaker Paul Sharits explained that this kind of cinema was not about representation, but about light as energy. He wanted to activate: '[....] the retinal screen; optic nerve and individual psycho-physical subjectivities and consciousness' (Sharits, 1969: 13). Indeed, testimonies show that flicker films '[...] somehow induced the perception of symmetrical, geometric, colored patterns [...]' (Small and Anderson, 1972: 31). Small and Anderson tested the experiences of 100 students watching a flicker film they specifically made for the occasion. This film they called *Mandala Alpha*, connecting it to the spiritual practice of meditation. Small and Anderson asked the students to draw their perceptions, resulting in coloured images of patterns and forms. This implies that every single one of them saw colours appear while watching the black and white flicker on screen (Small and Anderson, 1972: 31). Well-known flicker films in black and white are Tony Conrad's film *The Flicker* (1966) and Peter Kulbelka's *Arnulf Rainer* (1960).

Paul Sharits also used colour in his flicker films, such as *Ray Gun Virus* (1966), *Piece Mandala/End War* (1966), *N:O:T:H:I:N:G* (1968), and *T,O,U,C,H,I,N,G* (1969). The alternation of coloured frames created a flicker, plus a mixture of colours through after-images interfering with the following colour stimuli; this effect will be discussed in the second part of this chapter.

The Invasive Photo Camera

The trope or topos of blinding lights is present throughout the history of colour film, with an increase in occurrences around the early 1950s, and the 1980s. The highpoint for flicker and perception films lies from the late 1950s until the early 1970s. Interestingly, many of the films from the early 1950s use photographers' flashlights as the diegetic source of blinding light in certain scenes. Although flash bulbs had been on the market since the late 1920s or early 1930s, and despite the fact they offered an easier way of taking pictures in low-light situations, many photographers continued to use the open flash technique with flash powder, and it would take until the early 1950s before flash bulbs would entirely replace powder flashes. One important development that increased the advantage of flash bulbs over powder flashes was the invention of a camera with flash synchronisation. By the late 1930s manufacturers started to bring Kine Exakta, Falcon Press Flash, Agfa Shur-Flash and the Kodak Six-20 Flash Brownie box camera to the market, all mass-produced cameras with flash synchronisation. After the Second World War, the technology grew in popularity, and by the 1960s cameras that were able to take repeated photographs with flash technology had become a part of daily life. The difference between a powder flash and the new technology was

the speed with which it could be used: open flashlight needed preparation, and its subjects were forced to stand still in front of the camera, whereas synchronised bulb lights did not need any preparation and could be used without a break. This implied that anyone ran the risk of being 'flashed' by a photographer at any time, in any public space. Given this, it is not so surprising that many examples of the use of blinding photographic flashlights from the early 1950s emerged from the *FilmColors* corpus of 400 films. These films reveal how flashlights could be used to indicate stress, danger, and discomfort.

First of all, flashlights can be used to increase or induce stress, as in *A Star is Born*. When the main character, Esther, comes out of the church after the farewell ceremony for her husband, who has committed suicide, cameras immediately start to flash in her face. At first, her face and eyes are protected by a black veil, and she appears to remain numb. However, when an aggressive onlooker from the crowd rips off her veil, she opens her eyes wide, then closes them and starts to scream, turning her face away.

In *The Quiet Man* (USA 1952, Technicolor IV), John Ford uses flashlights to refer to and indicate stress in a brief flashback from the main character, former boxer Sean Thornton, to a traumatic experience from the past. During his boxing career Sean killed a young colleague in the ring, which has left him feeling guilty and made him decide never to fight again. When he gets knocked down due to a family dispute, he has a flashback in which he relives this traumatic experience. From a worm's-eye perspective, we see him in the ring as he stares down in horror at his opponent lying on the ground. A lamp in the left upper corner of the image shines a strong yellowish light straight into our eyes and flares in a soft purple and green over Sean's face. Sean starts to slowly back away while his seconds grab him and guide him to his corner. When the doctor covers the man's face with a white cloth, indicating he is dead, photographers start flashing intensively. The flashes create the effect of a slow flicker over a series of shots alternating the photographers, the deceased, and Sean's seconds. Finally, the flicker converges on Sean's face, lighting it from right and left. The last close-up is the most interesting because the increased frequency of the flickering flashes resonates with his facial expression of mounting horror and despair. The flicker created can be interpreted as a visualisation of the neurons firing away in his brain, inducing the stress he experiences. Even though the light sources are diegetic, the flashes slowly turn more subjective, and in the end, they clearly resonate with the short circuit that seems to occur in Sean's brain. Since the viewers are also temporarily blinded by the flashes, the alignment they might already feel with Sean as a result of the narrative and the look on his face is reinforced by the common experience of painfully strained and blinded eyes.

Finally, in Hitchcock's *Rear Window* (USA 1954, Technicolor V), the main character, Jeff, a photographer, defends himself with the help of his camera's blinding flashes. Jeff's neighbour, Thorwald, enters his apartment after realising that Jeff witnessed him commit a murder. In anticipation of the murderer's arrival, Jeff turns off the lights and

prepares his camera and a box of flash bulbs. After entering the apartment, Thorwald starts walking towards Jeff until he gets flashed in the face, causing him to falter and step back. Whenever he activates the flash, Jeff protects his own eyes with his hand. In a shot from Thorwald's perspective, we see Jeff reloading his flashlight through an iris-shaped red haze, which slowly clears. The haze visualises the light's blinding effect and the retina's slow recovery. Each time, we see Thorwald recovering his sight a little faster, creating a sense of mounting fear and tension. Hitchcock heightens the suspense by giving Jeff an unsynchronised flashlight, which forces him to stop and change the bulb before producing another protective flash. The red haze reminds of Goethe's description of the red circular appearance when the eye is flashed with white light.

All three films use the flashlight as an unpleasant, invasive, aggressive light, that can block sight and produce subjective colour effects. Arjen Mulder explains:[9]

> The flashlight is indeed the photo camera's most murderous aspect, a medial extension of the nocturnal lightning stroke. The explosion of white light, whether a bulb or powder, renders the invisible visible, but at the same time blinds what it depicts. For a moment no one no longer sees anything, neither the portrayed nor the photographer. (Mulder, 2017)

This is precisely the function that these types of lights play in the films mentioned above: they represent increasing stress and are experienced as an attack. Finally, in *Rear Window* they are even used as defence weapon to impede an aggressor.

A slightly later film that also works with the theme of the flashlight as threat, albeit in a more psychologically complex way, is *Peeping Tom* (GBR 1960, Michael Powell, Eastmancolor). Psychopathic murderer Mark Lewis has been traumatised by his father, who used him as a guinea pig for his investigations into the subject of fear. He would scare his son in the middle of the night with unpleasant things, all the while shining a bright light into his face in order to make a photographic record of his reactions. As a result, it seems that Mark has incorporated an unconscious connection between blinding lights and fear. He repeatedly reproduces this connection as an adult, with the help of a curious self-made weapon, comprising a camera on a tripod with a knife tied to one of its legs. A large mirror is attached to the camera, forcing his (female) victims to witness their own terror as he stabs them to death. As Mark blinds his victims with the bright camera light, the women, fearing for their lives, occasionally try to protect their eyes from the dazzling light radiating from the device.

At the end of the film, after confessing to his crimes and explaining his past trauma, Mark commits suicide using his own murderous machine. However, for this purpose, he has designed what could be described as a 'flash machine' to ensure that he becomes frightened enough to make the weapon work. Several cameras with

9 Mulder discusses this in a blogpost on the work of Dominique Somers. Somers is currently working on an art-based PhD project at Ghent University called 'Aesthetics of Flash'. I extend my thanks to Eva Hielscher for bringing this interesting project to my attention.

flashlights are connected to each other, and once activated, they flash Mark in the face one after the other, stirring up a terrible fear. Only then can he make his ultimate moving picture: one that records his own terror, as revealed in his eyes, while he stabs himself with the tripod-knife on his camera. Thus, in this film, it is the aggressive and invasive act of the camera and flashlights that is on display, filming and blinding the subject at the same time, and rendering him totally helpless.[10]

Destructive White Light

In 1950 Faber Birren published *Color Psychology and Color Therapy*, in which he discussed the aforementioned idea of eyestrain or 'fatigue' as it was called in nineteenth-century discourses on the retina. He discussed the destructive effect that too much or too little light could have on the eye, concluding that too little light could not really damage the eye, whereas too much light could. Birren (1950: 234) commented: 'Yet despite the fact that the human eye can do a prodigious job of seeing, it can be harmed by extreme glare, by excessive brightness extremes, [and] by exposure to [...] harmful radiation'. In the strict sense, excessive brightness implies such exposure because light is a form of radiation; however, Birren may also have been referring to other types of radiation that had increasingly become part of the early-1950s (visual) culture in another aggressive and invasive way: nuclear explosions.

By 1950, the year Birren published his book, the Cold War had already begun. After the USA dropped two atomic bombs on Japan at the end of the Second World War in August 1945, it continued its experiments, intent on developing an even more destructive nuclear weapon. However, on 24 September 1949, the Soviet Union tested its own nuclear bomb, signalling to the USA that it was no longer the only state developing a nuclear arsenal. This caused consternation in the American government, who by that time had carried out a total of eight nuclear tests. The USAstarted to increase its testing frequency, and by the end of 1953 had racked up 45 tests. In all, as James Stuart Olson (2000: 17) explains in his *Historical Dictionary of the 1950s*, '[t]he atomic bomb played a key role in the evolution of the Cold War during the late 1940s and early 1950s'.

Not only did nuclear tests become more frequent in the US, they also entered the nation's visual culture. Colour photographs were taken of the explosions and published in *Life Magazine* to garner public support for nuclear testing (Mallonee, 2015). One of these tests was actually broadcast live on television by KTLA on 22 April 1952. Mulder's remark about the flashlight being the photo camera's most murderous aspect can also be linked to this phase in American history: atomic blasts flashing into the living room through the television screen, combined with the fear of the Soviets

10 Laura Mulvey (2006) has analysed this scene as one that visualises the Muybridgean installation of photo cameras to analyse movement.

and their potency for atomic destruction, helped turn flashing light into a threatening and even deadly visual trope.

As American visual culture in the 1950s was filled with the flashing lights of these destructive weapons,[11] they naturally also found their way into cinema. For example, in *The War of the Worlds* (USA 1953, Byron Haskin, Technicolor IV), based on the book by H.G. Wells, in which Martians attack Earth, radioactivity, atomic energy and toxic radiation are visualised as blinding, deadly light rays. Soon after the Martians reveal themselves, they start killing people using small airborne devices with a telescope-like neck, at the top of which sits an orange eye that spits out a sparkling orange light. This first blinds its targets, then vaporises them. The vaporising is visualised with the use of masks and bluescreen technology, turning the characters or objects under attack into flat shapes in green, orange or yellow monochrome before they completely disappear. The combination of radioactivity and the mysterious way in which the Martians vaporise their victims with a beam of light already points in the direction of nuclear weapons[12] [Fig. 3.3].

After several casualties and a great deal of destruction, the army decides to use a similar weapon against the Martians, releasing an atomic bomb at the Martian mothership sitting in the desert. Unfortunately, they know how to defend themselves against even this immense power, and it has no effect. The film shows the bombing in full blast. We watch the explosion with the army and some of the main characters, who crouch behind piles of sandbags, wearing protective glasses. Another group of people sits on a mountain ridge to watch the explosion; they do not wear glasses and try to protect their eyes from the light with their arms or hands. The shots of the ridge differ in quality to the others in this scene; they are fringed with the Technicolor dyes of the film material, possibly indicating that the material derives from another, probably non-fiction film of actual people watching atomic testing in the Nevada desert where 'atomic tourism' was a regular phenomenon.

In the film, the explosion is shown at first as a white flickering light effect on the soldiers and main characters behind sandbags. Subsequently, the nuclear blast is shown with all kinds of colourful effects, such as blue-purple smoke against an orange and blue sky. Similarly, the film [昆虫大戦争] (*Konchu Daisenso/Genocide*) (JAP 1968, Kazui Nihonmatsu, Fujicolor), ends with a nuclear blast in a violent orange. Testimonies of people witnessing a nuclear test in the past often mention the colourful effects (Fehner and Gosling, 2006: 7).[13] Many colour photographs and films were made of the United

11 Interestingly, atomic tests in New Mexico and Nevada directly affected the film material Kodak had in stock in Rochester, New York. After complaining to the Atomic Energy Commission, Kodak received advance information on future tests so they could protect their films ('Radioactive Fallout', 1998).

12 In H.G. Wells' book *The War of the Worlds* (2008 [1898]), the weapons used by the Martians are called 'heat rays'. These are used for burning instead of vaporising humans. However, Wells later described a weapon that used radioactivity in *The World Set Free* (1914).

13 https://www.cbsnews.com/news/nuclear-explosions-lawrence-livermore-national-laboratory-film-preservation/

States nuclear tests. One of these colour photographs, depicting Operation Ivy in 1952, was put on display at the MoMA when they premiered the famous exposition 'The Family of Man' curated by Edward Steichen. MoMA mentioned this image in a press release announcing the exposition. The photo was displayed in a separate room:

> This gallery is painted black, and the only light comes from a six by eight foot (Eastman) color transparency of the explosion of a hydrogen bomb. (Shaw, 1955)

The colour version of this photograph only was displayed at the MoMA, and must have caused an effect of surprise since the rest of the photographs shown at the exposition were in black and white.[14]

All these examples of blinding flashes reveal how the nervous system can be shocked into temporary blindness and (phantom) colour perceptions. It is interesting to note that not only do the characters' reactions show the audience that they are blinded by the light, but the audience members themselves are simultaneously blinded and their nervous systems react in a similar way. The creation of what could be called a 'physical alignment' enhances the psychological and narrative alignment the film intends to evoke through the use of these kinds of scenes. The cultural connection to the atomic age was a constant during the 1950s and no doubt also helped to create a sense of fear among the audiences of such films.[15]

Successive Complementary Contrasts

Waking up the Audience

In addition to successive dark-light contrasts, films also use complementary contrasts, for example, in many of the silent era films that were coloured by tinting and/or toning. Several contemporary articles on the subject of colour in cinema explained the effectiveness of successive complementary contrasts in early film. W.E. Story, for instance, discussed the phenomenon of the after-image (or 'retinal fatigue') in relation to film in his 1921 'Tentative Report of the Optics Committee', mentioned above:

> We see then we can only bring color into the observer's immediate consciousness by change of color or by color contrast. This means to us, of course, that if a green picture is thrown on the screen it will soon become less green unless it is alternated with some other color, or unless we have in its neighborhoods light of a different color. (Story, 1921: 29)

Story also explained that colour changes were needed if a filmmaker wanted the audience to keep noticing the colours; without such changes, the effect of the colour

14 https://en.wikipedia.org/wiki/The_Family_of_Man

15 For a nuanced analysis of the colours of capitalism in relation to colours of the Eastern Bloc, see Dootson and Zhu (2020).

would decrease due to retinal fatigue. This, he continued, is a general characteristic of human perception, be it sound, vision, touch or taste: adaptation leads to a weakening of the effect. To 'wake up' the viewer's eyes, the colours must be changed regularly throughout the film. Interestingly, Story's analysis confirms Eric de Kuyper's (1992: 30) hypothesis that tints and tones might accentuate certain moments. For time-based arts such as film, this is of course an interesting observation, especially in relation to early cinema that so often worked with the alternation of monochrome colours created with techniques such as tinting and toning.

A beautiful example of a film that uses this tactic is *Die Abenteuer des Prinzen Achmed* (GER 1925, Lotte Reiniger; Carl Koch). One of the complementary colour pairs it uses is orange and blue, which follow each other in succession. Firstly, these two colours have a connotative function: they indicate the difference between inside and outside.[16] However, as they are complementary, they also strengthen each other during subsequent use: if the orange after-image produced by the blue tint matches the orange that follows it, it should strengthen the impression of the orange colour. The rest of the film also shows alternations between blue and yellow, which again create an awakening or arousing effect due to the dark-light and warm-cold contrasts formed by these colours. The Munsell system positioned saturated yellow closer to white and brightness, and saturated blue closer to black and darkness. The alternation between blue and yellow therefore produces a similar effect to that discussed above with the blue and orange, only in an attenuated form. In the nineteenth century, Michel Eugène Chevreul discussed the effects that could occur when working with such slightly off complementaries, creating what he called 'mixed contrasts'. He explained that these are in fact produced from the combination of an after-image that lingers on the retina with the colours of a new object: 'the sensation then perceived is that which results from this new colour and the complementary of the first' (Chevreul, 1855 [1839]: 30–31). In the case of a successive combination of a complementary—or close to complementary—pair, as we see in *Die Abenteuer des Prinzen Achmed*, Chevreul claimed that this could have a strengthening effect.

Finally, successive colour contrasts were also believed to increase the sense of (visual) rhythm. In the 1930s, the idea that colour can heighten the effect of rhythm in a film was tested by Dutch filmmaker Willem Bon. He made three experimental films for the Joris Ivens studio, one of which was created specifically to investigate the interrelationship between sound, colour and rhythm.[17] The film, which is called *Is er overeenkomst tusschen klank, rhythme en kleurafwisseling?* (Is There Similarity

16 Following Schopenhauer, Hölzer spread the idea that the alternation of blue and orange produces an embodied and sensorial experience as these colours were believed to activate opposite parts of the retina, causing a rapid shift from one to the other.

17 Two of these films are in the EYE Film Institute in Amsterdam. The first was a collage of film fragments from Joris Ivens shown simultaneously with the De Falla's *Danse Rituelle du Feu*. The images were edited in such a way that they matched the rhythm of this music (Bon, 1932b). This is a lost film.

Between Sound, Rhythm and Changing Colours?) (NL 1932), starts with a series of alternating black and white frames, followed by a sequence of coloured frames that alternate between red, yellow and blue.[18] The film was accompanied by the music of Ravel's Boléro. Bon wrote in *Het Lichtbeeld* (1932b: 56) that the experiment revealed that the alternation of coloured frames produced a stronger rhythmical effect than the alternation of dark and light at the beginning of the film.[19] Eric De Kuyper (1992: 31) has also reflected upon the importance of this element in his text 'La beauté du diable', in which he points out that with the alternation of colours, 'not only does the superficial aesthetic aspect change, the narrative seems better structured, but also, it adds something like another "rhythm", another "breath" that installs itself' (my translation).[20] Colour, he argues, adds an element that is comparable in function to editing but does not necessarily follow an editorial structure; rather, it adds another line of rhythm similar to the way that various rhythms and melodies are superimposed in musical pieces. All this would not be possible if colour changes and contrasts did not have an effect on the spectator. Towards the end of the film, the blues seem to have been mixed with red to produce purple, and the yellows appear more greenish. The reason is an increase of editing speed, creating an effect of coloured flicker which reminds of Sharits' flicker films in colours I mentioned above.

The monochrome colours produced by tinting and toning are much enhanced by the after-images created by their rapid succession, and despite cinema's later transition from applied colour systems to mimetic three-colour systems, filmmakers continued to use this effect. Adrien Cornwell-Clyne (born Adrien Bernard Klein) explored this facet of colour in his work *Colour Cinematography*, first published in 1936, which became one of the most widely read books on colour film. Most of the text is devoted to different colour-film techniques and processes, but it also contains a chapter on colour vision in relation to film.[21] In the 1951 edition, the first topic discussed in this short but interesting chapter is that of the after-image. Cornwell-Clyne argues:

> Since the colour film will often present rapidly varying stimuli to the eye, it is well that we should be acquainted with the phenomena of after-images, as it should thus prove possible to emphasize colour contrasts, and thereby to predict the aesthetic effect of certain sequences. (Cornwell-Clyne, 1951 [1936]: 632)

Thus, Cornwell-Clyne continued to pay attention to the phenomenon of successive contrasts in 1951, long after the transition to mimetic colours had taken place. And

18 The film is available online at: https://www.eyefilm.nl/collectie/filmgeschiedenis/film/is-er-overeenkomst-tusschen-klank-rhythme-en-kleurafwisseling

19 'Dit filmpje laat duidelijk zien dat door kleurafwisseling een veel grootere rythmeversterking verkregen kan worden dan door ongekleurde lichtafwisseling'.

20 '[N]on seulement l'aspect superficiellement esthétique change, la narrativisation semble être mieux structurée, mais encore, s'y ajoute comme une autre "rythmique", un autre "souffle" qui s'instaure.'

21 The subject is discussed in Chapter VII of the 1939 version, but in the 1951 edition, it is found in Chapter 14.

indeed, we can find manifold successive complementary colour contrasts in films from the 1940s and 1950s.[22] A much used successive contrast is that of orange and blue, creating a complementary successive contrast. In addition, these colour shifts are often diegetically motivated, indicating a light, space or time change, such as in *The War of the Worlds* (1953) [Figs 3.2–3.3]; and *All That Heaven Allows* (USA 1955, Douglas Sirk, Technicolor V) [Figs 3.4–3.5].

Figs 3.2–3.5 Examples of successive complementary colour contrasts in two films from the corpus

Fig. 3.2 *The War of the Worlds* (USA 1953, Byron Haskin). DVD 1999 Paramount Pictures. Time code: 00:17:44

Fig. 3.3 *The War of the Worlds* (USA 1953, Byron Haskin). Time code: 00:17:49

Fig. 3.4 *All That Heaven Allows* (USA 1955, Douglas Sirk). DVD: 2001 The Criterion Collection. Time code: 01:21:43

Fig. 3.5 *All That Heaven Allows* (USA 1955, Douglas Sirk). Time code: 01:22:21

In *Spartacus*, a similar pattern is used just before Antoninus runs from Crassus' villa after the latter has tried to seduce him (with snails and oysters). The inside of the

22 Cornwell-Clyne also warns filmmakers that eye fatigue and after-images can also have a negative effect on the appearance of, for example, faces. He advises using the mix and the fade to give the eye time to recover. The mix permits a brief recovery period and helps to reduce the distortion of colour fatigue, and the fade is even more effective. The period of a fade in colour should be longer than in black and white, as this will give the eye time to recover its neutral balance (Cornwell-Clyne, 1951 [1936]: 636).

villa is a brownish-orange colour, whereas the moonlight outside has a bluish light, and where it penetrates the interior, we see the blue light suffusing the walls[23]. The film *All That Heaven Allows* very effectively also uses the clash between blue and a brownish-orange very effectively. The successive contrast is mostly used in the film to indicate a difference between the cosy warmth inside and the cold, wintery space outside. Furthermore, an interplay between colour, time and space is choreographed through the movement of both camera and characters: the characters move from one colour into another, producing a successive contrast of coloured light (Flueckiger, 2020b: 31).

A further point of interest is the common connection between night scenes and the colour blue in both tinted films and films in mimetic colour (such as Technicolor). Leonard Troland, who developed Technicolor's dye transfer system in the late 1920s, wrote an article in 1918 called 'The Psychology of Color', in which he sought to understand why the world at night seems to appear bluish. His first explanation was that it might be an after-effect in the retino-cerebral process, as Ewald Hering also believed in the nineteenth century. Hering argued that the reason sunlight appears as a kind of yellow is because it is an after-effect of the blue we see at night. However, instead of simply connecting this effect to vision, Troland asked whether this might be a physiological or possibly more of a psychological response:

> Perhaps the most pervasive, if not the most fundamental principle of psychology is that of association, and it has been clearly shown that the workings of this principle can not only modify our imaginations, but can alter the quality of our perceptions and sensations. (Troland, 1918a: 114)

His conclusion was that the effect was probably the result of both. Firstly, he supported Hering's idea that an after-effect of the (yellow) daylight produced a subjective perception of the night as blue. Secondly, he thought this effect created an even stronger bluish colour in the viewer's perception simply because night had become commonly associated with the colour blue. Thus, an explanation that relates to Bourdieu's concept of habitus was discussed here, *avant la lettre*. In addition, the tradition in early cinema of presenting night as blue might also have strengthened the tendency to interpret it as such in real life.

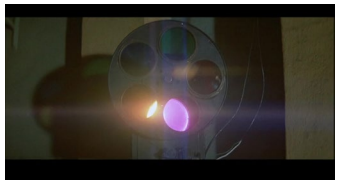
Thus, habituation and familiarisation were thought to influence how we interpret and maybe even see colours, reinforcing my overall argument concerning the concept of habitus and the idea that cultural context can influence how emotions, affects and feelings (in this case, relating to colours) are produced.

23 The bluish light, for example, fills the *compluvium*, the opening in the roof of a Roman villa that allowed the rain to fall into the *impluvium* underneath. The *impluvium* collected the rainwater and filtered it so that it became fit to drink.

Abstract Colours

The 1960s saw an increase in less mimetic and more experimental uses of colour in film. Jean-Luc Godard, for instance, used colour contrasts in a more abstract way as a visual reflection of colour theory. In his first colour film *Une femme est une femme* (FRA 1961, Eastmancolor), Godard experimented with complementary pairs of colours and diegetically impossible colours. For example, when the main female character, Angela, performs her striptease in a Parisian cabaret, the act is presented more as a light show than an erotic performance. Instead of showing us her body as she slowly undresses, the camera dwells on her face, which is lit by alternating coloured lights, an effect created by five coloured filters turning in front of a theatre light and producing a succession of purple, yellow, blue, green and red lights. This means that the first and last colour pairs create a successive complementary contrast: the yellow-blue and red-green pairs reflect Hering's two opposing colour pairs. Remarkably, the blue-orange complementary contrast that we know from subtractive colour mixing is not included in the filter; however, this specific combination is shown as a simultaneous contrast in a shot of Angela's face bathed in blue light against an orange background [Figs 3.6–3.11]. This scene therefore visualises colour theory, colour culture and colour aesthetics rather than the culture of voyeurism, nudity and sex, although it is the latter that seems to be the main element of the film's narrative.

Figs 3.6–3.11 Theatrical colours reflecting Hering's opposing color pairs in *Une femme est une femme* (FRA 1961, Jean-Luc Godard), DVD: 2004 The Criterion Collection



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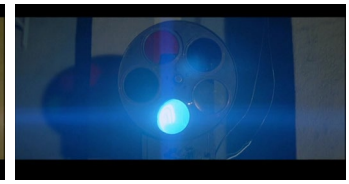

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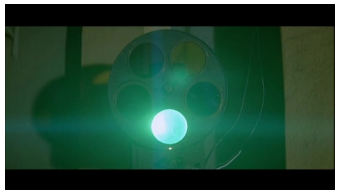

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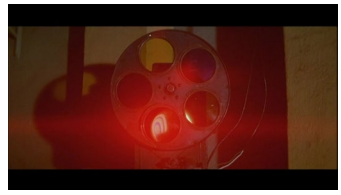

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Figs 3.12–3.15 Alternating complementary colours green and red to increase sexual tension in *Une femme est une femme* (FRA 1961, Jean-Luc Godard), DVD: 2004 The Criterion Collection

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Time code: 00:36:32

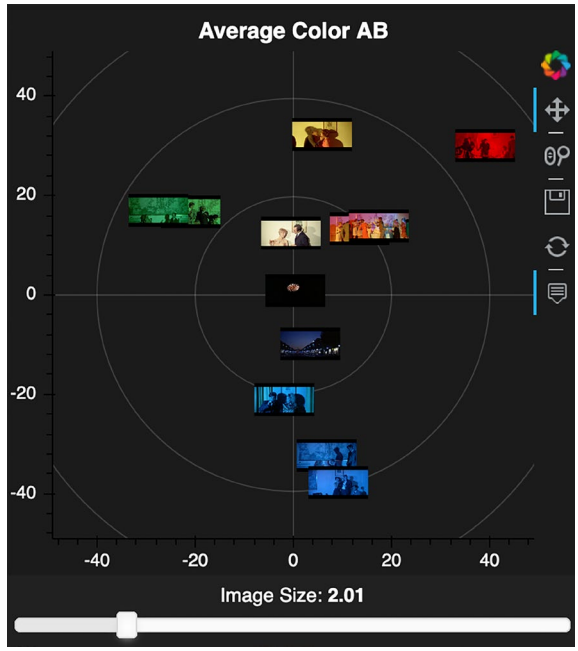
Later in the film, when Angela is apparently making love with family friend Lubitsch in the bathroom, coloured lights are again used in an aesthetic, more abstract way. The bathroom is alternately lit in red and green, without any clear indication of a diegetic light source. Interestingly, the alternation of complementary colours increases the tension in the scene, underlining the suggestion of sexual activity and the feelings of jealousy growing inside Angela's husband Émile [Fig 3.12–3.15]. Four years later, in *Pierrot le fou* (FRA 1965, Eastmancolor), Godard again uses successive colour contrasts, this time with the help of a combination of monochrome filters and coloured lights to illuminate a party scene. The film image is thus presented in red, green, yellow and blue. A VIAN visualisation of the stills from this sequence, positioned in the CIE L*a*b* colour space, reveals that they are divided into two pairs located opposite each other, once again reflecting Hering's opponent process theory [Fig 3.16].

Hence, in both *Une femme est une femme* and *Pierrot le fou*, Godard visualises theoretical concepts of colour while at the same time increasing their visual effect through the use of complementary colours and the appearance of after-images. This practice of working with colours relates to the way in which, as Volker Pantenburg (2015: 88) comments, '[t]he painterly principle of linking colors replaces a logic of narration'. Indeed, we also encounter this technique in abstract painting. For example, Johannes Itten and Paul Klee, who both taught and practised at the Bauhaus during the early 1920s, made concepts, ideas and theories of colour the starting point for their art (Wagner et al., 2013).[24] However, Godard's

24 In 2012–2013 the Kunstmuseum Bern and the Martin-Gropius-Bau in Berlin organised an exhibition around this particular theme. See: https://www.uni-regensburg.de/philosophie-kunst-geschichte-gesellschaft/kunstgeschichte/projekte/itten-klee-kosmos-farbe/index.html

films are more than just experiments; rather, he combines elements of narrative integration and experimental filmmaking. As a result, during these moments of pure abstract colour and the visualisation of the principles of colour theory, Godard also creates an effect of 'Verfremdung' or 'ostranenie', breaking the fictionalisation and producing a reading of the film's 'being-madeness'. The idea of ostranenie is developed further in Chapter Six.

Fig. 3.16 Visualisation in VIAN of colours in the party scene of *Pierrot le fou* (FRA 1965, Jean-Luc Godard), in which we recognize Hering's opposing colour pairs. Visualization made in VIAN Webapp based on the DVD released by The Criterion Collection in 2004.



During the 1960s, films in the horror and fantasy genre also used successive colour contrasts in an interesting way. Italian director Mario Bava, who often created characters haunted by their own madness, frequently used coloured light to produce an atmosphere of eeriness. An example of successive complementary contrasts can be found in the third part of his film *I tre volti della paura* (ITA 1963), called *La goccia d'acqua*. When the main character is talking on the phone, she is alternately lit in green and red, creating a strange effect that foreshadows the danger to come. Another example of a film that uses successive contrasts of complementary colours is Roger Vadim's *Barbarella: Queen of the Galaxy*. For example, the scene in which Durand Durand uses a positronic ray against people who are trapped in a labyrinth which is lit by alternating reds and greens. The ray is green, as are the effects of its evaporating powers (as in *War of the Worlds*) whereas the space in which Durand Durand wields his ray is dominated by the colour red. In addition to a spatial clarification, the colours are also used to increase tension by placing extra strain on the eye of the spectator.

4. Oscillating Op Art

Fluctuations and Interactions

Simultaneous contrasts occur when two or more colours appearing in a single image start to affect each other and the way they are perceived. For example, if we stare at a piece of black paper positioned against a white background, after a time, the edges of the black shape start to appear darker, while those of the white background bordering it appear brighter and, as a result, the rest automatically appears more greyish. The eye is basically activated by change (of colour, light and dark, etc.). This implies that when an observer tries to focus on something, the eye has to make small movements of adjustment in order to function correctly, an effect called 'tremor' or 'drifting',[1] which causes the emerging after-image to bleed over the edges of the perceived object. This is reinforced by the process of lateral inhibition that increases the effect of the contrast between colours and their intensity.

In all, the concept of 'simultaneous contrast' describes how each colour occurring in a single image influences and interferes with our perception of the others. As Goethe (1840 [1810]: 56) described it, '[i]f a coloured object impinges on one part of the retina, the remaining portion at the same moment has a tendency to produce the compensatory colour'.[2] A few years later, chemist Michel Eugène Chevreul, who also was director of the dye works in the famous French tapestry factory, Gobelins, made this latter phenomenon the focus of his experiments, building on earlier work by Count Rumford and M. Prieur de la Côte-d'Or. After noticing how colours could interfere with each other in unappealing ways, spoiling the appearance of the Gobelins tapestries, he started to systematically study the way in which two or more colours influenced each other's appearance when presented in a single image. In 1828 Chevreul published a lecture he gave at the Académie des Sciences, called 'Mémoire sur l'influence que deux couleurs peuvent avoir l'une sur l'autre quand on les voit simultanément', in which he introduced the concept 'contrast simultané' (simultaneous contrast). Chevreul's work

1 See, for example, Ko et al. (2016). I would like to thank Miriam Loertscher for explaining this phenomenon.

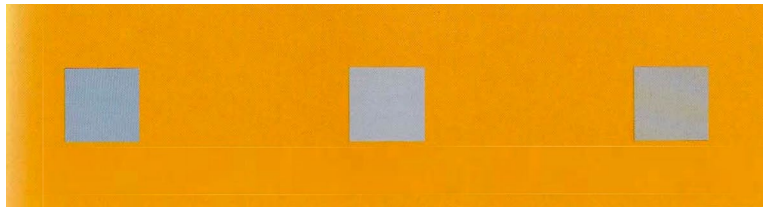
2 'Malt sich auf einem Teile der Netzhaut ein farbiges Bild, so findet sich der übrige Teil sogleich in einer Disposition, die bemerkten korrespondierenden Farben hervorzubringen' (English version: Goethe, J.W. v. (1840) *Theory of Colours*. John Murray).

 https://doi.org/10.11647/OBP.0380.05

and his 'laws' of simultaneous contrast were to become the key to colour harmony and found their way into painting (Gage, 1999: 198). Although he circulated his ideas over the course of numerous lectures, it was the publication of his book *De la loi du contraste simultané des couleurs* (1839) that brought his work international recognition. It was published in English as *The Principles of Harmony and Contrast of Colors and Their Applications to the Arts* that same year (Gage, 1999: 198).

Johannes Itten followed Goethe and Schopenhauer and their theories of the retina's craving for harmony and balance. In *The Art of Color*, for example, he explains simultaneous contrasts as arising from the fact that 'for any given color the eye simultaneously requires the complementary color', adding that 'the fundamental principle of color harmony implies the rule of complementaries' (Itten, 1973 [1961]: 87). Although he describes the eye as an organ with a will of its own—manifested in the need to create balance—Itten explains in his chapter on simultaneous contrasts how its urge for harmony can be controlled and used to the artist's aesthetic advantage. He demonstrates this with the help of the following illustration [Fig. 4.1]. In the orange rectangle, we see three grey squares. However, if we look at them separately, each square appears to be a slightly different colour: the square on the left looks very blue, the one in the middle also appears blue, but less so than the one on the left, and the square on the right remains grey and does not seem to be influenced by simultaneous contrast. These distinct effects are due to the fact that a little blue has been mixed with the first grey and is thus combined with the simultaneous effect; the second grey is neutral and shows only the simultaneous effect; while the third grey square contains just enough orange to cancel out the simultaneous effect and therefore shows no modification. This experiment clearly shows how the effect of simultaneous contrast can be deliberately amplified or suppressed (Itten, 1970b [1961]: 54).

Fig. 4.1 Illustration from Itten's *Elements of Color* with which one can experience the effect of simultaneous contrast.



Even though it seems most applicable to painting, filmmakers were also advised to consider this effect. For example, Adrien Cornwell-Clyne (1951 [1936]) turned to the issue of simultaneous contrast in the film immediately after discussing the after-image and eye fatigue. Referring to Michel Eugène Chevreul, he explained simultaneous

contrast as an effect created in the areas neighbouring an activated part of the retina, stating that '[w]hen two colours are juxtaposed they modify each other both in brightness and in hue' (Cornwell-Clyne, 1951 [1936]: 636), the effect being greatest at the edges, where the colours tend towards the complementary of the stimulus. He believed the phenomenon to be one of the major visual illusions, commenting on its extensive use by artists.[3]

Cornwell-Clyne was not the only cultural figure to advise filmmakers to pay attention to simultaneous contrasts: Jack Gieck wrote an article in 1952 targeted at amateur filmmakers, in which he also explained the effect of simultaneous contrast and the advantages it confers. Gieck specifically mentions the strengthening effect that occurs when using complementary colours in an image. Like Cornwell-Clyne, he explains this type of contrast with reference to Chevreul rather than Goethe. For Gieck (1952: 295, 305), the subsequent colours correspond to the complementary colours we know from painting and the subtractive system related to mixing red and green, blue and orange, and yellow and purple dyes.

Indeed, simultaneous contrasts do occur from time to time in films, although they are rarely noticeable. The reason is that the eye has to be fixed on an object for a while before the effect starts to occur, so it seems logical that they happen less frequently when watching a medium comprising moving images than when contemplating a painting. However, there are some rare examples, such as Willem Bon's *Kleur en vormafwisseling op 'Choo-choo' jazz*, the third film in the series that he made for Joris Ivens' studio. In this film, we see various rather small shapes in bright colours placed in the middle of a black background; the shapes remain in the same location, but because we explore the shape with our eyes, the after-image easily bleeds into the black background. A similar effect occurs in the aforementioned Japanese horror film *Kyuketsuki Gokemidoro* (Goke, Body Snatcher from Hell), which follows a group of survivors from a plane that crashes near the dwelling-place of a body snatcher, who appears in the shape of a blob. When the blob attacks some of the passengers, they undergo a strange transformation: the site where the blob lives is characterised by an orange colour, and those survivors that fall into its power also turn orange. The first time the body snatcher attacks, for example, the entire process is shown in a slow, stretched-out sequence in which we see the first victim begin to succumb to the alien's influence, reflected by their orange transformation. The sequence has a relatively slow rhythm, giving the viewer's eyes enough time to produce an after-image that bleeds into the rest of the image as a result of eye tremor or drift [Fig. 4.2].

3 Cornwell-Clyne added that, similar to the after-images, the simultaneously appearing colours did not exactly complement the stimuli. To support this argument, he referred to research by Sir William Abney in 1913, who measured the wavelengths of the colours produced by simultaneous contrasts.

Fig. 4.2 Example of an after-image that bleeds into the rest of the image as a result of eye tremor or drift in the film *Kyuketsuki Gokemidoro* (JAP 1968, Hajime Sato), DVD The Criterion Collection 2012. Time code: 00:23:48

In both films, however, it is unclear whether the effect was intended or whether it accidentally slipped in as a consequence of the overall film effects. Indeed, these effects are far more difficult to control in film and other forms of moving images than they are in the production of still images such as paintings. For instance, the effect of simultaneous contrast can produce unwanted discontinuity in the editing. An example of this can be found in a scene in the Japanese monster film *Konchu daisenso* (Genocide), in which policemen discover an unconscious man, dressed in orange overalls, lying on a pebbly beach. First, we are given a wide, sweeping view of the scene: grey water, grey pebbles and grey policemen, with the unconscious figure a small orange dot on the left of the picture. The following shot is a medium close-up, with the orange man at the centre of the image, surrounded by pebbles that now look more bluish than grey. Showing the same situation and the same location but from different distances creates a discontinuity in the colour scheme of the two images [Figs 4.3–4.4].

Figs 4.3 and 4.4 Shift from grey to blue pebbles in *Konchu daisenso* (JAP 1968, Kazui Nihonmatsu). DVD The Criterion Collection, 2012.

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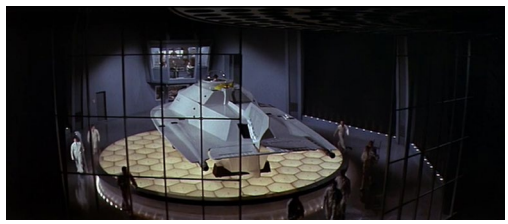
Another (probably unintended) example of unstable colour schemes resembling the effect of simultaneous contrast can be found in *Fantastic Voyage* (USA 1966, Richard Fleischer, Eastmancolor). In this science-fiction film, a medical team literally dives into a man's body in order to execute a complex operation on his brain. They need to a shrink a submarine to a microscopic size so that it can enter a blood vessel—and fortunately they have the appropriate technology. The film creates the illusion of the ship shrinking by simply moving the camera back, similar to the way in which Georges Méliès altered the size of the head in his 1901 silent film, *The Man with the*

Rubber Head. As the camera moves away, the background is kept stable with the help of matte colours, producing the impression that the submarine really is becoming smaller. What is remarkable is that on the Criterion DVD the ship changes colour from one shot to another. Before the shrinking process begins, it is filmed from a high-angle position. In this shot, the lower part appears yellowish, while the top of the ship appears greenish-white, and the platform it stands on is a soft yellow. However, in the top shot showing the ship during the shrinking process, both the platform and the ship appear in quite different colours: the ship is lavender, and the platform has turned more of a greenish-yellow. The change is in no way justified diegetically; rather, the colours appear to have been influenced by each other's presence. The question is whether the filmmaker consciously implemented this colour shift, imitating the effect of simultaneous contrast, or whether it happened accidentally because of the complexity of the film's special effects (Lightman, 1966). Either way, in terms of the narrative, the changing colour of the submarine and its platform resonates with the instability in the ship's size and the transformation it undergoes [Figs 4.5–4.6].

Figs 4.5 and 4.6 Colour shift resembling simultaneous contrast resonating with instability of the scene in *Fantastic Voyage* (USA 1966, Richard Fleischer), DVD Twentieth Century Fox Home Entertainment, 2007.



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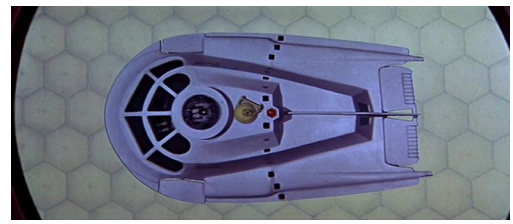

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Whereas *Fantastic Voyage* gives the impression that the simultaneous colour contrast might be a happy accident, Stanley Kubrick's film *2001: A Space Odyssey* (GBR / USA 1968, Stanley Kubrick, Metrocolor) appears to deliberately imitate the effect. We can see this if we refer to a rather short but important moment, around 45 minutes into the film, when a spaceship flies over the surface of the moon. A shot from behind the pilots allows the viewer to look through the ship's front window. Since the interior of the cockpit is lit with a red light, the grey rocks on the surface of the moon appear green—apparently a typical case of simultaneous contrast. Three minutes later, this effect appears again, but this time from space. We see the spaceship flying against a black background with its windows glowing red (due to the lights inside the ship), and as the exterior of the ship, which was white in earlier scenes, now appears green, this image again seems to imitate the effect of simultaneous contrast [Figs 4.7–4.9].

Figs 4.7–4.9 Aesthetics of simultaneous contrast in 2001: *A Space Odyssey* (GBR / USA 1968, Stanley Kubrick), DVD The Criterion Collection, 2001.

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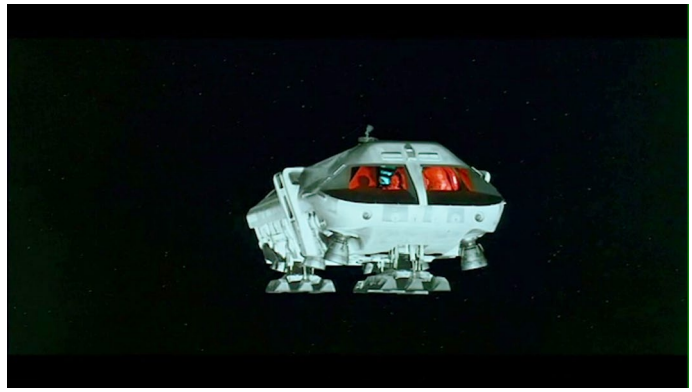

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Interestingly, the shot from the cockpit echoes an image seen ten minutes earlier in the film. Another cockpit in another spaceship is presented from exactly the same angle and with a similar red-lit interior. Not only that, but the windows are of a similar shape and in the same position. In fact, the compositions of both images are very similar even though they show two different spaceships. The colour of the moon's surface is the one thing that clearly differs in the two shots: in the earlier shot, the surface appears purplish, whereas in the later one, it looks greenish. And whereas in the second shot it might seem as if the green effect occurs accidentally due to the eye's lateral inhibition, the first shot reveals that the colours of the moon's surface are not accidental, but a controlled decision [Figs 4.7 and 4.9]. The variations in colour emphasise both the instability of colour perception and of the appearance of the moon's surface. More poignantly, the instability of the moon's colours reminds us of (and resonates with) the insecurity of an astronaut's existence.

Simultaneous contrast therefore often dovetails with an oscillating, dynamic, unstable situation. Interestingly, Itten (1973 [1961]: 87) described the occurrence of simultaneous contrast as 'a feeling of excitement and lively vibration of everchanging intensity'.[4] A similar effect to simultaneous contrast, he claims, can be obtained when combining two colours that are 'not precisely complementary'. Since each one will be pushed towards the complementary of the other, they will become 'tinged with new effects':

> Under these conditions, colors give an appearance of dynamic activity. Their stability is disturbed, and they are set in changeable oscillation. They lose their objective character and move in an individual field of action of an unreal kind, as if in a new dimension. Color is as if dematerialized. (Itten, 1973 [1961]: 87)[5]

Instead of emphasising that colour should be controlled and eyestrain avoided, Itten advises us to make use of the dynamic activity they produce—that is, the instability, oscillations and new dimension they open up. I would argue that this 'opening up' to eyestrain and instability is directly connected to the cultural context of the 1960s, in which colour appeared to be unleashed from its former prescriptive norms and rules, and grew ever wilder. Ironically, as film is an unstable medium, it cannot rely on the occurrence of simultaneous contrast unless it is emphasised strongly. Thus, film has to imitate the effects of instability with the help of precisely these rules of colour control it seemed to have shaken off.

4 'Weil die simultan entstehende Farbe nicht real vorhanden ist, sondern erst im Auge entsteht, erzeugt sie in uns ein Gefühl von Erregtheit und lebendiger Vibration von ständig wechselnder Stärke' (Itten, 1961a: 87).

5 'Die Farben scheinen in höchster dynamischer Erregung zu sein. Ihre Stabilität ist aufgelöst, und sie kommen in ein wechselvolles Vibrieren. Sie verlieren ihren objektiven wirklichen Charakter und schwingen in einem individuellen Wirkungsfeld unwirklicher Art wie in einer neuen Dimension. Die Farbe wirkt entmaterialisiert' (Itten, 1961a: 87).

Feeling Colour in Op Art

All these oscillations and instabilities have a direct connection to the art movement of the 1960s known as 'op art' or 'kinetic art' ('art cinétique'). The label 'op art' is of course an abbreviation of 'optical art', a term that encapsulates the playful experimentation with optical illusions that characterises this form of art. One film that appears to be related to this movement more than most is Roger Vadim's *Barbarella: Queen of the Galaxy* (1968). Space agent Barbarella travels the galaxy in her elaborately appointed spaceship to promote peace and love across the universe. The interior of the ship is entirely covered in a yellowish-brown furry material, except for a reproduction of Seurat's painting, *Un dimanche après-midi sur l'île de la Grande Jatte* (1884–86), and a rectangular light box on the wall. The light box is covered with silver petals that move whenever the ship's onboard computer speaks. Its panel is strongly reminiscent of op art aesthetics, with their recurring motif of metal petals; a well-known example of this style can be seen in Paco Rabanne's metal dresses.

The light box also changes colour from yellow to red, and back again, while the silver petals simultaneously change from silver to grey or black. Yellow combined with silver appears to indicate a calm state, whereas red and black indicate unpleasant or stressful events such as conflict [Figs 4.10–4.11]. These shifts in colour reveal that the ship itself is—in a sense—vibrantly alive, and maybe even a little unstable, an assumption that becomes even stronger during a landing that is disrupted by magnetic disturbances. Through the ship's window, we see an impressive colour show, dominated by the complementaries green and red; meanwhile, the petalled panel also alternates rapidly between green and red, as if panicking. When the spaceship hits the ground, the panel turns purple, again producing a complementary contrast, this time in relation to the yellowish furry walls. The combination of purple and yellow echoes the colour scheme in the left part of Seurat's picture hanging on the ship's wall [Figs 4.12–4.13]. All the movements and changes in colour not only give the scene an impression of oscillating instability, but they also appear to 'dematerialise' colour, to borrow Itten's words.

Figs 4.10 and 4.11 Op-art panel moves and changes colour when Barbarella's ship speaks with her in *Barbarella: Queen of the Galaxy* (FRA / ITA 1968, Roger Vadim). DVD Paramount Home Video, 1999.

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Figs 4.12 and 4.13 Colour palet of the ship echoes those of the reproduction of the Seurat painting. *Barbarella: Queen of the Galaxy* (FRA / ITA 1968, Roger Vadim). DVD Paramount Home Video, 1999.

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It is worth reflecting on this last image and the way it relates to Itten's colour theory and his explanation of simultaneous contrast. First, the transition of the petals from silver-grey to purple visually echoes the illustration (mentioned above) that Itten used to explain simultaneous contrast, in which the grey rectangle placed in the centre of a dominant orange colour appears in the complementary hue of the surrounding colour [Fig. 4.1]. Secondly, in *Kunst der Farbe*, Itten (1961a: 112–13) uses a reproduction of a study for *Dimanche à la Grande Jatte*, housed in the Metropolitan Museum in New York, to explain pointillism and its relation to colour theory and physics.[6] In short, this painting was not simply an example of the impressionist movement, but the example. Hence, its appearance in the film is clearly a reference to the way in which theories on the subjectivity of colour perception influenced art history. Nineteenth-century colour theory and its relationship to impressionism seems to have been a favourite topic among art historians and critics during the 1960s, especially those interested in op art. For example, William Seitz quoted poet and art critic Jules Laforgue (in Seitz, 1965: 5), who wrote that modernist painters were 'endowed with an uncommon sensibility of the eye'. According to Seitz (1965: 7), Laforgue's comments could equally be applied to perceptual artists in the 1960s. Finally, Itten's former Bauhaus colleague, Josef Albers, also explained the phenomenon of 'optical mixture' in his book *Interaction of Color* (Albers, 1971 [1963]: 33). These various references to *Dimanche à la Grande Jatte* seem to confirm the above interpretation of the colours and shifts in colour in the scene in Barbarella that contains the painting.[7]

Albers' *Interaction of Color* (1963), together with Itten's *Kunst der Farbe* (1961a), is considered one of the foremost studies of the mid-twentieth century on how to work with colour. Interestingly, Albers did not focus on the explanation of colour systems and colour harmonies; in fact, he took quite an opposite approach: instead of

6 Neo-impressionists did not mix dyes on their palettes but produced a visual effect of mixed colours by applying small dots of primary colours close together. As a result of the (subjective) simultaneous contrasts, the colours appear as if mixed.

7 The director of photography on *Barbarella* was Claude Renoir, the grandson of artist Pierre-Auguste Renoir, who was part of the neo-impressionist movement. Although it is unclear what his influence on the mise-en-scène of the film was, it is probable that he would have been very well informed about the neo-impressionists and the theory of simultaneous colour contrasts and their effects.

explaining the rules of colour, he described a series of experiments that he used for his 'teaching-by-doing' method. He aimed to teach his students to 'feel color relatedness' (Albers, 1971 [1961]: 1). As a result, he dismissed all the 'rules of thumb' in the form of colour advice, as he believed they led to dull, uninspired work such as 'interior and exterior, furniture and textile decoration following such colour schemes, as well as commercialised color "suggestions" for innumerable do-it-yourselves' (42).

Thus, instead of learning rules about colour harmony, Albers advised his students to become like cooks, tasting the potential of colour combinations for themselves. He wanted them to search for colour tensions and find dynamic asymmetries. For example, when Albers (1971 [1963]: 53) let his students copy the 'old masters', he told them not to dwell on the details but on the 'climate, temperature, aroma, or sound of their work'. He also encouraged them to find the (often unpleasant) ability of colours to vibrate:

> This initially exciting effect also feels aggressive and often even uncomfortable to our eyes. One finds it rarely used except for a screaming effect in advertising, and as a result it is unpleasant, disliked, and avoided. (Albers, 1971 [1963]: 62)

Albers wanted his students to look for the 'excitement [that] lies beyond rules and canons'. Consequently, he only refers to some of the 'masters' of colour theory, such as Goethe, Schopenhauer, Munsell, Ostwald and Birren,[8] at the end of the book, without explaining what their theories actually implied (Albers, 1971 [1963]: 66–68). In all, Albers taught his students what was possible with colour combinations, including how they could be made to vibrate using simultaneous contrasts and other optical effects—precisely the theme that op art artists pursued in their work.

Albers was a teacher for almost his entire working life. He was a master at the Bauhaus, where he worked from 1923 until 1933 when the Nazis shut down what they called this school of 'entartete Kunst' ('degenerate art'). In 1933 he and his wife Anni moved to North Carolina, where he taught at the Black Mountain College until 1946. Then in 1950 he was appointed chair of the department of design at Yale. If we add to this his many guest lectures at various institutions, Albers could rightly be said to have taught several generations of artists, not only in Germany but also in the US, and elsewhere.[9] This might explain why his teaching and his artworks were considered an important prelude to what would become known as op art—or, as Albers himself stated during the exhibition 'The Responsive Eye', which exhibited some of the main pieces of the op art movement, '[y]ou see, I'm the father, and I'm not supposed to say something bad or good about my babies... I had to wait fifty years, until people finally looked to me as if they looked with my eyes'.[10]

8 However, if we take into account the fact that Faber Birren was one of the main commercial 'do-it-yourself' colour consultants for interior design, it seems unlikely that Albers was a big fan.

9 See: https://albersfoundation.org/teaching/josef-albers/chronology/#1900

10 *The Responsive Eye* (USA 1965, Brian De Palma). Available at: https://www.youtube.com/watch?v=vaUme6DY8Lk. This is a documentary film de Palma made about the opening of the

Op art's focus on movement and optical illusion brought it close to cinema as an art form. As Pauline Mari shows in *Le voyeur et l'halluciné: Au cinéma avec l'op art* (2018), several films were made during the 1960s that either directly or indirectly referred to this art movement. Mari discusses a number of interesting colour films, including *Les demoiselles de Rochefort* (FRA 1967, Jacques Demy, Eastmancolor), *Les aventuriers* (FRA 1967, Robert Enrico, Eastmancolor), and *Les choses de la vie* (FRA / JAP / CHE 1969, Claude Sautet, Eastmancolor). Many of these films refer to op art principally by including famous pieces of this art in their sets or by using the aesthetics of optical illusions in the film's architecture or mise-en-scène. Other films such as *La prisonnière* (FRA 1968, Henri-Georges Clouzot, Eastmancolor), *Modesty Blaise* (UK 1966, Joseph Losey) and (again) *Barbarella* include op art aesthetics in their mise-en-scène and narrative in even more powerful ways, and the op art spaces in these films often resonate with—and even intensify—the inner states of one or more of the filmic characters.

As mentioned above, the first scene in *Barbarella* contains numerous allusions to op art; however, it is in the film's last scene, which takes place in the queen's 'dream chamber', that op art returns in a much more all-embracing way that includes the mise-en-scène, decor, Barbarella's costume and the scene's psychological connotations. Barbarella, for example, is wearing her green petal dress—possibly the best-known op art reference in the film. Yet, although the title sequence mentions that Barbarella's costume was inspired by the ideas of Paco Rabanne, there is a persistent misunderstanding that he actually designed it. Elizabeth Castaldo Lundén (2016), however, has made it clear, once and for all, that Jacques Fonteray designed not only the dress but also all the other space-costumes Barbarella wears in the film. It is interesting to note that the (final) scene in which she wears this dress takes place in a room whose decor appears to be a piece of op art in itself: the room's distorting mirrors create optical illusions that refer to the dream state the queen enters once in the room;[11] the distorting mirrors create confusion as people and objects constantly change shape; and the entrance to the room itself is located in an invisible wall and can only be opened with an invisible key. The room also has no logical structure and is divided only by projections of moving colours, and from the moment Barbarella enters, it appears to be at risk of collapse (and eventually does so at the end of the scene) [Figs 4.14–4.15]. Arguably, the room's op art mise-en-scène reflects the liminal, unstable state of sleep and the unreliability of dreams (where nothing is what it seems), which are brought together in a precarious balance that is easily disturbed.

exhibition. Albers' quote appears around 15 minutes into the film.

11 This space also refers to the dream-cinema analogy since Barbarella and the queen can see what is happening in other places with the help of a one-way screen without being seen themselves and without the ability to intervene.

Figs 4.14 and 4.15 The 'dream chamber' in Barbarella has an op-art design. *Barbarella: Queen of the Galaxy* (FRA / ITA 1968, Roger Vadim). DVD Paramount Home Video, 1999.

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The film *La prisonnière* presents a similar scenario, this time in a scene set in an art gallery during the opening of a fictional exhibition of kinetic art. One of its displays is an op art labyrinth, a space full of optical illusions that create a sense of disorientation and confusion with the help, once again, of distorting mirrors. It is here that the protagonist witnesses her boyfriend kissing another woman. Her confusion immediately resonates with her surroundings in which she herself appears as a visual component due to its multiple mirrors. After leaving the labyrinth, she enters the gallery space again, where her inner state appears to be reflected in the shimmering, shining, multicoloured pieces of op art on display. Her attention, however, is not directed towards the artworks but falls upon the gallery owner, for whom she starts to develop amorous feelings [Figs 4.16–4.18]. Whereas in *Barbarella*, it is the character's actions (Barbarella entering the dream room) that precipitates the op art environment's collapse, the op art in this film seems to increase the confused and stressful feelings of the main character at the same time as these feelings resonate in her surroundings.[12] It is the op art experience that seems to cause the inner stability of the protagonist to collapse, affecting her behaviour for the rest of the film.

12 In addition, some of the artworks are given a strong sexual connotation through the perceptive subjectivity created by point-of-view shots combined with what we know about the inner world of the main character.

Figs 4.16, 4.17 and 4.18 Colourful op-art reflects the mood of the main character in *La prisonnière* (FRA, 1968, Henri-Georges Clouzot). DVD Studio Canal, 2014.

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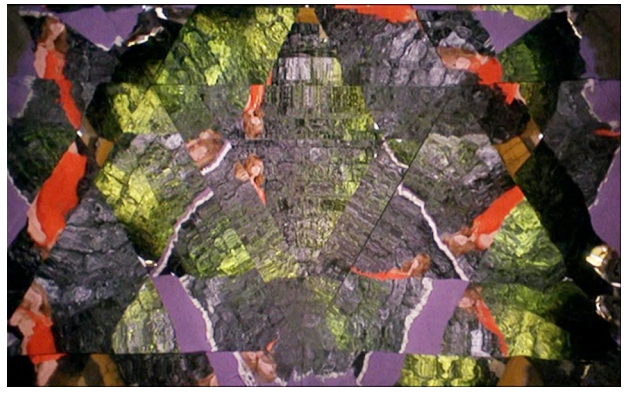

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Op art therefore can be used to create a space that amplifies stress and inner turmoil, and this reflects the physical pain that such pieces often cause to the viewer's eyes. George Rickey describes the experience in *Constructivism: Origins and Evolution*:

> Optical phenomena, with their no-aesthetic, dizzying, even nauseating, color situations, have been exploited for their direct impact on the spectator. […] [I]t is independent of ideas of harmonious order or any other kind of pleasure. (Rickey, 1967: 225)

The direct impact of 'dizzying, even nauseating' art can produce an effect of discomfort that resonates with inner instability and inner pain, as in *La prisonnière*.

Other films directly connect the eyestrain induced by a confusion of colours to physical pain. An example of this is the prison-cell scene in *Modesty Blaise*.[13] The interior of the prison is entirely covered in a pattern of magenta triangles of varying sizes on a dark grey surface, and it also contains a bright orange spiral staircase. The magenta and orange colours are split primaries. Simultaneous contrast gives the grey a tinge of green, while the inconsistent sizes of the triangular shapes create a forced perspective, rendering the location of the staircase uncertain. As a result, the entire space confuses the senses, and even causes eyestrain. When the main character, Modesty, enters the room, she looks around fearfully, then drops to the floor, revealing that these patterns hurt not only her eyes but affect her entire being [Fig. 4.19]. The effect gets even stronger when Modesty fights a prison guard in the room in a strange struggle pitched somewhere between love making and deadly violence. In the end, she kills the guard with two needles that she has hidden in her dress. The scene illustrates the piercing effect of pain that is created not only visually by the cell's decor, but also physically by the needles as they penetrate the guard's skin [Figs 4.20–4.21].

Figs 4.19, 4.20 and 4.21 Op-art patterns in *Modesty Blaise* (GBR 1965, Joseph Losey) create a pinching atmosphere, which resonates with her killing the guard with a hair pin. DVD Twentieth Century Fox Home Entertainment, 2002

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13 Some versions of the film show a colour change in Modesty's dress from white to blue as soon as she enters the cell, simulating the effect of simultaneous contrast comparable to the examples from *2001*: *A Space Odyssey* and *The Fantastic Voyage*. However, since not all prints show this change, this effect seems to be more the result of a grading problem of the particular print than an effect that was deliberately included in the film.

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In all, the analyses in this chapter add up to the conclusion that that eyestrain (which in the 1950s was considered an unwanted effect to be avoided in films) increasingly came to be regarded as an aesthetic asset during the 1960s.

PART II
COLOUR PSYCHOLOGIES

Giuliana is looking for her husband at the chemical factory where he works. Inside the factory, certain objects are assigned particular colours: the pipes running above the stairs are red, which may indicate danger but also renders them more visible, so that workers can avoid hitting their heads; other objects are highlighted in yellow or blue. Giuliana seems uncomfortable in the midst of this colourscape, ducking the red pipes, and looking around, startled and scared. She seems more affected by the colours than either her husband or his co-workers, perhaps because, being already 'neurotic', she is particularly sensitive to the colours' affective forces (Pierotti, 2019) [Figs 5.1–5.3].

Figs 5.1, 5.2 and 5.3 'Neurotic' Giuliana is affected by functional colours in her husband's factory in *Il deserto rosso* (ITA/FRA 1964, Michelangelo Antonioni). DVD The Criterion Collection, 2010.

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https://doi.org/10.11647/OBP.0380.06

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This excerpt from Michelangelo Antonioni's *Il deserto rosso* (ITA/FRA 1964, Technicolor V) illustrates the two ways in which colour was believed to influence, steer and discipline the human body in the mid-twentieth century. The first of these was the use of so-called 'functional colours': colour coding was used in workplaces to streamline production and discipline factory workers by preventing accidents, ensuring the production process ran smoothly and optimising productivity. The second was the psychological effect of colour and the ways in which it could be used to elicit certain feelings and emotions—it was also believed at the time that the mentally ill were more susceptible to this form of influence (Birren, 1978 [1962]). These interrelated beliefs—both important elements of what was known as 'colour conditioning'—were pervasive cultural phenomena in the 1950s and 1960s. In this part of the book, I will unravel the relationship between cinema and these forms of colour conditioning.

The idea that colour influences the human mind and body and the connections between colours and moods has a long cultural history. This idea that colour had the potential to influence both body and mind, became dominant in Western thinking since the nineteenth century onwards. As mentioned earlier, 1810, the year Goethe published *Farbenlehre*, is often seen as the starting point of this discourse gaining dominance. His conclusions pointed in the direction of embodied perception (Aumont, 1994: 27; Elliot, 2015), leading in turn to the assumption that our bodies not only react to certain stimuli, but also partly create the experience of perception that arises from the stimulation of the senses (Goethe, 1810; Crary, 1992: 71). Simultaneously, there was a shift in the way perception was studied, showing an increasing interest in (visual) perception as an embodied, sensory phenomenon (a belief that is still quite common today). This opened the way to the idea that the 'living organism' could be 'annexed and controlled by external techniques of manipulation and stimulation' (Crary, 1995: 47). Indeed, Joshua Yumibe (2012) believes that Goethe's work should be considered a 'science of perception rather than of optics', and that from this position it was but a small step to the sixth part of the *Farbenlehre*, called 'The Effect of Colour with Reference to Moral Associations' ('Die sinnlich-sittliche Wirkung der Farben'). Yumibe (2012: 21) explains that, in Goethe's opinion, '[i]f colors produce specific responses in the eye, they can further be relied upon to 'excite particular states of feeling' simultaneously in the mind'. As these ideas gained currency, colour became one of the instruments used to try and manipulate the human organism. Indeed, it rapidly became an important element in the biopolitical[1] control and disciplining of the human body that was such a dominant feature of western culture during the nineteenth century.

During the nineteenth century, questions of the subjectivity of colours were also connected to an increased interest in the impact of light and electromagnetic rays on the human organism. As Federico Pierotti explains in his book *La couleur une passion cinématographique* (2020), the impact of electromagnetic rays on the visual, psychological, and corporeal became the centre of scientific research. Furthermore, part of the belief in light rays' extraordinary power originated in the invention of photography, showing that light could influence material surfaces. It enforced the idea that the human body could also be considered impressionable, receiving stimuli which than produced sensations, emotions and perceptions (78). This also resulted in a belief in the powerful physiological influence of coloured light on the human organism. This was based on the assumption that the vibrations of light waves affect the human organism at a deep, cellular level. The belief also encompassed theories of 'aura', in which the body was thought to radiate different colours according to an individual's physiological and psychological state of health.

These assumed links between colour and emotions remained active until deep into the twentieth century and are known to have found their way into film theory

1 Biopolitics was a concept introduced by Michel Foucault in the 1970s. The concept will be discussed more extensively in Chapter Five.

and practice. Psychologists who worked on cinema, such as Hugo Münsterberg and Leonard Troland, believed that colour could introduce atmosphere and mood into a film, and colour specialists such as Loyd A. Jones (who worked for Kodak) and Matthew Luckiesh presumed an a priori connection between the perception of colour and the emotions (Münsterberg, 1916; Troland, 1927; Luckiesh, 1918; Jones and Townsend, 1925; Jones, 1929). An example of the prevalence of this belief can be seen in Jones' work on Sonochrome, a form of pre-tinted film material combining colour and sound. In an article promoting this film stock, he argued that colour and emotions have a strong connection to each other,[2] claiming that '[c]olor has been so inseparably linked with sensory experience throughout the evolution of mankind that it has acquired by objective and subjective association definite and important emotional value' (Jones, 1929: 216). Jones tells us here that this quasi-immobile connection between colour and 'sensory experience' results in the emotional associations related to certain colours. This implies that sensory experiences such as 'simultaneous contrast [and] previous retinal excitation' are pivotal to the character of the subjective emotional reactions.

Nevertheless, from the early twentieth century onwards, critical analytical studies began to question the presumption of a direct connection between colour and emotion, often using the framework of 'physiological psychology' that William Wundt (1910) created to conduct his analysis of the relations between physical and mental processes (Aumont, 1994: 25–26). Sidney Pressey, for example, in his article 'The Influence of Color upon Mental and Motor Efficiency' (1921), outlined the physiological-psychological experimental research he carried out at Münsterberg's laboratory at Harvard. Amongst other things, he investigated subjective experiences of colour. Following Wundt's method of experimental research, he gathered introspective data from a group of test subjects, using (in the interests of greater objectivity) a fixed set of emotional concepts and standardised colours of varying brightness and hue. In his article, Pressey offered some preliminary results concerning colour preferences based on the group totals, including the finding that green was considered the most pleasant, blue the most unpleasant and red the most exciting and arousing colour, while white and blue were thought to be both depressing and relaxing.[3] However, he did not consider these results to be particularly significant (Pressey, 1921: 351–52). This was partly because

2 Joshua Yumibe elaborates extensively on this subject. See: Yumibe, J. (2009) 'Harmonious Sensations of Sound by Means of Colors: Vernacular Color Abstractions in Silent Cinema', in *Film History. An International Journal*, 21, 2, pp. 164–76; and Yumibe, J. (2012) *Moving Color: Early Film, Mass Culture, Modernism.* Rutgers University Press.

3 Matthew Luckiesh already mentioned Pressey's work in 1918, although he was probably referring to his doctoral thesis. However, he gives a somewhat exaggerated summary of Pressey's results, making it appear as if he had definitively proved that colour did indeed have an effect on physiology and psychology. He notes, for example, that 'Pressey's work is encouraging from the viewpoint of the possibility of obtaining experimental data regarding the physiological and psychological influences of colors, for he finds constant differences indicated by the averages of the results from many subjects' (Luckiesh, 1918: 162).

he also found that habituation significantly decreased the affective reactions to both hue and brightness—'a feature common to all introspective reports' (353), and one that also arose in relation to successive contrasts in film. Apparently, individuals also gave very different responses when asked the same questions at different times, which indicated that the 'feeling-attitude' towards colours was determined by more than just the stimuli of the electromagnetic radiation of their various wavelengths and could include not only habituation, but also the subjects' personal situation, the time of day, the season and the cultural context.

Other researchers also concluded that the connections between colours and affective reactions could not be defined as permanent and immoveable, and placed these functions of colour within a perspective of historical and cultural change (Müller-Freienfels, 1907; Calinich, 1910; Ellis, 1906). For example, critical analyst Havelock Ellis concluded his study on the psychology of yellow with a warning to any psychologist wishing to use this colour in their treatment:

> [T]he strange history of yellow in the human mind [...] really bring [sic] us up to a great problem which the psychologist must constantly face under a myriad of aspects: the respective parts which must be assigned to the innate properties of the psychic organism and to the temporary reactions it has acquired under the influence of a slowly shifting environment. How far, the psychologist must so often ask himself, am I investigating the intrinsic qualities of the stream of consciousness? How far am I registering the images reflected from its banks? (Ellis, 1906: 463)[4]

Yet, despite the countervailing arguments, the hypothesis that colours had physiological effects other than those directly related to colour perception would remain an object of investigation in the field of psychology into the 1960s. Although, during the 1960s and 1970s, colour disappeared from the agenda of what is also called 'empirical aesthetics', the ideas remained alive and kicking, especially in popular culture (Whitfield and Whelton, 2013: 103). For example, in 1964 Jacob Nakshian gave a brief overview of the state of the art in this field, revealing that it remained an important component of pseudo-scientific discourses on colour:

> There is a vast body of assumptions, both popularly and scientifically held, concerning the effect of color 'environment' on various forms of behavior. These assumptions are given wide acceptance by such diverse groups as occupational therapists (1, 4, 16), 'color psychologists' working in the area of domestic and industrial 'color conditioning' (1, 11), and psychologists (8).[5] (Nakshian, 1964: 143)

4 These questions resonate with this book's theoretical framework, which is based on the theories of Fernand Braudel. On the one hand, Ellis directly links the quasi-immobile to the innate and biological, while on the other, he describes the cultural and historical component of the question of colour psychology as the 'slowly shifting environment', which is comparable to the slowly changing cultural context of colour film.

5 The numbers in parentheses refer to the following studies: 1. Faber Birren's *Color Psychology and Color Therapy* (1950); 4. Marguerite Emery's 'Color Therapy' (1942); 8. Goldstein and Rosenthal's 'Zum Problem der Wirkung der Farben auf den Organismus' (1930); 11. Matthew Luckiesh's *Color*

In *La couleur une passion cinématographique* Federico Pierotti explains that the colour-emotion connection was mostly a socio-cultural one that had stabilised over modernity through the more popular discourses of sciences, media and advertising. Advertising psychology strongly influenced this discourse and was one of the first fields to study the impact of colour on spectators (Pierotti, 2020: 85–86). Allessandra Ronetti confirms this and writes about how medical practices of measuring mental, sensorial and psycho-motor characteristics of individuals were adopted by advertising culture and how experimental psychology was increasingly used for commercial purposes (Ronetti, 2019: 27). Ideas on colour film and emotions were embedded in this particular cultural context during the 1950s and 1960s.

and Colors (1938); and 16. Blake Daniels Prescott's 'The Psychological Analysis of Light and Color' (1942).

5. How Can Colours (Be) Control(led)

Colour Consultancy

During the 1950s and 1960s, colour psychologists or 'colour consultants' were rather popular, and their ideas were often followed. This chapter discusses these discourses, and how they related to cinema and film aesthetics.

When colour consultancy is mentioned, film historians probably all think of Natalie Kalmus, who very directly introduced this activity into film culture through her work for the Technicolor company. However, she was not exceptional in consulting on colours, but can be positioned in an already existing practice of colour consultancy in consumer culture. In her important book *The Color Revolution* (2012), Regina Blaszczyk explains the history and importance of colour consciousness and consultancy in the (much broader than just film) Western colour culture. In a complex of consumer culture and good taste colour consultancy became an official task in colourful industries from the 1910s onward. In their book *Chromatic Modernity* (2019), Sarah Street and Joshua Yumibe agree that Kalmus' concept of colour consciousness did not appear out of thin air: it already existed in the world of fashion, and in the dye and textile industries. They particularly mention Margaret Hayden Rorke of the Textile Color Card Association (TCCA), and her plea for the development of a colour consciousness in the USA that would help create an appreciation of colour in terms of expression and taste (Blaszczyk, 2012; Street and Yumibe, 2019: 75–76).[1] Hence, we see the emergence of the cultural phenomenon of colour consultants, all trying to create colour consciousness through a greater knowledge of its application in such areas as film, interior design, fashion, textiles and art. Opinions on what constituted 'good taste' varied according to the norms of these various cultural industries.

In line with these historical developments in 1928 Natalie Kalmus joined her ex-husband's company, Technicolor, as a self-styled 'colour advisor' to filmmakers working with the two-colour Technicolor III technology. Then, from 1933, she turned her

1 Kalmus was not the only one to connect colour to consciousness. Leonard Troland, who later developed the Technicolor dye-transfer technology, published an article called 'Color as a form of consciousness' in 1918. However, Troland saw 'consciousness' as a form of perception, as opposed to Hayden Rorke and Kalmus, who considered it a form of awareness.

 https://doi.org/10.11647/OBP.0380.07

attention to the three-strip Technicolor IV system and was credited as 'Technicolor Color Director' on a number of films [Fig. 5.4]. From the second half of the 1930s onward, anyone else advising on colour in Technicolor films was credited as Kalmus's associate.

By 1949 these assistants had begun to work on films independently and were credited as Technicolor colour consultants in their own right.[2] And whereas Technicolor seems to have stopped using colour consultants in the late 1950s, Agfa, Ansco and Metrocolor continued to employ them into the 1960s [Fig. 5.5].

Fig. 5.4 Natalie Kalmus credited as 'Color Director' for Technicolor for *Lassie Come Home* (USA 1943, Fred M. Wilcox). DVD Turner Entertainment. Warner Bros. 2006

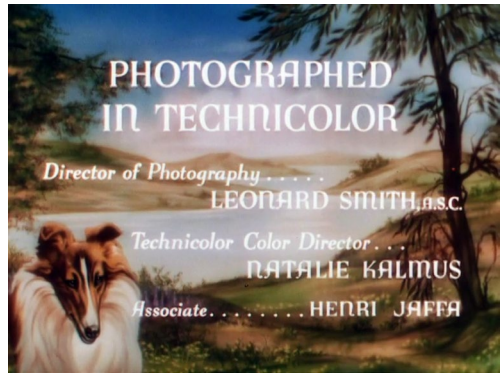
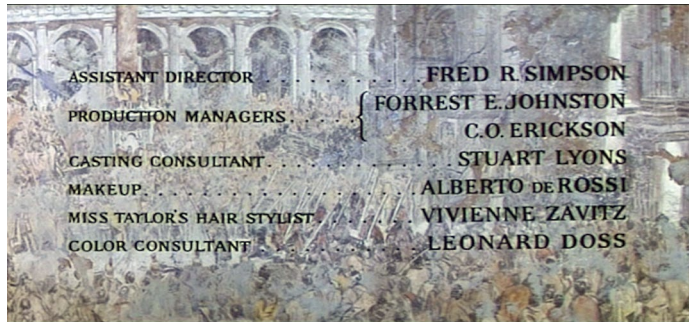


Fig. 5.5 Leonard Doss credited as 'Color Consultant' for the film *Cleopatra* (USA / SUI / GBR 1963, Joseph L. Mankiewicz) which was released on De Luxe (Eastmancolor). DVD Twentieth Century Fox Home Entertainment, 2002



2 Examples of colour consultants working with Technicolor include: Natalie Kalmus (1928–50); Morgan Padelford (1938–59); Joan Bridge (1938–58); Henri Jaffa (1937–58); Richard Mueller (1941–64); Monroe W. Burbank (1948–55); William Fritzsche (1944–57); James Gooch (1948–56); Leonard Doss (1954–58); Lansing C. Holden (only on the *Garden of Allah* (1936); Charles K. Hagedon (1955–63); Robert Brower (1944–57, later colour coordinator for TV); Francis Cugat (1946–57); Mitchell G. Kovaleski (1944–54); Alvord Eiseman (1952–54); John Craig (1954) (Source IMDb). Colur consultants working for other systems: Wilton R. Holm (colour or cinecolour consultant 1948–1953); Clifford D. Shank (colour or cinecolour consultant 1948–54); Alvord Eiseman(n) (1952–61, Agfa and Ansco); Gerhard Huttula (only on 1x Agfa); Charles K. Hagedon (1955–63, Metrocolor, 1967–68, TV); Leonard Doss (1954–63); Clifford D. Shank (1948–54); Hoyningen-Huene (1954–63, Technicolor) (Source IMDb.)

As is well known, the Technicolor company sent technical staff along with its three-strip camera equipment to control the way colours were handled in films released using its (rather technically complicated) colour system. This control was further consolidated by the widely accepted idea that films made in Technicolor should follow the norms of 'colour consciousness', which in this context referred to Kalmus's (1935) more or less prescriptive ideas on colour that were informed by her definitions of 'colour awareness' and 'good taste'.

Most importantly, Kalmus used the idea of a connection between colours and emotions tactically, in line with the colour-context model that had gradually evolved in Western society from the beginning of the nineteenth century. This perception of colour, she believed, would help the film director whose 'prime motive is to... *control* the thoughts and *emotions* of his audience' (Kalmus, 1935: 142, my emphasis). With the help of Kalmus's correspondence, along with other sources, Street (2011: 15) concludes that she not only wanted to control the colours used in Technicolor films, but also aimed to bring colour consciousness into everyday life: her aspiration was to produce an awareness of colour harmony amongst the cinema-going audience as part of a broader educative agenda.

Kalmus's article 'Color Consciousness' has been much discussed in scholarly writings on colour film (Neupert, 1990; Street, 2009 and 2011; Coates, 2010; Higgins, 2007a; Misek, 2010; Pierotti, 2020). In her article, which started as a lecture for the members of the Academy in Hollywood, she attempts to provide practical advice on how to control colour in Technicolor films, arguing that costumes should preferably reflect the characters' attributes and advising on the use of colour separation to enhance clarity—for example, preventing an actor's face or costume from blending into the background by limiting background patterns to rather neutral colours. Indeed, this type of figure-ground separation, often applied in Technicolor films produced under her supervision, was not only limited to the films she was involved in, but was also used on numerous occasions before and after her reign at Technicolor (Flueckiger, 2020b). Another idea Kalmus (1935: 141) propagated was the avoidance of 'unnatural' colours, arguing that '[i]t is a psychological fact that the nervous system experiences a shock when it is forced to adapt itself to any degree of unnaturalness in the reception of external stimuli'. She considered that using colour psychology and colour harmony to understand what would appear unnatural to audiences was key to controlling their shifting moods and impressions.

Federico Pierotti positions Kalmus's article in the context of colour psychology, colorimetry and psychotechnics developed throughout the second half of the nineteenth and early twentieth century. These discourses brought problems that uncontrolled use of colour could produce to the front. The first problem was eyestrain and fatigue, caused by shocking the eye through bad use of contrasts, sudden colour change, or unpleasant colour combinations. The second problem related to the idea that

the spectator's attention could be steered with colour, a technique used in advertising and publicities. As Pierotti explains, for publicity, colour should capture the observer's attention. In cinema, however, colours drawing attention to them would only distract from the narrative. Both eyestrain and an unclear narrative due to distracting elements were unwanted in Hollywood filmmaking practice.

> Kalmus's article should be seen in this context, and was meant as a tool for: [...] proving that colour [...] could [....] become a functional element in narration, if its presence would be adequately controlled. Kalmus's discourse expressed the need for a change of strategy.[3] (Pierotti, 2020: 97)

Scott Higgins also emphasises the importance of the moment the article was published. In 1935 the Technicolor IV films *La Cucaracha* (USA 1934, Lloyd Corrigan) and *Becky Sharp* (USA 1935, Mamoulian) started to become exemplary for what Technicolor IV was about. They are typical examples of what Higgins describes as the demonstrative mode for early Technicolor IV films showcasing what Technicolor IV could do. What Kalmus introduced in 'Color consciousness' Higgins defines as the 'restrained mode' which filmmakers used intensely during 1936–1938, using reduced contrasts and following the rules of colour harmony that dated from the nineteenth century (Higgins, 2007: 75–76). However, this does not mean that Technicolor IV was not used for other types of colour aesthetics.

For example, within the use of restrained Technicolor aesthetics, colour consultants, filmmakers, designers, cinematographers and other crew members also could influence the aesthetics of a film, to go against colour harmony, and use 'unnatural' colours to produce 'shock' effects as a way of heightening audience attention or indicating an intense emotional situation. In other words, the 'rules' of colour consciousness prescribing the use of 'natural' colours and a subdued environment made any deviation highly significant (Flueckiger, 2016: 150). Indeed, as the analyses of the *FilmColors* team have also shown, many of the Technicolor films made during the Kalmus period show marked deviations from what she described in her article.

Patrick Keating also analyses the use of deviating colour aesthetics in Technicolor IV films. In his book *Hollywood Lighting from the Silent Era to Film Noir* (2010), he writes that although many early-period Technicolor IV filmmakers indeed worked with restricted colour schemes, others experimented with different possibilities of the new material. This was especially the case with more independent cinematographers who already had a significant say in the lighting schemes of the films they worked on. They experimented with the system, 'creating a bold new style of Technicolor pictorialism' (Keating, 2010: 218). Keating mentions Leon Shamroy as a 'case in point',

3 '[...] prouver que la couleur [...] pouvait [...] devenir un élément pleinement fonctionnel de la narration dans la mesure où sa présence était contrôlée d'une manière adéquate. Le discours de Kalmus exprimait la nécéssité d'un changement de stratégie' (translation by the author).

explaining that he often experimented with complex lighting effects—for example, in *The Black Swan* (USA 1942, Henry King, Technicolor IV), a film that credits Kalmus as Technicolor director. Although Shamroy still followed the strict rule of creating neutral backgrounds that would allow the actors to stand out, Keating points out:

> [He] has followed the letter of this rule, but he has violated the spirit: even the colorful costumes cannot prevent the actors from getting lost in this maze of shadows. Rather than creating a balance of functions, Shamroy has prioritized pictorialism above all else. (Keating, 2010: 219)

In addition to unusual lighting and hard shadows, Shamroy also used coloured lights. In *Leave Her to Heaven* (USA 1945, John M. Stahl, Technicolor IV),[4] he began to use coloured lighting without a direct diegetic motivation. And as Keating (2010: 220) shows, he even used coloured light on faces, breaking the convention that skin should always be represented in its 'natural' color. Shamroy won an Oscar for best colour cinematography for *Leave Her to Heaven*, and also for *Wilson* (USA 1944, Henri King, Technicolor IV). According to Keating, it was the competitive character of the film industry that encouraged Shamroy to push the limits of colour film:

> [M]ost cinematographers began to think of Technicolor as an opportunity to exercise, even flaunt, their artistic talents. Some cinematographers did so by practicing [sic] the art of balance, carefully crafting a multifunctional style. Other cinematographers, like Shamroy, proved their artistic worth by pushing the limits of one particular aesthetic function. (Keating, 2010: 221)

Shamroy himself stated that he often came into conflict with Kalmus over his mannerist style, although she apparently did not prevent him from following his instincts—and subsequently winning an Oscar.

In 1964 Shamroy won a further Oscar for his cinematography on the film *Cleopatra* (USA / SUI / GBR 1963, Joseph L. Mankiewicz, Technicolor V). It appears that even though Leonard Doss was credited as colour consultant for the film, he did not do much actual consulting on site—in an article, 'Photographing "Cleopatra"' (Arthur, 1963) in *The American Cinematographer*, Doss is not mentioned once. All the finer details of the filming in colour, including the lighting effects, were left to Shamroy. His colours in this film are quite wild, and he only occasionally uses the neutral backgrounds that used to be so popular. The film mostly uses saturated colours for the costumes, such as the Romans' red cloaks or Cleopatra's brightly coloured garments, and introduces a colour aesthetics that combines coloured lights, coloured smoke, semi-transparent curtains and colourful, sometimes shimmering backgrounds [Figs 5.6–5.7].

4 The Technicolor director of this film is credited as Natalie Kalmus, with Mueller as her assistant.

Figs 5.6 and 5.7 Transparent curtains and colourful, shimmering backgrounds in *Cleopatra* (USA / SUI / GBR 1963, Joseph L. Mankiewicz). DVD Twentieth Century Fox Home Entertainment, 2002

Time code: DVD 1, 00:04:10

Time code: DVD 2, 01:25:04

Of course, the emergence of chromogenic camera material between 1945 and 1963 marked an important technological shift in colour film technology as it rendered the making of commercial colour films far easier. Consequently, around 1955, Technicolor introduced Technicolor V; it abandoned three-strip Technicolor IV technology in favour of chromogenic Kodacolor negative. As filming in Technicolor was now less complex, the services of specialist Technicolor cameramen controlling the technology and light settings were no longer required. Still, as Lucy Fife Donaldson convincingly shows in her video essay 'Tracing the threads of influence,' (2022) colour consultants did keep an important role in the production process of a film and its aesthetics and colour palette. Also, the fact that the production company Warner, which started to work with Eastmancolor negatives quite early in the 1950s, supposedly missed the colour consultancy they were used to when working with Technicolor, shows a continued wish for colour consultancy. Especially the poor latitude of the early Eastmancolor stocks made a colour consultant a welcome advisor on how to use the material the best way possible (Heckman, 2014: 138).

Functional Colours

Colour consultancy was not only a film industry practice; in fact, the most significant figure in the field of colour conditioning and control in the 1950s and 1960s, Faber Birren, did not work in cinema at all. Birren—who had an extraordinary influence on the colour culture of his time—entered the colour market in 1934 with the establishment of his own 'industrial colour consultancy' (Kaufmann, 1974: 73), advising companies, shop owners and factories on how to improve the safety, health, mood and efficiency of their employees, and boost their sales, with the help of colour. In other words, he explained how to increase productivity and profit by using colour to influence and control workers and consumers. To consolidate the reputation of his consultancy services, Birren also produced a number of books on the subject—in 1937, for example, he published *Functional Color*, 'his first full-length analysis of how business could use color to increase productivity and morale' (Blaszczyk, 2012: 222), and he followed this with works such as *The American Colorist* (1939) and *Selling with Color* (1945). According to Regina Blaszczyk (2012: 237, 2017: 209), by 1950 Birren's company, American Color Trends, was the leading colour consultancy in the US.

One of Birren's large industrial clients was DuPont, and his work for the paint and chemical manufacturer won attention far beyond the USA (Blaszczyk, 2012: 237).[5] The UK, for example, officially adopted the concept of functional colour around 1946, following the publication of a booklet by Robert F. Wilson, *Colour and Lighting in Factories and Offices* (Blaszczyk, 2017: 209), which drew heavily on Birren's work. Wilson himself made a trip to the USA a year later, where he met his exemplar and exchanged ideas with him. Meanwhile, Maurice Déribéré and Yves le Grand founded the 'Centre d'informations de la couleur' in France in 1951. Italy followed suit with the 'Centro Italiano di Studi per l'applicazione del colore' in 1957, inspiring the launch of new magazines dedicated to the study of colour, and the organization of exhibitions, and national and international conferences on the subject (Pierotti, 2019: 55–58). In the Netherlands, paint manufacturer Sikkens adopted Birren's concept of functional colours (functionele kleuren) in 1951,[6] mounting presentations on the subject across the country.[7] A little later, in 1957, a specialist course was created with the aim of training colour consultants who would spread the word throughout the Netherlands.[8] In all, after the Second World War, the colour-conditioning and functional-colours movement had an increasingly international character, as seen in the title of its

5 DuPont was also a manufacturer of film stock. For more information on their film stock manufacturing activities, see: *Better Pictures Through Chemistry* (Marzola, 2015).

6 'Ons Restaurant krijgt een nieuw aspect!' (1951), *Het Vaderland: staat- en letterkundig nieuwsblad* (January), p. 16.

7 A quick search in Delpher.nl shows that from the 1950s until well into the 1970s the concept of *functionele kleuren* was in common usage in the Netherlands.

8 'Ze Drukken m'n Stukjes in de Verkeerde Kleur! Klein Beeld' (1958), *Trouw, Dag*, *16*: 10 April. (Koninklijke Bibliotheek). See: https://resolver.kb.nl/resolve?urn=ABCDDD:010816305.

representative organisation, the International Association of Color Consultants. In the late 1950s, Birren himself began to create new offices for his American Color Trends company to enable it 'to assist clients in Australia, Austria, Belgium, Canada, Denmark, France, Germany, Italy, the Netherlands, New Zealand, Norway, Sweden, Switzerland, South Africa, and the United Kingdom' (Blaszcsyk, 2017: 215). All this implies that the strategy to control bodies and minds through the structured and organised use of colour in the practices of colour conditioning, functional colours and colour consultancy had gained international leverage.[9]

Although Birren was not directly involved in the film industry, his influence as a colour consultant who played the entire western market can be traced in cinema as well. For example, his 'colour safety code', promoting the idea that colour could be used to create safety, health and comfort, found its way into the films of the 1950s and 1960s—as seen in the excerpt from *Il deserto rosso* at the beginning of this chapter. Federico Pierotti argues in 'Biopolitics of colour in mid-century Italian visual culture' (2019) that this sort of regulation of subjects' lives and bodies can (and maybe should) be analysed as an element of biopolitics. As he explains:

> The premise of biopolitical governmentality is not necessarily linked to a state mechanism, rather it is apparent 'at every level of the social body and utilized by very diverse institutions', with the specific aim of 'the investment of the body, its valorization and the distributive management of its forces'. (Pierotti, 2019: 54)

Thus, colour could be used to manage and control the health, efficiency, productivity and profitability of workers' bodies through the dominant cultures of capitalism.

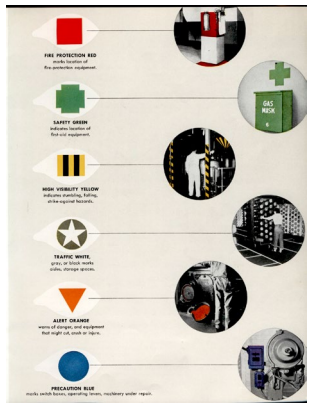
In an advertising flyer from 1956, Birren's principles of colour conditioning are explained in an illuminating way. The text is full of phrases like 'more productive employees', 'boosting efficiency', 'speeding [...] convalescence', 'efficiency', 'tireless seeing', all indicating the focus on maximising the productivity of the human body, be it at work or in recovery from accident or illness. Birren also discusses specific characteristics of colour perception, such as complementary colours that enhance each other, the after-image and the phenomenon of simultaneous contrasts such as irradiation.

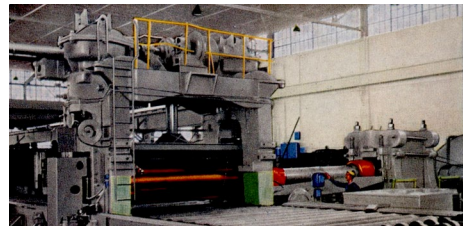
Birren began his collaboration with DuPont in 1944, developing what was called the 'three-dimensional colour' (an idea that dated from 1937) into an official colour safety code for the industry that would go on to become a national standard (Kaufmann, 1974: 74; Blaszczyk, 2012: 226). The code included the colours 'fire-protection red', 'safety green', 'high visibility yellow', 'traffic white', 'alert orange' and 'precaution

9 Linda Nead explains how with this practice of colour consultancy, colour names and their sometimes-racist connotations also were distributed. For example, the naming of a bright red as 'Kenya Red' was in line with the idea that bright colours were for 'primitive' people, children and women (Nead, 2017: 148; Batchelor, 2000; Taussig, 2006). Another brilliant source to learn more how colour control naturalised existing hierarchies along the lines of gender, race and class I advise the work of Lida Zeitlin-Wu, 'What's Your Color? Mood Conditioning the Postwar Domestic Interior' (2023).

blue'. More important than their supposed signalling functions was the fact that the colours were saturated, thus increasing their visibility, especially when encountered in an otherwise overwhelmingly dull grey factory building. To illustrate their use in situ, the advertising flyer was illustrated with a couple of images in which the monochrome background was overlaid with colours, like spots of dye added to a black and white photographic image, recalling the hand-and stencil-colouring techniques of silent cinema [Figs 5.8–5.9].

Figs 5.8 and 5.9 Birren's colour safety code as distributed by DuPont in the flyer *Color Conditioning* from 1956.





These images are also reminiscent of the colour aesthetics associated with Suprematism, and later with De Stijl (Piet Mondrian, Theo van Doesburg, Gerrit Rietveld) and Bauhaus (Wassily Kandinsky, Herbert Bayer, Hinnerk Scheper). Here, colours were used in art, design and architecture, with geometrically shaped planes of saturated colour placed on top of more neutral backgrounds. At Bauhaus, most of these colour practices were the result of work by the 'Wall Painting Workshop', initially run by Johannes Itten and Oskar Schlemmer, and after it moved to Dessau by Hinnerk Scheper. Scheper gave colour a more controlling, functional role. For example, he used colours to assist orientation around the Bauhaus school's new building in Dessau: 'Inside [...] paths through the building were painted in colors corresponding to the functional articulation (workshop, administration, and so on) of the spaces and underscoring the school's complex organization' (Michelis, 2009: 186).

We can also find literal references to the aesthetics of the safety colour code in films of the 1950s and 1960s, mostly in representations of industrial and technological environments. We have already visited the scene in the factory in *Il deserto rosso* in which functional colours are so prominent. Another example is *Destination Moon* (USA 1950, Irving Pichel, Technicolor IV): the scaffolding surrounding the rocket destined for the moon flight is colour-coded, and following the launch, the film takes us inside

the rocket itself where we encounter colour-coded tubes, apparently indicating the kind of gases or fluids they contain, and whether they are hot or cold [Figs 5.10–5.11]. Interestingly, another space film, this time from the former East Germany, *Der schweigende Stern* (GDR 1960, Kurt Maetzig, Agfacolor) has an almost similar use of colour on a rocket's pipes and scaffolding, displaying the code's international reach [Figs 5.12–5.13]. The pipes (and other constructions), for example, are painted in bright oranges and yellows, signifying that caution is needed. Meanwhile, functional colours abound in the factory interior in Jacques Tati's *Mon oncle* (FR 1958, Eastmancolor): a fire extinguisher is painted 'fire-protection red' and a blue door indicates the exit [Fig. 5.2]. The fact that these films, produced in a variety of countries, all contain a direct reference to the colour safety code again shows the international nature of Birren's work, as well as that of the film industry at the time.

Figs 5.10, 5.11, 5.12 and 5.13 Examples of colour coding in the films *Destination Moon* (USA 1950, Irving Pichel). DVD: Image Entertainment, 1999, and *Der schweigende Stern* (GDR 1960, Kurt Maetzig). DVD: Icestorm Entertainment, 2009.

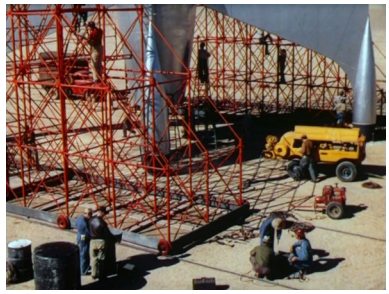


Fig. 5.10 *Destination Moon*. Time code: 00:21:03

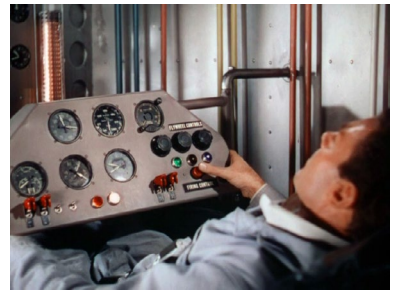


Fig. 5.11 *Destination Moon*. Time code: 00:36:18

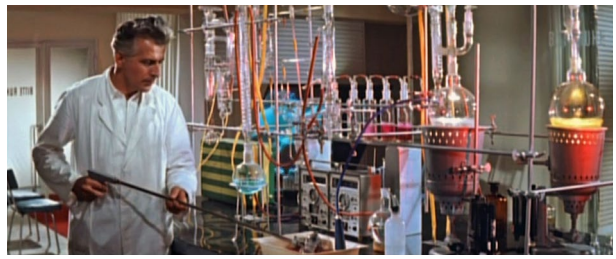


Fig. 5.12 *Der schweigende Stern* Time code: 00:02:53

Fig. 5.13 *Der schweigende Stern* Time code: 00:13:43

Figs 5.14, 5.15 and 5.16 Space suits in *Destination Moon* (USA 1950, Irving Pichel) and *Der schweigende Stern* (GDR 1960, Kurt Maetzig).

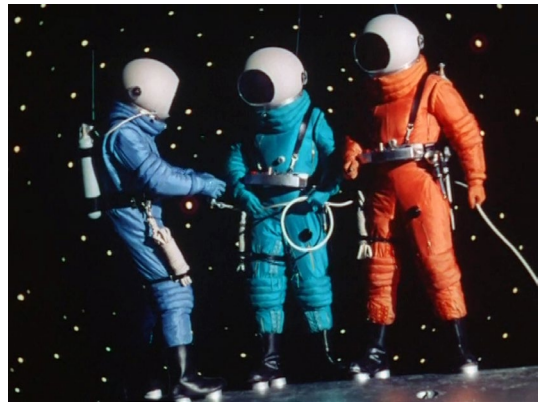


Fig. 5.14 *Destination Moon.* Time code: 00:51:06

Fig. 5.15 *Destination Moon.* Time code: 01:09:49

Fig. 5.16 *Der schweigende Stern.* Time code: 01:04:33

However, these films not only contain these literal references, they also reveal the way in which functional colours, in the form of primary colours, corresponded to other cultural forms. One example is the various hues of the astronauts' costumes in both

the space films [Figs 5.14–5.16]. Of course, this enables the audience to immediately recognise the characters even when they are wearing helmets, but more than that, it produces an aesthetic effect of 'nesting colours' that reflects the De Stijl/Bauhaus design aesthetics—as exemplified in Breuer's and Albers' nesting coffee tables [Figs 5.17]. Such nesting colours appear in many film interiors in the later 1950s and early 1960s, often in the form of multicoloured cushions scattered on a sofa.

Fig. 5.17 Example of Bauhaus 'nesting tables' from the mid 1920s by Josef Albers. Source: https://shop.bauhaus-movement.com/nesting-table-josef-albers

Stanley Donan's *Funny Face* (1957),[10] a film about the operations of a fashion magazine, is a good example of how these aesthetic patterns trickled down into other forms of popular culture such as interior design and fashion photography. The magazine's offices are predominantly white; however, they are shot through with colourful accents—for example, a series of doors, cushions arranged in the nesting-colour mode on a couch, and the samples of fabrics on display in the chief editor's office [Figs 5.18–5.19]. The film is based on the life and (specifically) work of fashion photographer Richard Avedon. Avedon himself collaborated on the film as a colour advisor, and also designed the credits at the beginning of the film, whose aesthetics, with their patches of colour on a plain background, recall the colour safety code [Fig. 5.20]. Interestingly, some of Avedon's fashion plates from 1957 reiterate this aesthetic and push it even further in the direction of the Birren/DuPont illustrations in the 1956 colour-conditioning flyer. His work shows models photographed in soft neutral colours, with brightly coloured dots of makeup that look as if they were added to the image after the printing process [Fig. 5.21]. Both the Avedon photographs and the Birren illustrations

10 *Funny Face* was filmed in Technicolor V, and the colour consultant was Richard Mueller.

create a contrast between the black and white photographic images and the colours added later, mimicking a reality in which paint is added to walls, floors and machines, and make-up applied to the skin, lips and eyes. The contrast emphasises the colours as an addition that improves the original—one that is accessible to everyone since it can be bought in a tin or a bottle.

Figs 5.18 and 5.19 Colour use that reminds of the colour code and nesting table aesthetics in the film *Funny Face* (USA 1957, Stanley Donen). DVD: 2007 Paramount Pictures.

Time code: 00:02:01

Time code: 00:02:54

Fig. 5.20 Credits of *Funny Face* by fashion photographer Richard Avedon recalling the colour code aesthetics. Time code: 00:01:40

Fig. 5.21 Fashion plate by Avedon featuring Jean Patchett.

In Tati's *Mon oncle*, the safety-code aesthetics in the factory are mirrored in the modern design of the home of M. Hulot's sister. Its colour scheme plays with the aesthetics introduced by the Bauhaus style of design and architecture—occasional spots of colour on a grey or white background—creating a correspondence between the decor of the factory and the interior design of the modern living space [Figs 5.22–5.24]. This affinity, as well as the clear references to Bauhaus aesthetics, suggests a critical interpretation of the way architecture and design were meant to discipline and control the human body in both the workplace and the domestic space. This is illustrated in an extreme form in the scene where two women are walking towards each other on the meandering garden path, with their arms outstretched in greeting. Because they have to follow the layout of the path, they never actually meet, but continually turn towards and away from each other in a ridiculous dance of failed interaction.

Tati is ridiculing here the modernist ethos of the use of colours that supposedly demarcate spaces and control human behaviour. For example, M. Hulot entirely misunderstands the ethos of the factory, with all its disciplinary colour signals, and by the end of the film has inadvertently caused chaos [Fig. 5.25]. Meanwhile, the architecture of his sister's modernist home seems to separate the family rather than bringing it together. The meandering path is an example of this, as well as the moments when we see the boy (M. Hulot's nephew) eating alone in the kitchen, or the parents gazing out of their separate bedroom windows.[11] The isolating effect of the design is clearly accentuated by the separate colour areas indicating various functions: green for the sofa, for example, and purple for the dining chairs. Tati presents these modernist spaces as dysfunctional: they cause miscommunication and are isolating, impractical, overly hygienic and uncomfortable. To emphasise the faults of this modern environment it is contrasted with M. Hulot's neighbourhood, which is filled with haphazard liveliness, food, chaotic architecture and a lack of hygiene, but which enables adults to meet and communicate, and children to play together.

Figs 5.22, 5.23, 5.24 and 5.25 Disciplining architecture and colour use in *Mon oncle* (FRA 1958, Jacques Tati). DVD The Criterion Collection, 2001.

11 This image gives the house the appearance of a face with eyes.

Tati's references to disciplinary, controlling colours do not, however, result in a film that is itself disciplinary. Eye-tracking investigations have shown that in general Tati's method of filmmaking does not steer or control the audience, but actually produces a more wandering and exploring eye due to the scattered focus of attention. Tati works with a slow editing pace, giving the spectator time to explore the image: he frequently uses long shots with a deep focus that increase the amount of visible information in the frame; he often locates the main action at the frame's periphery; and he overlaps information by presenting various actions simultaneously (Bazin, 1967 [1958]: 35–36; Burch, 1973: 47; Faden, 2019).[12] This creates a contradiction in the scenes in *Mon oncle* that use modernist functional colour aesthetics, since the colours refer to control and discipline while the film's style scatters the attention.

Other films do not ridicule the idea of controlling and disciplinary functional colours quite so directly, but play with it in another way. One such is *Niagara* (USA 1953, Henry Hathaway, Technicolor IV), in which Marilyn Monroe plays Rose Loomis, a woman who is cheating on her shell-shocked husband. She convinces her lover to murder him, and the two agree that once the deed is done, he will set the bells in the 'Rainbow Tower' ringing the song 'Kiss' to indicate all went well. However, the husband survives the attack, and instead kills the lover. It is only when she attends the morgue to identify the corpse, which she initially believes will be her husband, that Rose finds out that something went terribly wrong. After a period in hiding, the husband returns to punish Rose for her criminal, uncontrolled behaviour. He has the bells play the same song as a warning to her that he knows all. She tries to escape but he follows her up into the Rainbow Tower, where he kills her beneath the bells that have turned her dream into a nightmare.

An interesting point here is that inside the Rainbow Tower we see various functional uses of the colour red: the elevator door is red, highlighting the way up to this important location; a red light above the elevator buttons indicates that it is occupied; and a red light in the room below the bell tower seems to signal danger. Red, the colour of warning, is used in the narrative to announce and then dramatise Rose's murder. Just before she is killed, we see Rose in a medium close-up, standing beneath a red lamp that throws its colour onto the wall behind her, creating a halo of red light around her hair. It is as if a red aura were radiating from her body like a visual metaphor for her inner state of fear [Figs 5.26–5.27]. Finally, I would suggest—possibly risking the charge of overinterpretation—that the use of these functional and controlling colours at this moment in the film refers to the control that Rose's cheated husband is about to recover through his fatal deed.

12 In his video essay and accompanying blog, Eric Faden (2019) compares Tati's style of 'invisible cinema' with Hollywood's so-called 'invisible style'. The latter, he explains, in fact controls and disciplines the eyes of the spectator in such a way that they are compelled to follow the narrative.

Figs 5.26 and 5.27 The colour red shifts from functional warning into an indication of an inner feeling of fear in *Niagara* (USA 1953, Henry Hathaway). Blu ray: 20th Century Fox, 2013.

Time code: 01:03:45

Time code: 01:06:05

Selling with Colour

Not only did Birren develop and finalise the colour safety code, but the entire *raison d'etre* of his business was to advise clients on how to profit from the use of colour. This becomes clear when reading his book *Selling with Color* (1945), in which he elaborates his ideas on how colour could help increase sales. To add authority to his advice, he often refers to psychological or other more-or-less scientific discourses on colour, using them to add a patina of authority to his attempts to convince potential clients that colour has direct physiological, biological and psychological effects (Birren, 1945: 159–72; 1961a: vii), including his claim that the colours used in interior design could influence mood (1945: 123). Of course, if the colour of the walls in an office or hospital could be said to affect the state of mind of staff or patients, so too could the colours encountered on a cinema screen, not least because they are projected back onto the audience, producing a colour effect in both the filmic space and the auditorium.

Birren's main purpose was always of a commercial nature—and it was not without success: he could number among his clients 'DuPont, the Hoover Company, General Electric, Masonite, Minnesota Mining, National Lead, House & Garden Magazine, the West Virginia Pulp & Paper Company' (Morrow in Birren, 1961a: xiv). What is of more interest to us, however, is the way he turned the theories and scientific discourses he discussed in *Color Psychology and Color Therapy* (1950) into practical advice. To better understand this procedure, we need to take a closer look at two other texts that Birren published during this period. The first is the 1956 flyer, mentioned above, which introduced his DuPont Color Conditioning system, while the second is his book *Color for Interiors* (1963). The flyer not only presents the colour safety code, but also a so-called colour programme focusing on colour as the 'veritable

storehouse of hidden power that can sway our emotions and our actions, too' (Birren, 1956: 2). Birren assures his clients that colour conditioning would work beneficially (and profitably) in factories, hospitals, offices, schools and homes. In addition to the colour safety code, he claims that the correct use of colour improves visibility and prevents eyestrain in factories, gives the hospital patient a psychological lift, reduces eyestrain and lessens 'classroom fatigue' in schools, and encourages emotional and physical relaxation in the home, as well as in restaurants, hotels and motels (3). Incidentally, colour conditioning not only existed as a prescriptive project, but was also the name of a brand of paint sold by DuPont (Birren, 1956: 26). Hence, it is probably safe to claim that the main purpose of the colour-conditioning programme was to sell paint [Fig. 5.28].

Fig. 5.28 Can of DuPont paint by the name 'Color Conditioning'. Source: *Color Conditioning* (1956)

In all, I would argue that DuPont and Birren's concept of colour conditioning is an excellent example of a biopolitical project harnessed to the demands of capitalism: tying the programme in with a brand of paint made it clear that it was almost entirely a commercial activity, with the aim of controlling the bodies and minds of factory workers, office personnel, consumers, patients and students in the interests of productivity, efficiency and profit.

As mentioned earlier, the discourse of functional colours and colour conditioning took off internationally during the 1950s, coinciding with a postwar demographic shift in Western society. Europe was experiencing poverty and a housing shortage (the result of intense bombing raids during the war) and was gripped by a fever of reconstruction. At the same time, in the US, millions of African Americans started to colour the urban centres in the Northeast, Midwest and West of the country, fleeing the poverty and racism of the south. In turn, many of the white inhabitants of the city centres moved into newly constructed bungalows in the suburbs. Mass suburbanisation in the USA took off between 1945 and 1970; during the 1950s 'suburbs grew at a rate

ten times faster than [...] central cities' (Avila, 2004: 4). This 'white flight' from the cities had the effect of a de-facto segregation of citizens from different cultural and racial backgrounds (16). In addition, suburbanisation not only produced uniform and monotonous landscapes, characterised by a compartmentalisation of spaces into various functions such as shopping malls, highways, churches and houses, but also created an environment in which people could be managed and potentially steered into adopting a consumerist lifestyle.

In his chapter 'The senses of the marketplace: Commercial aesthetics for a suburban age' (2014), Adam Mack writes that this 1950s desire for control was rooted in Cold War tensions. As already discussed in Chapter Three, the West had entered the so-called 'atomic age', dominated by the testing of atomic bombs and an escalating arms race between the USA and the Soviet Union that created an atmosphere of existential anxiety. In response, people 'nestled' into their suburban homes, seeking shelter in the nuclear family (Mack, 2014: 88). The creation of an orderly, comprehensible environment seemed to promise the individual control over their personal lives in a world that was perceived as chaotic and threatening.

A promotional film for suburban homes, *Westinghouse all Electric House* (1959), for example, presents its audience with just such a functional compartmentalisation of a domestic interior. The house showcased in the film is organised around several 'electric centres': 'the entertainment centre', 'the laundry and home planning centre', 'the food preparation centre', 'the dining centre', 'the child's education centre', 'the health and beauty centre', 'the hobby centre', and last but not least, 'the outdoor living centre'. This was a highly functional house, with a high standard of comfort and the possibility of control over every detail of domestic life. Of course, such a house also controlled its inhabitants, disciplining behaviour and movement through its controlled spaces, each dedicated to specific activities. Furthermore, these modernist houses (and the films advertising their high level of functionality), with their 'control centres' supposedly easing the burden of managing a household, were also intended to persuade women back into their traditional role of mothers and housewives.[13]

Interestingly, despite the functional compartmentalisation of the home in *Westinghouse all Electric House*, its colour scheme—a combination of wooden walls with orange, yellow and blue details—remains the same throughout the entire building. Some spaces, such as the entertainment centre (or living room), have a preponderance of orange with touches of blue, presumably giving them a 'warmer' effect. Other areas, such as the dining room, are predominantly blue (a colour thought to produce a 'cooler' atmosphere), providing a complementary colour contrast with the living room. The

13 As discussed in the previous section, the film *Mon oncle* mocks the disciplinary functions of the modern house (and factory). The aforementioned scene on the meandering garden path is a perfect example of Tati's ridicule of the way that architecture and landscaping control and discipline behaviour and movement. The film turns this upside down when, for example, the old-fashioned M. Hulot parks his bike inside a painted rectangle meant for a car, and causes a series of minor disasters inside the factory, messing up the plant's well-structured modernistic spaces.

camera pans from one space to another, emphasising the contrast and revealing the diversity and compartmentalisation of the house. This is also established by the shifting emphasis on one or another colour, although the fact that the colour scheme remains the same throughout the entire interior design helps create a harmonised whole.[14] This is in line with Birren's advice in the DuPont flyer for the interior design of an industrial plant:

> If different sections of the plant were painted without regard for each other, the result would [...] look chopped up. [...] By treating the many departments as a related whole, Color Conditioning gives the plant a consistent, attractive appearance. (Birren, 1956: 11)

Yet, a search in VIAN shows that the strategy of brightly coloured walls that we see in the *Westinghouse* promotion were a rarity in the Hollywood films of the 1950s. Interiors were still predominantly rendered in restrained, subdued colours. It appears that even though Kalmus's colour consciousness was never adopted in its entirety, filmmakers did put her idea of using subdued backgrounds for the colour-saturated characters into practice. Backdrops of coloured walls and furniture were decidedly not in line with Kalmus's (1935: 146) 'law of emphasis': 'nothing of relative unimportance in a picture shall be emphasized'.

Slowly Unleashing Colour in Film

During the second half of the 1950s, (Technicolor) colour consultants appeared to loosen their attitude towards colour control. One reason might be that the introduction of Technicolor V three-strip camera technology was no longer needed. This shift from a highly complex camera technology towards a much easier way to shoot colour made the presence of the Technicolor personal on set no longer needed. This might have included the colour consultants.

Film interiors began to show an increase in the sorts of colour schemes that could be linked to the concept of colour conditioning and the newer ideas of colour harmony propagated by Birren, the dye industry, and many others. For example, several scenes in Douglas Sirk's *Written on the Wind* (USA 1956, Technicolor V) show a bolder use of darker and more colourful backgrounds than was usual up to then in a Technicolor film: the interior of a plane is depicted in soft greens and grey-blues, for example, and the walls of a bar in warm reds and ambers. Likewise, the interior of the hotel where the main characters are staying displays a controlled use of colour: the walls in the corridor are magenta, and this is repeated in a more subdued tone in the female character's room, whereas the room of the two male characters has blue walls and yellow furniture. Thus, we see a differentiation in the use of colour according to character, with a strong focus on gender. The way in which this emotional connection between character and colour is manifest within the narrative of the film is rooted in the contemporary fashion of painting walls in colours that

14 *Westinghouse all Electric House* (Color). Available at: https://www.youtube.com/watch?v=jyrTgtPTz3M from 10:07-10.30.

were believed to correspond to the emotional feel of a space (or to the attributes of a character in a film) [Figs 5.29–5.31].

Figs 5.29, 5.30 and 5.31 Coloured hotel walls in *Written on the Wind* (USA 1956, Douglas Sirk). DVD: 2005 Universal.

Time code: 00:18:52

Time code: 00:16:03

Time code: 00:22:55

Interestingly, the gender-coded colours in the interiors in the earlier scenes of *Written on the Wind* prepare the audience for a later moment in the film when it becomes clearer which of the two men Lucy Moore (Lauren Bacall) is falling in love with. The emotional intensity of this moment is amplified with coloured lighting, a technique that Sirk, his cinematographer Russell Metty and colour consultant William Fritsche had already experimented with in *All That Heaven Allows* (1955). The scene shows Bacall, lit in blue and yellow—colours similar to those in the male characters' hotel room, creating a visual connection between Lucy and the two men. This highly constructed way of making the emotional connotations of a scene explicit came to be known as the 'Sirkian style' of filmmaking [Fig. 5.32].

Fig. 5.32 Colour creates a visual connection between Bacall and the male characters she is involved with in *Written on the Wind* (USA 1956, Douglas Sirk). DVD: 2005 Universal. Time code: 00:17:20

We also encounter colourful interiors in Alfred Hitchcock's *North by Northwest* (USA 1959, Technicolor V),[15] beginning with the film's beautiful entrée depicting the United Nations building with its modernist architecture and pastel colours. We also see a train's restaurant car—decorated in a combination of yellow, blue and rose—where the two main characters meet, apparently by accident, and a play of seduction begins. Again, as in Sirk's film, an emotionally charged moment takes place in a space full of colour.[16] The film exhibits a perfect example of colour harmony, combining the pastels that were so popular at the time. Kalmus's rule that a film's background should have a subdued and restricted palette in order to throw the characters into relief appears to have lost its influence in favour of the sort of colour combinations Birren and DuPont introduced into interior design in the second half of the 1950s [Figs 5.33–5.35].

15 *North by Northwest* was shot in Technicolor V, with Charles K. Hagedon as colour consultant.

16 Another example is put forward by Christine Brinckmann in her article 'Filmische Farbe als Artefakt' (2014 [2001]). This is a scene in *Pal Joey* (*USA 1957*, George Sidney) that is set in a blue-and-green bedroom with a bright yellow bed, where *femme fatale* Vera (Rita Hayworth) is shown in a yellow negligee after spending the night with Joey. Brinckmann argues that the colourful space is clearly related to sensuality and sex, since the atmosphere of a steamy night of passion still hangs in the room.

Figs 5.33, 5.34 and 5.35 Colourful interiors in *North by Northwest* (USA 1959, Alfred Hitchcock). DVD Turner Entertainment, Warner Bros. Entertainment, 2009.

Time code: 00:53:14

Time code: 00:36:00

Time code: 00:46:36

Besides the influence of fashionable interior designs, the increase in the use of colour for interior scenes in films might have been connected to the fact that film was increasingly shot on Eastmancolor, also known at the time as Cinecolor, Metrocolor, Warnercolor

or Pathecolor. This colour system was not accompanied by colour consultants bound by Kalmus's rules and regulations. *Rebel Without a Cause* (USA 1955, Nicholas Ray, Eastmancolor), for example, was shot on Eastmancolor negative and released on Warnercolor. The film's interiors appear to follow the fads of the decade: the Starks' bathroom is mint green; in Judy's house, the corridor and her parents' bedroom are pink, while her bedroom is blue; and in the school, the corridor has blue walls with doors painted peach. In addition, blue lighting is used to indicate night, and since most of the narrative takes place outside after nightfall, this lighting is present during a large part of the film. These examples can be explained by the fact that in real life it had become increasingly popular to decorate interior spaces in a wide variety of colours—possibly a result of the fairly aggressive marketing strategies that the paint companies used to convince consumers that it was essential to take into account colour conditioning, functional colours or colour harmony when decorating a room, be it in a home, restaurant or hotel [Figs 5.36–5.37].

Figs 5.36 and 5.37 Colourful interiors in *Rebel Without a Cause* (USA 1955, Nicholas Ray). Blu ray Warner Home Video, 2013

Time code: 00:57:11

Time code: 01:15:01

There are further examples of films that also show an obvious relationship between walls rendered in warm saturated colours (red or purple) and sex or sensuality—three of which I will briefly mention here. The first is *Gigi* (USA 1958, Vincente Minnelli, Metrocolor). The apartment where Gigi lives with her mother has dark red walls and furniture, with details of amber and gold. Logically, the saturated red that characterises this room indicates that Gigi is from a family of high-class prostitutes and is predestined to also become a rich man's mistress. The intense red of this space

contrasts strongly with the other scenes in the film, which use a far more subdued colour scheme. Other filmic spaces decorated with saturated reds and occasionally purples indicate 'inappropriate' sex before or outside of marriage, as in the living room of Mike Hagen's mistress in *Designing Woman* (USA 1957, Vincente Minnelli, Metrocolor),[17] and the dressing room of chorus girl Rebel Davis, where we see Jerry Webster massaging Davis in a suggestive manner in *Lover, Come Back* (USA 1961, Delbert Mann, Eastmancolor).[18] These colours do not only engage the eye, but also speak to us on a more physical level, hinting at illicit sexual relationships or even prostitution. Here, we have definite examples of the way sexually charged spaces can be further intensified by colour—for example, by red's connotations of sexual passion [Figs 5.38–5.39].

Figs 5.38 and 5.39 Sexually charged spaces intensified by colour

Fig. 5.38 *Gigi* (USA 1958, Vincente Minnelli). DVD Turner Entertainment, Warner Bros. Entertainment, 2007. Time code: 01:11:20

Fig. 5.39 *Lover, Come Back* (USA 1961, Delbert Mann). DVD Universal Studios, 2006. Time code: 00:20:29

Arguably, the increasing presence of such colourful interiors in Hollywood films represented a significant step in the evolution of cinema. As such, not only the shift from the formerly predominant Technicolor three-strip towards chromogenic camera material, but also the cultural context played an important role in the 'colour turn' in film during this decade.

17 Charles K. Hagedon was the colour consultant on *Designing Woman*.
18 *Lover, Come Back* was shot in Eastmancolor by Pathe, and the colour consultant was Henri Jaffa.

Playing with Conditioned Colours

All this confirms the hypothesis that German film scholar Christine Brinckmann advances in 'Chords of color' (2015 [2006]), her article on colour aesthetics in Hollywood films between 1956 and 1964. Brinckmann (2015 [2006]: 53) argues that 1956 saw the beginning of a new attitude towards colour as a reaction to the long dominance of the Kalmus standards, 'for the use of color was overripe and mannerisms and parodies were in the air'. In her article, Brinckmann discusses two films that are extremely interesting from the point of view of contemporary interior design: *Bachelor in Paradise* (USA 1961, Jack Arnold, Metrocolor)[19] and *Lover, Come Back*. Both contain colour schemes in their indoor scenes that are reminiscent of the decoration displayed in the advertising film *Westinghouse All Electric House*, mentioned above.

Bachelor in Paradise, however, clearly parodies the ideal of suburban bungalow life that Westinghouse promotes. In the film, we follow the exploits of Adam Niles (Bob Hope), who writes books about sexual habits in foreign countries. When he is forced into hiding, due to sloppy tax management, he finds himself in a suburb called 'Paradise Village' that is fashioned to exclusively house young families. All the houses are built with the same motifs, the only touch of individuality being their different colour schemes.

The general manager of Paradise Village, Rosemary Howard (Lana Turner), rents Adam her own house. When she shows him around, Adam (and the audience) are presented with a perfectly styled living space. Similar to the house in *Westinghouse All Electric House*, it has a consistent colour scheme, characterised partly by the bar and television set (hidden away behind wooden panels) and partly by the cushions—another example of nested colours—arranged on the sofa. Only the red of the hearth and a plant pot show stand-alone touches that are not repeated in any of the other spaces (the red of the hearth might be a direct reference to the warmth this colour has been associated with ever since Goethe). Each more or less separate space has its own atmosphere due to the dominance of one or another colour from the overall scheme: for example, the bedroom is predominantly blue, whereas the kitchen is mainly yellow and green.

Interestingly, this colour scheme shows similarities to the recommendations Birren makes on home decoration in *Color Psychology and Color Therapy* (1950, 1961a). Birren (1950: 109) writes: 'The kitchen may be nice cool tones of green or turquoise, such colors tending to shorten the apparent passage of time' and '[b]edrooms may be in any color, preferably of light tint'. He repeatedly describes blue as a calming colour, and (in medical contexts) claims that it can be used to treat 'intractable insomnia'. As the bedroom is painted in various gradations of blue ('Painter couldn't make up his mind, hey?' Adam quips), its decoration seems to follow Birren's suggestions, or at least shows that such colour coding was already part of 'common sense' in 1961. With the help of this neat colour scheme, the 'working woman' (a synonym for a young single woman at the time) is represented as organised and in control [Figs 5.40–5.42].

19 *Bachelor in Paradise*'s colour consultant was again Charles K. Hagedon.

Figs 5.40, 5.41 and 5.42 In *Bachelor in Paradise* (USA 1961, Jack Arnold) Rosemary seems to have followed Birren's advices for the decoration of her bungalow. DVD Turner Entertainment, Warner Bros. Entertainment, 2011.

Time code: 00:17:39

Time code: 00:18:43

Time code: 00:40:56

Rosemary's house is one of the more modern ones in Paradise Village. For example, the television set and wet bar are hidden in a built-in cabinet in the 1960s fashion (Shonfield, 2000: 29). The colour design of the bar—a coarse checkered pattern in a soft darkish orange and light blue—is noteworthy: the contrast of saturated complementary colours has a vibrant effect (as we saw in Chapter Four when discussing op art), creating a sense of gaiety and restlessness at odds with the harmonious colour combinations in the rest of the house. Because the television and the bar, with its pulsating colours, are shut away when not in use, Rosemary even controls when it is time to surrender control:

she decides when to open the built-in cupboard and let fantasy and intoxication loose in the living room [Figs 5.43–5.44].

Figs 5.43 and 5.44 The colour scheme in Rosemary's bungalow changes drastically when she opens the build-in cabinet in *Bachelor in Paradise*. DVD Turner Entertainment, Warner Bros. Entertainment, 2011.

Time code: 00:18:10

Time code: 00:18:18

The interior of the house indicates great sensibility in its decor and colour scheme, and this is confirmed when we see Rosemary sitting in her office in front of a collection of samples of material showing potential combinations of colours [Figs 5.45]. Clearly, she is the colour specialist in Paradise Village, probably advising new residents on how to use colour in their interior design. It is telling that the decoration of her office space echoes a 1963 photograph of Birren standing in an (his?) office, similarly surrounded by colour charts and samples of material and tiles, implying that colour consultancy was an accepted cultural practice in the real-estate business at the time [Fig. 5.46]. Both representations show a greater flexibility in the combination of colours and invention of colour schemes. The colour charts, with their possibility of various colour combinations, show a far less rigid system than that of the colour safety code and its biopolitically charged recommendations for factories, offices and hospitals that Birren prescribed between 1937 and 1956. However, this accords with his arguments in a later book, *Color for Interiors, Historical and Modern* (1963), in which he advocates freedom in the use of colours in domestic interiors. He even states, in retrospect, that the end of the Second World War ushered in a revolution in taste that was not 'one of dictation

from above but of the democratic insistence of a massive population' (Birren, 1963: 106). This of course contrasts with his earlier advocacy of the use of functional colours to increase productivity and efficiency.

Figs 5.45 and 5.46 Rosemary's office in the film presents her as true colour specialist similar to Faber Birren.

Fig. 5.45 *Bachelor in Paradise*. DVD Turner Entertainment, Warner Bros. Entertainment, 2011. Time code: 00:11:49

Fig. 5.46 Faber Birren in his office. Source: http://www.araratrugs.com/blog-home/the-faber-birren-color-theory

Bachelor in Paradise is an interesting example of how decor and colour can give very similar houses touches of individuality. The film shows the domestic interiors of a number of married couples, each one characterised by its own particular colour scheme, recreating the atmosphere of family life in varied ways. When Adam convinces the bored housewives to conduct an experiment in which they try to seduce their husbands, we get a glimpse inside a few of these homes, including that of Camille and Leland Quinlaw, which is a jarring mixture of the modern and the traditional. The mismatch seems to mirror the state of their marriage, since the husband runs out of the house as soon as he sees his wife appear in a pair of babydoll pyjamas [Figs 5.47–5.48].

Figs 5.47 and 5.48 The mixture between modern and traditional in the interior design echoes the mismatch between wife and husband in *Bachelor in Paradise* (USA 1961, Jack Arnold). DVD Turner Entertainment, Warner Bros. Entertainment, 2011.

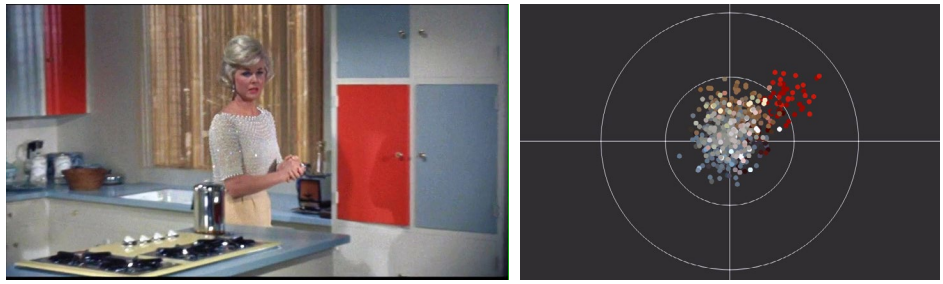
Time code: 00:53:59

Time code: 00:54:03

Another couple also appears to have a somewhat rocky marriage: whereas the wife has prepared a candlelit dinner in the bedroom, strategically placing it by the bed, which she has covered with a red duvet, the husband wants the light on so he can see his kids when he gets home, and he absolutely does not want to have a 'romantic dinner' in

the bedroom. Finally, the Delavanes' house shows an interior design with traditional furniture and curtains with strong detailed patterns. The colours are mainly pinks and purplish reds, all in quite subdued tones. Although it is much less full of saturated colours, their living room reminds us of the interior in Gigi which acted as a synonym for sensuality and promiscuity. And as a matter of fact, this is the house of the most sexually compatible married couple we encounter in the film. All the different couples' feelings about their marriages are thus mirrored in the interior designs of the suburban houses of Paradise, despite the fact that they all resemble one another in their architectural layout.

Figs 5.49 and 5.50 Similarities in colour schemes of two apartments in *Lover, Come Back* (USA 1961, Delbert). DVD Universal Studios, 2006.



Film still with a VIAN visualization of colorimetric analysis of the image. Time code: 00:13:44.

Fig. 5.50 Film still with a VIAN visualization of colorimetric analysis of the image. Time code: 01:19:53

In the other film that Brinckmann discusses, *Lover, Come Back* (1961), we meet Carol Templeton (Doris Day), who also is a 'working' or single woman. Carol lives in a similar modern apartment to Rosemary's in *Bachelor in Paradise*. The house is light, with an overall colour scheme of blue, yellow and orange, and a modern, tasteful design. The living room's blue and yellow decor match Day's hair and eyes and is repeated in her dresses. The soft light blue also has religious connotations, referring to the Virgin Mary, hinting at Carol's purity and presumed virginity. The male love interest in the film, Jerry Webster (Rock Hudson), is a bachelor with no moral scruples, be it in matters of business or love. His apartment 'turns out to be the somber counterpart to Day's' (Brinckmann, 2015 [2006]: 56)—and both apartments contain touches of the

same orange of the built-in bar in Bachelor. Could this be foreshadowing a future relationship between the two? [Figs 5.49–5.50]. On the other hand, Birren's *Color for Interiors* displays two colour charts with a quite similar colour called 'sunset orange', one for the modern American home of the 1950s and the other demonstrating the optimal colours for offices, indicating that this shade of orange was particularly fashionable in this period [Figs 5.51–5.52]. Still, even though the colour scheme of the two interiors appears to reference the fashion of the time, if analysed in the context of the film, it presents a 'well-calculated concept' with a narrative function, and reflects the personalities of the characters.

Figs 5.51 and 5.52 'Sunset orange' can be identified as a popular colour of the time in Birren's *Color for interiors* from 1961.

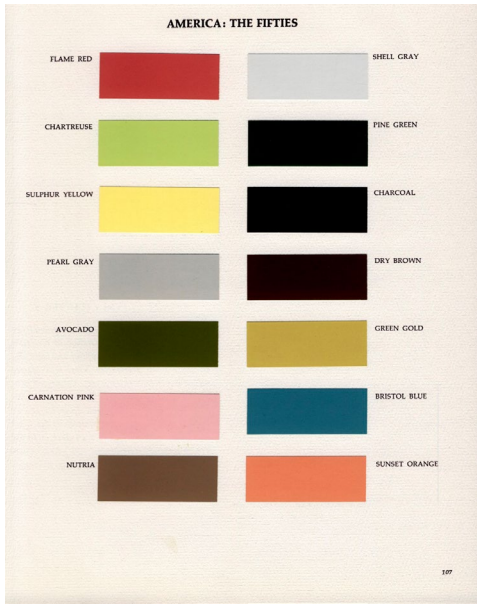


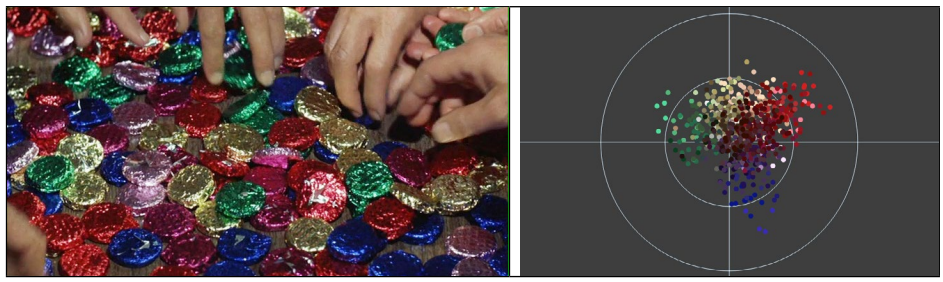
Fig. 5.51 'Sunset orange' indicated as popular colour of America during the 1950s.

Fig. 5.52 'Sunset orange' as a colour to be used in offices.

In addition to its narrative functionality, Brinckmann draws attention to several moments in the film where the colour scheme spills over the borders of colour consciousness and colour control. The clearest of these is the scene in which we see a chemist developing a new mysterious product called 'VIP' in a basement laboratory; he is surrounded by an array of test tubes which occasionally produce explosions of large colourful clouds that leak from the laboratory into the street above. Brinckmann (2015 [2006]: 55) notes that 'color becomes autonomous as a result of exaggerating a plot element to the point of absurdity, thanks to the sensuous appeal these color interludes possess'. Thus, colours form a sensuous deviation from the rest of the

narrative or, as Brinckmann writes, they appear to be 'pushing the action into the unreal'. Finally, when the product is finished, it presents another example of colourful extravagance: '[A] torrent of metallically shining sweets rains down on the table—an event that is privileged with a close-up, justified solely by the fascination of the colors' (Brinckmann, 2015 [2006]: 56). Indeed, the VIAN visualisation of the colorimetric analysis of this image reveals a wide range of hues, creating a multicoloured effect similar to those used by clowns and other 'deviant' characters [Fig. 5.53].

Fig. 5.53 VIAN colorimetric analysis shows a gaudy colour scheme for the candy called VIP in *Lover, Come Back* (USA 1961, Delbert). DVD Universal Studios, 2006. Time code: 01:31:20



These various examples of films from the late 1950s and early 1960s reveal a loosening of formerly rigid colour aesthetics. Functional colours, when present, were translated into strong emotional responses in films such as *Niagara* and *Il deserto rosso*, and the fad of colour conditioning, promoting the idea that the use of colour in interior design was synonymous with good taste, replaced the more restricted use of (subdued) colours in interior scenes. Many of these ideas were influenced by Birren's writings on colour conditioning and the notion of colour harmony. The loosening of (Kalmus's) strict colour schemes in Hollywood cinema enabled an increase in the interplay of contrasts, emphasising difference of gender by the colour of rooms, for example, or introducing clashing or swirling colours to indicate intoxication or trance.

In all, this chapter has shown the ways in which the more or less controlled colour culture in film (and in wider society) slowly but surely started to break free of the conventions and regulations that dominated the first half of the twentieth century—although it is interesting to note that the new uses of colour can be traced back to yet another, equally prescriptive fad: that of functional colours and colour control (as promulgated by Birren). However, we also see directors such as Tati taking an ironic view of such uses of colour and colour schemes. All this dovetails with the conclusions of Part I, in which the use of colour contrasts also led to the interplay of colour and perception in forms like (or similar to) op art. The next chapter turns to a discussion of the idea of 'losing control' in relation to the use of coloured lighting to create immersive, atmospheric spaces.

6. Coloured Light, Vibrations, Temperature, and Mood

Immersed Bodies

Another factor considered to have a high influence on the human body was coloured light. This chapter discussed discourses and beliefs concerning the power of coloured light and the ways in which these may have influenced the habitus of the contemporary film audience.

Colour and Temperature

Half an hour into Jacques Tati's film *Playtime* (FRA 1967, Eastmancolor), M. Hulot finds himself at an 'ideal homes' fair in a modern Parisian building. After some misunderstandings (typical of M. Hulot), he loses his coat and hat, and as a result, two elderly ladies mistake him for a salesman and ask him to demonstrate the attributes of a particular lamp. After connecting it to a power socket, he manages to switch it on, bathing the women in rays of red light. Their reaction is one of relaxed delight: they sigh, leaning back slightly, as if enjoying the comforting warmth of a fire. In this very short scene, Tati plays with the cultural connotations of warmth attached to the colour red [Fig. 6.1]. *Il deserto rosso* also uses red to indicate a pleasant feeling of warmth. During the cabin scene, in which a few friends gather for a dinner party, one of the female characters holds her stockinged feet close to the glowing red stove—indicating that the rest of the room must be cold [Fig. 6.2].

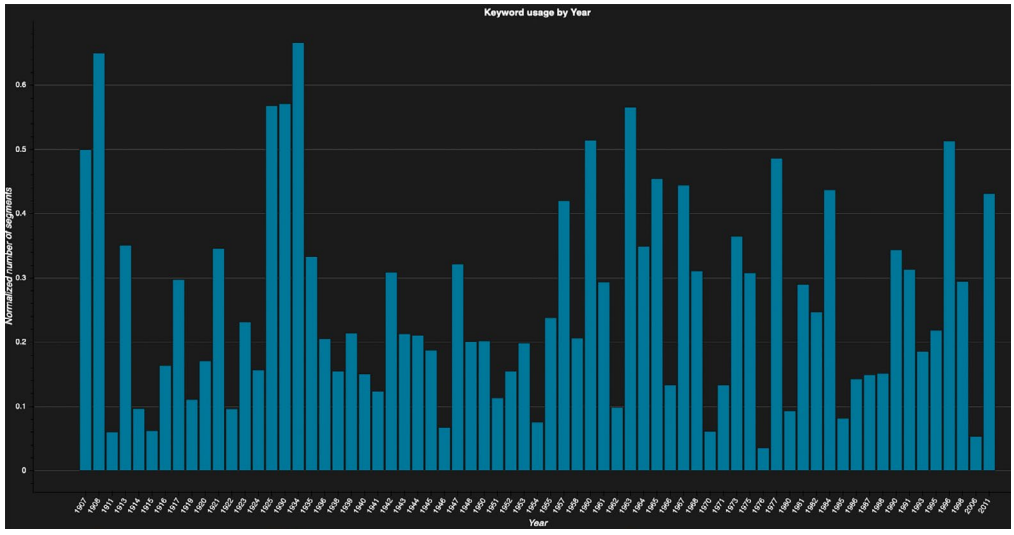
Fig. 6.1 In *Playtime* (FRA 1967, Jacques Tati) M. Hulot 'warms' two ladies with a red lamp. DVD The Criterion Collection, 2001. Time code: 00:36:52

Fig. 6.2 The red glow indicates warmth in *Il deserto rosso* (ITA / FRA 1964, Michelangelo Antonioni). DVD The Criterion Collection, 2010. Time code: 00:44:58

https://doi.org/10.11647/OBP.0380.08

Colour culture was characterised by a strict divide between 'warm' colours and 'cool' colours. In some ways, these associations can be linked to our everyday experience: the flames of a fire are indeed orangey-yellow and the glowing wood, an orangey-red. Furthermore, as a result of Rayleigh scattering,[1] we perceive the sky as blue, and because it is often reflected in water and ice, this may have been the reason that we began to associate blue with cold. Goethe discusses this link between colours and temperature in *Farbenlehre*, as did every colour theorist after him, including the main writers on colour in the 1950s and 1960s. For example, in 1961, Johannes Itten wrote that the cold-warm contrast had great expressive potential, and in *Interaction of Color* (1963), Joseph Albers discussed the theme in a brief chapter called 'From color temperature to humidity in color'. Albers (1963: 59) states that '[a]s to warm and cool, it is accepted in Western tradition that normally blue appears cool and that the adjacent group, yellow-orange-red, looks warm'. He then explains that these differences in temperature are not absolute but always relative, which implies that warm blues and cold reds are also a possibility—a theory that can be traced back to Goethe's work. Interestingly, Albers (1963: 60–61) was of the opinion that the warm-cool contrast was not in fashion at the time he wrote his book; nevertheless, whether or not this was the case in art, the *FilmColors* team discovered an increase in cold-warm contrasts in its corpus of films from 1957 onwards [Fig. 6.3].

Fig. 6.3 VIAN visualization of the appearance of cold-warm contrast with a slight decline between the mid 1930s and the mid 1950s.



These cold-warm contrasts were often combined with other connotations attached to the colours red and blue. For example, the cabin in *Il deserto rosso* is also characterised

1 For a scientific explanation of Rayleigh scattering, see: https://www.britannica.com/science/Rayleigh-scattering

by colours that display a cold-warm contrast: the living room/kitchen/dining space is bluish-white, a colour conventionally associated with cold, while a platform bed is separated from the rest of the cabin by wooden panelling covered in a saturated red varnish, mirroring the glowing fire in the stove. This is the space where the group gathers and where the warmth of the red slowly shifts towards an implication of sexual arousal: the colour red and its associations with sexuality share a long history (Flueckiger, 2016: 153). The swingers' party-to-be, however, is interrupted when Giuliana's husband, Ugo, realizes he is cold; he leaves the red platform bed and enters the grey-white-blue part of the cabin which resonates with the cold he is experiencing. He starts to poke the fire, putting the last pieces of wood into the stove, but it is not enough to revive it. Trying to find a solution, Emilia and two others begin to smash up the bed's panelling for fuel, allowing the warm red of the bed to spill over into the colder bluish tones of the rest of the cabin's interior, reflecting the heat of the stove and returning the colour to its initial connotation of warmth [Figs 6.4–6.6]. Clearly, in this scene, director Michelangelo Antonioni's cold-warm contrasts convey different layers of meaning: the hints at temperature segue into connotations of arousal and sexual energy.

Figs 6.4, 6.5 and 6.6 An interesting play with blue and red in *Il deserto rosso* (ITA/FRA 1964, Michelangelo Antonioni). DVD The Criterion Collection, 2010.


Time code: 00:49:45


Time code: 00:58:29


Time code: 00:59:11

The secondary connotations of cold or warm colours are more the rule than the exception. In the giallo (horror thriller) *Sei donne per l'assassino* (ITA / FRA / GER 1964, Mario Bava, Eastmancolor), red is not only hot, but also becomes dangerous and even deadly when one of the seven murder victims is tortured to death with the help of a hot stove. At first, the sadistic murderer holds his victim's hand against the stove, then he kills her by pushing her face against its hot surface. There is a sizzling sound of burning flesh and small clouds of smoke. The stove itself glows a bright saturated red that emphasises its immense heat, and the colour suffuses the victim's face and hair, indicating that her skin has already been touched by the heat of the stove even before she is killed [Figs 6.7–6.8]. As temperature is detected with and through the skin—a sensation we incorporate into our subconscious over the course of our lives—when we are shown a hand being pushed against a hot red stove, the feeling it conveys is contagious. Through a form of direct affect and motor mimicry, the sensation of the skin on our hand aligns with that of the character on the screen (I will elaborate more on such mechanisms of perception in Part III).

Figs 6.7 and 6.8 A red glowing stove is used as a deadly weapon in *Sei donne per l'assassino* (ITA / FRA / GER 1964, Mario Bava). DVD Arrow Films, 2015.

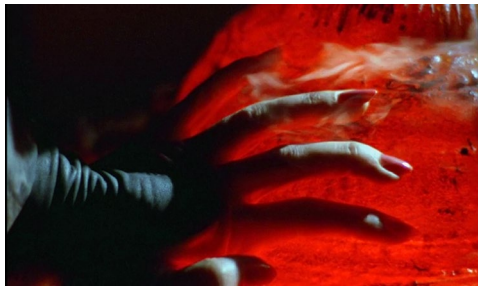


Fig. 6.7 Time code: 00:42:52

Fig. 6.8 Time code: 00:42:18

Rudolf Arnheim also discussed the cold-warm contrast and its connection to colour in *Art and Visual Perception* (1956 [1954]: 276), explaining that it is the most commonly known distinction. However, he warns his readers that the connection between these colours and actual temperature is without scientific proof, referring to an investigation by G.J. von Allesch in 1925 that failed to return any conclusive results. Arnheim therefore proposes another theory or hypothesis as to why we make this distinction:[2] he asks himself whether the different senses might have similar qualities, causing comparable reactions. In this particular case, he hypothesises that seeing the colour red produces a similar effect in the nervous system as the feeling of warmth or heat does through the sensations on the skin:

> As long as we investigate the phenomenon only in the various branches of perception, we may wonder whether stimulations by heat and light—and we may add sound as well—produce in the nervous system effects that, whatever their nature, are actually similar or identical in certain respects. (Arnheim, 1956 [1954]: 279)

Arnheim is referring here to certain characteristics of perception that can be recognised through the various senses. Rhythm, for example, can not only be experienced aurally, but also visually. Equally, in the case of colour, '[w]e are dealing here not with a transfer of skin sensations to seeing, but with a structural quality common to both senses' (Arnheim, 1956 [1954]: 279). According to Arnheim, the link between temperature and colour perception is of a more physiological nature than the result of a habitus related to cultural context; nevertheless, he was also aware that, even if his hypothesis was proved to be right, the adjectives 'warm' and 'cold' are also used in speech in ways that are not related to the senses (e.g. 'a warm reception' or a 'heated debate'). After acknowledging this, he immediately turns to the distinction between warm and cold colours, calling blues 'retiring' and reds 'approaching', which Allesch apparently did

2 In later editions of his book, Arnheim also mentions Johannes Itten and Joseph Albers. The reason they are not, however, referred to as colour theorists is that neither of their books had yet been published at the time Arnheim was writing. He references Albers mainly because of his work as an artist.

manage to confirm scientifically (Arnheim, 1956 [1954]: 279). In all, Arnheim believed that the cold-warm contrast has a significant place in the firmament of colour culture, including in colour film.

Others, however, were less careful and precise. In 1935, for example, Natalie Kalmus wrote about the division between cool and warm colours as if it were a factual certainty. In her article 'Color consciousness' (Kalmus, 1935: 142), she rehashes the generally accepted division between warm and cool colours without referring to any confirmation of these ideas by colour theorists or scientists. Starting from the optical effect of reds as appearing to advance and blues seeming to retract, she concludes that warm colours call forth sensations of excitement, activity and heat, whereas cool, 'retiring' colours suggest rest, ease and coolness.[3]

Faber Birren also juggled with these connotations of cold and warm, directly linking them to notions of activity and passivity. For example, in his book *Color Psychology*, he writes:

> In the main, the colors of the spectrum are to be associated with two moods, the warm, active, and exciting qualities of red and its analogous hues, and the cool, passive, and calming qualities of blue, violet, and green. Areas of these hues tend to enliven the mood or to quiet it. (Birren, 1961 [1950]: 141)

This is precisely what happens in the layered appropriation of reds in *Il deserto rosso*, in which the scene of sexual arousal takes place in a red environment and the cooling of that energy in a bluish-white one. In *Selling with Color*, Birren (1945: 125) went even further, calling 'warm colours' such as red aggressive, importunate and associated with positive things, whereas '[t]he other [blue] is cool, passive, and retiring'. In *Color Psychology*, he even questions the validity of psychological research into colour—for example, Sidney Pressey's experiments, which failed to furnish any proof for these assumptions—and instead references semi-scientific research that confirms his statements. In the end, Birren (1950: 169) asserts: 'Red will stimulate the autonomic nervous system, while blue will tend to relax it. The equilibrium of the body, pulse rate, heart action, respiration, nervous tension, even digestion will all be affected'. He gives no evidence, no sources for this statement, simply presents it as a commonly accepted truth.

Similarly, Itten starts his chapter on the cold-warm contrast in the 1961 version of *Kunst der Farbe* with a description of several physiological experiments on the connections between red and warmth, and blue and cold, but again without referring to any sources or evidence. In addition, he links the warm-cold contrasts to the functioning of the heart, claiming that blue dampens the circulation of the blood whereas red increases it. As with Birren, Itten expands the contrast to encompass physiological effects, such as relaxation and excitation, speaking of blue as 'light' (and

3 Interestingly, the 'Kalmus period', between the mid-1930s and mid-1950s, seems to show a small decline in the use of this contrast in the contemporary analyses of colour.

also 'distant'), and red as 'heavy' (and 'nearby'). Finally, he connects blue to humidity and red to dryness (Itten, 1961a: 64).

The many characteristics assigned to red and blue were considered part of a quasi-immobile biological domain, even though there was neither evidence nor scientific source material to verify this assumption (Aumont, 1994: 25–26). Nevertheless, the belief in the supposed qualities of colours and their power to affect human physiology was part of the colour discourse of the time, and therefore also part of the cultural context in which the films I discuss were made and shown. Furthermore, the warm-cold distinction, resting on ideas about physiology, found its way into theories of colour harmony. In fact, the laws of colour harmony were often based on the belief that the power colour wielded over the physiology of the body followed the laws of nature (Whitfield and Whelton, 2013: 99).

The cold-warm contrast and the physiological connotations it carried in its slipstream were but one part of the discourse on the affective powers of colour. Many more ideas relating to colour and the physiognomy of the human (and other) organism(s) were popularly regarded as undeniable facts.

Coloured Light and the Vibrating Body

However, in order to discuss the colour discourses of the 1950s and 1960s, we need to return to Birren. After establishing himself as a colour consultant from the 1930s onward, he published a strangely intriguing book, *Color Psychology and Color Therapy* (1950), which became quite a hit, and was reprinted a decade later in 1961.[4] According to Birren (1950: 28), his aim was 'to present the story of color therapy as developed through research methods acknowledged and accepted by modern science'. In his text, he refers to all kinds of research into electromagnetic radiation and radiotherapy, and the effect of coloured light on plant growth.[5] He skillfully connects these more scientific discourses to pseudo-sciences such as heliotherapy and chromotherapy in an attempt to substantiate his claim that colour therapy is an effective method of healing.[6] Indeed, he claims that '[a]ll electromagnetic energy—including visible color—will affect the human organism' (Birren, 1950: 65). By using these discourses to underpin his business model, he positioned himself and his work in the context of the research into the properties of colour and light, ensuring that

4 The book continued to remain very popular, with later reprints in 1985, 2000 and 2011.

5 Although referring to research results that show this influence, Birren (1950: 83) finally admits that the results were not due to the beneficial effect of coloured light but to the negative effect of light deprivation, a consequence of reduction in the radiation that a plant normally receives through white light. This type of research is still ongoing: '[R]esearch on the effect of spectral wavelengths on plant growth and development is still in progress' (Bayat et al., 2018). However, plants are not human beings; they have a completely different biology.

6 As a result, Birren argued that colour therapy should be taken seriously. This plea seems to indicate that the idea of colour as a healing and therapeutic tool was not taken up by the medical sciences. However, as we see later, it did find its way into mass culture.

his colour consultancy assumed the appearance of a legitimate, scientifically based business (which it clearly was not).

The assumption that visible colour 'will affect the human organism' can be traced back to Goethe's *Farbenlehre*, or more precisely to the last part of his book called 'Die sinnlich-sittliche Wirkung der Farben', in which he states that the affective power of colour is directed through the eye, which needs to be 'entirely surrounded with one colour [so] the hue [could] attune the eye and mind in mere unison with itself' (Goethe, 1840 [1810]: 306). Another source of Birren's inspiration was Edward D. Babbitt's *The Principles of Light and Color* (1878), which he claimed was the main foundation for his ideas on colour therapy. Almost simultaneously two other publications on the influence of colour on the living organisms were published, *Blue and Sun Lights: Their Influence Upon Life, Disease* (Pleasonton, 1876) and *Blue and Red Light: Or, Light and Its Rays as Medicine* (Pancoast, 1877). Another important publication in this line was Robert Hunt's *Researches on Light* from 1844, which mostly discussed colour's effect on plants.

Birren discussed Babbitt extensively, especially his idea on the atom as the 'epitome of the universe; color was produced by its miraculous workings' (Birren, 1950: 55). This implies that, unlike Goethe, Babbitt believed that coloured light affected the human body directly. As a result, he used smaller, more locally focused devices to project coloured light onto those inflamed or diseased parts of the body that needed healing (Birren, 1950: 56),[7] dispensing with the mediation of the eye altogether.

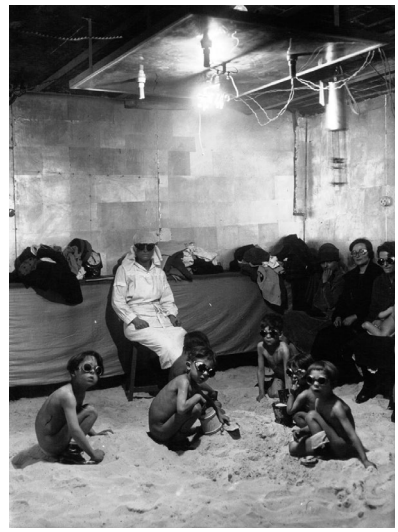
During the late nineteenth and early twentieth century, chromotherapy (and its underlying theories and discourses) increasingly found 'proof' in the scientific discoveries in electromagnetics and the way in which (in)visible radiation could affect the human body. In 1895 Wilhelm Röntgen had discovered that electromagnetic radiation, in a wave-length range known as X-rays, could penetrate the skin to reveal the skeleton beneath. This was quickly followed by the discovery of gamma rays in 1896, which Marie Curie (and her husband Pierre) worked on intensively, using Marie's newly discovered element, radium, as their gamma ray source, rendering X-ray machines more accurate and powerful.[8] In 1918 the use of ultraviolet light in the treatment of rickets, a disease caused by lack of vitamin D, was scientifically proven to be medically effective. Most of these effects are indeed of a biological nature; they belong to the human organism's quasi-immobile biological system. During the late nineteenth century and the first decades of the twentieth, these discoveries found their way into (semi-)medical practices: for example, in France, they were subsumed into categories such as 'photothérapie', 'héliothérapie', 'héliochromothérapie' and

7 Babbitt (1878: 254) not only described the pseudo-scientific fundamentals of this method, but also pointed to various examples of 'successful' treatments in psychiatric hospitals, including in an Italian asylum which 'treated' its patients with coloured light.

8 See: https://www.nde-ed.org/EducationResources/CommunityCollege/RadiationSafety/introduction/gamma.htm

'actinologie' (Hyppolyte, 1904; Niewenglowski, 1921; Dabout, 1924; Saidman, 1929). In the following illustration, Fig. 6.9, we see Professor Saidman, one of the more popular and well-known doctors who practised these types of therapies in France at the time, supervising a session in 1927 at his 'Institut d'actinologie' in which a group of children is collectively treated with radiation (Lefebvre and Raynal, 2010).

Fig. 6.9 Professor Saidman's artificial beach, used to treat children at his 'institut d'actinologie' in Paris. 'La plage artificielle à l'Institut d'actinologie passage Dombasle' ; professeur Saidman: [photographie de presse] / Agence Meurisse 1927. Source: https://gallica.bnf.fr/ark:/12148/btv1b90561605?rk=21459;2#



Inevitably, in this period of new discoveries, the borders between what was scientifically proven and what was not (or not yet) was blurred: 'The distinction between the scientific and the paranormal may be apparent [now]; but at the time it was not' (Whitfield and Whelton, 2013: 100). This enabled chromotherapy to become one of several supposedly beneficial forms of 'light therapy', despite the lack of proof that the electromagnetic radiation of visible light could affect or penetrate the body in any way other than through the eye[9]. To overcome the lack of scientific proof, hypotheses were advanced speculating on the power of (visible) light on the human organism. J. Dodson Hessey (1920), for example, reasoned that as the cells of the body consist of atoms comprising vibrating particles, the movement of these particles would be altered when exposed to the electromagnetic radiation of any wavelength (implying visible light). Birren (1950: 59–60) adopted this hypothesis as fact, stating: '[C]olor therapy postulates a rhythmic order of vibrations of several degrees'.[10]

9 To further strengthen the argument that coloured light affects living organisms, Birren also dedicated a chapter to research investigating how light affects biological processes, including the ways in which colour and light appear to influence the growth of plants, the behaviour of insects, fish and birds, and day-night rhythms.

10 In a way, these ideas of colour as a therapeutic medium place it on the same level as sound and music. As Michel Chion (1995: 221) correctly states in *La musique au cinéma,* sound has a bi-sensorial

However, while Birren used the work of writers such as Babbitt, he also criticised their tendency to become too spiritual or esoteric. By critiquing aspects of the work of his predecessors in this way, he no doubt hoped to strengthen his claim that the majority of their work was in fact scientifically sound, even though psychological research undertaken in physiological laboratories did not offer any convincing proof of—and sometimes even refuted—the claim that coloured light affected human physiognomy. Pressey (1921: 353), for example, measured physiological reactions to changes in light and hue, and came to the conclusion that '[t]he objective measurements showed no effect of hue [...] upon the functions tested'. The only significant effect he was able to prove was the reaction of the human body to changes in the intensity of light: when the light was stronger people became more active, and when it was dimmed their activity decreased.[11] Indeed, if we take into consideration the fact that light is a key regulator of circadian rhythms, also known as the 'biological clock', this claim makes scientific sense. Pressey clearly stated, however, that the activating effect of light was in no way connected to changes in hue. Nevertheless, Birren (1950: 122) kept alive the suggestion that the different colours of light were an important factor, claiming that anyone who thought otherwise was prejudiced and close-minded. Without the backing of any valid arguments, he simply dismissed both Pressey's work and that of others whose experiments returned comparable results, stating that in the US, 'the medical profession by and large disdains the general subject of color therapy' (1950: 121).

Other professionals, such as neuropsychologist Kurt Goldstein, also investigated the influence of colour on the human organism. In a 1942 article, 'Some experimental observations concerning the influence of colors on the function of the organism', Goldstein described his findings on the differences in physiological reactions to the colours red and green. However, his limited number of test subjects (three to five), and the fact that they all had organic diseases of the nervous system, rendered his results somewhat unreliable (Wise and Wise, 1988: 7). Still, since Goldstein was well-known and respected in his field, Birren (and others espousing his views) built their entire argument upon his research. Birren himself remained convinced that visible light affected the human organism in an innate, biological way.

Birren's views on this topic seem to have been lacking in nuance, and he must have been aware that the scientific ground on which he based his claims was rather shaky. Nevertheless, his arguments were substantiated by Arnheim in 1954 in his famous and still popular book *Kunst und Sehen. Eine Psychologie des schöpferischen*

nature because it not only resonates in the ear, but also in the skin and bones. Although Chion remarks that light does not have this double effect, the appearance of colours, the harmonies we can build with them, and maybe also the fact that colour and music work so well together help create the belief that light and colour also resonate in our skin and bones.

11 Apparently, Birren could not avoid Pressey's research. This might be related to the fact that Pressey (1921: 326–27), without specifically mentioning Birren, stated that he aimed to investigate the legitimacy of claims that colour and light were pivotal to the productivity of workers—claims made by Birren and other 'colour consultants' at the time.

Auges, an English translation of which was published two years later under the title *Art and Visual Perception* (1956). In a chapter on colour, Arnheim (1956 [1954]: 275) discussed its presumed power over the human organism: 'It is known that strong brightness, high saturation, and hues corresponding to vibrations of long wave length produce excitement. A bright, pure red is more active than a subdued grayish blue'. Arnheim refers to Charles Féré, who in 1886 claimed to have found correlations between blood pressure and the wavelength of visible light. The use of this example as scientific evidence was remarkable since research dating back to 1886 could hardly be called state-of-the-art in 1954 or 1956. However, the difference between Birren and Arnheim was that the latter did not claim that these presumed effects were biological and innate:

> [T]here is no telling whether we are dealing here with a secondary consequence of the perceptual phenomenon or whether there is a more direct nervous influence of light energy on motor behavior and blood circulation. (Arnheim, 1956 [1954]: 276)

In other words, according to Arnheim, it remained unclear whether these effects were the result of the (cultural) context creating a habitus that produced cross-modal interactions relating to the perception of colour, or whether they were biologically innate phenomena and hence part of the quasi-immobile biological structure of the human body. He also mentioned the results of other research (by Goldstein, Kandinsky and Pressey), stating that no definite conclusions could be drawn on the question of whether or how colour and the nervous system were correlated (Arnheim, 1956 [1954]: 276).[12]

As T.W. Allan Whitfield and Jianne Whelton explain in their article, 'The arcane roots of colour psychology, chromotherapy, and colour forecasting' (2013), these days the claim that the energy generated by visible coloured light produces innate biological sensations can easily be refuted. For example, what we define as a sensation of green can be the result of stimuli that have very different wavelengths, meaning that various greens have different energetic properties. Not only can the descriptor 'green' refer to many different colour sensations, but different illuminants can also produce the same colour sensation. This clearly undermines the plausibility of colour therapy as a reliable method based on biological facts (Whitfield and Whelton, 2013: 104). However, the claim that these discourses created a habitus within which, in Arnheim's words, 'secondary consequences of the perceptual phenomenon' occurred, does seem plausible. It would at least explain why some of the investigations mentioned here led to results that favoured the theory that different hues caused physiognomic reactions while others refuted it, and it also explains the differences in the results of experimentation with various hues.

12 Birren did not mention Arnheim in *Color Psychology and Color Therapy* (1950). This might be due to the fact that Arnheim's book was not published until 1956. However, even in the 1961 version of *Color Psychology*, Birren still did not refer to Arnheim's *Art and Visual Perception*. This is surprising, since Arnheim was one of the major authorities in the field.

Birren, however, seems to have been more concerned about conflating or exaggerating research that appeared to bolster his theories than seriously answering questions about the psychology of colour. In a way, this confusion was made possible by the very nature of colour and its various descriptors—colour could be perceived as a phenomenological percept, as a sensation, or as a property of surfaces or light, measurable through human observation or with colorimetry, subjectively or objectively. In discourses such as colour therapy and colour psychology, these different denominators were (and are) used in an inexact and confusing way, mixing subjective and objective perspectives on colour and colour research. Birren's aim was to convince people that the effect of colour on the human body is part of the more or less fixed physiology of the human organism, and as such is of the utmost importance for our physical and psychological well-being. This of course was driven by a commercial imperative—it helped him to sell his books and services.

Since Birren's writings were part of a slowly evolving discourse on the therapeutic power of colour that stretched back at least as far as Goethe, they appeared to carry the authority of long-held traditions. Besides, Goethe (1810: 305) himself had described these characteristics or Wirkungen (effects) as unchanging and innate, part of the body's biological system, declaring that '[f]rom some of our earlier observations we can conclude, that general impressions produced by single colours cannot be changed, that they act specifically, and must produce definite, specific states in the living organ'. *In Color Psychology and Color Therapy*, Birren (1950: 258–60) discusses 'The effects of the major hues' with a similar assumption of their unchangeable specificity and determination, using phrases such as: 'Red is perhaps the most dominant and dynamic of colors', 'Yellow has been said to have a favorable effect upon human metabolism', and 'Greens [...] tend to reduce nervous and muscular tension'.

The belief in the controlling and therapeutic power of colour was the basis of the emotional regime relating to colour that was predominant in the 1950s and 1960s, and was therefore part of the contemporary culture in which colour film was deeply embedded. Even though, as explained before, the experimental research of Pressey and others did not return any significant results indicating an innate biological connection between colours and feelings, this connection was commonly accepted as fact in popular culture, and as such was part of the habitus creating 'secondary consequences of the perceptual phenomenon' (Arnheim, 1956 [1954]: 276). Birren's success is proof of this, and it kept alive beliefs and discourses based on a confusion that was (and often still is) inherent in what colour means to us.

Mood, Atmosphere and Coloured Light

Interestingly, the belief that vibrating particles of coloured light can set the human organism in motion is directly linked to the idea that the 'atmosphere' of a film can elicit feelings and emotions. On the one hand, it explains why coloured light is

used to give a filmic space an emotional charge or produce emotional effects such as feelings of estrangement; on the other, the colours can reflect the characters' moods, a phenomenon also known as 'mood lighting' (Keating, 2010). Film scholar Margrit Tröhler (2012) relates 'mood' to the German word 'Stimmung'. These terms are not entirely synonymous but both share connotations of subjectivity and felt emotion,[13] and both in a sense create what is called 'atmosphere'—a concept that is often used as a more abstract (and maybe even slightly anthropomorphic) descriptor of (cinematic) spaces. Atmosphere can be defined as 'what we immediately, although maybe unconsciously, notice when we enter a space: light, color, air, music, objects and [...] people' (Tröhler, 2012: 11, my translation).[14] As Tröhler explains, atmospheres are imaginary phenomena, summoned into existence by the perceiving/experiencing subject.

Following Gernot Böhme, Tröhler (2012: 17) locates atmosphere in the relationship between subject and object. Hans-Jürgen Wulff (2012: 111) agrees that atmosphere does not exist as an independent entity positioned between the subject and its surroundings but is called into being through a configuration of objects and the specific impression this creates. Hence, a cinematic atmosphere consists of its 'expository elements' and belongs to the descriptive, not the narrative side of the (film) text. This implies that atmosphere is created through filmic expression (i.e. the image, mise-en-scène, sound and music). The first of these, the image, consists of the filmic space, and this includes the constellation of characters, objects, light and colour, and the interrelationship between figure and ground (Wulff, 2012: 113).

Both Tröhler and Wulff tell us that colour and light belong among the elements that evoke atmosphere, which makes sense when we take into consideration the slowly changing discourse on colour's affective powers. However, a further analogy can be drawn between colour and atmosphere as theoretical concepts: in a similar way to atmosphere, colour is considered to be an intangible, immaterial 'qualia', summoned into existence by the act of perception in reaction to external stimuli. This implies that colours not only evoke atmosphere, but also '[b]y their intrinsic qualities [...] are an atmospheric element, excited by the object world, but not fully part of it' (Flueckiger, 2017: 149). In all, colour could be considered one of the more important parameters in the creation of a specific cinematic atmosphere.

Colour and light are close companions and are often discussed as having equal weight. David Katz, for example, connected the two from the very start of *Der Aufbau der Farbwelt* (1930), dedicating the first part of his book to the appearance of colour

13 Tröhler (2012: 11) also connects atmosphere to the concepts 'mood' and 'aura'. Although she refers to the benjaminian use of aura as the magical radiation of an 'original' work of art, the term also refers to coloured light radiated by the human body. For more reflections on the concept 'Stimmung', see: Wellbery, D.E. (2003). 'Stimmung', in Barck K. (ed.) *Ästhetische Grundbegriffe. Historisches Wörterbuch in sieben Bänden*. J.B. Metzler:. 703–733.

14 '[E]s ist das, was wir zuerst, vielleicht nicht bewusst, bemerken, wenn wir einen Raum betreten: Licht, Farbe, Luft, Musik, Objekte und wiederum Menschen.'

and the phenomenology of lighting.[15] Böhme (2006: 103) also easily jumps from one to the other when he states that '[i]t is color, light, the distribution of light, the intensity, the concentration or [...] the diffusion of light that grants a space, a scene its particular atmosphere' (my translation).[16] One of the more interesting phenomena Katz touched on when discussing colour, light and the phenomenology of space is the fact that light makes empty space appear full. When a space is illuminated, he explains, objects, furniture and walls become visible, which gives the space the appearance of being filled with the light (Katz, 1930: 51–52). According to Katz, even when an illuminated space may not actually be filled with matter of any sort, the relevant fact is that we experience it this way.

To explain the quality of this experience, Katz gives several examples of ideas or theories of the kind of matter that might actually be filling this empty space. He first mentions K. Bühler (1922), who was convinced that air was filled with a type of plankton that radiated light. He then refers to E.R. Jaensch (1911), who postulated a 'Zwischenmedium' or an 'in-between medium' that supposedly imbued illuminated spaces (Katz, 1930: 53–54). Finally, he name-checks Fr. Schumann (1920, 1921, 1922), who described the sensuous (sinnliche) experience of empty space as a 'glass-experience' (Katz, 1930: 57). This corresponds to the atmospheric experience of space. More literally, however, the concept of 'atmosphere' is used to describe the mixture of gases that envelops the earth (Tröhler, 2012: 11). A space that is experienced as 'atmospheric' is often perceived as being alive with various elements, be it air, dust, particles, or specific sorts of light, and as a result both atmosphere and light can be perceived as an imaginary 'in-between medium', filling empty space with some form of matter. If colour is added to the list of potential elements, coloured light should be regarded as a strong atmospheric component. Thus, the relationship between atmosphere and coloured light can be summarised as a visualisation of a space (presumed to be filled with some form of matter) that either represents or influences a human being's inner state, their feelings and emotions.

Nevertheless, the imagined materiality of empty space, as described by Katz, remains invisible, and for a highly visual medium such as film this is problematic. In order to create an atmosphere in filmic space, the experience needs to be made visible—for example, with the help of lighting, as Böhme suggests. Light—its intensity, concentration, diffusion and the way it is distributed—can increase or decrease the atmospheric effect. Currently, the imaginary atmosphere in a film is often visualised with the help of diffused lighting created with damp air, rain, smoke or filters, which generates shimmering moving images, enhancing the illusion of matter imbuing the 'empty' space of the diegetic film world. This use of diffusion

15 Katz's book was first published in 1911 as *Die Erscheinungsweisen der Farben*. This particular phenomenon, however, was not discussed in the 1911 edition of the book.

16 'Es sind die Farben, das Licht, es ist die Verteilung des Lichts, die Intensität, die Konzentration oder umgekehrt die Diffusität des Lichts, die einem Raum, einer Szene eine gewisse Atmosphäre verleihen'.

can also result in what is called 'volumetric light'. Light appears volumetric when projected onto and reflected by particles in the air, creating the appearance of a light cone, ray or cloud, and revealing in the process that a seemingly empty space is actually filled with 'atmosphere'. Examples of this can be seen in films from the silent period to the present day: it often gives the image an uncanny effect and is frequently used to reference the divine, the magical or death.[17]

Katz also mentions the atmospheric effect that occurs when the material base or carrier of the photographic image becomes visible. He quotes Schumann's observations that the illusion of three-dimensional space created through stereoscopic photography was often accompanied by the impression of swirling motes of dust—one that increased with the use of coarse-grained mat paper. Katz (1935: 47) explains that '[t]he texture of the paper affects disparate retinal points, and in this way produces the impression that the space before the picture is filled with dust'. This accords with Jörg Schweinitz's (2012) work on the interrelationship between the photographic materiality of film images and the potential atmospheric effects experienced when watching the film. Even the decay of a photographic image, it appears, is able to summon up an atmosphere of nostalgia. Hence, coarse, grainy moving images can create atmospheric effects even though all they are actually revealing are the dye clouds or grains of the emulsion layer. This graininess can be emphasised with an out-of-focus, blurred image, helping create a filmic atmosphere. Overall, it appears that light and colour are intimately connected—phenomenologically and conceptually—to the construction of atmospheric space in artistic creation, including in film.

Historically, atmosphere and mood have been linked to colour and film from early on in the history of cinema. One of the better-known examples of this is Loyd A. Jones's work on Kodak's Sonochrome, a pre-tinted film stock combining colour and sound in the late 1920s and early 1930s. Jones attempted to convince potential buyers that colour could guide the mood of the audience: Sonochrome would 'enhance the powers of reproductive imagination in the observer' and manipulate viewers unawares (Yumibe, 2012: 144). In 'Tinted films for sound positives', for example, Jones (1929: 222) discusses the 17 tints Kodak offered in the Sonochrome series, which he often describes using the word 'atmosphere': for example, 'Tint No. 3, Afterglow [...] lends to interiors an *atmosphere* of warmth and intimacy stronger than firelight' (my emphasis), or 'Tint No. 1. Rose Dorée [...] is adapted to the rendition of scenes representing an intimate *atmosphere*, such as a luxuriously appointed boudoir' (my emphasis). Jones directly linked the creation of specific atmospheres in filmic spaces ('interiors', 'boudoir') to the use of particular colours. He also related 'mood reactions' to colour and affect.[18] It

17 Other examples of volumetric lights in film often occur in scenes set in the theatre. Theatre was usually characterised in the late-nineteenth and early twentieth centuries by the presence of bright lights. No doubt the filmic use of this aesthetic technique was inspired by theatre practice, which was a frequent reference point for film.

18 This concept derives from Luckiesh. He used it to describe the work of N.A. Wells, who investigated the effects of colours on himself. Luckiesh (1918: 197–98) labelled these effects 'mood-affections' or 'mood-reactions'.

is notable that he referred to the presumed psychological effect of colour on audience members rather than reflecting the inner states of the characters depicted in the film (Jones, 1929: 222). Kalmus (1935: 142) referred to the creation of mood in a similar way, stating that the effect on the cinema audience could be enhanced by an understanding of how to use colour in film: '[W]e can subtly convey dramatic moods and impressions to the audience, making them more receptive to whatever emotional effect the scenes, action, and dialog may convey'. Joshua Yumibe (2012: 22) sees a direct connection between the ideas of the early film colourists such as Jones and those of the colour culture induced with chromotherapeutic heritage from the 1950s and 1960s, stating that the idea that filmmakers could 'influence and uplift the spectator sensually—and positively—for specific moral and aesthetic ends' perfectly fitted such discourses.

In the cinema, colours can not only be seen on the screen, but are also reflected back onto the audience, and this effect is especially strong in the case of monochrome colours created with the help of tinting, filters or coloured lights. Thus, colour's presumed affective power also reaches the audience, synchronising the spectator's mood with that of the film's narrative, including its characters. As mentioned earlier, the actual experience of atmosphere is internally created by the perceiving subject; in cinema practice, this means that it is the spectator who experiences the filmic space as atmospheric. However, although the film's characters are part of the constellation creating this atmospheric effect (Wulff, 2012: 110), the film's atmosphere can simultaneously express a character's emotional state. Hugo Münsterberg referred to this aspect of atmosphere in *The Photoplay* (1916), in which he discussed the then-relatively new medium, film, from a psychological perspective. One of the subjects he remarked on was the idea that filmic space could be used to represent a character's emotions. In his sixth chapter, 'Emotions', he explains that a person's state of mind could not only be revealed by gestures and facial expressions, but also that 'his whole room or house may be penetrated by his spirit [...]. The feeling of the soul emanates into the surroundings' (Münsterberg, 1916: 119). One strategy theatre used to represent emotions was the stage arrangements and decor, including the use of colour and coloured lights:

> From the highest artistic color and form effects of the stage in the Reinhardt style down to the cheapest melodrama with soft blue lights and tender music for the closing scene, the stage arrangements tell the story of the intimate emotion. (Münsterberg, 1916: 119–20)

In Münsterberg's opinion, the stage set-up, with its colourful artefacts and coloured lighting, helped convey the characters' emotions. He upended the prevalent, if spurious, claim that colour makes human bodies vibrate, creating certain physiological effects, by stating instead that it was the body that radiated its emotional state into the surrounding space. This effect was imitated on stage with the help of—among other artefacts—coloured lights.

Birren, when discussing the effects of coloured light on the body in his work on the psychology of colour, also elaborated on ideas relating to the ability of the human

organism to radiate colours. As mentioned in the previous chapter, he connected this ability to the concept of 'aura', pointing to the importance of colour in recognising the inner state of the human body and mind. Examples of studies on this supposed phenomenon include Walter J. Kilner's book *The Human Atmosphere* (1911), George Starr White's *The Story of the Human Aura* (1928), and Oscar Bagnall's *The Origin and Properties of the Human Aura* (1937). These texts were very popular and influential, and beliefs in the properties of aura became part of the cultural context of the films of the period. Aura was (and remains) a concept that was much used in theosophical and spiritualist circles—an early example of a book dedicated to the power of aura, *Man Visible and Invisible*, was written by theosophist Charles Leadbeater in 1902, and is still in print today. It is interesting to note that the title of Kilner's book, *The Human Atmosphere* (1911), makes a direct link between atmosphere and aura. Kilner's motivation was to replace the term 'aura'—a concept generally only used by those familiar with occultism, a practice he dismissed—with the term 'human atmosphere'. His description of the phenomenon was of 'a haze intimately connected with the body', a 'mist' or 'cloud' (Kilner, 1911: 1). These descriptors could also be used as analogies of the idea of atmosphere filling an empty space, the difference being, however, that Kilner's 'human atmosphere' (or aura) specifically surrounds the human body and is viewed as connected or related to it. Hence, it was (and still is) believed that coloured light could either affect the human body from the outside in or radiate from it from the inside out, revealing its 'normally' invisible state.

Coloured Light in Film

Diegetic Lights in Colour

Coloured lighting was (and continues to be) a convention in the theatre, an example being the 'serpentine dances' that were so popular around the turn of the century. Coloured light was projected onto the dancers' white dresses so that their movements created shimmering, rainbow effects. Cinema imitated these effects by hand-colouring black and white films in the most fabulous ways (Yumibe, 2013), introducing a sense of beauty and awe. And, as coloured lighting was frequently used on stage to create an atmospheric or emotionally charged theatrical space, films containing theatrical scenes, such as musical films or those that took the theatre world as their theme, often represented this practice on screen. This of course had a diegetic motivation: by referencing the lights used on stage sets, these films could create a theatrical atmosphere.

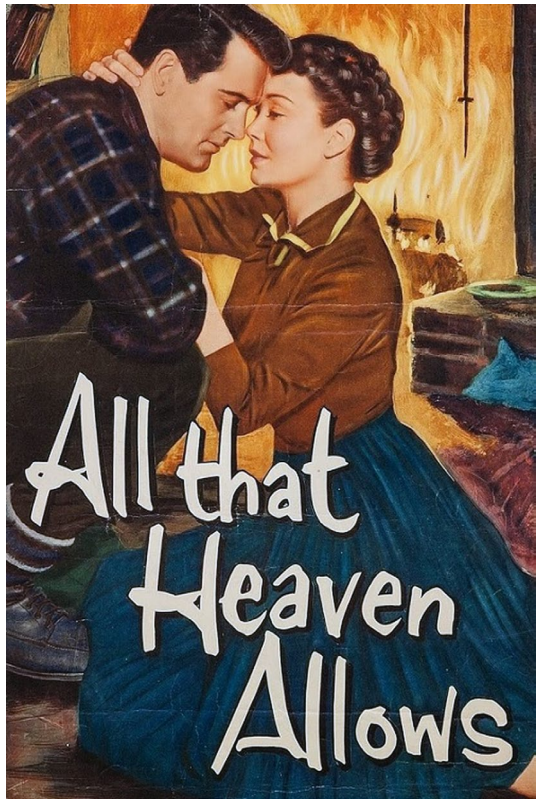
However, coloured light was also used in films without any theatrical references. In most of these, other narrative motivations explain the presence of coloured light in a scene. For example, in *She Wore a Yellow Ribbon* (USA 1949, John Ford, Technicolor IV), coloured light creates the effect of a sunset, and in *Funny Face* a scene in monochrome

red is motivated by the location—a photographer's darkroom, which is lit with the sort of dim red light usually used in the developing process to protect the light-sensitive photographic paper. However, these diegetically motivated lights also carried other, more emotional implications. In musical films, for instance, the connotations of the coloured lights on the stage often bleed into the narrative when play and reality begin to merge, while in *She Wore a Yellow Ribbon* the sunset scene takes place in a cemetery, where the main character sits by the grave of his deceased wife; the background's tense colours help convey the intensity of his grief. And in *Funny Face* the two main characters start to fall in love under the dull red light of the darkroom. Although darkroom safelights can be either red or amber, director Stanley Donen stated that he felt red looked more attractive for this particular scene, even though he believed that amber was more commonly used at the time (Penning, 1990: 71). The reason for this might have been red's added connotations of passion and sensuality.

Aside from indicating the time of day (sunset, daytime, night), some films also used coloured lighting to refer to a location (internal or external). For example, many films in the 1950s and 1960s used royal blue for scenes in outdoor spaces at night, and snowy winter landscapes were often tinged with a blue glow. One of the most eloquent examples is Douglas Sirk's *All That Heaven Allows* (1955), a film that plays with this kind of blue by contrasting it with the warm yellow-amber atmosphere that characterises its interior spaces. The colour contrast is clearly visible in every still from the film [Figs 6.11 and 6.12]. The poster advertising the film also reflects its warm-cold contrast [Fig. 6.10]. Interestingly, this alternation of blue and amber was frequently used during the silent period with the help of tinting and toning; it seems that cinema used mimetic colours, such as those made with Technicolor technology, to recreate some of the colour patterns of an earlier period of film. As Scott Higgins (2013: 176) explains, this way of using the power of colour to shape film visuals emotionally and produce 'direct sensuous engagement' does indeed 'date back to silent additive color'.

Of course, Sirk (in collaboration with cinematographer Russel Metty) was renowned for his intense use of coloured light to create a strong emotional emphasis (Higgins, 2013), as can be seen in *All That Heaven Allows* when the blue light from outside invades the interior through a door or window. The characters moving through this space, move in and out of the blue and yellow coloured light, and the presence of both colours in the same image creates a sense of tension [Figs 6.11–6.12]. This is an example of what Kappelhoff (2004) has called 'expressive movement' ('Ausdruckbewegung'), an aesthetic concept that refers to an emotionally charged connection between space and time. As Barbara Flueckiger (2016: 212) explains, colour can play an important role in the portrayal of expressive movement in film: 'Characters, objects, and lights establish patterns of pure colors, thereby addressing the unmediated sensory response of the viewer/listener, often as a combination of sound/music and color'.

Fig. 6.10 The colour scheme in *All That Heaven Allows* (USA 1955, Douglas Sirk) relies heavily on blue and yellow-amber, creating light–dark and warm–cold contrasts throughout the film. The colours also dominate the film poster of the time.



Figs 6.11 and 6.12 Characters moving through variously coloured spaces creating 'Ausdrucksbewegung'. Credit: Library of Congress. Photograph: Barbara Flueckiger. Film: *All That Heaven Allows* (1955).

Often, practical lighting provides the coloured lights in a film with narrative motivation: the light comes from sources that are present in the film's diegesis. During the 1950s and the 1960s, one such source was neon lighting. Not only did the reference to neon signs substantiate the presence of coloured lights in the film image, it also brought its own cultural connotations. As Christoph Ribbat explains in *Flickering Light. A History of Neon* (2013), neon lights date from the early 1900s, and were thought to possess an aura of modernity, novelty and urban night life. In the 1930s, neon signs spread across the US: '[I]n 1934 alone nearly 20,000 neon advertisements went up in Manhattan and Brooklyn' (Ribbat, 2013: 35). Manhattan housed the Egani Institute—for a time, the only school for neon design—and there was of course the constantly flashing environment of Time Square that was almost synonymous with an advertising culture of neon signs and coloured lights (45). As a result, neon lights became an iconic way of locating the setting of a film in Manhattan: for example, Hitchcock's psychological crime thriller *Rope* (USA 1948, Technicolor IV)[19] uses a backdrop of neon lights to indicate that the setting could not be anywhere but Manhattan. Of course, the fact that the protagonists' intellectual experiment (i.e. to commit a murder, undetected, while entertaining a group of dinner-party guests) takes place in a penthouse that appears to hover over a densely populated city filled with human activity helps to emphasise their feeling of superiority to or elevation above the rest of the human race.

Hitchcock also turns the neon lights in the streets outside into a dramaturgical presence. First of all, they mark the passage of time from late afternoon to evening; as the sun sets and night falls, their visual presence increases. In particular, the light from one of these signs, which is attached to the outside wall of the apartment building, begins to light up the penthouse interior. During one scene, the coloured light creates a strange effect. It begins with the moment Rupert confronts Brandon and Phillip with the fact that he knows they are murderers, disclosing that he has found the murder weapon: a rope. This is followed by a scene—some eight minutes long—filled with a sense of suspense that is dramatically heightened by the jittery, flashing light of the neon sign outside as its continual changes (from red to white to green, and back) flood the room. The alternation of colours, especially between red and green, creates a complementary contrast, amplifying the narrative tension. If we take into account that, at the time of the film, red was perceived as a stimulant and green as a more soothing colour, we can see that this particular alternation between calming and exciting stimuli may well have intensified the sense of stress. The flashing colours are also projected onto the faces of the characters, creating an 'aura' effect, as if the colours were actually radiating from their bodies, reflecting their inner turmoil. Hence, the coloured light is used in this scene to evoke an atmosphere of instability and tension, underlining the conflict between the characters [Figs 6.13, 6.14].

19 Natalie Kalmus is credited as colour consultant for *Rope*.

Figs 6.13 and 6.14 Coloured neon light evoking an atmosphere of instability and tension in *Rope* (USA 1948, Alfred Hitchcock). DVD Universal Studios, 1999.

Fig. 6.13 Time code: 01:14:28

Fig. 6.14 Time code: 01:14:39

Paris, the 'city of lights', was also known for its hundreds of neon street signs advertising products day and night. Jean-Luc Godard, who was renowned for referencing and commenting on popular culture in his films, often made use of this trope. A wonderful example is *Une femme est une femme* (1961), in which we are continually made aware of the neon lights outside, suggesting that the characters live in the city centre. However, the effect of the lighting here—the apartment interior is lit by an occasional blue flare—is much less intense than in *Rope*.[20] The neon lights in Godard's film are more of a reference to modernism, consumerism and popular culture than they are a source of intensifying, contrasting light as in Hitchcock's film. After the Second World War, neon light had become increasingly connected to consumerism, commercial advertising, the noise of city life and a vibrant popular urban culture (Ribbat, 2013: 21). One exception is the bathroom of the apartment in *Une femme est une femme*, which is brightly lit by the neon lights outside. The first time this occurs is when sex is indicated, in a highly charged atmosphere of passion and jealousy. As already seen in Chapter Three, red and green lights alternate inside the bathroom, creating a complementary contrast that is even visible beyond the room when the door is closed. In a similar way to *Rope*, the alternation of green and red light underlines that tensions are high. As the neon lights outside can be seen through the windows in the rest of the apartment, we gain the impression at first that the light in the bathroom has a similar source. This illusion, however, is soon disproved—the light appears to come from the opposite direction to the window:

20 Of course, Hitchcock was not the first director to use neon signs; they were often used in films during the 1940s and 1950s to suggest an entertainment or theatrical environment. Example of such films are *Nothing Sacred* (USA 1937, William A. Wellman, Technicolor IV); *Down Argentine Way* (USA 1940, Irving Cummings, Technicolor IV); *The Gang's All Here* (USA 1943, Busby Berkeley, Technicolor IV); *Million Dollar Mermaid* (USA 1952, Mervyn LeRoy, Technicolor IV); *Singin' in the Rain*; and *A Star is Born*.

whenever it is visible, the bathroom window remains dark even though the rest of the room is bathed in colour. As a result, the light in the bathroom conveys a feeling of tension, not only because of the constant alternation of complementary colours, but also because its source cannot be ascertained, creating an effect of estrangement.

The fact that Godard uses coloured light to suggest a situation of adultery, sex and jealousy accords with the idea that the 'neon city' has also become the place where 'women went bad', and of which '[f]amily men [...] could only fantasize [...] from the safety of the suburbs' (Ribbat, 2013: 72). This connection is made explicit by a neon sign declaring 'Jolie Poitrine!', referring to the cabaret where Angela works as a stripper [Fig. 6.15]. The fact that she is bathed in coloured light during her stage act carries the same connotations, even though it also refers to the theatrical tradition of coloured lighting.

Fig. 6.15 Neon sign 'Jolie Poitrine' in *Une femme est une femme* (FRA 1961, Jean-Luc Godard). DVD: 2000 The Criterion Collection.

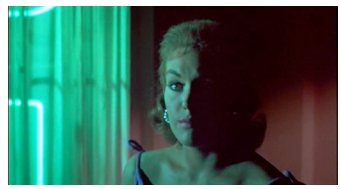
Time code: 00:42:03

Hence, neon not only belonged to the city, it also became an indicator of what was deemed as 'loose living' and 'immoral conduct', and this was amplified when the middle classes began to migrate to the suburbs, with the result that inner cities became mainly associated with the poor and underprivileged, and with 'drunks, hookers, gamblers and small-time crooks' (Ribbat, 2013: 21). As Ribbat (70) comments, '[n]eon now served as a dividing line between well-adjusted and dysfunctional neighbourhoods, between the abandoned underclass and the middle class that was rapidly becoming suburban'. In Hitchcock's *Vertigo* (1958),[21] for instance, the difference between rich, upper-class Madeleine and working-class Judy is visualised with the help of this trope. Judy lives at the Empire Hotel, whose name is illuminated in a large green neon sign on the façade; Madeleine, on the other hand, lives at the McKittrick Hotel, an all-grey, sedate Victorian villa next to Jefferson Square Park. During an interview with François Truffaut, Hitchcock explained that he consciously picked the Empire for his film because of the green neon sign outside the window. Not only does it highlight Judy's different social status but, as her room is located directly next to the sign, it also creates the effect

21 This film was shot in Technicolor V, with as colour consultant Richard Mueller.

of bathing the interior—and Judy—in a green light [Figs 6.16–6.17]. This is the decor in which a particularly emotional scene takes place, in which Judy slowly gives in to her love for Scottie, the man she betrayed, placing herself in an impossible situation.

In the same interview, we also learn that Hitchcock effectively used the green light as a leitmotif, connecting several important moments in the film. He explains that during the filming of an earlier scene at the cemetery he gave Madeleine 'a dreamlike, mysterious quality by shooting through a filter. That gave us a green effect, like fog over the bright sunshine' (Truffaut and Hitchcock, 1967: 186). As we have seen, fog is often used to visualise an atmospheric space, and the filter simultaneously creates a green tinge that heightens the effect. The combination of fog and greenish light also gives Madeleine a 'dreamlike and mysterious quality'—in other words, a green aura that appears to be a presentiment of death. This dovetails with the narrative in which Madeleine's character is presented as being possessed by a dead ancestor.[22] Again, during the interview, Hitchcock connects this moment in the cemetery to the one in the hotel room where Judy shows herself, dressed as Madeleine, to Scottie, who has slowly but determinedly forced her to reassume her impersonation of Madeleine. Hitchcock (in Truffaut and Hitchcock, 1967: 186) states: 'So when the girl emerges from the bathroom, that green light [from the neon sign] gives her the same subtle, ghostlike quality [as in the cemetery scene]'. And, indeed, on the DVD and the dye-transfer prints, Judy appears from the bathroom in a less saturated, more hazy and therefore more atmospheric version of the green light, giving her a ghost-like appearance. It is at this particular moment that Scottie confuses Judy with Madeleine. As Hitchcock (in Truffaut and Hitchcock, 1967: 186) describes it, he is '[t]emporarily dazed by the vision of his beloved Madeleine come back from the dead'; the hazy softness of the image is then drained away 'to indicate that Stewart's come back to reality'. In this way, Hitchcock uses the light of the neon sign as mood lighting, producing a ghostly atmosphere that is a subjective representation of Scottie's inner confusion [Fig. 6.18].



Figs 6.16 and 6.17 The neon light on the hotel façade emphasizing Judy's lower social status in *Vertigo* (USA 1958, Alfred Hitchcock) DVD 1999 Universal Studios. Fig. 6.16 Time code: 01:43:07/Fig. 6.17 Time code: 01:45:14

Fig. 6.18 Later the same neon creates a ghostly atmosphere representating Scotty's inner confusion. Time code: 01:55:38

22 A similar effect seems to occur during the scene in the forest, when Madeleine disappears behind a tree after she has hinted that she might be a ghost. When she reappears, she also has a greenish, slightly blurred presence, albeit less so than in the cemetery.

That being said, one important question remains with regard to the colour green in *Vertigo*. As pointed out in the Introduction, the different prints and versions of the film show a remarkable difference in colour. One example is the moment when Judy emerges from the bathroom and Scottie kisses her. During the kiss, the camera turns around the couple, and the space changes from the hotel room into the space where Scottie and Madeleine kissed just before the staged suicide. On the DVD, the background is green throughout the entire scene, whereas on the dye-transfer prints in the Harvard and the Academy film archives, the background turns blue: not only the imaginary space, but also the light from the hotel's neon sign, and even the sign itself, are blue [Figs 0.10–0.11]. A similar thing happens the first time Scottie sees Madeleine at the restaurant. On the DVD, her dress appears green, whereas on the dye-transfer prints it appears blue. As a result, although it might seem, based on the analysis of the DVD, as if green is the true leitmotif for Madeleine, the prints suggest otherwise. Still, nitrate prints do not refer to the colours as they appeared in projection. It might very well be that the projection light was yellowish, turning the blue on the print into a green on screen. Furthermore, the nitrate prints also seem to differ in colour, as was more rule than exception with Technicolor dye-transfer technology. Here again, we see the complexities and problems that arise when working on colour in film. What does remain clear, however, is the fact that the coloured light produces a tense atmosphere and casts an aura of death around the characters in a way that aligns with the emotions and feelings in the narrative.

Coloured Lights Hovering in Filmic Space

In the early 1930s, Robert Edmond Jones experimented extensively with coloured lights as mood and emotion enhancers in *La Cucaracha* (USA 1934, Lloyd Corrigan). This film was an experiment designed to demonstrate what the new Technicolor IV (three-strip technology) could do. Jones used coloured lights abundantly to communicate emotions and moods. Characters were lighted in the colour that supposedly underlined their mood, e.g. an angry character would be illuminated red, and a sad character blue. As Higgins (2007) explains, Jones might have stressed colour too much by aligning it so directly with the characters' emotions, and during the period of Technicolor's dominance in Hollywood colour film productions, the firm's colour consultants mostly avoided such extreme uses of coloured lights (Higgins, 2007: 35).

What is interesting about the use of coloured light in *La Cucaracha*, is that they have no diegetic motivation. So far, we have looked at the use of practical coloured light in films—that is, lights with a visible source. However, films like *La Cucaracha* used coloured lights without such a diegetic motivation. The absence of a recognisable source can make the light more mysterious and open to affective interpretation. In the use of coloured light there also was a racial bias. An example Richard Dyer gives in his canonical text 'White' (1997), perfectly illustrates this

connection between coloured light and the unfamiliar, the 'other'. In Lucien Lorelle's *The Colour Book of Photography* from 1955, only one non-white person is represented, a black woman lit with coloured lamps. The image is used to illustrate unusual use of colour in photography, 'to which the model's 'colourfulness; is unwittingly appropriate' (95).

Despite Kalmus's system of rules for filmmaking that considered certain uses of coloured light a serious deviation that should be avoided, she did not necessarily avoid scenes with coloured lighting.[23] In fact, there are numerous examples of films released in Technicolor, with Kalmus credited as colour consultant, that exhibit the use of coloured light in what she deemed an 'unnatural' way, as this VIAN visualisation of a search for the subjects 'Natalie Kalmus' and 'coloured light' shows.[24] [Fig. 6.19] Indeed, Kalmus's condemnation of the 'unnatural' use of coloured light in cinema—which seems to be an established part of the Technicolor story—may be more myth than reality.

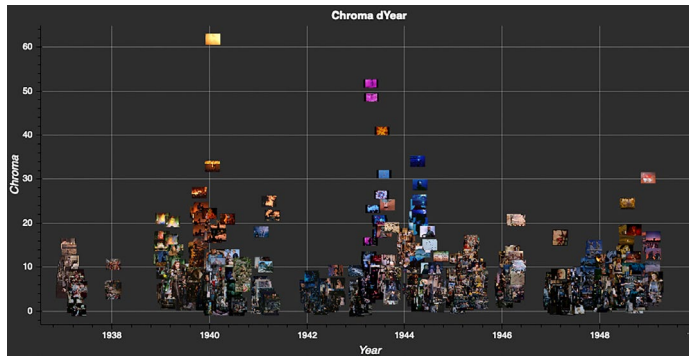


Fig. 6.19 This visualisation of a VIAN search for 'Natalie Kalmus' and 'Colored Light' shows that Kalmus frequently allowed coloured light in films she consulted on.

One of the reasons for the persistence of this myth might be that it helped individual cinematographers create a narrative emphasising the uniqueness of their work by claiming that they used colour in an especially distinctive and creative way. Cinematographer Jack Cardiff, for example, claimed to have started stretching Technicolor's rules by playing with sharpness and detail. According to his account, he insisted on the use of fog filters and diffusing techniques when filming Michael Powell and Emeric Pressburger's *A Matter of Life and Death* (GBR 1946, Technicolor IV) and *Black Narcissus* (GBR 1947, Technicolor IV). Cardiff declared that the Technicolor personnel were not enthusiastic about his creative bending of the rules and initially opposed his way of filming in colour; however, when they saw the results, they were apparently reconciled to this practice (Street, 2009: 210–11). Even though this story

23 Kalmus was almost always appointed as the main colour director for Technicolor films before 1949.
24 *La Cucaracha* (USA 1934, Lloyd Corrigan) credits Natalie *M.* Kalmus as colour consultant instead of just Natalie Kalmus. As a result, this film did not show up in the search.

could be apocryphal—a bid to increase Cardiff's authorial credibility—*Black Narcissus* remains an extraordinary film; it is an exceptional example of how colour could be used to accompany and intensify a film's increasing emotional tension (211).

Another film that deploys coloured lights without a direct diegetic motivation is *Moulin Rouge* (GBR 1952, John Huston, Technicolor IV, colour consultancy Joan Bridge and Ian Craig). In this film, the purpose of the intensive use of coloured lights, smoke and fog is to recreate the artistic ambience of a bohemian Paris. The film's director, John Huston, also experimented with colour in *Moby Dick* (USA / GBR 1956, Technicolor desaturation process), adding extra black to the Technicolor print. The reason behind this was, apparently:

> [T]o get something of the effect of old coloured engravings in the image […]. Actually the principal effect of this process was to desaturate the colours, though where there was already black in the image, it was spread and intensified slightly. (Salt, 1992 [1983]: 242)

In the case of *Moulin Rouge*, it is said that Huston worked with colour in a highly original way, disregarding the advice of the film's Technicolor colour consultants Joan Bridge and Ian Craig. He even went so far as to install Life photographer Eliot Elisofon as his preferred colour designer, bypassing the official Technicolor personnel. Various techniques were used to make the colours more 'Lautrec'-like. As Rouben Mamoulian commented in 1960:

> This being the story of Toulouse Lautrec, the whole picture was treated in the style and mood of his canvasses. Also, in the process of photography, diffusion and filters were used to excellent advantage. The whole film had a continuous colour quality and effective style. (Mamoulian, 1960: 78–79)

The diffusion, filters, fog and smoke make the film image appear more fluid, more out of control, but also more atmospheric. In Sarah Street's words:

> [This film is] particularly striking for cinematographer Ossie Morris's innovations with Technicolor [...] using filtered lights, fog filters on the camera and smoke effects on the set to recreate the style of Toulouse-Lautrec's postimpressionist paintings. (Street, 2009: 213)

As Thomas Elsaesser (2016: 280–81) explains in *Film History as Media Archaeology*, this privileging of the atmospheric element and mood over exact realism, Renaissance perspective and precise framing has a long tradition within the entertainment industry and the visual arts. Elseasser especially mentions J.M.W. Turner (1775–1851) as a painter who stretched the rules of perspective, working with diffusion and compositions that overlapped the frame. It seems, however, that Technicolor was perceived as a company that was not particularly fond of this break with tradition. In an interview with Al Hine in 1953, Huston explained that Technicolor tended to dismiss images that were not sharp and crystal clear, and his way of working with colour in *Moulin Rouge* involved him in a battle with the company:

> All their thinking is to make everything equally bright and sharp and clear. Like a beer ad, where you can see every bubble in the foam. And here we were with color that was hazy in some places, that was light or dark according to mood. (Huston in Long, 2001: 9–11).

We can see that this was no doubt the case if we take into account the fact that hazy images and fringing posed long-term problems for those making colour films with Technicolor three-strip technology. However, haziness is not necessarily a sign of deficient technology; rather, it helps to create atmosphere and convey the mood of a film, both of which are connected to inner feelings and the affective power of light and colour.

As previously mentioned, *Moulin Rouge*, in addition to deploying haziness, filtered lights, fog filters and smoke effects, also deviates from more traditional ways of working with coloured light by excluding any indication of a practical source from which it could emanate. This absence makes it easier to interpret the light as a reflection of a character's mood or state of mind. For example, when the film's main character, artist Henri Toulouse-Lautrec, sits drinking absinthe in a bar, his surroundings are suffused with the type of yellowish-green light that is usually associated with the intoxicating drink. As a result, the light itself could be interpreted as a reflection of his inebriation, or even as the spirit of the absinthe itself radiating from him as a kind of aura.

A scene around halfway into the film offers an even more interesting use of coloured light with no feasible source. Henri is depressed because his lover has left him: we see him entering his apartment and slumping down on a chair with his coat still on. The scene's lighting is low-key, casting heavy shadows on the walls—back-cast shadows and cookie lighting can immediately create atmosphere, since both forms of shadow help give the impression of light as a tangible presence filling an otherwise empty space (see Katz, 1935 [1930]). In addition, both the apartment and Henri himself are bathed in a blue light, indicating that night has fallen. Suddenly, Henri gets up to close the window, then starts to open all the gas taps in the house, and the blue begins to alternate with a dark amber-coloured light, similar in hue to the copper gas taps,[25] as if the gas were a tangible substance gradually filling the empty (blue) room. Here again, we see the use of coloured light to create an impression of filled space. After opening the gas taps, Henri sits down to await death. However, while he waits, he starts looking at his paintings. The light in the room shifts towards a soft green, and Henri simultaneously gets up to add green paint to a poster he is working on. The green light can be interpreted as a projection of Henri's growing awareness that his latest painting demands a greener aspect, as the idea of greenness that suddenly occurs to him appears to radiate from him once again[26] [Figs 6.20–6.22].

25 For me, this colour also cross-modally represents the smell of the gas, which of course is a very subjective interpretation.

26 Another association might be that of the aforementioned 'green spirit' of the absinthe giving Henri inspiration.

Figs 6.20, 6.21 and 6.22 Coloured light as an almost tangible presence filling space in *Moulin Rouge* (GBR 1952, John Huston). DVD: 2007 NewKSM.

Time code: 01:05:09

Time code: 01:05:36

Time code: 01:06:36

This scene shows how an atmosphere is created by the choice of coloured lighting, particularly with its reference to the deadly (invisible) gas, followed by the effect of an aura emanating from Henri, reflecting the emergence in his mind of the memory of a colour. This is confirmed when he starts to add the same green to his unfinished painting. The scene affirms that Huston wanted to stretch the traditional norms of colour film, not only through fog and haziness, but also with a more fluid use of colours and shapes, helping the atmosphere in the film align with the emotional core of the narrative.

During the second half of the 1950s, filmic colour schemes loosened up, and coloured lights became increasingly used in cinema. As Scott Higgins remarks:

> [C]olor was becoming more generalized and less strictly controlled [...]. As Russell Merritt has argued, this is a period where technological change encouraged experimentation, as it had done in the 1930s with the innovation of three-color Technicolor, or with the current rise of Digital Intermediate. The ascension of Eastmancolor helped to broaden color's dramatic range in all genres. (Higgins, 2013: 176–77)

An example of this type of experimentation happened during the making of the Hitchcock film *To Catch a Thief* (1955)—Richard Mueller, the colour consultant of this Technicolor V film, was later involved in Hitchcock's *Vertigo*. The use of colour in this film is particularly noteworthy, first and foremost because Hitchcock and Mueller used a green filter instead of the usual blue for the night scenes. According to Hitchcock (in Truffaut and Hitchcock, 1967: 166), this was an experiment: '[T]o get rid of the Technicolor blue for the night scenes [...] we shot with a green filter to get the dark slate blue, the real color of night, but it still didn't come out as I wanted it' [Fig. 6.23].

Fig. 6.23 Example of green night-scene in *To Catch a Thief* (USA 1955, Alfred Hitchcock). DVD: 2012 Paramount. Time code: 00:02:06

What is interesting here is that these night scenes are the ones that contain the film's action, suspense and increasing tension—it is in these scenes that the burglaries take place. One exception is the scene in which Cary Grant and Grace Kelly kiss in front of an open window, creating an atmosphere of sexual tension that is only released when a firework display suddenly erupts outside, lighting up the green sky, suggesting that more than just a kiss has happened between the two. This diversion from the 'normal' Technicolor blue for a night scene creates an effect of estrangement. Also, even though Hitchcock may not have intended it, such deviations from the usual colour conventions can have, as we saw earlier, the effect of alerting the spectator, making them more attentive to the action in a scene.

The film's narrative misdirects the audience as to the identity of the burglar. Interestingly, the green colour also appears in the film at those moments when the real culprits, the staff of the local restaurant, appear. This time it is a coloured light that creates the green effect: for example, there is a slight touch of green in the kitchen, a wine cellar wall is lit with green caustic lighting, and when the staff are catering for a party at the end of the film, there are hints of the same greenish light on the tablecloth. Since there is no practical source for this light, it can easily be interpreted as a green aura that radiates from the culprits themselves, hinting at their true motives. One of the claims concerning auras was that they were only visible to certain people. This is the case here: the green light is barely noticeable unless we pay it particular heed. In this way, Hitchcock and Mueller create a subtle aura of negativity around the actual criminals [Figs 6.24–6.26].

Figs 6.24, 6.25 and 6.26 Hitchcock and Mueller used green coloured light that indicate the criminals in a subtle way in *To Catch a Thief* (USA 1955, Alfred Hitchcock). DVD: 2012 Paramount.

Time code: 00:13:26

Time code: 00:17:21

Time code: 00:32:19

Coloured Light and the Creation of 'Ostranenie'

So far, we have come across such terms as 'strange' or 'estrangement' on a number of occasions. Certainly, the use of coloured light without a clear indication of a practical source often gives rise to a feeling that something is 'not quite right'. This sense of estrangement (or defamiliarisation) can be theorised using the concept of 'ostranenie' that Russian formalist Viktor Shklovsky introduced in 1917 to describe how defamiliarisation can be employed to challenge or refresh perception:

> The purpose of art is to impart the sensation of things as they are perceived and not as they are known. The technique of art is to make objects 'unfamiliar,' to make forms difficult, to increase the difficulty and length of perception because the process of perception is an aesthetic end in itself and must be prolonged. (Shklovsky, 1965 [1917]: 12)

Hence, estrangement usually refers to those moments when a work of art—a film, in this case—becomes self-referential, alluding to its own creation or sense of 'being-made-ness', breaking the illusion of reality. Playwright Bertolt Brecht's idea of 'Verfremdung' could be seen as a version of 'ostranenie' in that it describes a similar mechanism, but one that also intends to raise awareness. Brecht wanted to educate his audience, but he could not do this if they were carried away by the theatrical drama; he wanted to confront the spectator with their own reality of being a spectator and encourage them to reflect on the real social injustices he was highlighting in his plays (Christie, 2010: 88).

In the world of cinema, the modernistic Nouvelle-Vague films by Jean-Luc Godard are often associated with Verfremdung: he clearly and purposefully disregarded the rules of classical cinema, including in his use of colour, and this can lead to a sense of estrangement. For example, in the scene in *Une femme est une femme*, mentioned earlier, the light in the bathroom heightens the tension with its alternation of the complementary colours green and red. At the same time, because its source is mysterious, it creates an effect of 'ostranenie'. Logically, the light should derive from the neon signs outside the window, but this conclusion is undermined by several

inconsistencies: for example, when we see the bathroom's interior, the red and green lights appear to come from different directions, and although they appear to vary in intensity inside the room, when we glimpse them through the window of the closed bathroom door, they seem to be of equal intensity. The estranging effect Godard creates by playing with coloured light, however, appears to be more of an experiment in escalating the tension between the three main characters in the film than an attempt to create awareness or Verfremdung.

A film in which Godard's use of monochrome colouring does create a true sense of Verfremdung is *Le mépris* (1963). A specific example of this is the scene where Camille (Brigitte Bardot) and Paul (Michel Piccoli) are lying together on a bed, and Camille asks Paul to comment on various parts of her body. This very act, in combination with the film's display of her naked body, easily turns the fictionalising spectator into a documentarising one. Instead of watching Camille talk to Paul, we see Bardot commenting on the body of Bardot, and as a result, we start reading the photographic image as an indexical proof of her body 'having-been-there' in front of the camera. This breaks the narrative illusion and turns the film into a documentary about Bardot's body, creating the effect of defamiliarisation with the intention to challenge and refresh perception.

This is not an unusual stance for Godard, since he considered every film to be a documentary about its actors (Paige, 2004: 14). However, in the above scene, Godard specifically uses monochrome colour to tease out the friction between the persona of the star and the character she plays in the film. As Nicholas Paige (2004: 9) describes it, '[t]here was [...] quite a bit more at stake in Godard's choice of color and stars, for *Le mépris* was somehow about color and Bardot as much or more than it was about Homer or even Lang'. Indeed, Bardot was a huge star in 1963, which made her the ideal actor for a film commenting on stardom. In addition, Bardot's unique selling point was her body, which ever since *Et Dieu… créa la femme* (FRA 1956, Roger Vadim, Eastmancolor) could be admired in colour, which emphasised the sensuality of her flesh. However, in the aforementioned scene in *Le Mépris*, Godard uses colour to frustrate the audience's desire for an unadulterated view of Bardot's body, turning it red and blue with the help of filters. These monochrome images are alternated with images in mimetic colours: the switch between the view of her body in realistic colours and the abstract body in monochrome red and blue increases the effect of Verfremdung. It breaks the illusion and the fictionalisation of the film, and points towards the star status of this body and the erotic way it was used in the film industry. By blocking the lust for the pornographic non-fiction view of her body that contemporary audiences clearly expected when going to see a Bardot film, this scene creates a visual Verfremdung effect, confronting the audience with their own lustful expectations.[27]

27 I discuss this excerpt in more depth in Chapter Nine.

In addition to the creation of ostranenie, with the aim of provoking an awareness through Verfremdung, alienation can also be used to conjure a sense of the uncanny or the 'unheimlich'. This type of ostranenie takes place inside the narrative or diegesis, and as such is not intended to break the illusion of reality or the fictionalisation process. Simon Spiegel (2013: 255) calls this an ostranenie of the second order, which can only be achieved after a successful naturalisation of the strangeness, making it a part of the diegetic world. It is a type of ostranenie we can find in more popular genres such as science fiction and horror. Indeed, coloured light was often used to create such a secondary or diegetic Verfremdung in science-fiction films. In *Der schweigende Stern*, coloured light is used to create the strange, disturbing atmosphere on Venus [Fig. 6.27], which is linked to the fact that the planet has suffered a nuclear war that has wiped out all its life forms. As a result, the colours used to create the uncanny landscape also indicate an atmosphere filled with toxic particles, similar to the scene in *Moulin Rouge* in which coloured light indicates that the room is slowly filling with a deadly gas.

Fig. 6.27 Coloured light creates an uncanny atmosphere in *Der schweigende Stern* (GDR 1960, Kurt Maetzig). DVD: 2009 Icestorm Entertainment. Time code: 01:05:59

Another good example of a film that uses coloured light to suggest the unknown is *The War of the Worlds* (1953).[28] Throughout the film, the coloured lights are used for the extraterrestrials and their death-dealing, radioactive rays, and it becomes obvious that these are strange and dangerous creatures that should be feared. Interestingly, towards the end of the film, when the Martians start dying from earth viruses which they have no immunity to, coloured light is also used to indicate the presence of death. After one of the flying saucers crashes, the door opens and we see a Martian's arm slowly moving towards the exit. It is the first time we are made aware there are living creatures inside the metal ships. The white light shining on the arm makes it appear slimy (Chapter Seven discusses this aspect in more detail), but then a green light from the left suddenly touches the arm, and it stops moving. This light has no practical source and no function other than to create an aura suggesting the creature's passing from life to death, from this world to another (that is not Mars) [Figs 6.28–6.29].

28 *The War of the Worlds* was shot in Technicolor IV, with Monroe Burbank as colour consultant.

Figs 6.28 and 6.29 In *The War of the Worlds* (USA 1953, Byron Haskin, Technicolor IV, color consultant Monroe Burbank) a colour change indicates death. DVD: 1999 Paramount Pictures.

Fig. 6.28 Time code: 01:23:09

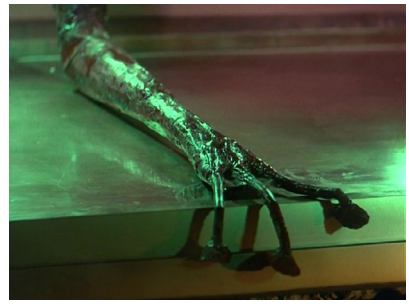


Fig. 6.29 Time code: 01:23:43

Indeed, coloured lights with no practical source were often related to the extraterrestrial or the radioactive. These references were strongly embedded in the 1950s and 1960s cultural lexicon: the period itself was frequently characterised as the 'space age' and the 'atomic age'.

Strange, coloured lighting was also used to evoke the presence of the supernatural or of death.[29] These themes can easily be connected to what Freud described as the uncanny or unheimliche in his piece 'The uncanny' (1925), which elaborates on Ernst Jentsch's 1906 article 'Zur Psychologie des Unheimlichen'. Both texts point towards the idea that the uncanny is that which is considered unfamiliar, novel, uncertain. In Freud's (1925: 243) opinion, this is related to specific themes and topics such as 'animism, magic and sorcery, man's attitude to death, involuntary repetition and [of course] the castration complex'. Jentsch is more subtle in that he connects the concept to the idea of unheimlich, as in not feeling at home or at ease:

> [T]his word [unheimlich] appears to express that someone to whom something uncanny happens is not quite 'at home' or 'at ease' in the situation concerned. The thing is or at least seems to be foreign to him. In brief, the word suggests that a lack of orientation is bound up with the impression of the uncanniness of a thing or incident. (Jentsch, 1995 [1906]: 2)

Freud (1925: 221) explains this feeling as follows: 'The better orientated in his environment a person is, the less readily will he get the impression of something uncanny in regard to the objects and events in it'. Thus, an environment—and the extent to which it is inexplicable or unfamiliar—plays a fundamental role in the experience or sensation of uncanniness. In the tradition of visual and theatrical representation, the creation of an atmosphere of abhorrence, fear and the uncanny can be traced back to baroque theatre (which introduced a host of new machinery producing strange noises and trickery into the stage culture of the time), as well

29 An earlier example is the British Technicolor film *Blithe Spirit* (1945), which uses colour to distinguish the living from the dead. The film uses 'green light in conjunction with costume to create the film's ghostly effects' (Street, 2020).

as to the 'phantasmagoria' of eighteenth- and nineteenth-century popular culture. The latter included magic lantern shows, which projected images onto moving screens in a darkened space with the aim of disorienting the audience. Coloured lantern slides were frequently used in these kinds of shows, creating a play of shifting colours against a backdrop of smoke, walls or screens (Barbar, 1989). This creation of uncanny spaces—the habitat of ghosts, death and magic—is an aesthetic that returned in the form of fairies in the work of filmmakers such as Georges Méliès. Méliès regularly used coloured elements as part of his filmic arsenal of disorienting effects, which also included smoke, fire and explosions.

A similar use of coloured lights in the aesthetics of the uncanny, death and the supernatural returned in the 1960s in the horror films of Mario Bava, one of the first masters of the 'giallo'. As Tim Lucas explains:

> Bava's film achieves an atmosphere of otherness entirely through its inventive uses of color and settings. Consequently, color—applied luminously and often irrationally—suggests the flaring presence of madness of the supernatural. (Lucas, 2007: 511)

When the horror genre turned to colour during the late 1950s, the supernatural and the uncanny became truly visually connected to colour. Bava is recognised for his seminal influence on the colour aesthetics of horror: with his particular use of colour, he created gloomy, spectacularly atmospheric spaces in which his characters live in a sort of suspension between fear and death. Bava's *La Frustra e il Corpo* (ITA 1963, Technicolor V), for example, contains phantasmagoria-like locations which produce a sense of estrangement with the help of coloured lighting. To increase the defamiliarising effect of uncanny atmospheres, the exterior scenes were filmed in more 'natural' colours, whereas the locations inside the house and the dungeon where the action takes place are filled with strange, coloured lights. Another film that successfully renders spaces strange and unfamiliar with the help of coloured lighting is Bava's *Sei donne per l'assassino* (1964), as well as the episodes *Il telefono* and *La goccia d'acqua* in his triptych *I tre volti della paura* (1963). The setting of *La goccia d'acqua*, for example, includes alternating lights in complementary colours that create a sense of escalating tension.

However, it is the gothic atmosphere of *I Wurdulak*, the third film in Bava's tryptich, that bears the most similarities to an actual phantasmagoria. The outdoor scenes are predominantly foggy and damp, with a bluish atmosphere that hinders visibility and distorts the images, disorienting the spectator. The danger indeed comes from 'out there', breeching the safety of the house, which is portrayed in a warm yellow-brown colour: the eerie blue light enters the warm amber atmosphere through a window in the background, or it simply appears without any clear diegetic source, grazing the beds of the sleepers during the night. The appearance of the blue light creates a sense of mounting tension as it indicates that some sort of existential danger is slowly invading the safety of the house. At the time, the use of blue for interior shots was thought

to create 'a feeling of coldness, gloom, neglect, poverty, or night—the "haunted-house" type of atmosphere' (Mitchell, 1964: 12). Of course, the creation of this sort of atmosphere only became fully possible when the horror genre turned to colour in the late 1950s and early 1960s with the likes of Bava and Roger Corman. Hammer horror also embraced colour around this time (Street et al., 2022: 12). For example, Hammer horror films shot by cinematographer Jack Asher also used unnatural colours; however, in these cases they were produced with colored light sources (Lucas, 2007: 511).

In *I Wurdulak*, a family man returns home from a trip, in the course of which he has been changed into a wurdulak (a type of vampire). He gradually begins to attack each of the members of his family, turning them into wurdulaks. The daughter, however, tries to escape, together with her lover. The couple flees, hiding in an old ruin filled with dead plants, shadows and cobwebs. The lighting in the ruin creates cast shadows, with cookie lighting increasing the tense, eerie atmosphere, and on a number of occasions we see the characters through screens of cobwebs, creating diffusion and obscuring our vision. The atmosphere is filled with tension, and this is heightened by lights of various colours—green, purple, yellow, blue, pink—brushing the walls of the ruin. As in *Moulin Rouge*, coloured light gives the impression of the space being filled with particles, creating an illusion of an invisible presence. In addition, the strange colours again give the space the unfamiliarity, unheimlichkeit needed to turn it uncanny or eerie.

When the couple is asleep, the wurdulak enters the ruin, forcing the daughter to come out of her hiding place with the magic of thought (it seems). It is at this moment that we are confronted with the other family members who are also wurdulaks. Whilst they are looking straight into the camera, push-in dollies are used to create the impression of them approaching the audience. This aesthetic is directly related to the phantasmagoria, where similar effects were created by moving a magic lantern towards or away from the screen, increasing and decreasing the projected image—this is confirmed by the fact that earlier in the scene a similar camera movement is used in the filming of a skull. Once again, colour is used to increase the eerie effect: for example, throughout the film, unfamiliar colours are projected onto the face of the wurdulak father, emphasising his transformation into something strange and uncanny (or unheimlichkeit), while the faces of the other family members are coloured green, also rendering them unheimlich. In fact, *I Wurdulak* seems to be a tribute to the phantasmagoria aesthetic. The defamiliarisation of the space through diffusion techniques such as fog and cobwebs is further increased by the grazing coloured lights used throughout the film. The strangest use of coloured light, however, occurs precisely at the moment when the setting is most phantasmagoric, when the camera movements create a sense of suspense and tension.

Bava's diegetic ostranenie, or 'secondary Verfremdung', defamiliarises the filmic space, separating it from the world we live in and indicating that something is not quite right. Bava was the king of diegetic ostranenie, as Lucas explains:

> [A]s his characters move through darkened rooms or under darkened skies, the light falling on their faces might be amber, lavender, green or a seething, incendiary red, depending not on natural light sources, but on the emotional tonality Bava wished to interject at that precise moment. *Ercole al centro della terra* had given Bava the opportunity to interpret Hell, but *I tre volti della paura* unleashed those colors on the surface world. (Lucas, 2007: 511)

These coloured lights or monochrome film images were often used for particular scenes or shots that carried a strong emotional resonance. They represented contexts in which strange, dangerous, stressful or illegal activities take place, as well as powerful subjective moments, either by revealing the inner states of the characters or by visually increasing the stress of a high-tension scene.

This brings us to the final example of a scene in Donen's *Funny Face* (1957) that experiments with coloured light in a way we have not yet discussed. The scene concerned takes place in an underground jazz club in Paris, where unconventional coloured lighting is part of the theatrical setting. However, the gaudy coloured lights are not limited to the stage; they invade the entire cellar, a space that conveys an atmosphere of existentialist philosophy and 'hip' intellectual conversation. During this scene, Jo starts dancing to the music of the band, before meeting the philosophy professor she has idolised from afar, who then tries to seduce her with his intellectual conversation [Fig. 6.30]. Later, the action moves to the professor's apartment. Here, the space is filled with smoke, diluting the colours and blurring the shapes of the furniture. The professor makes his move, but Jo rejects him. With its portrayal of a bohemian atmosphere with liberated sexual mores, the scenes in *Funny Face* could be seen as a prelude to the unleashing of psychedelic colours in the films of the later 1960s, colours that were connected to a hallucinogen-infused music culture, while the setting of the bohemian jazz club could be seen as a forerunner to the later psychedelic venues, with their coloured lights and atmospheres of intoxication.

Fig. 6.30 Wild colours in a Parisian night club in Funny Face (USA 1957, Stanley Donen) foreshadow the unleashing of psychedelic colours of the 1960s.

PART III: TOUCHING AND TASTING IN COLOUR

In 1950 Technicolor released a film, *Technicolor for Industrial Films*, promoting the 16mm film material it produced specifically for the making of industrial films.[1] It did so by presenting a number of products, such as fabrics, liquids, cosmetics and food, that it claimed would benefit from being advertised in Technicolor. This corresponded with the contemporary belief that if a product was reproduced in colour, this would help emphasise its texture and materiality, and thus increase its commercial appeal. The film cleverly displays the profilmic materiality of the objects while a voice-over draws attention to, for example, the glossy sheen and lustre of rayons, or the texture of woollen material, claiming that '[the] texture, weave, and pattern of woollen fabrics are reproduced in color so accurately that a film could be used to replace the sample books of salesmen' (*Technicolor for Industrial Films*).

To emphasise the film's rendition of texture, the fabrics are constantly touched, fondled, and caressed by a pair of disembodied female hands (See: https://archive.org/details/Technico1949. Time code: 1:59-2:27), conveying the impression that we are touching them ourselves. This is a form not only of motor mimicry but also of contagion—we feel what these hands feel, in the same way as we often start to cry when we witness someone else in tears (Plantinga, 2009). Another moment in which the film subtly makes use of a pair of anonymous hands is its promotion of Technicolor's rendition of pastel-coloured bars of soap: here, the hands are not shown touching the soap on display but instead appear in front of it, wet and foamy, in the act of washing themselves. The appearance of these hands increases the sense of the haptic in the image, maybe even including the scent of the soap (See: https://archive.org/details/Technico1949. Time code: 3:24–3:32).

Around halfway into the film, the focus shifts from textiles, soaps and other such items to food. As the voice-over explains, food needs the realism of colour to elicit 'appetite appeal', pictures that 'step out of their conventional black and white

1 Rick Prelinger's dating of the film around 1949 might not apply to the version shown. At the film's beginning when the 'Color by Technicolor' logo is shown, a voice-over explains that "today" Technicolor prints can also be struck from various colour negatives, such as Eastmancolor and Anscocolor. The Anscocolor negative/positive system was launched in 1950, which tells us that this version of the film has to date from that year, or later.

 https://doi.org/10.11647/OBP.0380.09

setting and become part of the tasty, wholesome, appetizing dinners we know so well' (*Technicolor for Industrial Films*, 1950). In the meantime, we are presented with colourful images of vegetables such as carrots, tomatoes and lettuce being prepared and served (See: https://archive.org/details/Technico1949. Time code: 5:07-6:09), as well as pancakes with maple syrup, drinks, grapes and other consumables, showcasing how well Technicolor can reproduce any variety of colours.

In all, the film tries to sell Technicolor to industrial filmmakers by emphasising that colour has the power to turn visual representations into tactile, tasty experiences. This echoes the claims of earlier colour technologies, such as Gaumont's Chronochrome and Prizma II, which used films of fruit or flowers to display the abilities of the new systems. Others, such as Kodachrome and Pathecolor, produced fashion films whose representations of fabrics and clothes displayed a combination of materiality and colour in a bid to show the advantages and powers of their various technologies.[2] Technicolor's advertising film sits within this tradition of combining colour, taste and touch—a strategy of cross-modal perception—to promote its colour system to those who wanted to sell textured, soft or tasty products to potential customers. At the same time, the film reveals the importance of the connection between cross-modal transfer and colour film in the 1950s—the starting point of our period of interest. To investigate the ways in which texture, taste and touch played a key role in colour film throughout the 1950s and 1960s, I will explore these two sides of cross-modal transfer through the visualisations of food and surfaces, including the rendition of female white skin.

The message of the Technicolor film dovetails with the texts produced in the 1950s and 1960s on colour theory and the interconnectivity of the various senses. For example, Joseph Albers states in *Interaction of Color*:

> Though we were taught, only a few years ago, that there is no connection whatever between visual and auditory perception, we know now that a color changes visually when a changing tone is heard simultaneously. This, of course, makes the relativity of color still more obvious, just as tongue and eye perceptions interdepend when colors of food and of its containers increase or diminish our appetite. (Albers, 1971 [1963]: 72)

This quotation reveals that the discourse on colour perception was full of assumptions on how the senses were interdependent. Another of the main players in colour and colour discourse was, of course, Faber Birren. In 1950 he wrote in his characteristically overconfident style: 'It has long been known that the stimulation of color will produce reactions throughout the human organism and that the activity of one sense organ will influence another' (Birren, 1950: 147). To substantiate this idea, Birren refers to

2 See: *Timeline of Historical Film Colors* and the film *L'élégance* (FRA 1926, Sonia Delaunay) (https://colourandfilm.com/2019/12/07/sonia-delaunays-lelegance-1926-and-the-keller-dorian-colour-system-by-lucy-moyse-ferreira/).

Nobel-prize winning neurophysicist Charles Scott Sherrington, who at the turn of the twentieth century investigated the phenomenon of reflexes in relation to the nervous system, publishing his conclusions in *The Integrative Action of the Nervous System* (1920 [1906]). Sherrington declared:

> All parts of the nervous system are connected together and no part of it is probably ever capable of reaction without affecting and being affected by various other parts, and it is a system certainly never absolutely at rest. (Sherrington, 1920 [1906]: 8)[3]

Birren's ideas, based on Sherrington's statements about the nervous system, are confirmed by what we now know and describe as cross-modal and multisensory phenomena. In his book *The Phenomenology of Perception* Merleau-Ponty argues that human perception is basically synaesthetic, which is overruled by scientific knowledge on the human body that separates the senses. As a result, we unlearned how to see, hear and feel synaesthetically (Merleau-Ponty, 1962: 266). In psychoanalytical theory this was also the more common belief. In 1950 psychoanalyist Paul Schilder wrote that '… synaesthesia… is the normal situation. The isolated sensation is the product of an analysis' (1950: 38). Another psychoanalyst Daniel Stern argues that children perceive mostly in an amodal way; modal perception is only developed later (Stern 1985).

While Albers and Birren were more descriptive than scientific when discussing this phenomenon, others used the concept 'synaesthesia'. For example, in 1965 Victoria Ball published an article called 'The aesthetics of color: A review of fifty years of experimentation', in which she covered half a century of psychological experiments on colour. She defines synaesthesia as:

> [T]he strange symbolic power of the mind whereby phenomena in one field of experience cross wires with those which exist in other ones to become a synecdoche for an entire group of affections thereby gaining immensely in riveting force. (Ball, 1965: 446)

Ball reinforces the idea that 'through synaesthesis color can be identified with the other sensations' with such examples as the 'kinaesthetic sense', the impression that some colours appear heavier than others, and the 'tactile sense', connecting certain colours to low or high temperatures. The impression of the comparative weight of colours, however, is actually more a theoretical problem of perception than the result of cross-modal transfer, and the relationship between colour and temperature is mainly a reflection of the cultural connotations of the 'longue durée' and not an innate biological process.

Synaesthesia is (still) often used as an umbrella term for all cross-modal experiences. Art theory, for example, uses it metaphorically to describe an aesthetic activity that produces a unity of feeling and perception (Koch, 2011: 7–9). The concept is also used this way in film theory: for example, Vivian Sobchack (2004: 68) speaks of 'the

3 Sherrington cited in Birren (1950: 147).

cinesthetic subject, who is moved and touched by going to the movies'. To stress the importance of this phenomenon, Sobchack (2004: 54) draws on an older body of film theory that includes the writings of Sergei Eisenstein, who reflected on the relationship between cinema and our sensate bodies, and Walter Benjamin. She also elaborates on Siegfried Kracauer's theoretical work on film, in which he explains that '[t]he material elements that present themselves in films directly stimulate the material layers of the human being: his nerves, his senses, his entire physiological substance' (Kracauer in Hansen, 1993: 458).

In medical terminology and in the psychology of perception, however, synaesthesia refers to a condition that only occurs in limited numbers of people and takes a wide variety of forms. Others claim that although the condition is not necessarily pathological, it is still a deviation caused by structural and functional differences in the brain (Jewanski et al., 2019: 1; Sagiv and Ward, 2006: 259). According to Matthew Fulkerson (2014: 19), synaesthesia as a medical condition might be '[an] extension of ordinary perceptual capacities, part of the same functional units that underlie our general experience of the world'.

It is also believed that this extension of the senses and their cross-modal potential can be induced by hallucinatory drugs, a subject that is explored further (in relation to colours produced by the brain without any visual stimulus) at the end of this book. However, we first need to differentiate between cross-modal transfer and synaesthesia as physiological phenomena if we are to unravel the confusion between quasi-immobile biological processes and the influence of cultural discourses—a subject that has played a central role in our earlier discussions on feeling and colour.

In fact, the terminology used during the 1950s and 1960s was very unclear, resulting in an unscientific tangle of connections between various phenomena. Yet, around the same time, scientific research into these questions was meeting with some success, resulting in the emergence of the term 'cross-modal transfer' to describe these phenomena. During the 1950s, researchers studied human learning behaviour in different sense modalities within various experimental settings. Then, from 1960 onward, scientists began to perform experiments—including brain surgery—on primates (i.e. monkeys) to observe their perceptual behaviour. In particular, George Ettlinger, who led groundbreaking research in the field of comparative neuropsychology, studied these phenomena by comparing the results of tests on animals with operationally produced brain lesions with those of humans with brain dysfunctions. Ettlinger presented his results in an article, co-authored with Donald Burton, on cross-modal transfer in monkeys in the journal *Nature* (1960), and followed this with a further article, 'Cross-modal transfer in man', written in collaboration with M. Cole and S.L. Chorover (1961). This type of research was mainly focused on the relationship between the visual perception of objects and object recognition through touch. Nevertheless, despite his results, Ettlinger still declared in 1977 that 'the nature of cross-modal equivalence in man is not yet understood'.

Currently, these phenomena are referred to as 'cross-modal transfer' or 'cross-modal matching'. In this part of the book, I explore how the unimodal visual stimuli entering the body through the eye potentially interact cross-modally with the tactile, olfactory and gustatory senses. While taking into account the fact that biological and cultural elements also interact in this domain, I also present some hypotheses on cross-modal transfer in the perception of colour films in the 1950s and 1960s.

In 1994 David Lewkowicz and Robert Lickliter published an edited volume, *The Development of Intersensory Perception: Comparative Perspectives*, that seemed to herald a new period of increased research interest in the topic. New technologies such as fMRI were helping to chart brain activity, and revealing that an impressive number of regions in the brain are involved in the phenomena of cross-modal and multimodal perception (Calvert, 2001). In the foreword to *The Development of Intersensory Perception*, Linda Smith (1994: x-xi) explains that earlier research had been characterised by the idea that the sensory information processed by and through the separate senses is brought together in the cortex, but this belief had been replaced over time by the current perspective that the sensual modalities are in constant interaction.

In the years following Smith's piece, her more hypothetical stance would be confirmed with the help of new visualisation technologies. As a result, cross-modal transfer and multimodal perception are currently accepted as common traits of the way our senses, neurons, brains and bodies work. As Alksandra Mroczko-Wasowicz (2016: 5–8) points out, interdisciplinary investigations of cross-modal and multisensory phenomena have led to the conclusion that the interaction of the sensual modalities is indeed the rule rather than the exception. This implies that vision (and visual perception) is not a stand-alone, unimodal sensory modality, but 'a complex collection of interacting subsystems' (Fulkerson, 2014: 9). The overall conviction of neuroscience is that if we wish to understand how the mind works, we need to consider the 'multifaceted links holding between various mental domains and their mutual impact' (Mroczko-Wasowica, 2016: 6).

Vittorio Gallese, who as I explained in Chapter One, was involved in the discovery of mirror neurons in macaques at the University of Parma in the 1990s, has translated these findings to understanding how the brain-body, as he calls it, relates to images we make and watch. Regarding this, he emphasises the importance of the multimodal nature of visual perception:

> Neuroscience has shown that vision is multimodal: it encompasses the activation of motor, somatosensory, and emotion-related brain networks. Motor neurons not only cause movements and actions but they also respond to body-related visual, tactile, and auditory stimuli, mapping the space around us, the objects at hand in that very same space, and the actions of others. (Gallese, 2018: 72)

Interestingly, he turned his study towards cinema, collaborating with film scholar Michele Guerra. This resulted in several publications such as the book *The Empathic*

Screen: Cinema and Neuroscience (2019), and a special issue of the SCSMI (Society for Cognitive Studies of the Moving Image) journal *Projections* dedicated to neuroscience in film studies. In their introduction to the special issue Gallese and Guerra write that film is a complex construction that includes the body, its motor potentialities, the senses, emotions, imaginations, and memories. As a result, we are moving away from the long-dominant oculocentric perspective on visual perception and towards a more haptic, emotional, and affective interpretation of it (Gallese and Guerra, 2022: 2).

Researchers have detected many small nuances and variations within the field of cross-modal research, and a wide range of terms and concepts have been used to try and capture the various processes and phenomena. Charles Spence, Daniel Senkowski and Brigitte Röder (2009) suggest clustering these terms into two groups described by the main concepts 'multisensory' and 'cross-modal'. Multisensory integration, they explain, is 'currently generally used to describe those situations in which multiple typically near-simultaneous stimuli presented in different sensory modalities are bound together' (Spence et al., 2009: 108). This type of perception is mostly functional; it is used for orientation in space and to locally connect, for example, a voice we hear to a person we see. Although a more general study of the cinema audience might benefit from thinking about this modality, it is not especially relevant for our exploration of the perception of colour in film—unlike the phenomenon of cross-modal perception that Spence, Senkowski and Röder describe:

> [The term cross-modal perception] is normally used to refer to situations in which the presentation of a stimulus in one sensory modality can be shown to exert an influence on our perception of, or ability to respond to, the stimuli presented in another sensory modality. (Spence et al., 2009: 107)

As film is an audiovisual medium, the ability of an audience to experience the touch or feel of an object or surface when they see it represented on screen is perhaps one of the most fascinating of all phenomena. The same can be said about taste and smell: similar to the haptic-visual axis, we also have connections between the auditory, olfactory and gustatory senses on the one hand and the visual on the other. It is these cross-modal phenomena that are of particular interest to this investigation into colour and film, and I will develop this theme over the next two chapters, following the *Technicolor for Industrial Films*'s focus on taste and touch.

There are two positions in the idea that cross-modal perception and synaesthesia are neurobiological phenomena. The first is the neonatal synaesthesia hypothesis, which developmental neuropsychologist Maurer introduced in 1993, suggesting that the infant's brain is hyper-connected, a state of being that slowly diminishes with ageing. Only weak, implicit cross-modality remains in the neuro-typical adult brain. Occasionally, an unusually high cross-modal perception remains into adulthood, a condition we now identify as synaesthesia (Ludwig and Simner, 2013: 1090). On the other hand, research points out that cross-modal potential is mainly developed during the first year of an infant's post-natal life; it is a learning process that occurs

by touching, tasting, seeing, smelling and hearing in a very intense way during this earliest period. Consequently, by the end of their first year, infants 'have an extensive and rapidly growing glossary of [for example] haptic-visual linkage in memory' (Bushnell, 1994: 28).

Currently, the general consensus is that multisensory neurons, in particular, require a maturation process and are strengthened through experience (Wallace, 2004; Connolly, 2014). This means that the hardware is programmed, and the multisensory processes trained throughout our first year, and they then continue to change and adapt during the rest of our lives. As Kevin Connolly (2014: 5) puts it, '[p]erceptual systems are flexible rather than hardwired so that they can better support cognitive tasks'. This accords with the argument of emotion historians who describe emotion and affect as a flexible part of a person's habitus that is shaped by different cultural contexts. It also confirms my earlier argument regarding the different temporalities in emotion history: like unimodal optical perception, the multisensory biological hardware—the ingredients for multisensory processes present in the brain—changes rather slowly. Contextual, familial and cultural factors play a vital role in how this hardware is wired—in other words, in how our brains are trained to perform cross-modal and multisensory activities.

7. Colour, Taste and Food

Colour and Taste

Technicolor for Industrial Films was not the first film to emphasise the sensuous effect of colour on the representation of food. In 1939 Buster Keaton recalled the way *Adventures of Robin Hood* depicted 'roast meats in the forest banquet', giving him visions 'in insomniac hours' of the 'suckling pig turning on the spit' (Higgins, 2007b: 2). Even Rudolf Arnheim (1956 [1954]: 273), who had not always spoken in favour of mimetic colours in film, believed food looked better in colour than in black and white. As a result, filmic representations of food in colour were (and are) believed to have an increased cross-modal effect. In her book *Tiger in the Smoke* (2017) Linda Nead explains that during the 1950s colour and food became a much-used combination in printed media advertisements. She connects the appetite for food in colour to the ending of fourteen years of food rationing due to the war. As a result: 'food and colour became, in equal measure, symbols of abundance and of the end of austerity and self-denial' (142). Imagining the taste of food when one is hungry makes it easier to understand the impact of coloured representations of food in a period following a time of food scarcity and hunger.

The importance of colour in stimulating appetite was something the 'colour influencer' of the period, Faber Birren, also noted in his 1945 *Selling with Color*, in which he explained which colours were regarded as the most 'edible' and therefore the best for restaurants to use. These were 'warm red, orange, a pale yellow, peach, a light green, tan, and brown' (Birren, 1945: 125). In 1950 he wrote something similar in *Color Therapy and Color Psychology*, this time calling these colours the 'true appetite colors', adding that everyone is sensitive to the colour of food, which has an almost direct effect on appetite. He reiterated this belief in the 1963 version of the book, stating: 'Color is forever a part of food, a visual element to which human eyes, minds, emotions, and palates are mighty sensitive' (186).

This implies that a monochrome representation of food indicates a lack of sensuousness, of feeling. The film *Sedmikrásky* (Daisies) (1966, Chytilová), which tells the story of the subversive adventures of two young women (both called Marie), occasionally shifts from a mimetic colour scheme to a monochrome one, playing with

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various layers of cross-modal effects. This technique creates the surprise of a sudden change in colour scheme, as discussed in Part I. For example, a sudden shift from black and white to mimetic colour during a scene at the end of the film indicates a heightened sensuousness and an increase in cross-modal transfer. The Maries find themselves in an empty room where a large buffet sits unattended. First, we see them, in black and white, carefully exploring the room and all the dishes on the table with little cries of awe and joy, sniffing, tasting and caressing the food. Gradually, they start to pick up and nibble tiny pieces of food, warning each other to ensure no one will notice. By the end of the black and white part of this scene, however, they have thrown caution to the winds and started to feast on the banquet before them. As soon as the Maries decide to serve themselves heaped plates of food, the scene seems to demand colour. And indeed, the moment that one of the girls knocks a glass over, with a shattering sound that resonates around the room, the scene turns from monochrome to colour. Immediately after this switch, a brief sequence of shots pans over the colourful dishes of food at a fast-edited pace, presenting the audience with the full banquet in all its sensuous glory. Before the real gastronomic orgy begins, one Marie asks the other if she has already eaten something green, emphasising the shift to colour and its importance to the rest of the scene [Figs 7.1–7.2].

Figs 7.1 and 7.2 Buffet scene in *Sedmikrásky* (ČSSR 1966, Vera Chytilová) shifts from black and white to colour. DVD: 2012 Criterion.

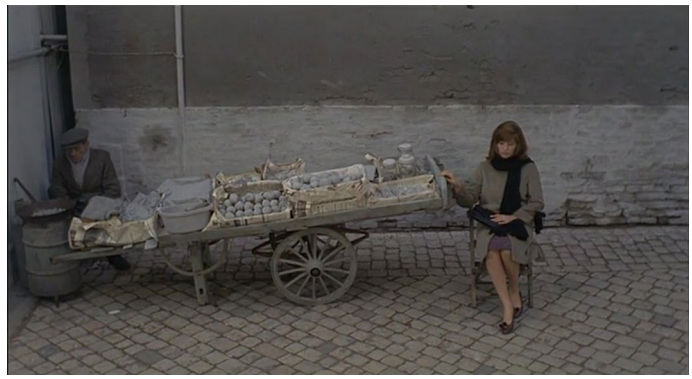
Time code: 01:01:11

Time code: 01:03:11

In the black and white part of the scene, by contrast, the food is presented in a rather neutral way; its visual representation lacks any cross-modal appeal. During the first half of the twentieth century, health and hygiene were conventionally associated with the colour white, as seen in the white uniforms of nurses and street cleaners, sterile white lab coats, and white foodstuffs such as milk, crackers and bread. Of course, the food industry used whitening products to create this 'healthy' appearance, which therefore was not that healthy. This aesthetics of the 'simple supper' was related to 'the Protestant ethic of monochrome clothing and minimal sensory stimulation' (Ross,

2014: 158) that not only found its way into fascist discourses of purity, but also into the modernist aesthetics of simplicity and clarity. The minimal sensory stimulation of colourless food was also used by Michelangelo Antonioni in *Il deserto rosso* (1964) to visualise the main character Giuliana's disengagement from the world. When she is shown sitting next to a stand of vegetables painted white, it becomes clear that she can no longer experience the sensuousness of life. In this case, the film's use of minimal sensory stimulation (the white vegetables) does not represent hygiene but reflects instead Giuliana's low sensory potential, the emotional impotence caused by her descent into depression [Fig. 7.3].

Fig. 7.3 Black and white food as a subjective reference to Giuliana's emotional numbness in *Il deserto rosso* (ITA / FRA 1964, Michelangelo Antonioni). DVD: 2010 The Criterion Collection



The Fraught History of Food Dyes

Colourful food, then, was associated with high sensory appeal (Ross, 2014: 157), and the idea that food and colour are strongly connected is confirmed by the long-lasting tradition of food dyes. Adam Burrows elaborates on this history in his article 'Palette or palates' (2009), in which he claims that although food dyes can help increase appetite and inform the sensation of taste, they can also produce quite the opposite effect. In an interview with Judy Hevrdejs, Nicki Engeseth, an expert in food science and human nutrition, comments on the important role that sight plays in the imagination of taste:

> People are strongly influenced by perception based on sight. [...] If you put yellow food coloring in vanilla pudding, before they even taste it, they will think it will be lemon or banana. They will tell you it is lemon or banana even after tasting it because they are so strongly perceiving it as lemon or banana. (Engeseth in Hevrdejs, 2000)

This is indeed one of the cross-modal reactions that an infant's neural system develops during the first year of its life. Object recognition starts when a child acquires the ability to combine various types of information—in this case, colour and taste.

The general hypothesis is that food colouring started around 1500 BCE with the use of saffron, paprika, turmeric, beet and flower petals as colourants. As the ingredients were rare and of relatively weak potency (meaning large quantities were necessary), coloured food was mostly a luxury for the rich. At the beginning of the Renaissance, colour indicated that food was nutritious and healthy—since medieval times, chalk, lime or crushed bones had been used to make bread appear fresh, while butter was coloured yellow to make it look rich. These practices, however, were occasionally regarded as criminal activities, since they were in fact used to deceive customers. In the late eighteenth century, the first chemical dyes emerged, and these were also applied to food. In 1820 many of these dyes were recorded in a publication called *A Treatise on Adulterations of Food and Culinary Poisons*, written by an English chemist, Friedrich Christian Accum. Especially shocking is Accum's exposition of the everyday use of poisonous substances such as copper to dye pickles green and other colourants containing mercury, lead, copper and arsenic to produce coloured sweets for children (Burrows, 2009: 395). The first Food Adultery Act in the UK dates from 1860, and was followed over the years by similar laws, including a new Food and Drugs Act. In the US, legislation only came into force in 1906 with the Wiley Act, which banned toxic colourants in food and regulated (with a very light touch) the use of coal-tar dyes such as aniline (396).

When hundreds of children were hospitalised in the USA in the early 1950s after eating Halloween candy and popcorn containing FD&C Orange #1, which at the time was deemed safe to consume, the event ushered in a new era of debate over the safety of food dyes. During the 1950s and 1960s, the use of coal-tar dyes as food colourants was subject to investigation, and they were occasionally taken off the list of safe colourants. The discussion became more vehement when cancer became part of the debate (Burrows, 2009: 401–03; 'The history of food colour additives', ca. 2008), coinciding with an increase in criticism over the use of convenience foods such as frozen dinners, fast food and processed food with artificial flavours and colours (Howes, 2019 [2014]: 17). This counterreaction emerged from the hippy culture of the second half of the 1960s:

> [There was a] desire for a more 'spiritual,' 'natural,' 'environmentally sound,' and 'ethical' diet. Synthetic, industrially produced foods were rejected (at least in theory) in favor of natural or organic foods, which were touted as both healthier and more flavorful (Howes, 2019 [2014]: 8).

In all, brightly and especially unnaturally coloured food such as candy was increasingly viewed with suspicion. This might explain the emphasis on colour in Birren's discourse on how food should be displayed for sale, or in the voice-over commentary on the film *Technicolor for Industrial Films* which underlined the importance of using 'natural' colours when filming food.

Burrows (2009) describes those colours rarely found in natural food, such as blue, as far less appetising, even to the point of causing a loss of appetite. We need only recall the blue leek soup in the film *Bridget Jones's Diary* (UK 2001, Sharon Maguire); this would not be such a successful joke if blue was not considered inedible. Birren also saw blue as particularly unappetising: he stated that it was not a good colour for food, confirming that the aversion to blue food was also prevalent in the 1950s and 1960s. According to Burrows (2009: 394), however, colours that were considered unfit for 'normal' or 'healthy' food could be found in 'fun' food, such as candy, cake, chocolate, chewing gum and fizzy drinks. This was confirmed by Birren (1950: 167; 1963: 190), who writes that tints of blue and pink are 'sweet', and that sweets and candies could therefore be any colour.

It is this aspect of colourful food in film that Scott Higgins discusses in his article 'Technicolor confections' (2007). Focusing on the 1930s, he argues that—with the exception of *Adventures of Robin Hood*'s roasted meat that so appealed to Keaton's palate—it was precisely the artificial colouring of sweets, cakes and cookies (which began during this period) that found its way into cinema. He mentions two short animated films in Walt Disney's 'Silly symphonies' series called *The Cookie Carnival* (USA 1935, Ben Sharpsteen, Technicolor IV), and *Funny Little Bunnies* (USA 1934, Wilfred Jackson, Technicolor IV) as examples. He also analyses Technicolor scenes in other black and white films such as the final scene of *Kid Millions* (USA 1934, Roy Del Ruth, Technicolor IV), which is a feast of coloured candy, and the party with the pink cake in *The Little Colonel* (USA 1935, David Butler). Taking up the sweet theme of these films (and adopting Tom Gunning's ideas on colour in early film), Higgins calls their colours 'eye candy', a 'superadded quality' that increases 'sensual intensity' (Higgins, 2007: 275). He connects this to Gunning's concept of the 'cinema of attractions', which was characterised by its direct address to the viewer's senses through movement, beauty, thrills, fear, and other attributes. In these films, Technicolor used colour for the potency of its attraction through the gustatory senses.

In the films of the early 1950s, such examples of 'chemical' and sweet colours mainly appear in relation to cakes. For example, in *The Long, Long Trailer* (USA 1953, Vincente Minnelli, Ansco Color), we see a very pink wedding cake, and in *Singin' in the Rain* (1952), Kathy jumps out of a huge pink-and-green cake. The pink dresses of Kathy and the girls in her chorus, as well as the green dress Lina is wearing, perfectly match the colours of the cake, indicating that the cake and the dresses might have been coloured with the same (coal-tar?) colourants. As a result, the film links enjoyable food with the sensuality of female bodies, using colour as a signifier [Fig. 7.4].

Moving into the 1960s, we encounter other, more ironic representations of food and artificial colours. For example, in *Pierrot le fou* (1965), Jean-Luc Godard comments on the artificial colours of filmic cake. Early in the film, the main character Ferdinand lingers around at his wife's birthday party, whose strange atmosphere is emphasised by

monochrome lighting. The way people appear to be talking in advertorial catchphrases serves to underline the sterility of his married life, controlled as it is by the urge to earn money and partake in the consumer culture that Godard was known for criticising.[1]

By the end of the scene, he moves towards a group of people who seem to be gazing at something in awe, pushing the crowd aside to expose what they are looking at: a huge birthday cake out of which a woman bursts. Ferdinand reacts by grabbing a handful of the cake and throwing the creamy substance in his wife's face, an action that is immediately followed by a burst of fireworks. What is interesting about the cake scene is the way multicoloured lights play over the crowd. Clearly, a different light source was used for each separate colour, and the light itself comes from multiple directions, projecting colourful shadows on the wall behind [Fig. 7.5]. The colours created by this lighting lend the scene an air of hyper-gaudy artificiality, which—in combination with the cake with the woman hidden inside—cannot be anything but a reference to the overly sweet fakery of the entertainment industry and consumer culture that was already referenced in the texts during the preceding sequence. Ferdinand, by destroying this token of consumer and entertainment culture, announces that he is breaking free from this emotionless life tied to keeping up appearances.

Fig. 7.4 Colours connecting female bodies to cake in *Singin' in the Rain* (USA 1952, Stanley Donen; Gene Kelly). DVD: 2007 Turner Entertainment, Warner Bros. Entertainment. Time code: 00:22:37

Fig. 7.5 Gaudily coloured lights of the cake scene in *Pierrot le fou* (FRA 1965, Jean-Luc Godard). DVD: 2007 The Criterion Collection. Time code: 00:10:13

As mentioned above, during the 1950s and the 1960s the legal response to food colourants entered a new era. Among other things, this meant that both Europe and the USA saw a centralisation of legislation and regulation. In 1962 the six founding countries of the European Community—Belgium, France, Italy, Luxembourg, the Netherlands and West Germany—released the first Directive on Food Colours, which listed the colour additives deemed safe to use in food (Lüdzow, 2006). Meanwhile,

1 In her article 'Colour and the critique of advertising' (2020), Sarah Street analyses how the aesthetics of glossy surfaces, superficiality, and performance in advertising are used to critique this practice in similar ways to Godard.

the USA Congress passed the Color Additive Amendments on 12 July 1960, which gave the USA Food and Drug Administration (FDA) control over all colour additives. These changes directly affected daily practice by listing colour additives that were considered safe for human consumption, automatically excluding all colourants that were not mentioned in the list. The European Directive allowed 36 colours, of which 20 were natural colours and 16 synthetic ('History of food colour', ca. 2008). And across the Atlantic, the FDA began a comprehensive round of approval or rejection of all colourants on the market. Of around 200 dyes placed on a provisional list, the FDA declared only 90 safe to consume (Burrows, 2009: 401).

Not only did these laws intervene in daily practices related to food, they also produced a certain discourse of fear around synthetic food colourants. Forbidding the use of some as unfit for human consumption gave people a sense of security, but it also reminded them of the fact that food dyes can be poisonous, and because of their chemical origin, artificial—even in modern times. This direct link between chemistry and colour is a trope that we see in various cultural forms, especially as dyes were produced from coal. This is visualised, for example, in *To Spring* (USA 1936, Hugh Harman; Rudolf Ising, Technicolor IV), where the colours of the new spring are extracted from mined stones in an underground laboratory. After the stones have been processed into dyes, they are sent up to the surface through a system of test tubes that also resemble a colour organ.

We can see this theme of chemical colours in the film *Lover, Come Back* (1961), which we have already discussed in relation to colour control (and loss of control) in Chapter Five. The colours in the film are also shown in the process of creation: just as in *To Spring*, the chemist's basement laboratory is full of test tubes and glass jars containing coloured fluids, with occasional small explosions producing clouds of coloured smoke. The chemist finally develops brightly coloured candies that have a similar effect on people as alcohol or drugs. The bright colours of this chemically produced food have connotations of artificiality, entertainment and consumerism, similar to those of the cake in Godard's movie. Both examples push the colours of candy and cake more towards the extreme than the earlier examples of films from the 1950s. On the one hand, this was possibly due to the fact that these films were released after food colour legislation was centralised (and professionalised) in the USA and Europe, re-emphasising that the colourants used in food could be poisonous and needed to be regulated, strengthening the negative discourse on dyed food. On the other hand, colour culture had begun to take a psychedelic turn, symbolised by the use of even stronger, brighter and more gaudy colours than before. As such, the production of VIP might be an implicit reference to the chemically produced drug LSD, which unleashed the potential of colour perception within the mind. The almost hallucinatory display of colourful candies mirrors the effects of LSD and the colour culture associated with it, as I discuss in the last chapter. Besides, LSD was already well known in Hollywood in the early 1960s due to its therapeutic use in medical contexts, including in clinics that were frequented by famous actors such as Cary Grant.

Colour Change and Decay

In a scene in *Playtime* (1967), Jacques Tati plays with the way coloured lighting changes the appearance of food. The setting is a bar located next to a pharmacy that advertises its presence with a large green neon cross (as is the norm in France), and Tati's joke is built on the way the neon sign sheds its greenish light on the bar's display of prepared dishes, transforming them into something that is not immediately recognisable as food. Arguably, as pharmacies are one of the main signposts of the chemical industry in society, the colour the sign radiates could be a reference to the chemical colourants that not only turn food into something playful and 'fun', but also into a substance that can be poisonous, even lethal. In this case, the change in the food's colour also diminishes its appeal; it is no longer appetising. This is confirmed by M. Hulot's reaction—he looks at the food in perplexity, leaning in close to smell it to make sure it has not gone bad. Clearly, the strange green colour gives it the appearance of rot and decay. The look on his face reveals to the audience that the colour of the food has turned it into a suspicious entity, something that could very well be disgusting [Figs 7.6–7.7].

Figs 7.6 and 7.7 Green coloured light turns the food in *Playtime* (FRA 1967, Jacques Tati) into something rather undesirable. DVD: 2001 The Criterion Collection.

Time code: 01:17:18

Time code: 01:17:36

For a better understanding of food colour and decay, it is worth visiting Eugenie Brinkema's ingenious analysis of the film *The Cook, the Thief, His Wife and Her Lover* (GBR 1989). Director Peter Greenaway's use of colour very cleverly gives the impression of decay, degeneration and putrescence. Brinkema (2014) points out that the dress 'Georgina the Wife' is wearing changes colour according to the different decor and spaces of the film's diegesis, and links the instability of dress colour to the notion of decay, referring to Aurel Kolnai's 1929 theories on the sensation of disgust. One of Kolnai's main conclusions was that disgust is provoked by objects in the process of deterioration or putrescence, which is indicated by a change in quality such as a 'variation in coloration, often glaring, as in the greening spread of mold' (Brinkema, 2014: 170). It is the changing state

of an object—the transformation in its 'Sosein' (or 'so-being') as Kolnai calls it—that turns it into something that we find 'disgusting'. This 'so-being' is, among other things, connected to the object's colour: when green-coloured light grazes the food in Tati's *Playtime*, changing its appearance, it also changes its 'so-being', turning it into a strange object that is probably not good to eat. Greenaway in *The Cook, the Thief, His Wife and Her Lover* gives food such as poultry, vegetables and fruits a similar greenish tinge, lending it an unappetising appearance. This effect is strengthened by the complementary contrast with the red of the background [Fig 7.8].[2]

Fig. 7.8 A similar combination of green light and food can be found in *The Cook, the Thief, his Wife and her Lover* (GBR 1989, Peter Greenaway). DVD: 2003 Universal Studios. Time code: 00:12:51

If we take into account the correlation between colour, food and disgust, it is not so surprising that in 1957 filmmakers were advised to avoid using coloured light on food:

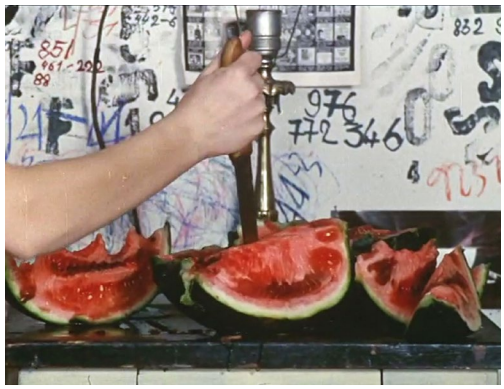
> Except for intentionally bizarre effects, colored light is seldom used on faces or food, since most people are especially critical of the color rendition of such subjects. A green face or a purple slice of bread, for example, is almost intolerable. (Holm, 1957: 76)

This advice, however, was increasingly ignored during the 1960s. In contrast, although *Sedmikrásky* directly confronts us with food that is indeed in a state of decay, the first time our attention is drawn to the rotting food is through the rendition of the sense of smell as we watch one of the Maries walking around the banqueting room sniffing the dishes, rapidly followed by an image of sour milk, eggshells, half-empty glasses,

2 The deviant use of colour and the grotesque representation of the human body in the film seems to partly fit the 1980s and 1990s phenomenon of 'Abject Art'. Similarities occur, for example, with the work of photographer Cindy Sherman, who also used coloured light to render disgusting objects even more so. 'Abject Art' was one of the practices that grew out of Julia Kristeva's 1982 interpretation of the concept 'abjection'. (For more on this see: Arya and Chare, 2016).

wine bottles and other detritus. Later in the film we are presented with images of watermelons, whose fresh pink colour has been replaced by whitish-grey mould [Figs 7.9–7.10].

Figs 7.9 and 7.10 The fresh pink of the watermelons is replaced by whitish-grey mould in *Sedmikrásky* (ČSSR 1966, Vera Chytilová). DVD: The Criterion Collection 2012.



Time code: 00:39:58

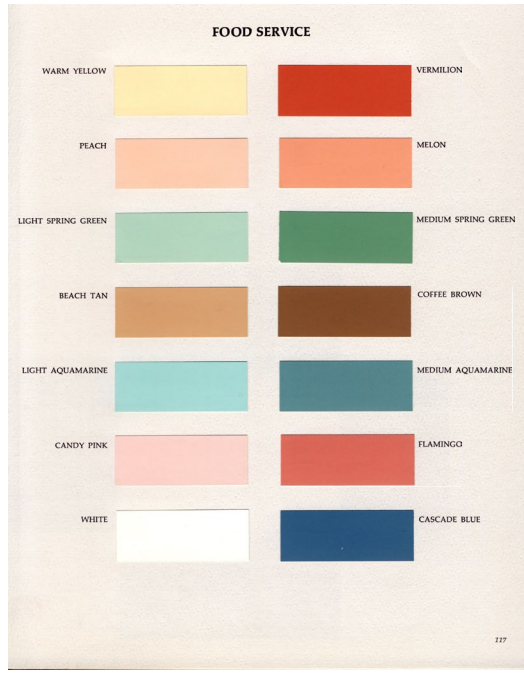
Time code: 00:55:13

Sedmikrásky indicates decay in its simple, unvarnished, unappealing form without the use of coloured light or dyes; the food actually loses its colour as it rots, creating a parallel to the colourless food shot in black and white earlier in the film.

Controlled Food Compositions

In *Color Therapy and Color Psychology* (1950), Birren focused on composition and particularly on which colours to use as a backdrop for a harmonious and attractive food display: for example, he considered blue to be the perfect background colour. He returned to the subject in 1963 with the publication of a colour chart laying out the colours suited to backgrounds or accents in spaces where food was sold or served. True to form, he claimed that this advice was based on research into the psychological associations between food and colour—without supplying any scientifically sound references (Birren, 1963: 116) [Fig 7.11]. Aquamarine, he tells the reader, will, 'by direct visual complementation, give meats a pinker and more appetizing look'. And, he continues, sometimes coloured lighting such as pink for meat and green for vegetables can be used to illuminate the food sections in supermarkets to emphasise the natural colours of the products. Finally, he lists the colours that are supposed to be poor for the representation of food: 'purplish reds, purple, violet, yellow-green, greenish yellow, orange-yellow, gray and most olive and mustardy tones' (190).

Fig. 7.11 Colour advices for the presentation of food in Birren's *Color for interiors* (1963: 116).



As we have seen, one of the places Birren targeted with his colour advice was the food store or supermarket: the right use of colour, he claimed, would put the customer at ease and help increase sales. Around this time, suburbs were emerging across the US, complete with standardised shopping malls, creating a visual predictability. These controlled spaces generated an atmosphere intended to entice housewives into buying and consuming; women, it was believed, were emotionally attracted to the sensuous, and thus could be seduced by smells, tastes and textures. Occasionally, this atmosphere even entered the realm of the sexual, 'providing female shoppers an intimate private-like experience in a public space' (Mack, 2014: 90). For instance, the grocery store Casanovas (the clue is in the name) used romantic lighting and music to sell its products, and its display of fruit and vegetables had strong sexual overtones, particularly in the way they were described as 'plump', 'juicy', 'ripe' or 'ready-to-use' (88–91). It seems that these sensualised ways of displaying food became normalised during the 1950s and 1960s, and so it is no surprise that some of these formulas combining food and colour found their ways into cinema.

In Roman Polanski's *Rosemary's Baby* (USA 1968, Eastmancolor), the kitchen in the main character's apartment is partially coloured and styled in the 'warm yellow' recommended by Birren's colour chart. When Rosemary fries and eats a steak, this colour forms the background to the scene, which, according to Birren, should make the meat appear more appetising. Later in the film, the

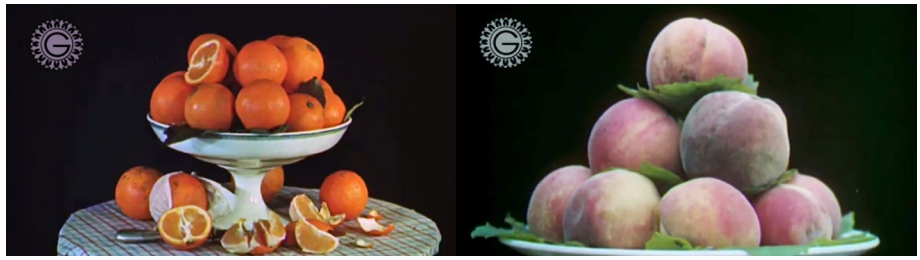
table is filled with seafood and other ingredients that stand out against the 'warm yellow' decor [Fig. 7.12]. These moments in the film show great care in the composition of the food and the way it combines or contrasts with the background colours. In a similar way, *Les parapluies de Cherbourg* (FRA 1964, Jacques Demy, Eastmancolor) pays close attention to the colour composition throughout the film, including the colour of food. At one point in the scene in which Geneviève has dinner with her mother in a salon wallpapered in pink and grey, we see her in a close-up with a lettuce leaf in her hand, its green forming a complementary contrast with the pink of her cardigan and of the wallpaper behind her—a perfect example of the film's underlying aesthetic [Fig. 7.13]. Food in this film is mainly used as an element in the overall style of the apartment's decor and the costumes of its inhabitants. Other scenes containing food simply display it in a decorative way without directly focusing on the act of eating.

Fig. 7.12 Birren's 'warm yellow' as a background for food in *Rosemary's Baby* (USA 1968, Roman Polanski). DVD: 2012 The Citerion Collection.
Time code: 01:16:09

Fig. 7.13 Green lettuce contrasts with pink walls in *Les parapluies de Cherbourg* (FRA 1964, Jacques Demy). DVD:
2004 Koch Lorber.
Time code: 00:18:25

Food as a decorative and compositional element has a long tradition in Western art and culture. Fruit bowls, for instance, are a reoccurring trope throughout the history of Western visual representation, and can be found in manifold paintings and drawings. We also find them in the earlier forms of colour film: one of the test films Gaumont made to display its three-colour system, Chronochrome, shows fruit and vegetables in still-life compositions [Figs 7.14–7.15]. Another early example is a Prizma II film housed at the EYE Filmmuseum in Amsterdam. Many of the decoratively set tables we encounter in films feature a carefully arranged bowl of colourful fruit.

Figs 7.14 and 7.15 Fruits were a fine topic to show off early film colour systems as we see here in *Fruits* (FRA 1912, Anonymous), https://www.youtube.com/watch?app=desktop&v=YvRPJvvcNtg



Figs 7.16 and 7.17 In *Goldfinger* (GBR 1964, Guy Hamilton) the camera pans from the beautiful display of food to the bed where Bond and a young woman make love. DVD: 2012 Metro-Goldwyn-Mayer Studios.

Time code: 00:13:45

Time code: 00:13:53

Goldfinger (GBR 1964, Guy Hamilton, Technicolor V) contains just such a carefully composed display of food in James Bond's hotel room: a nicely set table with a plate of salmon in pink and green, with red and orange details in the foreground, is flanked by a bouquet of flowers in perfectly matching shades of white, green and salmon pink. A fruit bowl forms the finishing touch. This image could in itself be used as an advertisement for a food provider of some kind [Fig. 7.16]. The plate of salmon, however, will not be eaten: when the camera pans from the beautiful display of food to the bed, it first reveals bare feet, then legs, and finally Bond and a young woman making love [Fig. 7.17]. Here, food and sex are linked—another topos of Western culture that enables implicit references to sex through the meeting of taste and touch.[3] However, the 1960s Bond was sexual and seductive in a calm, composed way, never losing control, never sweaty or smelly.[4] The composition of food as a visual rather than

3 Death comes a few minutes later, when Bond finds the woman on the bed, suffocated, covered in gold paint, creating a sense of shock and maybe even awe at the surprising way the murder was carried out

4 This connection between sex and food in film probably found its climax in the scene in *9 ½ Weeks* (USA 1986, Adrian Lyne) in which Kim Basinger keeps her eyes shut as she is fed all kinds of food

a haptic pleasure reflects the rational, synthetic, almost artificial creature that Bond is, as though he were a magazine cut-out.

In contrast, *Sedmikrásky* appears to mock the artificiality of 1960s advertising culture that Goldfinger mirrors, particularly in the scene in which the Maries start cutting up sausages, eggs and pickles with scissors, and then cutting photographs of food out of a magazine. These actions begin to merge when one of the Maries cuts up a real banana, holding it in such a way that it looks like an image from a magazine, and the other Marie starts eating the coloured images of food with an expression of delight, as if she can really taste the food in the photographs; however, watching her eat printed magazine paper produces in us not a similar delight but a cross-modal effect of touching and tasting ink and paper [Figs 7.18–7.19]. As a result, this scene not only overturns all conventions regarding table manners and the consumption of food, but also creates a moment of self-reflection, illustrating the power of photographic representation to create cross-modal transfer, while at the same time breaking the illusion and potential cross-modal effect of hunger or disgust (either is possible in this scene).

Figs 7.18 and 7.19 The Maries cutting (images of) food in *Sedmikrásky* (ČSSR 1966, Vera Chytilová). DVD: 2012 The Criterion Collection.

Time code: 00:35:02

Time code: 00:35:42

Presenting food in a balanced composition using the right colours and colour combinations is also closely connected to class distinctions. In 1939 Norbert Elias published a groundbreaking book, *Über den Prozess der Zivilisation*, a history of manners from the early modern times onwards. When it was later translated into English in 1969 under the title *The Civilizing Process, Vol. 1: The History of Manners*, the work gained widespread renown. Elias analysed the 'increasing levels of self-restraint and self-control, especially with regards to violence, sexual behaviour, bodily functions, table-manners and forms of speech' (Hailwood, 2015). A large part of his work focused on table manners and the sort of behaviour that was expected when

in a variety of colours, spilling over her face and body.

eating in company, explaining how members of the higher social classes used these rules and regulations to elevate themselves above the rest of society. Simply put, the rich and educated tended to use table manners as a distinguishing characteristic to mark themselves out from the poor and uneducated.

This idea is in many ways connected to Pierre Bourdieu's 'habitus', a concept we have already encountered in relation to the history of emotions. Habitus refers to the way we internalise the norms of our particular society or social group to the extent that they become automatic and embodied forms of reaction, behaviour and feelings. Thus, customary ways of handling food, for example, can be markers of social difference. Bourdieu illustrates this in *Distinction* (1996 [1984]: 195–96), explaining that working-class people handle their food with a freedom the bourgeoisie deem unacceptable.[5]

A film that contrasts upper-class with lower-class habits is Jacques Tati's *Mon oncle* (1958). The film vividly exposes the differences between a popular part of Paris and a modernist, exclusive residential area inhabited by the rich. In the poorer area, food is sold in the street, and the rubbish and garbage bins attract stray dogs. Meanwhile, little Gérard lives with his parents in the modernist environment, and we see how artificial and boring his life is. This is encapsulated in the image of him eating his breakfast (an egg and a sandwich wrapped in plastic) by himself in an overly sterile white kitchen. In contrast, when he visits his uncle's neighbourhood, he strolls around with a group of street boys. When they are hungry, they simply buy sandwiches at a food stall and sit down to eat them in the street [Figs 7.20–7.21].

Figs 7.20 and 7.21 Contrasting ways of food consumption in *Mon oncle* (FRA 1958, Jacques Tati). DVD: 2001 The Criterion Collection

Time code: 00:41:22

Time code: 00:47:57

Whereas Tati implicitly connects the consumption of food to class differences, table manners and class differences are literally thematised in *Gigi* (1958). Gigi, who is meant to become a high-class courtesan like her aunt and grandmother before her,

5 First published in France as *La distinction. Critique sociale du jugement* by Les Éditions de Minuit in 1979.

visits her aunt Alicia once a week for lunch. While they eat, Alicia teaches Gigi table manners to facilitate her entry into the domain of the rich: she needs to learn how to deport herself and control her embodied reflexes if she is to become a rich man's mistress. Every time they practise these table manners, the food is almost absent from view, concealed by a bouquet of flowers. The lesson includes instructions on how to cut up a quail without making a sound, and how to eat it without anyone noticing. By contrast, in Gigi's home, food is touched, prepared, cooked, smelt and tasted, not only by Gigi and her mother, but also by Gigi's future (rich) husband [Figs 7.22–7.23]. And yet all this earthly pleasure in food does not appear to tarnish the man's upper-class status, whereas Gigi in this context remains a girl of working-class origins, without any real chance of entry into a higher class. Added to this, the fact that all the lower-class characters trying to climb the social ladder are female, while the higher classes are represented by men, indicates the particular way inequality impacts issues of gender.

Figs 7.22 and 7.23 In *Gigi* (USA 1958, Vincente Minnelli) the girl is taught table manners by her aunt, whilst her future husband eats from the pan at her mother's kitchen.

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Time code: 00:47:53

The visual representation of food in film, following the stylistic rules related to the traditions of painting and colour control, can thus be linked to class distinctions, implying that one of the marks of belonging to a higher social class is the ability to disconnect from your embodied self. When you eat, you should not draw attention to the fact; food should be presented in the right colour combinations and in tasteful compositions; and, finally, food should never be touched.

Subversion, Food and Touch

A number of films, however, offer scenes that directly contrast with the well-composed, stylised presentation of food in 'tasteful', non-sensuous ways. For example, when the pregnant Rosemary (Mia Farrow) in *Rosemary's Baby* is eating raw, bloody liver in the kitchen, the scene is the polar opposite of the one showing seafood ingredients. Rosemary picks up the slippery, slimy liver with her bare hands and starts eating it with the relish of a hungry animal, a disturbing image. It produces several cross-modal effects, first seeing her touch the liver creates a haptic sense of

touching this raw, cold and slimy substance. When she starts eating, a similar effect is created for the inside of the mouth, accompanied by a cross-modal experience of the metallic taste and smell of blood and liver. Indeed, when she glances up and sees herself mirrored in the toaster, her delight is replaced by disgust: she becomes the spectator of her own spectacle. The cross-modal effect created within Rosemary when she catches the reflection of herself eating the raw, red liver immediately dissipates her animalistic joy. At the same time, this action stimulates an alignment between the viewer and the character as both are physically affected by the act of looking: Rosemary exhibits all the characteristics of a physical reaction of disgust, producing a similar feeling in the viewer through contagion. The filmic strategies of visual representation induce in the audience a strong embodied reaction that is related to Rosemary's devilish pregnancy that 'forces' her to eat raw liver in this disgusting way [Figs 7.24–7.25].

Figs 7.24 and 7.25 Rosemary disgusting herself when eating raw liver in *Rosemary's Baby* (USA 1968, Roman Polanski). DVD: 2012 The Citerion Collection.

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Time code: 01:14:38

In addition, this fragment of film also shows us that red is not always appetising, as Birren (1950: 166–67) claimed; in the context of raw meat, it becomes disgusting. On the one hand, this indicates that cross-modal perceptions of colour and food are not part of our biological hardware; rather, they are incorporated reactions to the gradually evolving cultural connotations of a particular colour, combined with the rapidly changing context in which it appears. On the other hand, the way the monochrome surface of the meat is highlighted by a hard white light influences the way we perceive its colour (red) as moist and slimy, and therefore repellent.

During the 1950s, food was not often shown in such a tangible, haptic fashion in colour films. An exception is *To Catch a Thief* (1955), where eggs are treated in a way food is not supposed to be handled. First, an egg is thrown against a window as an act of aggression, and then the Hitchcockian mother figure stubs out a cigarette in the yoke of a fried egg left over from the hotel breakfast. In both situations the eggs' slippery, unappetising aspect is emphasised to create a somewhat comical effect [Figs 7.26–7.27].

Figs 7.26 and 7.27 Eggs' slippery, unappetizing aspect is emphasized to create a somewhat comical effect in *To Catch a Thief* (USA 1955, Alfred Hitchcock). DVD: 2012 Paramount.

Time code: 00:11:26

Time code: 00:40:47

Such actions, however, are small details in a film that otherwise treats sensuous moments implicitly (e.g. the fireworks symbolising sexual activity). Throwing food is of course a common theme in cinematic comedy: pushing a cake into someone's face is part of slapstick tradition, which we also encounter in the 1950s in, for example, *Singin' in the Rain* from 1952.

The second scene in the tale of Giulietta from the film *The Tales of Hoffmann* (GBR 1951, Michael Powell; Emeric Pressburger, Technicolor IV) is a remarkable exception to the limited hapticity of images of food in 1950s cinema. The scene takes place in the Venice palazzo of Giulietta the Courtesan, and drops the spectator right into the sensuousness of carnal pleasure that is associated with a brothel. While Hoffmann sings a song about how he could never be seduced into partaking in such pleasures, he walks into an orgy scene that combines food and sex, taste and touch in a particularly colourful way. The first thing Hoffmann does is position himself at the centre of a table loaded with food and drink—the food once again mimics the generic still-life fruit bowl, indicating that this is actually a high-class event. There are beds shaped like pieces of cake, arranged around the central dish, on which men and women are eating and having sex in very physical, sensuous, but also balletic and stylised ways. They wear extremely colourful make-up and their hair is dyed in an array of unnatural colours—green, red, blue and orange and pink—also giving them a resemblance to slices of cake [Figs 7.28–7.29].

Figs 7.28 and 7.29 Orgy scene in *The Tales of Hoffmann* (GBR 1951, Michael Powell; Emeric Pressburger) that combines food and sex, taste and touch in a particularly colourful way. DVD: 2005 The Criterion Collection.

Time code: 01:03:57

Time code: 01:03:59

This mixture of colours, food and bodies increases the sensuality and confusion of the scene, which could be interpreted as a representation of cross-modal transfer from taste to touch, and back again. It is interesting to note the difference with the earlier example from *Goldfinger*, in which sex and food are juxtaposed rather than merging and blurring as in the *Hoffmann* film. The scene passed the censors without any problems, even though on closer inspection it appears very physical and orgiastic. This might be due to the film's allusion to high art, since it is adapted from the celebrated opera of the same name, or to the fact that Michael Powell and Emeric Pressburger were filmmakers of high repute.

The way *Hoffmann* was treated by the authorities was very different to the fate of *Sedmikrásky*. Its female director, Vera Chytilovà, had studied philosophy and architecture, worked as a model and held many different jobs in filmmaking before attending the FAMU film school in Prague. With *Sedmikrásky*, she wanted to make a film that would allow her to get the very best from film language, to sweep aside its conventions and use it to express what otherwise could not be expressed. This resulted in a film that experiments with discontinuous spatiality and colour aesthetics. In 1967, however, the film was banned because, as the Czechoslovak National Assembly stated, it had 'nothing in common with our Republic, socialism, and the ideals of communism', and Chytilovà was barred from making another film for a full six years (Lim, 2001: 37–38).[6] The film was classified as a celebration of bad behaviour, and it was believed that it might exert a harmful influence on women and children (Lim, 2001: 44).

6 This line of argument that was used to ban the film from the screens and bar Chytilovà from working is reminiscent of the obscenity ruling in the Roth v. United States case in 1957. In this instance, the Supreme Court defined 'hard-core porn' as those depictions of sex that it considered to be 'utterly without redeeming social importance' (Williams, 1989: 87).

One of the film's main themes is the consumption of food. The two Maries are shown stuffing themselves with all kinds of dishes, fruit and snacks throughout the film. They also prepare food in unconventional ways: for example, setting their room on fire to grill sausages, producing the imaginary smell of smoke, which they then eat sitting on the bed; using forks to prick each other in the stomach, creating a cold and prickly sensation in the spectator's belly; cutting up food with scissors; eating pickles out of a jar filled with green water (i.e. poisonous food dye) resulting in audience's disgust; and bathing in soft, silky milk. All the conventions related to food are turned upside down, creating a cross-modal cacophony in a perfectly choreographed mess [Figs 7.30–7.32].

Figs 7.30, 7.31 and 7.32 In *Sedmikrásky* (ČSSR 1966, Vera Chytilová) food conventions are turned upside down. DVD: 2012 The Criterion Collection.

Time code: 00:33:51

Time code: 00:33:58

Time code: 00:48:36

The climax of all this destruction comes in the aforementioned scene in which the Maries gatecrash a buffet prepared for some wealthy guests. After the scene turns from black and white into colour, they begin a gastronomic tour of the long table, filling up their plates, and mashing, eating, gorging, throwing and destroying the carefully prepared dishes of food. Their carousal ends with the trope of the cake fight, leaving them covered in cream and crumbs, after which they climb on top of the table and use it as a catwalk, sashaying through the devastation [Fig. 7.33].

Fig. 7.33 By the end of the film the Maries gatecrash a buffet prepared for some wealthy guests.

Time code: 01:08:30

The fact that the Maries are shown trampling and crushing food brings us to another reason the deputy of the National Assembly Jaroslav Pružinec gave for banning the film. He attacked the depiction of 'food orgies' at a time when 'our farmers with great difficulties are trying to overcome the problems of our agricultural production' (cited in Lim, 2001: 43). However, it was precisely the food shortages that the scene is referring to as part of its overall critique of the political system in Czechoslovakia: the banquet the Maries destroy at the end is clearly prepared for rich, probably highly placed officials in the Communist Party. Film audiences would no doubt be experiencing hunger, and watching the two girls (one of whom is in her underwear) dancing on top of the food, they might indeed have interpreted the scene as a subversive act.

Sedmikrásky's strong sensuous and cross-modal effects are described by film critic Guido Rohm, who nevertheless dismisses the social critique that has been read into the film:

> [The film] is mostly beautiful, and jumps from behind a tree in front of our feet like a young girl, and invites us to follow her, so she can show us the Seeing and Tasting, the Smelling and Touching before it is too late.[7] (Rohm, 2012, my translation)

This begs the question of why its critical message should have to be dismissed before the film can be interpreted as one that submerges us in an avalanche of sensations. Is it not precisely the sensuousness of the film that enhances its critical message? Is it not the way the female protagonists display their bodies, defying convention, that highlights the hypocrisy of 'good table manners' at a time of hunger and political crisis? They eat in bed in their underwear, stuff their faces with chunks of meat, drink like Cossacks, dance on the table, crushing the food under their feet, bathe in milk and cover themselves with cream and pie. All these actions evoke sensations of disgust, hunger or thirst through cross-modal transfer while emphasising the joyful physicality of the young women's bodies in a way that violated the contemporary social norms of female behaviour and decency.

Sedmikrásky not only tells the story of two bored young women who want to subvert the inhibiting values of their restrictive society, but also displays their actions in an extremely sensuous, haptic way, making them resonate cross-modally with the audience. Hence, critics have claimed the film as a critical perspective on the world of male dominance, one that encouraged its audience to fight for the right to experience life in the fullest, most sensuous way possible.[8] The two Maries' disdain for the 'acceptable' way of handling food could be seen as a demonstration of female

7 '[...] diesem Film, der vor allem schön ist, der wie ein junges wildes Mädchen von einem Baum vor unsere Füße springt und uns auffordert, ihr zu folgen, damit sie uns das Sehen und Schmecken, das Riechen und Fühlen zeigen kann, bevor es zu spät ist.'

8 'Er bringt antiautoritäre und feministische Gesellschaftskritik auf verfremdende und urkomische Weise in diese verdorbene Welt der Herrschaft, in der wir für die Selbstverständlichkeit einer erfüllten Existenz für alle kämpfen sollten, die einen Drang danach haben, ihr Leben voll und ganz zu spüren und auszukosten' (https://www.untergrund-blättle.ch/kultur/film/tausendschoenchen-film-2003.html).

resistance against these behavioural rules and regulations. Even though Chytilovà declared it was not intended as such, *Sedmikrásky* could indeed be called a feminist manifesto, comparable to the work of other female artists and directors of the time such as Valie Export.

Chytilovà's film fitted within an emerging movement of female artists who, during the 1960s, used representations of female bodies and food to create scandals. Three years earlier, on the other side of the former 'Iron Curtain', experimental filmmaker and performance artist Carolee Schneemann created a performance piece called *Meat Joy* in which she combined sexuality and food. Taking up Antonin Artaud's concept of the 'Theatre of Cruelty', she aimed to agitate the audience by bombarding their senses, enveloping and immersing them, blurring the borders between life and theatre (Middleman, 2018: 46–47). Eight performers, wearing only underwear and bikinis, moved or crawled around the stage, interacting with each other: painting each other's bodies, wrestling, lying on the ground cuddling, and playing with raw food, such as fish, meat and poultry. Jill Johnston, a dance critic, wrote in *The Village Voice* of 26 November 1964:

> The point of the meat and fish and paint was to demonstrate the sensual and scatological pleasure of slimy contact with materials that the culture consumes at a safe distance with knife and fork and several yards away in a gallery or museum. [...] Schneemann sought to challenge standards of appropriate behavior for women and decorum in art. (Johnston in Middleman, 2018: 47–48)

And, indeed, *Meat Joy* did provoke radical reactions amongst the audience. In New York, someone vomited, and in Paris a man was so enraged by the event that he tried to strangle Schneemann. These responses indicate that her art had the intended effect of challenging women's position in society. *Sedmikrásky* appears to have had a similar effect on the Czechoslovakian government. In the end, irrespective of Chytilovà's possible intentions, the way the film was received clearly shows that it was interpreted as a critique of patriarchal society (Lim, 2001: 41), giving her an international reputation as a feminist filmmaker.

8. Touching Colours

Haptic Mimicry

As we have seen, when skin touches other surfaces, it tends to create strong cross-modal effects. The following chapter explores this subject in greater depth. One of the key reasons behind the frisson of disgust we feel when we see someone handle food is the knowledge that it may be soft or wet, and as such, unpleasant to touch. In film, this sort of reaction is produced by the representation of textures and surfaces, and colour plays a particularly important role in our cross-modal perception of a surface's tactile qualities. Of course, this is not just the case for objects that provoke disgust: our cross-modal senses of touch are activated by the sight of all kinds of smooth, course, regular, uneven, and other types of coloured surfaces. We are alerted to the feel of the object by the appearance of its colour, which differs according to the surface. For this reason, the textile industry published colour cards in the 1950s and 1960s showing how the new season's dyes would look on different materials, such as silk, cotton, wool or leather.[1]

In the film *Technicolor for Industrial Films*, discussed in the introduction to this Part III, Technicolor promoted its colour system by emphasising that a cinematographic representation in colour was especially beneficial for those products characterised by their texture and materiality. Barbara Flueckiger analyses this phenomenon in her article 'Color and subjectivity in film':

> Color's physical properties are intimately connected to their material basis, the material properties of the object, the small-scale variations of their surface, the dyes or pigments in connection with their binders. [...] Shiny, glossy, matte, textured, coarse, dry or humid and wet, smooth, or translucent and transparent: Every surface creates its individual color appearance. (Flueckiger, 2016: 221)

These variations in the appearance of colour according to the material properties of an object's surface enable us to cross-modally experience the feel of it, or as Flueckiger (2022: 10) describes it, 'to address haptic perception'.

1 An impressive collection of these cards can be found in the institutional archives of the Textile Color Card Association (TCCA) housed in the archives of the Hagley Museum in Wilmington, Delaware.

 https://doi.org/10.11647/OBP.0380.11

In his 1972 article 'Tales of sound and fury', Thomas Elsaesser directly connects the representation of surfaces to a film's narrative structure, especially the representation of the inner states of the characters. To illustrate this, he cites Douglas Sirk:

> Asked about the color in *Written on the Wind* (1957), Douglas Sirk replied: 'Almost throughout the picture I used deep-focus lenses which have the effect of giving a harshness to the objects and a kind of enamelled, hard surface to the colours. I wanted this to bring out the inner violence, the energy of the characters which is all inside them and can't break through'. It would be difficult to think of a better way of describing what this particular movie and indeed most of the best melodramas of the fifties and early sixties are about. Or, for that matter, how closely in this film style and technique are related to theme. (Elsaesser, 1992 [1972]: 68)

And since these visual representations of surfaces address haptic perception, all the elements in the film will start to resonate. The narrative construction of the characters is expressed through the haptic effect of the visual appearance of their environment.

Expanding on the arguments advanced by Vivian Sobchack (1992), Jennifer Barker (2009), and Laura Marks (2000), Barbara Flueckiger (2016: 153) concludes that haptic perception is one of the most immediate of all human sensations and is particularly influential in the creation of embodied experiences in a film audience. She considers tactility as a crucial strategy that can be used 'to align the viewers with selected characters' subjective experience of their environment' (153). As she explains, the filmic representation of materiality is highly complex, the main problem being that textures—the three-dimensional characteristics of surfaces—have to be represented as two-dimensional filmic images or 'visual textures' (Flueckiger, 2022: 6). Arguably, these 'visual textures' signify the 'have-been-thereness' of particular types of profilmic materials and textured surfaces. Through this indexical connection to 'having-existed' textures, visual textures are always 'a sensory quality related to touch, even if they are transformed into patterns in two-dimensional visual representation' (5). Put simply, textures are modelled surfaces, which in turn are the 'reflective and transmissive properties of objects and materials, whether opaque, transparent, semitransparent, translucent or dull, shiny, glossy, shimmering, or sparkling' (7). The way textures appear depends on their surface. Furthermore, since textures can also be a quality of a monochrome surface, they are usually made visible by the interplay of light and shadow (or by its absence in the case of smooth surfaces).[2]

Finally, film itself is also an object, consisting of celluloid, gelatine and dyes that combine to form a surface with its own textural characteristics. How these elements form a particular constellation influences the appearance of the surfaces and textures represented in the photographic image: '[The] surfaces and textures in film perception thus address the senses through a dual mechanism, as a visual texture of the film's skin [...] and the rendition of profilmic textures

2 For a highly interesting and extensive study on texture in film please read Lucy Fife Donaldson's *Texture in Film* (2014) and Guiliana Bruno's *Surface. Matters of Aesthetics, Materiality, and Media* (2014).

in filmic representations' (Flueckiger, 2022). This is precisely the facet of the new process that Technicolor was advertising in *Technicolor for Industrial Films*: it wanted to convince its clients that the 'skin' of its film material was perfect for the rendition of textures and surfaces in colour. Of course, these advertising discourses disguise the fact that the technology, materials and chemistry to produce colour film derived from skin and bones from cattle used lots of dirty energy and produced chemical residue polluting the environment (Dootsen, 2023: 1).

To recap, the way colours appear in a film's two-dimensional representation of an object is strongly connected to the object's three-dimensional materiality, and as a result, viewers can experience the effect of touch through cross-modal perception when they see a character touch these textured surfaces. As we saw in the last chapter, cross-modal effects activating other senses can occur through the mere act of watching an action on screen. *Technicolor for Industrial Films* deploys this strategy by showing a pair of disembodied hands stroking the advertised fabrics, touching the objects, or washing with colourful bars of soap.[3] This cross-modal effect is strengthened when combined with a form of motor mimicry. As explained in Chapter One, 'motor mimicry' is defined as 'the tendency of an observer to outwardly mimic the facial and body movements of another person' (Plantinga, 2009: 124): we feel pain when watching Ada's finger being cut off in Jane Campion's *The Piano* (FRA / NZL / AUSA 1993, Jane Campion), or we might cry seeing Stella Dallas watching her daughter's wedding through a window. A similar effect occurs when we see human hands, feet or other body parts touch textured surfaces. This type of motor mimicry is directly connected to the cross-modal transfer from sight to touch. Hence, I suggest introducing a new concept—'haptic mimicry'—to capture this type of cross-modal hapticity, which is arguably a subcategory of motor mimicry.[4]

Although I far from deny that black and white films create haptic mimicry in similar ways, the manifold examples of such haptic mimicry from the colour film corpus shows it was a popular trope in colour cinematography from the 1950s and 1960s. The idea was not new, of course. Already in the 1920s, Technicolor technician Leonard Troland (1927: 687) attempted to achieve 'perfect flesh values on a two-color basis'. He declared that colour added sex appeal to films, claiming that 'there is a considerable use of this sort of appeal in motion pictures; to such an extent that I believe the appeal in question has been designated as "it" in this domain' (Troland, 1927: 688). This indicates that the colour inserts of fashion shows or young women bathing that were oftentimes edited into black and white films of the 1920s were already related to the sensuous, the haptic, the sexual—or, in Troland's words, to the 'it'. Troland referred

3 In addition, the fabrics shift and move as they are touched, caressed and lifted in front of the camera. Since the appearance of the colours depends on the interplay between the reflective qualities of the surfaces of the fabrics and their illumination, moving either the surface or the source of illumination changes the appearance of the colours.

4 The concept 'haptic mimicry' was the result of one of many Zoom discussions I conducted with Barbara Flueckiger during 2020.

to the representation of white skin when talking about 'flesh values'. This aligns with the fact that most Hollywood actresses were also white. Black skin was not only excluded from the technical discourse on colour film, but it was also hardly shown in fan magazines of the time. Cathy Lomax explains:

> [...] the USA fan magazines of the mid-1950s, a time when the civil rights movement was gaining traction, maintained a conservative and essentially racist agenda by only promoting white actors. (Lomax, 2021)[5]

This racist agenda without a doubt influenced the choice to cast the white Hollywood star Elisabeth Taylor for the role of Cleopatra, whose racial identity was topic of many historical debate.

I would like to emphasise two types of haptic mimicry related to two sorts of surface textures. The first example is a moment in the film *The Tales of Hoffmann* (1951), which occurs just seconds before Schlémil is killed in a duel with Hoffmann. The shot shows Giulietta, the cause of the duel, walking barefoot over a sculpture of dead and dying men [Fig. 8.1]. The second scene is from John Ford's *The Quiet Man* (1952). Here, the haptic mimicry occurs in a scene where the two main characters escape their chaperone and slip away to a stream, where the woman takes off her shoes and stockings and runs into the water. A little later, they kiss in the rain [Fig. 8.2].

Fig. 8.1 Giulietta walks barefoot over a frieze with dead men in *The Tales of Hoffmann* (GBR 1951, Powell and Pressburger). DVD: 2005 The Criterion Collection. Time code: 01:23:18

Fig. 8.2 Water touching skin smoothening a starting love story in *The Quiet Man* (USA 1952, John Ford). DVD: 2008 Süddeutsche Zeitung Cinemathek. Time code: 01:09:43

In these examples, we see two possible types of haptic mimicry. The first shows bare feet touching a coarse-textured surface, introducing an emotionally charged moment in the narration of the film (presaging a death). A form of haptic mimicry gives rise to a feeling of discomfort, maybe even pain. In the second, we see water touching

5 Following the dominant visual culture of the time, this chapter also mainly focuses on white female skin.

skin, which invokes a smoother and more pleasant moment of touch, emphasising the sweetness of young love. The fluidity of the water resonates with the sensation of flowing into one another that often accompanies falling in love.

The following part of this chapter elaborates on these two types of haptic mimicry. This will help clarify the different types of cross-modal effects and how they were strategically used in the 1950s and 1960s colour films. To explain the shifts in using this filmic tactic to refer to the 'quasi-immobile' side of human perception, we will also look into contextual changes in relation to sex and representations of the body in relation to the shift from a black and white to colour dominance in film. Since the taboos around sexuality and the representation of nakedness in film were mostly related to the white female body, it is necessary to focus on female nudity in relation to smooth or rough surfaces and the sense of touch.

Figs 8.3, 8.4 and 8.5 Movie stars represented in *Photoplay*

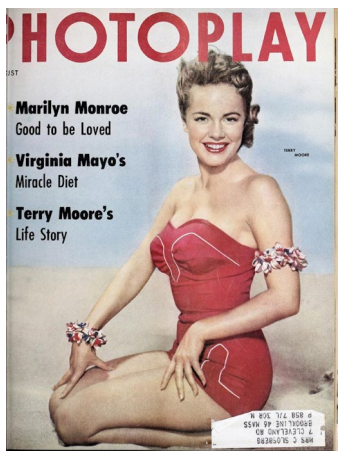
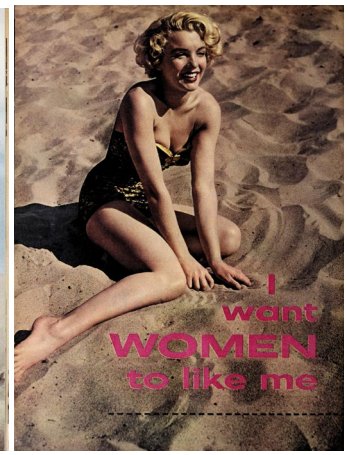


Fig. 8.3 Teddy Moore avoiding physical contact with her environment. *Photoplay* August 1954, cover (Source: IMDB)



Figs 8.4 and 8.5 Marilyn Monroe and Kim Novak as exceptions to the non-haptic rule of Photoplay. *Photoplay*, November 1952, p.58 and *Photoplay*, November 1955, cover (Source: IMDB)

However, the visual culture of the early 1950s was not as filled with haptic mimicry as *Technicolor for Industrial Films* film might suggest. For example, if we look at the aesthetics of celebrity colour photographs in *Photoplay* during this period, most movie stars sit or stand in rather stiff poses and rarely have any physical contact with their environment [Fig. 8.3]. When they do touch surfaces, it is as though they cannot feel them. A notable exception is a colour photograph of Marilyn Monroe in a bathing suit (she is sitting in the sand of what is presumably meant to represent a beach) published in the November 1952 issue of *Photoplay*. Monroe is seated on one leg, with the other stretched out along the sand towards the camera. Her fingers also touch the sand:

she appears to be about to gather up a handful, leaving traces of sand up the left side of her body. The image is all about skin touching sand, producing an effect of haptic mimicry that evokes in the viewer the felt sensation of a sandy beach in summer [Fig. 8.4]. Director Billy Wilder, quoted in *Playboy* (1964: 102) praised Monroe's flair for presenting haptic images of herself: 'She had flesh which photographs like. You feel you can reach out and touch it'. Kim Novak was another movie star with a talent for haptic mimicry, an example being a colour picture of her in a bath on the cover of the November 1955 issue of *Photoplay* [Fig. 8.5].

In American films in the 1950s, however, these moments of haptic mimicry that were closely related to sensuality and sexuality were an exception. One of the reasons for this was, of course, the Production (or Hays) Code that became active as a tool of Hollywood self-censorship in 1934. The Hays Code implied that nudity was not allowed and that 'passions should be treated in such manner as not to stimulate the lower and baser emotions'.[6] During the second half of the 1950s, the Code's boundaries were gradually breached. At first, this meant that European films, which were considerably racier than their Hollywood counterparts, began to appear in American cinemas. In their article 'History of Sex in Cinema Part XIII: The Fifties—Sex Goes International' (*Playboy*, 1966: 232), Arthur Knight and Hollis Alpert comment: 'If America's attitudes toward sex in the movies underwent a drastic change during the Fifties, it was due in no small part to the stepped-up importation of foreign films throughout that period'.[7] The countries the authors mention are France (the films of Martine Carol and Brigitte Bardot), Italy (Sophia Loren and Gina Lollobrigida), Sweden (Ingmar Bergman), Japan (Rashomon), and England ('a whole new tribe of angry young men'). Interestingly, most of these films were in black and white. During the 1950s, such racier films showing naked female skin seem not to have been made so much in colour. The illustrations accompanying the *Playboy* article give a clear impression of the amount of nudity and sex these non-American films contained. Nonetheless, even though such films were imported more easily, censorship remained a live issue.

In the US, *Playboy* was one of the most popular proponents of a more liberal position towards mainstream depictions of naked women, including movie stars. From its inception in 1953, the magazine—which presented itself as 'entertainment for men'—introduced nude photography into the legal domain (Allyn, 2000: 27). With Marilyn Monroe as its first playmate [Fig. 8.6], it was also linked to cinema from the start.[8] Other Hollywood stars appearing in its pages included Jayne Mansfield, who was the regular February 'Playmate of the Month' from 1955 to 1960, and Brigitte Bardot, who also became a regular after her first appearance in its March 1958 issue when *Playboy* printed a set of photos from some of her films, including *Et Dieu… créa la femme* (1956).

6 See: https://productioncode.dhwritings.com/multipleframes_productioncode.php)

7 Alpert and Knight published 'The History of Sex Cinema' in *Playboy* in twenty episodes between 1965 and 1969.

8 In this first issue, *Playboy* called the phenomenon 'Playboy Sweetheart', but by January 1954 it had already changed the sobriquet into 'playmate'. The photo of Monroe dates from 1949.

Interestingly, the centrefolds in *Playboy* were always in colour whereas the overall rest of the magazine's photography stayed in black and white for a long period.

All these shifts were related to the so-called 'sexual revolution' that is popularly synonymous with the 1960s. Like any revolution, however, the changes had started long before the mainstream majority caught up with the movement. For example, the concept of the sexual revolution had already appeared in 1945 as the title of the English translation of *Der sexuelle Kampf der Jugend*, written in 1932 by Wilhelm Reich, a student of Freud. Reich was an extremely controversial figure in the field of psychoanalysis, focusing on what he called 'orgone-energy'. Unsurprisingly, the Nazis blacklisted him and symbolically burned his books in 1933. The blacklisting was repeated after the Second World War when Reich was living and working in the US, when his writings and equipment were seized by FDA officials. He died in prison in 1957, and his library was destroyed by the FDA.[9] Reich, however, was not simply a controversialist; he was a committed socialist who combined political activism with agitation for sexual liberation. He considered sexual oppression to be the cornerstone of totalitarianism, and believed that sexual liberation was essential to the achievement of political liberation (Allyn, 2000: 45). Reich had many followers, and his legacy was kept alive in bohemian circles by figures such as Norman Mailer, Saul Bellow, Paul Goodman and William Burroughs, who were all advocates of Reichian therapy (308, note 8).

Three other important thinkers in the US, Fritz Perls, Herbert Marcuse and Norman O. Brown, were also advancing ideas about sexual liberation some time before the 'official' sexual revolution got under way (Allyn, 2000: 202). Fritz Perls studied with Reich during the late 1920s in Vienna and in the early 1930s in Berlin. He moved to the USA in 1946, where he founded Gestalt therapy (together with his wife Laura Perls and Paul Goodman), which transformed the practice of psychotherapy through the introduction of the theory of sexual liberation. Like Reich before him, Herbert Marcuse was inspired by Freud's psychoanalytical theories. In 1955 he published *Eros and Civilization*, which combined Marxist and Freudian analysis but rejected Freud's idea that libidinal impulses need to be repressed if civilisation is to thrive. Marcuse's belief was that if adults returned to their original childhood state, 'prior to the division of the body into specific zones for working, eating, genital intercourse, and the like', this would enable amity and peace to overcome competitive capitalism and corporate greed (Allyn, 2000: 198–99). This rejection of repression was also the main subject of Norman O. Brown's *Life Against Death* (1959). Interestingly, however, current research points to the increased integration of initially separate senses over time through cross-modal transfer, seeming to negate Marcuse's theory that it is only the child's state that is characterised by wholeness and integration. His ideas may have been influenced by the cultural connotations attached to the separation and concealment of emotions and feelings as a marker of upper-class distinction. The common trope of the time that

9 See: https://bpsi.org/library/archives/collections/reich-wilhelm-1897-1957/

compared the lower classes and their habits to that of children fits with the discourse that distinguishes the female, the non-white and the child as the more sensitive and less rational 'other'.

In all, the 1950s can be seen as a transitional period during which a more liberal attitude to sexuality and nudity found its ways into cultural expressions such as film and photography, as well as scientific discourse and therapeutic practice. Nevertheless, these initiatives continued to be considered highly problematic, as the banning (and destruction) of Reich's books clearly illustrate. By no means did everything suddenly change in the 1960s; it was the contrary. For example, on the one hand, the FDA licensed the birth control pill in 1960, potentially giving women the freedom to explore their sexuality, but on the other, it remained illegal in many USA states throughout the decade, and it would take until 1965 for the USA president to speak out in favour of birth control. The contrast with the atmosphere generated by *Playboy*, the emergence of go-go dancing and imported European films could not be greater (Allyn, 2000: 36).

Similar developments concerning the youth movement and the urge for liberation happened in Europe, for example, in France, as Simone de Beauvoir discusses in her booklet *Brigitte Bardot and the Lolita Syndrome* (1959), using the famous French sex symbol as a symptomatic example. De Beauvoir, however, explains the events in the late 1950s less as a generational conflict and more as a gender war. Her conclusion, based on an analysis of how France reacted to the appearance of Bardot, was that 'to say that "BB embodies the immorality of an age" means that the character she has created challenges certain taboos accepted by the preceding age, particularly those which denied women sexual autonomy' (1959: 58). De Beauvoir states that the liberation of ideas concerning female sexuality was not necessarily related to age but to opening the mind to 'truth'. The following incident relating to the film *Cleopatra* (1963) illustrates that the denial of women's sexual autonomy which de Beauvoir speaks of was still very much alive during the 1960s. In January 1963, five months before *Cleopatra* was released in cinemas, *Playboy* published film stills and set photos of Elizabeth Taylor. Then, in April of that year, *Photoplay* published an article called 'Now Liz poses nude!', in which it denounced these pictures as scandalous exhibitionism that called for a psychological interpretation. The article's author, W. Tenenoff Reich (what's in a name?), asks himself rhetorically: 'What term can we use to characterize Liz's compulsion to bare herself to the camera (and to the world)? Is she "modern" or "immoral", is she "emancipated" or "exhibitionistic"?' A page further on, he answers his own question by declaring that the term for her behaviour is clearly 'exhibitionism', which he then defines as 'an act of defiance against [her] mother' (Tenenoff Reich, 1963: 96). Likewise, the 'immoral exhibitionism' of Monroe and Bardot, he believed, naturally indicated they had similar problems with their mothers.

What is interesting here, of course, is that Tenenoff Reich mentions 'immorality' and 'exhibitionism' in the same sentence as 'modernity' and 'emancipation', ostensibly comparing them but, in fact, placing them in the same category of unwanted

developments and types of behaviour. When looking at societal changes during the 1960s, we can see how the emotional regime of the time could be defined as flouting moral conventions and rebelling against restrictive social norms—French cinema's *Nouvelle Vague* exemplified this in its literal rejection of the films of the so-called 'Tradition de Qualité' (Truffaut, 1954: 15–29). This Tradition de Qualité would later be defined in a slightly more denigrating way as the 'Cinéma de papa'.

Taylor was far from the first movie star to appear in *Playboy*. As mentioned above, Monroe became the magazine's first 'playmate'—photographed in full colour, in a further predominantly black and white magazine—in December 1953. Still, it was Taylor who was widely criticised for showing her body, first in *Playboy* and later in *Cleopatra*. The reason might be that Bardot, Mansfield and Monroe were classed as 'promiscuous' from the start. As such, they could be identified as part of a youth culture that might still be innocent in some respects, and their lapses were something they would 'grow out of'. Taylor, by contrast, began her screen career with the persona of 'the girl next door', who respects the norms of society, and only freed herself of this image at a later stage. She seems to have changed into someone who supports a revolution in morality, and her sexual freedom could not be dismissed as a youthful phase, rendering it all the more dangerous. In fact, rather than displaying psychological problems that called for pseudo-psychoanalytical answers, these women should be regarded as forerunners of the sexual revolution that would find its complete breakthrough in the psychedelic 'free-love' culture of the second half of the 1960s.[10]

This same reaction against female freedom took place in France. Even though showing nudity in film was less problematic than in the US, this tolerance was not unlimited. As in the US, Bardot's films were also censored in France. De Beauvoir (1959: 28) reasoned that French men were reluctant to relinquish their dominant societal role and felt challenged by Bardot. At the same time, however, the directors of her films (as with other films that contained nudity) were men, and they knew how much it would benefit the box office. This double standard is still invoked in ongoing debates about nudity and pornography in the context of women's liberation and feminism. According to David Allyn (2000: 5), it would not be until the late 1960s that nudity was generally accepted in films and on the stage. This, of course, was not only related to the sexual revolution but also to the decline of Hollywood's influence and power. The rise of independent filmmakers, production companies and cinemas (128) helped to disempower the Hays Code and change the unwritten rules regarding the portrayal of nudity, sexuality and 'promiscuity' in film.

These struggles, or 'culture wars' were reflected in the films of this period. We glimpse these developments not only in the increase in nudity on screen but also in different presentation strategies relating to haptic mimicry and the representation of the white female body in colour.

10 For more information on the sexual revolution in relation to feminism, see: Allyn, D. (2000) *Make Love, Not War: The Sexual Revolution. An Unfettered History*. Little, Brown and Company.

Smooth Surfaces and the Female Skin

When *Playboy* introduced its 'playmates' in the 1950s, their, overall white, skins were reproduced as smooth, flawless surfaces, and they were posed against coloured backgrounds, touching soft, smooth fabrics. The very first playmate in the very first issue was Monroe. The photograph shows her in a pose somewhere between lying and sitting, almost hovering, against a background of heavy red velvety cloth (*Playboy*, 1953: 19) [Fig. 8.6]. Her body is flawless, with perfectly smooth, unblemished skin.

Fig. 8.6 Marilyn Monroe as first playmate in *Playboy* of December 1953.

This sort of heavily retouched representation became the *Playboy* aesthetic for playmates, giving them an artistic, sculptural appearance that resulted in a dematerialisation and dehumanisation of their actual physical bodies. In 1975 feminist Susan Braudy (cited in Allyn, 2000: 282) described this *Playboy* practice as '[t]he clean, neat, fantasy figure so de-humanized as to be really de-sexed—hairs plucked, smells replaced, pores filled with make-up, smoothed to unthreatening blandness'. In other words, the sensuous characteristics of their bodies, such as smell and texture, were removed, creating an ideal of the female body as plastic as that of a Barbie doll.

In addition to the suppression of the materiality of the female body, the playmate also possessed another particularity that increased the impression of smoothness. Over the first two years of *Playboy*, the playmate centrefold developed from a photograph of an 'ordinary' pin-up into an erotic poster with its own particular atmosphere and style. In an article called 'The first two dozen playmates' in 1956, *Playboy* described this development as follows:

> In the early issues, she wasn't very different from any other pin-up picture, but as the months passed she began to develop a personality distinctively her own; she became more sophisticated; she left a little more to the reader's imagination; and though some kidded her about a new-found bashfulness, they loved her more than ever before. (*Playboy*, 1956: 53–55)

Looking at the playmates over the first two years of the magazine, the change becomes clear. First, we see a shift from fully naked pin-ups, with breasts fully on display, to partially dressed women with breasts and nipples somewhat more covered. This more 'prudish' phase continued into the early 1960s,[11] and the representation of playmates became more anecdotal and even filmic. The early 'classic' pin-ups were clearly photographed in a studio setting, with pastel-ish, monochrome backgrounds, some lying on a large curtain or a zebra or tiger skin, others sitting on a pedestal (*Playboy*, 1953–1956). Similar to the photographs of movie stars in *Photoplay*, they barely touched the textured surfaces. In contrast, the 'more sophisticated' playmates were often shot in a living room sitting on a couch or in front of a fireplace, in a bathtub filled with foam, in a boudoir applying make-up, or in the doorway of a hotel room putting up the 'do not disturb' sign. Some of the settings show traces of men in the form of a pipe in an ashtray, a second glass of wine, or a man's hand (the rest of him being outside the shot). Occasionally, the playmate wears clothes with male connotations, indicating the former presence of a man, such as shirts or jeans, fabrics with somewhat rougher textures. But most wear smooth trousers, nylon stockings, tulle, fur, velvet, lace or wool, all of which create a haptic effect mirroring the pleasant feeling of smoothness, cleanliness and softness.

There was little nudity in mainstream films of the same period. As we have already seen, the rare films that did show female nudity in American cinemas were mostly European imports, such as those featuring Bardot. When looking at Bardot more closely, we notice that she seems to reflect the playmate aesthetic, first of all by refraining from wearing a bra, enabling the audience to see the shape of her breasts through the fabric of her dress, shirt or bed sheets, as in *Et Dieu… créa la femme*. Besides which, the film 'opens with a shot of Brigitte, stretched from end to end of the Cinemascope screen, bottom up and bare as a censor's eyeball. In the hard sun of the Riviera her round little rear glows like a peach' ('Down Movie Lane', 1957: 6). This description indicates that her skin was shown as a soft, smooth surface comparable to the skin of a peach, and her appearance on the big screen must have been like an enormous version of a *Playboy* pin-up. It is precisely this moment in the film that is referenced in the scene with the little boys masturbating on the front row of the theatre in the film *Cinéma Paradiso* (ITA/FRA 1988, Guiseppe Tornatore) (Vincendeau, 1992: 82). As Linda Williams explains

11 These more 'prudish' playmates were often shown in the same issue as more explicit pictures. It appears that playmates, whose images were made to be pinned on walls, were more decorous. Around 1962, however, full nudity returned, interspersed with the partly dressed playmate. See: *Playboy* (1953–1970).

in her book *Hard Core* (1989), this type of appreciation borders on pornography, the ultimate form of the practical, non-fictional use of film.

Jean-Luc Godard's *Le mépris* references Bardot in *Et Dieu… créa la femme*. In the July 1957 issue of *Cahiers du Cinéma*, Godard (1957: 35–37) declared himself a fan of the film's director, Roger Vadim, explaining that *Et Dieu… créa la femme* was a film that was 'résolument moderne' and definitely a 'film d'auteur', and that he rated Vadim as one of the best young directors of the time. Godard also presents nude shots of Bardot in *Le Mépris*, including one of her in a similar pose to the one in Vadim's film, 'stretched from end to end of the Cinemascope screen'. He shoots her body from different angles as she lies on top of white, blue or red fur rugs. Bardot's body sinks into the soft surfaces, producing a 'haptic mimicry' as the entire surface of her skin makes contact with the material, similar to the sensations evoked by the pictures in *Playboy*.

In his article 'Bardot and Godard in 1963', Nicholas Paige (2004: 13) explains that the style of the image indicates that *Le mépris* was intended to be more documentary than feature film and cites Godard as saying that it would be similar in a way to 'newsreels, supposing they were filmed in CinemaScope and in color'.[12] With this in mind, we can see why he decided to ask Bardot to play the role of Camille: as Godard (in Paige, 2004, p. 14) was of the opinion that every film was a documentary record of its actors, 'a color film with Brigitte Bardot […] is all the more cinéma-vérité because Bardot frustrates our own desire for psychological fiction'. Indeed, in *Le mépris* Godard presents Bardot in natural colours, similar to Vadim's representation but with the extra stimulus of a cross-modal sensation of touch activating the process of haptic mimicry. At the same time, however, the depiction of Bardot is clearly posed and unnatural. This aligns with the nude shots at the beginning of the film, in which Godard again refers to the French flag (blue, white and red), showing sequences of Bardot's body in red and her face in blue, with the help of coloured filters. As I mentioned in Chapter Three this use of unrealistic colours in an otherwise naturalistically coloured film helps disrupt the viewer's fictionalising impulse and, as a result, 'Godard destroys the illusion of reality and also the belief that "Camille" is a real person' (Taoka, 2012: 251). Instead, the audience is forced to see not Camille but the actress Bardot lying naked in front of the camera.

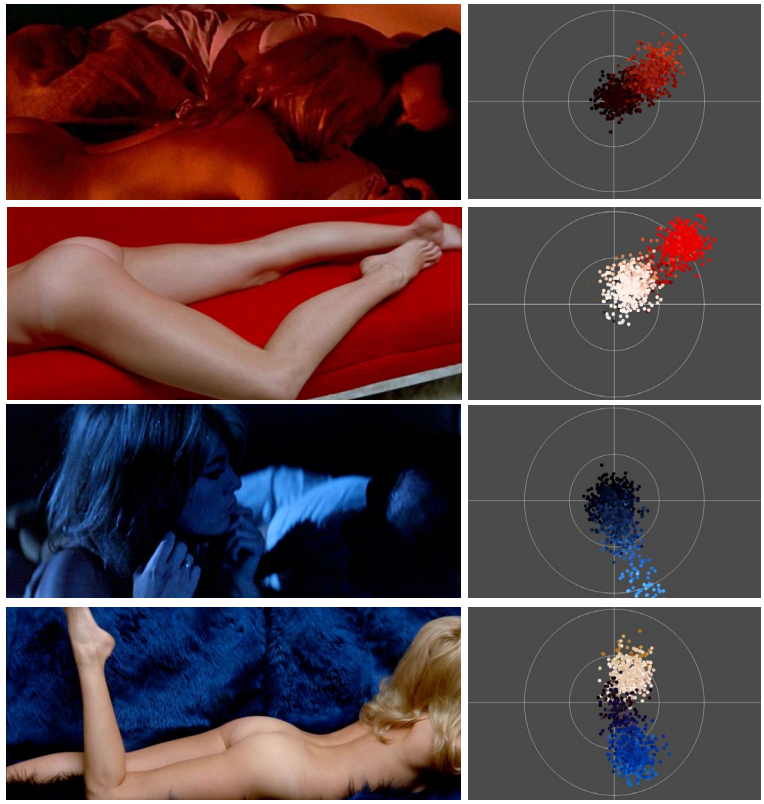
An analysis in VIAN reveals that both moments in the film are colorimetrically connected: the red and blue filters appear to be in the same colorimetric domain as the blue and red rugs on which Bardot lies. Furthermore, the colour of her skin in the shot on the red rug appears to be of the same hue as the red of both rug and filter.[13] Finally, the colorimetric analysis of the shot of Bardot lying on the blue rug not only shows a light-dark but also a warm-cold contrast. This last finding makes sense if we take into

12 Both elements were part of the core ingredients of the film, as Richard Misek remarks on *Le mépris* make clear. As he points out, the film was made with a relatively high budget, 'necessitating both colour and a nude scene with Brigitte Bardot' (Misek, 2010: 57–58).

13 Of course, the skin colour has a much lower level of chroma which makes it appear pinkish.

account the fact that the colour of Bardot's skin is actually the same hue as the red filter and the rug [Figs 8.7–8.10].

Figs 8.7, 8.8, 8.9 and 8.10 VIAN colorimetric analyses show that the red and blue coloured lights on Bardot's body, show similar hue values as the rugs Bardot is lying on in *Le mépris* (FRA/ITA 1963, Jean-Luc Godard). DVD: 2002 The Criterion Collection. Time codes: 00:04:40, 00:58:03, 00:05:43 and 00:57:28.



Overall, Godard's cinéma verité in colour, showing Bardot as an actress, a star and most of all a female body, appears much more constructed than the concept would suggest. Of course, it could be said that the way Godard plays with realism and the representation of Bardot's body in fact emphasises that body, along with all the references and fantasies its image creates in the audience.[14]

The concept of cinema verité and the words of both Godard and Paige shed light on another example from the early 1960s, the aforementioned nude scenes of Elizabeth Taylor in the box-office success *Cleopatra*. The example is important because this film was (at least partly) an American production. Since Taylor was one of Hollywood's biggest

14 As a matter of fact, Al Di Lauro and Gerald Rabkin (in Williams, 1989: 58) called the stag film precisely that—'the *cinéma vérité* of the forbidden'.

stars at the time, the fact that she revealed all in a commercial production was arguably a revolutionary moment. Still, these scenes are all set in Cleopatra's bathing quarters, which gives her nudity a narrative justification. This logic can also be found in a 1963 review of the film in *Photoplay*: 'Justification can be made for her nudity in the actual bathing scenes in "Cleopatra". It can always be said that such naked and near-naked bathing scenes are part of the Hollywood "spectacle" tradition' (Tenenoff Reich, 1963: 39).[15]

The first nude appearance of Cleopatra shows her lying on her front as one of her female slaves massages her back. The location is her gigantic bedroom, which resembles a luxurious private spa. Again, the pose and what it does and does not reveal is similar to Bardot's sunbathing scene at the beginning of *Et Dieu… créa la femme*. However, Bardot's skin in this scene is not visibly in contact with any other surface; in contrast, the hands of the slave massaging Cleopatra's back create a cross-modal effect of haptic mimicry [Fig. 8.11].

Fig. 8.11 Cleopatra appearing naked when getting massaged. *Cleopatra* (USA / SUI /GBR 1963, Joseph L. Mankiewicz) DVD: 2002 Twentieth Century Fox Home Entertainment. DVD 1, Time code: 01:30:25.

A second moment of nudity comes when Cleopatra is taking a bath: a frontal camera shoots Taylor from a slight overhead angle, hinting at the potential for uncovering more of her body and thus creating a certain frisson of tension. For example, when she reaches for a toy boat holding bathing oils, we see her bare leg shimmer through the water [Fig. 8.12]. A final moment of interest, in which Taylor once again reveals the sensuality of her naked body is when she is lying on a couch, covered by a transparent piece of silk and surrounded by female slaves attending to her hands and feet. The shot reveals her form, and even for a brief moment, one of her breasts.[16] All of these moments use the effect of haptic mimicry—the massaging hands touching Taylor's back, the soft silk cloth sliding over her body, and the milky water in the bath caressing her arms and chest.

15 As mentioned earlier, bathing scenes provided a good narrative justification for showing nudity in Hollywood films. However, this does not mean that they were not considered problematic. For example, it was Claudette Colbert's bathing scene in *The Sign of the Cross* (USA 1932, Cecil B. DeMille) that provoked Hollywood to install the Production Code, also known as the Hays Code (Lenning, 1975).

16 There is an amusing detail in the scene, in which a sudden movement causes Taylor's silky covering to drop, and one of her servants quickly adjusts it so as to cover her bottom.

Interestingly, the colorimetric analyses of all these moments in the film show a similar colour scheme of mostly subdued and neutral pastel colours in a range from pink to blue. The massage scene shows the most saturation, contrasting with the shot of her wrapped loosely in transparent silk, which is the most subdued of these scenes.[17] The rest of the film shows much more saturated colours and greater variations in hue. For example, when comparing Cleopatra's bathing scene with that of Richard Burton's (as Mark Antony) later in the film, the differences become obvious: instead of the predominance of subdued natural colours and pastels, Burton's bathing scene is shot in contrasting tones of blue, red and yellow. Moreover, the additional red and yellow hues show higher levels of saturation and chroma, creating a completely different atmosphere, without the mounting sensual tension of Taylor's bathing scene [Figs 8.12–8.13].

Figs 8.12 and 8.13 Interesting difference in the colour schemes of Taylor's and Burton's bathing scenes. *Cleopatra* (USA / SUI /GBR 1963, Joseph L. Mankiewicz). DVD: 2002 Twentieth Century Fox Home Entertainment. DVD 2 Time codes: 00:08:41 and 00:30:02.

Of course, the subdued pastel colours of Taylor's scenes increase the softness of the image already created by the smoothness of the fabrics, the water and the potions. This might have created an effect of realism, especially in comparison with the other interior scenes in the film that, for instance, frequently show unrealistic coloured lighting in the image's background. As in *Le Mépris*, this seems to gesture towards a 'documentary' approach, emphasising the nakedness of movie star Liz Taylor rather than that of Cleopatra the character.

17 The difference in saturation could also be an effect of the Eastmancolor film print's deterioration over time.

Rough Surfaces and the Female Skin

In a scene in *Pal Joey* (USA 1957, George Sidney, Technicolor V), Linda (Kim Novak) is taking a bath while Joey (Frank Sinatra) stands outside the bathroom door trying to persuade her to come out to dinner with him. The scene alternates between shots of Linda in the bath and those of Joey in front of the closed door. Joey clearly would like to be permitted into the bathroom, but he is not—even the keyhole is covered with a band-aid to stop him from peeping. Meanwhile, the audience is allowed inside the bathroom, seeing what Joey cannot see, and since the 'Peeping Tom' scenario was (and is) a common trope in porn movies, this sets up an erotic atmosphere (Williams, 1989). The scene is filmed slightly from above, revealing Novak's soft-coloured skin touched by the foam. She is leaning forward, stroking her legs and occasionally splashing water on them, giving the scene a haptic power that produces an urge in the viewer to be either in the bath themselves, caressed by the soft foam and warm water, or to be next to the bathtub, touching Novak's naked skin.

As in *Cleopatra* the colours of the bath scene in Pal Joey are subdued, but instead of smooth pastels, the colour scheme has a certain dull patina created by a combination of the brownish-grey of the wood panels behind the bath, the white foam and the colour of Novak's skin. The background's earthy, subdued colours (the unpainted wood and its coarse texture, emphasised by the shadows that delineate the panels) increase the shot's haptic feel. The absence of patterns on the wall or coloured objects in the bathroom force the focus onto Novak sensuously washing her legs in the bath. In her forthcoming article 'Textures, patterns and surfaces in color films', Flueckiger argues convincingly that coarse, haptic textures in film often correlate with low saturation levels. When she analysed colour trends in filmic spaces with the help of the VIAN WebApp visualisation tool, Flueckiger found that the visualisation of the way chroma developed from 1930 onwards does indeed reveal low saturation levels combined with coarsely textured environments.[18] The reoccurring pattern appears to be an aesthetic motif, in which low-saturated, earthy, natural colours accompany strong textures and haptic effects. This is reflected in *Photoplay*'s earlier mentioned images of Monroe on the beach in a swimsuit of a subdued yellow/golden colour that matches her hair and skin, as well as the sand. By comparison, Terry Moore, although also depicted on a beach on *Photoplay*'s cover (August 1954), is shot in a non-haptic pose, wearing a swimsuit of saturated red [Figs 8.3–8.4].

Returning to *Et Dieu… créa la femme*, as one of the most haptically sensual films to enter American cinemas in the 1950s, it launched Bardot's international career and her fame as a so-called 'sex kitten' and was great box office in Europe and the USA (Vincendeau, 1992: 83). The film was referred to as the 'sexiest soufflé France has deposited on our shores in years' ('And God', 1957: 9). Gossip columnist Sheilah

18 Flueckiger correctly excludes early cinema, with its completely different use of colour, and convincingly explains the few exceptions to this rule in the following period.

Graham (1958: 74) disclosed that Frank Sinatra was willing to offer Bardot 'the sun, moon and stars' to appear alongside him in a movie, adding, '[p]ersonally, I think she's too hot for Hollywood to handle'. Indeed, despite its financial success, the film was heavily censored throughout the US: the trade press of the time shows that it was either banned or censored in many states, and condemned for being 'lewd, lascivious and immoral' ('Memphis', 1957: 3) and 'an open violation of Christian and traditional morality' ('Two pictures', 1957: 1–2).

There are of course many reasons why it might have been judged 'immoral', 'unchristian' and 'lascivious', especially in 1950s America. First, the 'story about a woman of easy virtue' indicates immorality, furnishing a reason for censorship. Secondly, as discussed above, the film's opening shows Bardot entirely naked, stretched out across the length of the screen. Thirdly, the sensuousness of the film not only relates to this almost-documentary shot of Bardot's body, but it also derives from the haptic mimicry evoked by the film's manipulation of colour and texture. To fully appreciate this use of colour, it may be helpful to conduct a more detailed analysis of one particularly haptic scene that also forms an important affective climax in the film's narrative structure.

The film is set in the picturesque coastal town St. Tropez and shot on Eastmancolor. It tells the story of the orphaned Juliette (Bardot), who strongly desires the freedom to enjoy life, dance and make love—she decides with whom she sleeps and when, leading to various scenarios of adultery and jealousy. All this takes place in a setting of buildings with stone walls, wooden beams and half-finished or abandoned boats with tangled ropes and pots of paint. The basic, naturalistic tone of this environment resonates with Bardot, whose first fully naked appearance in the film portrays her skin in a de-saturated beige and underlines de Beauvoir's (1959: 34) description of her as the 'earth, earthy'. The film shows Bardot barefoot, strolling around or dancing, with her wild, flowing hair emphasising her sensuality. Her feet touch the warm sand, the cold water, the town's hot streets and the cool tiles in the bar, producing a sensuous effect through haptic mimicry and directly connecting her character to its surroundings.

The scene I will discuss here occurs halfway through the film, when Juliette cheats on her husband with his brother Antoine. The entire scene takes place among rugged natural scenery. The couple is literally thrown into this environment by the sea that washes them ashore after a boat accident. Exhausted, they lie half in the water, half on the beach. Juliette stands up, and we see her from below, with her wet beige dress clinging to her skin, which is only a slightly different shade of beige, her breasts outlined against the bright blue of the sky behind her. She walks slowly towards Antoine and puts her wet foot on his face, pushing it further into the sand. The gesture has a violent, erotic effect, which increases the sexual tension already visible between them. When Antoine tries to free himself, Juliette falls back into the

sand, where she remains prone, displaying her body. This pose, stretched out on the beach in her wet dress, resembles the playmate aesthetics mentioned above.

When Antoine walks away from the beach, she follows him, forcing him to stop after a while to make love in the desolate environment, surrounded by sand, trees and dead wood, under a blazing sun. They start kissing while they lean against the rough bark of a bent pine tree, Antoine's hand resting on the coarsely textured tree trunk. After he lies her down on the sand, which must be burning hot, there is a dissolve with an ellipse that jumps forward to the moment after the act. During the scene, we continuously hear the shrill song of crickets, resonant of long, hot summers in southern France. The colours in the scene are subdued, desaturated, and natural, which are characteristic of coarsely textured environments. The combination of the sound of the crickets, the heat and the rough textures touching the characters' skin reproduces in the viewer the feeling of salty heat and skin scuffing on rough surfaces that is somehow similar to the way the characters seem to almost violently force themselves on each other. This moment shows why Vadim's offering is more than just a film about a carefree woman who is sexually impulsive; it is also a film that very cleverly produces haptic mimicry through a combination of surfaces, textures and colours. It not only touches the viewer through the skin of the 'earthy' Bardot, but also combines unpleasant encounters with water, sand, trees and earth with the suggestion of sexual pleasure, confirming the hypothesis that the film presents an implicit representation of a more 'animalistic' female sexuality by using the depiction of rough surfaces to increase the physical impact of the images, creating a strong cross-modal transfer in the audience.

However, this relation between the earthy, natural and simple on the one hand and the erotic on the other was not new. Indeed, other European actresses were also depicted as a combination of natural beauty and promiscuity. For example, Swedish actress Harriet Andersson, who played the sensuous Monika in Ingmar Bergman's *Summer with Monika* (SWE 1953, Ingmar Bergman), was held up as a new kind of film star, 'one with a natural beauty that shuns Hollywood glamour' (Hubner, 2012). Another example of a 'natural' diva of postwar European cinema was Silvana Mangano in *Riso amaro* (ITA 1949, Giuseppe De Santis). These films were all shot in black and white, as were earlier Bardot films such as *Manina* (*The Girl in the Bikini*) (FRA 1952, Willy Rozier), *La lumière d'en face* (The Light Across The Street) (FRA 1955, Georges Lacombe) and *En effeuillant la marguerite* (Plucking the Daisy) (FRA 1956, Marc Alégret). The difference between these earlier films with European actresses on the silver screen and *Et Dieu… créa la femme* was that the latter was shot and released in Eastmancolor and Cinemascope. As a result, the appearance of nudity, sensuality and sex in colour must have had a remarkable effect. Leonard Troland of Technicolor had already written in 1927 how 'natural flesh values [would be] of tremendous assistance in the particular matter', by which he meant in the portrayal of sexuality. He continued:

> Of course, the censors may frown upon the advocacy of color on this basis, but as a psychologist I feel quite sure that the point is a very important one, because all experts admit that the basic appeal of motion pictures must be through primitive emotions, among which eroticism is not the least. (Troland, 1927: 688)

In addition, the use of subdued, natural colours not only meant female skin could be represented in a more haptic way, but also increased the effect of unmediated representation: the audience was invited to perceive the body of the actress herself rather than the body of the character she was supposedly playing.

Contrast and Tension

The contrast between the surfaces in an image makes these examples of rough textures and soft female skin particularly interesting. In his analysis of Sirk's films, Elsaesser (1992 [1972]: 77) explores how he used textures and materials to create emotional contrasts or amplify tension or clashes in the image or the filmic space. Elsaesser gives a particularly pertinent example of a scene where a black silk bow falls off a garland of flowers and is blown away by the wind. As it is swept across a concrete path, the way the soft silk is filmed stroking the hard concrete intensifies the contrast between the texture of the two surfaces, giving the image a strong emotional resonance. Elsaesser connects this use of decor, style, texture and materiality in Sirk's filmic image to the censorship and morality codes that limited the creative possibilities of Hollywood directors. These limitations, he believes, stimulated the conscious use of visual style to produce underlying meanings and create emotions and affects (Elsaesser, 1992 [1972]: 77).[19]

In 'Color and subjectivity' (2016), Flueckiger elaborates on a similar effect in Michelangelo Antonioni's film *Il deserto rosso*, and further connects this to colour. Antonioni creates a strong contrast between the slick man-made interior surfaces, covered in layers of shiny paint, and the subdued matte colours of the natural landscape, characterised by uneven, textured surfaces which show traces of the pollution, destruction and dirt of industry. This dichotomy is enlarged when Giuliana and her husband gather with some friends in a cabin to eat, drink and socialise (a scene referred to in Chapter Five). The cabin's wooden walls are covered in heavy blue, red and white varnish layers. Yet although the paint gives the wood an artificial, synthetic coating, we can still perceive the textures of the organic material beneath, creating a tension between the organic and the synthetic, the biological and the

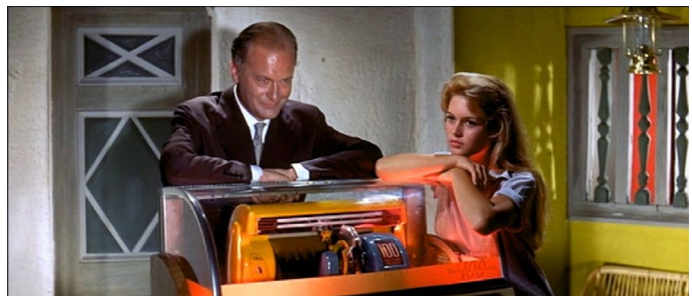
19 Many other films from the 1950s and 1960s created tension in an image through the contrast between coarse, natural materials and smooth synthetic surfaces. This was partly due to the habit of using natural stone in interior design that was in vogue during the period. Such films include: *Johnny Guitar* (USA 1954, Nicholas Ray, Trucolor), *All That Heaven Allows*, *Mon oncle*, *North by Northwest*, *West Side Story*, *Le mépris*, *Les parapluies de Cherbourg*, *Modesty Blaise*, *Pierrot le fou*, *Fahrenheit 451*, *Blow-up* (GBR 1966, Michelangelo Antonioni), *Playtime*.

chemical. According to Flueckiger (2016: 153), this 'echoes the underlying conflict between Giuliana's seeming neuroticism and the superficial shallowness of the society surrounding her'. In this instance, however, as *Il deserto rosso* is a European film, it was not necessarily the constraints of Hollywood that impelled Antonioni to use this aesthetic strategy to express conflicted sentiments.

In addition to its combination of smooth skin and rough surfaces, *Et Dieu… créa la femme* (1956) also contrasts rough natural surfaces with smooth painted ones. These textural contrasts are also combined with colour contrasts, such as saturation and complementary colours: a blue wall and bathroom door contrast with Bardot's orange dress; a blue painted boat stands out against the colour of the sandy beach; the screaming yellow and orange walls in a café are echoed in the jukebox that is lit from within in the same colours [Figs 8.14–8.15].

Figs 8.14 and 8.15 Beauvoir's 'background of fake colours' in *Et Dieu... créa la femme* (FRA 1956, Roger Vadim). DVD: 2000 The Criterion Collection.

Time code: 00:16:40



Time code: 00:48:26

De Beauvoir (1959: 44) links this 'background of fake colours' to the presumed artificiality of the entire film. Vadim not only creates a 'fake' world in which he can display Bardot, but also uses the saturated colours to contrast with the natural, desaturated colours of Saint Tropez itself—a contrast between surfaces and colours that, in a similar way to *Il deserto rosso*, reflects the inner conflict of Bardot's character. *Le mépris* displays a similar combination of contrasts. As mentioned earlier, Godard

(1957: 35–37) enthusiastically praised Vadim and *Et Dieu… créa la femme*, and his appreciation is evident in *Le Mépris*. The film uses similar aesthetic tactics, combining saturated colours with coarse textures and surfaces when showing Bardot's (semi-) naked body. However, since *Le mépris* functions on more of a meta level, commenting on film, the haptic, the erotic and mimicry, it is far from being as sensuous as *Et Dieu… créa la femme*.

A much later European example can be found in Henri-Georges Clouzot's film *La prisonnière* (1968), where it is the inner conflict of the male rather than the female character that is cross-modally emphasised with the help of colour and surface contrasts. José and Stanislav are on a short holiday in Camaret-sur-mer in Brittany. They decide to go for a walk dressed like Breton fishermen, with Stanislav in a red fisherman's smock and José in one in 'survival yellow'. They start to play hide and seek between the buildings of the old village and on the beach among a collection of rotting, abandoned boats with peeling layers of paint. The saturated colours of their smooth smocks create a strong contrast with the coarse textures of the background rendered (again) in desaturated colours,[20] giving the couple an unnatural appearance as if they do not belong in their surroundings. The newness, brightness and 'folksiness' of their bright clothes emphasise the fact that they are tourists playing at being locals.

The sense of artificiality, however, seems to apply more to Stanislav; José appears to be more comfortable in her fake 'authenticity'. This difference in attitude can be related to a gender difference in the representation of characters in colour films. In contrast to male characters, who are usually dressed in blacks, greys or subdued browns, female characters are often shown wearing clothes in saturated colours. Thus, whereas José's bright yellow clothing was not unusual in a 1960s film, Stanislav's outfit in saturated red subverts the contemporary cinematic norms, and the contrast with the subdued colours of the coarsely textured surroundings seems to reflect his inner struggle. It also indicates that the love affair, which is based mainly on sexual passion, feels unnatural to Stanislav. Even though the colours seem to speak of the gaiety and carefree happiness of the moment, these feelings will turn out to be as insubstantial as a thin layer of varnish, and like the paint on the boats and village houses, they will not last. Back at the hotel, Stanislav finds out that José is, in fact, seriously in love with him, and he flees back to Paris [Figs 8.16–8.17].

20 A 1969 Dutch review connects the bright primary colours to the couple's 'honest' romance: 'Het meisje weet zijn gecamoufleerde angst voor 'de vrouw'—een angst die bij hem impotentie heeft veroorzaakt—te doorbreken en er volgt een romance van elementaire, heldere kleuren, gezond geravot en gerèn op een strand en vertraagde lyrische opnamen.'; 'The girl manages to break through his fear of the "woman"—a fear that results in his impotence—and [results in] a romance of elementary, bright colours, healthy romping and running on a beach, and lyrical shots in slow motion' (Visscher, 1969: 15, translation by the author).

Figs 8.16 and 8.17 Saturated colours of slick surfaces in a course environment of subdued colours, creating colour and surface contrasts in *La prisonnière* (FRA 1962, Henri-Georges Clouzot). DVD: 2014 Studio Canal.

Time code: 01:20:05

Time code: 01:21:02

The examples of films we have looked at so far have shown how individual scenes can use surface contrasts in combination with colour contrasts to underline the inner conflicts of one or more of the characters. Vadim's *Barbarella: Queen of the Galaxy* (1968), however, displays a poetic touch throughout the entire film, presenting us with an erotic intertwining of materials, forms, rhythms and movements (Lötscher, 2018: 306).[21] *Barbarella* presents recurring compositions of materials with contrasting surfaces—plastic combined with mohair, metal with fur, rocks with feathers—creating the tension Elsaesser discerned in Sirk's films. This surface tension, which creates conflicting feelings in the viewer through haptic mimicry, is present throughout the entire film and could be defined as its aesthetic core.

21 The film is of course based on the French comic series by Jean-Claude Forest published in *V Magazine* between 1962 and 1964. The drawings, however, were in monochrome and did not have the pop-art appearance usually associated with comic culture (Collins, 2016). Also, the film character Barbarella is less naive. Instead of men seducing her, this Barbarella initiates sexual encounters on several occasions.

Figs 8.18 and 8.19 Barbarella is introduced as erotically charged body in *Barbarella: Queen of the Galaxy* (FRA / ITA 1968, Roger Vadim). DVD: 1999 Paramount Home Video.

Time code: 00:00:52

Time code: 00:04:10

However, there is one moment that is an exception to this pattern. At the very beginning of the film, after Barbarella (Jane Fonda) has stepped out of her plastic space suit, we see her naked body floating through the spaceship. Then, she turns on the gravity and, as she gently falls into the fake fur that covers the inside of the ship, we briefly glimpse her naked breasts—a rare moment in a commercial film. The sight of the soft brown fabric touching Barbarella's skin creates a haptic mimicry of softness against softness. The way the film plays with haptic mimicry through its visual representations of soft surfaces and female nudity is reminiscent of the *Playboy* aesthetics discussed above. As a result, Barbarella (or indeed Fonda herself) is presented as if she were a 'playmate', an erotically charged female body, thus programming the audience to perceive this character in a certain way [Figs 8.18–8.19].

Playmate Barbarella moves through spaces with contrasting surfaces during the rest of the film. She also experiences contrasting moments of extreme pain as well as pleasure. For example, after landing her spaceship on her destination planet, she is attacked by mechanical dolls that bite her with their metallic teeth, drawing blood. The entire scene has a highly sadomasochistic flavour, especially when her bloody wounds and torn tights are shown in close-up [Fig. 8.20].

Fig. 8.20 Biting dolls attacking Barbarella. Time code: 00:18:57

This association is continued when Mark Hand the Catchman and his two black guards catch some stray children in a net and whip them as punishment. But the haptic mimicry in the film changes completely when Mark Hand brings Barbarella to his ice-craft and makes love to her. Barbarella's discovery of sexual pleasure—procreation on Earth in the 41st century is accomplished by taking a pill, which is quite the opposite of the birth-control pill—changes her affective state, a change made visible in the way the warm amber colour of the ice-craft's bed is projected onto Barbarella's hair and skin. After the act, Barbarella sings as she caresses her face and hair. Last but not least, we see her lying naked in a pile of brown furs, creating a haptic mimicry that would again perfectly fit a *Playboy* centrefold, the difference being that she is lying in a construction made out of milky plastic, producing a surface contrast [Fig. 8.21]. The whole structure of the film is built on the alternation of experiences of pain and pleasure, in combination with changes in the affective state of the characters. For example, in the scene in which Barbarella has been invited into the fluffy nest of the blind angel Pygar, who has lost the will to fly, we see her lying in the soft yellow hay, singing and stroking her face with a feather, and we immediately intuit that they have made love. But this time it is Pygar who registers a changed affective state: he is now in the air, circling over the nest, flapping his majestic wings, against a background of the same warm amber-yellow we encountered in the ice-craft [Figs 8.22–8.23].

Figs 8.21, 8.22 and 8.23 Amber after sexual pleasure in *Barbarella: Queen of the Galaxy* (FRA / ITA 1968, Roger Vadim, Technicolor V) DVD: 1999 Paramount Home Video.

Fig. 8.21 Barbarella in furs after she discovered sexual pleasure. Time code: 00:26:09

Figs 8.22 and 8.23 Amber-yellow background after Pygar and Barbarella had sex in his nest.
Time codes: 00:39:58 and 00:40:18

Overall, the film alternates and combines these two types of haptic mimicry: one fits the tradition of soft female skin touching pleasantly soft or smooth surfaces (as in *Playboy*); the other registers pain and suffering. The latter sense is partly related to the so-called 'space age', and the fashions and fads it brought in its wake. For example, Barbarella's costumes, with their hard plastic or metallic surfaces, were clearly inspired by the clothes of fashion designer Paco Rabanne, which referenced the op art movement and the aesthetics of the space age. In February 1966 Rabanne presented a show called 'Douze robes importables en matériaux contemporains'[22] at the hôtel Georges V (Mari, 2018: 42).[23] The title indicates that the materiality of the dresses was intended to clash with the models' skin, emphasising the material's strangeness and hostility to the body. Clearly, Vadim wanted to create a similar effect in his film by putting Barbarella on these strange planets with their rough, unfamiliar surfaces and alternating experiences of pain and pleasure.[24]

22 'Twelve unwearable dresses made of contemporary materials' (my translation).

23 Many sources claim that Paco Rabanne designed the *Barbarella* costumes. Others deny this, saying the costumes were all designed by Jacques Fonteray. The film's credits mention that the costume in the last sequence was inspired by Rabanne's style at that time, which seems to be a strong hint that Fonteray was the sole designer.

24 In a way, the roughness of the surfaces on the unknown planet resembles the surface contrast as it occurs in *Star Trek TOS* (The Original Series). But whereas *Star Trek* contrasts the starship Enterprise with its smooth surfaces and its crew with their soft costumes with the strange planets they visit and their inhabitants, *Barbarella* shows a much more complex use of surface contrasts.

Fonda, writing about *Barbarella* in retrospect, asked herself why she made such a shallow, childish film at a time when it seemed that the world was on fire (Lötscher, 2018: 306)—although the film might be more political than she realised. Arguably, the mixed feelings the film produces resonate with the emotional regime of the second half of the 1960s. This was a period dominated by the 'summer of love' on the one hand and the extreme violence of the Vietnam War on the other. Meanwhile, in 1968, the Paris streets witnessed violent clashes as the students revolted, occupying their universities, blocking the streets, throwing over and burning cars, and throwing bricks at the police. The police reacted with extreme violence. Many students were taken to the hospital, and others were arrested.[25] After several days, what started as student protests only grew into a general strike organised by the French trade unions, bringing the entire country to a halt. Paris was bathing in an intense atmosphere close to civil war and revolution.[26] The student strikes did not only hit France; protests and riots took place all over the world, in a boiling atmosphere of civil rights movements and anti-war protests. Finally, in 1968, Martin Luther King (April) and John F. Kennedy (June) were assassinated.[27] This complex combination of violence, war, revolutionary hope and the desire for peace formed the backdrop to the making of *Barbarella* and is reflected in the film's aesthetic.

In summary, the tension between smooth and rough surfaces seems to have been a rather common aesthetic strategy in European cinema during the 1950s and 1960s—one that, according to Elsaesser, was also used in American cinema to add tension to films otherwise constrained by the taboos and strict limitations of the Hollywood system (Elsaesser, 1992 [1972]). What is missing in *Barbarella* in comparison with *Et Dieu… créa la femme*, *Le mépris* and *Il deserto rosso*, however, is the combination of surface contrasts with contrasts of saturated colours. This might be linked to the simple fact that the fad for bright colours was already fading into the 1970s desire for more natural colour schemes, but it could also be related to the way in which, at the end of the decade, bright colours were highjacked by psychedelia, giving saturated hues certain cultural connotations that are not present in the film.

Porn and the Visceral Materiality of Colour

The increase in nudity in colour appears to have come with an increase in haptic mimicry. Although this could be connected to the 'sexual revolution' that was rolling across the Western world from the late 1950s into the 1970s, these representations of the naked female body were invariably made by men, and as such remain very

25 https://enseignants.lumni.fr/fiche-media/00000000105/la-revolte-etudiante-au-quartier-latin-en-mai-1968.html

26 https://www.lefigaro.fr/histoire/archives/2018/05/11/26010-20180511ARTFIG00263-mai-68-la-greve-du-13-mai-ou-l-union-difficile-entre-ouvriers-et-etudiants.php

27 https://www.historic-newspapers.co.uk/blog/1968-timeline/

much part of a long artistic tradition of presenting the female nude to the male gaze. However, notwithstanding the truth of this observation, my hypothesis is that film in the 1960s, with its increase in colour, was simultaneously opening up more to the female eye and to the subjectivity of female sexual experience.

Although 1960s American film culture became more open to sexuality, showing more female flesh, including breasts, sex remained an off-screen suggestion until rather late into the decade. Portrayals of sexual acts and orgasms did not become part of mainstream cinema; they remained limited to pornography and experimental cinema. As Williams (1989) lays out in her historical overview of pornographic film, early hard-core porn was silent and filmed in black and white. These so-called 'stag films' presented the 'unstaged, unfaked mechanics of sexual action'. Williams (1989: 48) compares the 'truth' of such films to the practice of making photographic records of the 'hysterical' convulsions of female patients at the Hôpital de la Salpêtrière, under the supervision of Jean-Martin Charcot, as well as to 'Freud's involuntary slips of the tongue and verbal associations', which she describes as 'techniques of confession'. Such pornographic confessions could only be visualised in ejaculation (or 'money') shots,[28] solely representing the male orgasm. This moment was considered as 'the mechanical "truth" of bodily pleasure caught in involuntary spasm; the ultimate and uncontrollable [...] confession of sexual pleasure in the climax of orgasm' (101).

Stag films were shown illegally to exclusive, all-male audiences. Towards the end of the 1960s and the beginning of the 1970s, feature-length, legitimate, X-rated pornographic films were introduced into special X-rated cinemas that were open to both men and women. These changes in accessibility created a new 'porn culture', enabling couples to go to see these films together. This resulted in 'men and women waiting in line to see a hard-core porn film as a first date' (Allyn, 2000: 5), although Cybill Shepherd's reaction when she is taken to a porn film in Martin Scorsese's *Taxi Driver* (USA 1976, Martin Scorsese, Metrocolor) indicates that this was not normal practice in all sections of society. In addition to drawing in new audiences and creating a new porn culture, these films were now shot in sound and colour. In their book *Dirty Movies* (1976), Al Di Lauro and Gerald Rabkin criticise this shift, praising the stag films precisely for their lack of sound and colour, which supposedly increased the 'raw "reality" of the form'. In their opinion, the absence of sound and colour made these films more realistic than the new legitimate films that had begun to take their place (Di Lauro and Rabkin cited in Williams, 1989: 58).

The first pornographic films in colour to be shown in American cinemas were presented as sex-education documentaries. Williams (1989: 97) writes that the first two films to show hard-core material in public movie theatres were 'two documentaries about Denmark and its recent legalization of mass-produced visual pornography: *Sexual Freedom in Denmark* (John Lamb, 1970) and *Censorship in Denmark: A New*

28 The shot showing ejaculation in 1970s feature-length commercial porn films was commonly known in the jargon as the 'money shot' (Williams, 1989, p. 94).

Approach (Alex de Renzy, 1970)'. Both films, although set in Denmark, were made in the US. However, their educational aura enabled the exploitation cinemas in which they were screened to avoid prosecution as the films could be presented as 'investigative documentaries' about Danish porn culture. As Williams (1989: 97) points out, '[b]oth films took immediate and clever advantage of the "redeeming social importance" clause of the 1966 [US] Supreme Court rulings', which ruled that nudity and sex could be allowed in a film if their presence could be shown to have a social purpose. Another example of a pseudo-documentary containing explicitly pornographic scenes is *Ur kärlekens språk* (The Language of Love) (SWE 1969, Torgny Wickman). This 1969 Swedish film was released in the USA in 1971.

However, not only did changes occur in explicitly pornographic films, but other feature films also started to show the sort of racy themes and visuals that the Hays Code had forbidden:

> The evolution of the motion picture, in particular, reflected and encouraged the revolt against reticence. Between 1967 and 1969, movies underwent a marked transformation as barriers against four-letter words, nudity, and sexual subject matter came tumbling down. (Allyn, 2000: 127)

This is something we have already noted in European films of the time. Two early mainstream Hollywood films that included shots of bare breasts were *The Graduate* (USA 1967, Mike Nichols, Technicolor V) and *The Trip* (1967). *The Graduate* contains two frontal shots of Mrs Robinson's breasts, although the audience hardly sees these shots as they are very brief and are edited into a subjective sequence representing Benjamin's confusion when Mrs Robinson tries to convince him to have sex with her by showing herself to him, naked. In *The Trip*, full-frontal nudity occurs during a scene in a nightclub in which body-painted, topless go-go dancers perform to the music of a band [Fig. 8.24].

Fig. 8.24 Topless go-go dancers in *The Trip* (USA 1967, Roger Corman), DVD 2007 Metro-Goldwyn-Mayer Studios. Time code: 01:01:18

Before the representation of sex in cinemas became acceptable, thanks to the use of a documentary aura that helped cast certain films as 'socially important', other forms of cinema had already crossed the line of sexual taboo. For example, 'exploitation films' during the 1950s covered topics the Hays Code deemed unacceptable for cinema, such as drug addiction, mixed-race sexual relationships, abortion, and many other contemporary taboos (Williams, 2008: 88). Over the course of time, these films would become increasingly more suggestive. Another related genre was the Blaxploitation film, which emphasised the black body and defied the taboo against sex between black men and white women (92–104). Finally, avant-garde film had started experimenting with the depiction of 'carnal knowledge'. Like stag films, the results of these filmic experiments were presented at private screenings, but they also found their way into museums, galleries and other art spaces. In addition to the forbidden practice of showing sex on screen, these films were often concerned with cinematic experimentation: they often used 'flicker effects, fast cutting, superimposition, or the intentional lack of focus' (104) to create a surreal, subjective effect relating to the more subjective experience of sex, as seen for example in *Flaming Creatures* (USA 1962–1963, Jack Smith), *Christmas on Earth* (USA 1963, Barbara Rubin) and Andy Warhol's *Couch* (USA 1964, Andy Warhol). Like the stag films, these experimental films were all shot in black and white. What is especially noteworthy, however, is the fact that female directors who worked within this genre, such as Barbara Rubin, also started to make pornography representing a female perspective.

An exception to the dominance at this time of black and white depictions of explicit sex was the film *Loving* (USA 1957). Director Stan Brakhage explained that he experimented with colour as it helped him show (again) the subjectivity of the sexual experience: 'In Loving (1957), a couple make love in the sun and their optic system flares—it's really the nervous system's ecstasy—in oranges and yellows and whites'.[29] We have already encountered the idea of using colour to represent subjective experience; however, in the case of the representation of sexual activity or orgasm, the colours are not deployed to show how colour can control the human body and mind, but to represent the mind and body relinquishing control. Brakhage achieves his effects by breaking down the colours of the chromogenic film material into magenta, cyan and yellow, fragmenting the 'normal' constellation of the film material to reveal its materiality and simultaneously mimic our subjective perceptions of colour. During the 1960s, this technique—breaking down the colours of an image into the separate dyes used in the chromogenic Eastmancolor material—began to appear in other films such as *West Side Story* (1961), where the effect is used to illustrate the transition from Maria's room to the dance floor. Vera Chytilová also uses the effect to represent the subjective experience of drunkenness in *Sedmikrásky* (1966), as well as to indicate moments of transition: every time the Maries bring another poor

29 https://letterboxd.com/film/loving-1957/

man to the train station, we see the tracks displayed in the split trichromacy of the chromogenic material.

Until the mid-1950s, Brakhage 'was making black and white "trance films" that [...] were characterized by their existential focus on a psychologically splintering protagonist' (Osterweil, 2014: 152), but during the second half of the decade, his films became more corporeal, which implied a shift to colour film material. At the same time, he developed an interest in the role of body in the process of visual perception. *Loving* is a perfect example of this shift: the film is a photographic representation of a couple making love and shows how the excited nervous system influences and deforms the perception of colour. The connection between sex and colour was used in later films such as *Barbarella*—for example, in the scene in which Durand Durand tries to kill Barbarella by seating her in a colourful device called the 'Exsexsive Machine' that supposedly incites fatal orgasms. While she is in the machine, we can see Fonda's facial expressions indicating her orgasmic experience—according to Williams (2008: 169), this is the first depiction of a female orgasm on the American screen.[30] The lyrics 'Barbarella psychedelia [...] dazzle me with rainbow colors [...]' of the opening song to the film that accompanies the famous weightless stripping scene similarly connects colours to sex.[31] A more abstract correlation between sex and colour can be found in *The Rocky Horror Picture Show* (USA 1974, Jim Sharman), in which Janet Weiss is lit with all the colours of the rainbow as she experiences an orgasm, accompanied by the song 'Toucha, toucha, toucha, touch me'. *The Trip* also uses colour to depict sex as a subjective experience in a scene showing the male protagonist, in the grip of an LSD hallucination, imagining himself in a threesome. The three bodies involved are covered in colourful light projections with moiré patterns and kaleidoscopic insect eye effects frequently used in psychedelic culture.[32]

It is interesting to analyse how this connection between colour and surface contrasts, materiality and hapticity found its way into experimental film. In *Separation* (UK 1968, Jack Bond), experimental colours directly relate to intimacy and nudity. The film is in black and white; however, it contains colour inserts in which the main character, Jane, is shown alongside projected images, which either appear on a white screen above her bed or on her naked body [Figs 8.25–8.26]. These 'colour effects' were created by Mark Boyle, whose installation art included work such as *Son et Lumière for Bodily Fluids and Functions* (UK 1966, Boyle and Hills), a piece in which Boyle and his wife, artist Joan

30 Linda Williams explains that for hard-core porn, the female orgasm was somewhat problematic, because it is 'the secret place of a woman's pleasure', which is invisible to the camera. Besides, not much was known about the female orgasm. Masters and Johnson's research on 'female orgasm' in 1966 is generally regarded as the starting point of the erosion of the myth of male sexual dominance and female passivity (Williams, 1989: 49, 171).

31 The Bob Crewe Generation (Ft. Glitterhouse)—Barbarella, https://genius.com/The-bob-crewe-generation-barbarella-lyrics.

32 See the Coda for a more elaborate discussion of this scene.

Hills, projected images of bodily fluids onto the wall and their own bodies.[33] One of their pieces showed a simultaneous view of the inside and outside of the body through a combination of moving images and light shows. The colour effects in *Separation* are based on this type of artwork, and the two taboos, images of bodily fluids and the naked body, meet in these colourful inserts.

Figs 8.25 and 8.26 The colour effects in *Separation* (UK 1968, Jack Bond and Mark Boyle) colourful moving projections on Jane's body, similar to Boyle's projection art. DVD: 2009 BFI.

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However, the best example of the combination of materiality, colour and sex can be found in *Fuses* (USA 1964–1967) by Carolee Schneemann [Figs 8.27–8.28]. Schneemann was the wife of one of Brakhage's old high-school friends, composer James Tenney, with whom she performed in Brakhage's *Loving*. According to Ara Osterweil (2014: 152), both artists developed similar theories, indicating their mutual influence on each other. Both rejected the ocularcentrism of Western painting, which limited the expansion of vision by confining it within the constraints of compositional perspective, and both

33 See: https://www.boylefamily.co.uk/boyle/texts/journey2.html

believed that vision could not be separated from the body; it was an embodied activity and therefore always corporeal. Schneemann materialised these ideas on tactility and vision in 'painting-constructions', which were composed of materials such as cloth, paper, wood, nails, glass and meat, in addition to paint. But most of all, she used her own body as an extension of her painting, bringing back the flesh which 'had been rendered taboo by the Cartesian privileging of cerebral subjectivity' (144).

Figs 8.27 and 8.28 Schneemann's *Fuses* (USA 1964–1967) is a perfect example of how materiality, colour and sex are presented together, https://vimeo.com/512695159

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Schneemann's ideas on embodied vision included the problematisation of her position as a woman in a male-dominated art world. This impelled her to reflect on the way the embodied vision is gendered—if vision is considered to be an embodied activity,

the female 'eyebody' has to be different from the male one. Due to this revelation, Schneemann came to the conclusion that Brakhage's perspective on her body and the way he represented her in his films could not be right.[34] In addition, as Williams explains, the cinematograph had created a new social apparatus:

> And this social apparatus is ultimately what constructs women as the objects rather than the subjects of vision, for it is what places women in front of the camera and what determines the repertoire of activities in which they will engage. (Williams, 1989: 45)

Williams draws a line from Edweard Muybridge (whose seminal moving images of locomotion showed men in active pursuits and women in passive roles) to stag films, which put the female body on display for a male audience, and money shots, representing the male orgasm, that were built on the belief in photographic indexicality. In reaction to the patriarchal teleology of pornography, Schneemann wanted to show sex and sexual experience from her—female—point of view, and the result was *Fuses*.

Over a period of three years, Schneemann filmed herself and her boyfriend making love, the sex scenes alternating with shots of their cat and of Schneemann herself coming out of the ocean or sitting by a window. *Fuses* has generated several scholarly discussions over the years, mainly focused on its presumed female point of view that can be identified by the following novel characteristics. Firstly, the pornographic shots are filmed with either a hanging camera or a camera fixed in ways that capture an unusual perspective that is meant to represent the 'neutral' view of the cat, Kitch, disrupting the usual male gaze. Secondly, as Kathleen Bühler (2009: 101) explains, the film is structured in spirals and circles, mimicking the female experience of pleasure. Thirdly, Schneemann's editing turns female genitals into male ones, merging the gendered bodies into one another. This is illustrated by how '[b]inary oppositions dissolve as warm and cool colors merge in the frame' (Osterweil, 2014: 157). Fourth, the film shows numerous shots that create haptic visuality such as images of cat fur, hair, textiles and skin. A fifth remarkable characteristic is that Schneemann's film shows the female orgasm, which until then was hardly a priority for either stag films or experimental porn, which was generally made by men. And finally, we see the couple touching, caressing, and holding each other, creating a haptic mimicry unlike that usually found in pornographic films. This could be interpreted as advancing a female perspective, particularly if viewed through the lens of the feminist philosophy of Luce Irigaray, who argues that the female erotic has a stronger tactility than the male variant (Bühler, 2009: 102).

34 This remark alluded to Brakhage's film *Cat's Cradle* (*USA 1959*) in particular. Apparently, Schneemann was upset because Brakhage made her wear an apron, which she considered to be the ultimate patriarchal act.

It appears that flesh touching flesh supersedes all other forms of haptic mimicry, and it is precisely this type of imagery that Sobchack discusses in reference to a fragment from *The Piano* in which we see Ada playing for Baines, who lies on the floor underneath the instrument:

> I 'objectively' watch Baines—under the piano and Ada's skirts—reach out and touch Ada's flesh through a hole in her black woolen stocking. [...] I [...] felt an immediate tactile shock when flesh touches flesh in close-up. (Sobchack, 2004: 66)

And, indeed, watching flesh upon flesh appears to be one of the ultimate visual instigations of a haptic experience in a film. As philosopher Maurice Merleau-Ponty described in 'The philosopher and his shadow' (1964: 166), 'touching my own hand is both an act of touching and being touched, resulting in the ultimate confusion of subject and object, perceiver and perceived'. This is precisely what happens when we see Baines' finger touch Ada's leg: we experience the experience of touching and being touched through both Baines and Ada, through the finger and the leg, in a confusion of these haptic mimicries. A similar confusion is created in *Fuses* when we watch the lovers simultaneously touch and being touched.

Finally, Schneemann creates a strong haptic dimension in *Fuses*, mainly by adding all kinds of materiality to the film after it was developed: she painted it, baked it, burned it, scratched it and exposed it to the weather. In the end, '[t]he heavily worked film appears as an aggregate of color, texture, and figurative imagery that moves in a nonlinear fashion' (Middleman, 2018: 50). The film shows its materiality—its 'body' and 'skin'—and thus its haptic dimension, or as Bühler (2009: 104) puts it, 'you feel the film material'. As a result, it presents us with 'images of bodies "writhing underneath" the "rippling contours" of the film's skin [that] appear before being submerged again in dark waves of pigment' (Osterweil, 2014: 159). This implies a constant alternation of the spectator's attention between the carnal pornographic image and its actual materiality. Thus, not only do the genders become fluid, but so does the celluloid, with its scratched and burned surface with the paint layered on top of it. All these elements flow into the flesh of the bodies engraved in its gelatine layer. The colours on the surface of the photographic image appear like fireworks in the film: exploding dots of colour or rainbows moving across the bodies of the copulating couple (157). As in the examples mentioned above, the colours in Schneemann's film are of an abstract nature, potentially representing the subjectivity of the female sexual experience.

Besides making *Fuses* more material and haptic, the layers of paint on the gelatine film material also decrease the optical visuality of the image. As Laura Marks (2002: 3) explains, '[t]he difference between haptic and optical visuality is a matter of degree [...]. In most processes of seeing, both are involved, in a dialectical movement from far to near, from solely optical to multisensory'. Schneemann also used other techniques to obscure visibility and so increase the film's haptic dimension, including grainy images, shots that fluctuate in and out of focus, overexposure, and crooked framing. Jennifer Barker (2009: 24) argues that it is this emphasis on the surface more than

depth that makes the film exclusively feminine:[35] it forces the viewer's eye to caress or touch the image, rather than encouraging the sort of 'penetrating gaze' so characteristic of male porn. Yet, at the same time, by obscuring the visibility of the photographic image, the film actually forces the viewer to try to penetrate it in order to decipher the representation. In my opinion, this could be interpreted as mimicking the frustration of climactic failure that can also occur during sexual activity—not necessarily a strange thought if we remember that many women continue to fake orgasms today, let alone during the 1960s.[36]

It appears, then, that occasionally the increase of materiality in a film's representation was accompanied by an increase in the presence of the photographic or filmic material—the skin of the film—boosting the appeal to the embodied viewer, whose eye is forced to dwell on the surface of the material, consisting of grain and colour dyes. The fact that these images were in colour increased the effect of the surface materiality of both the characters' skin and of the filmic material. As Barker comments:

> [There is] a visceral resonance between film and viewer that is closer than that which occurs at the skin and the musculature, because it moves through the skin and the musculature to get here. As I will show, the viscera are awakened precisely through the film's appeal to those more accessible dimensions of the body. (Barker, 2009: 123)

Thus, in contrast to the earlier stag films, later representations of sexuality and sensuality included much more creative cinematic tricks in order to produce a 'female' subjectivity: for example, the use of haptic mimicry supported by natural colours that emphasizes the appearance of specific surfaces, such as female skin, as seen in both *Et Dieu…* and in *Cleopatra*. Colour was also used as an indicator of the experience of the (female) orgasm, bringing subjectivity into the filmic image in addition to the plainly mechanical part of sex. Whereas the latter can be shown through visual representation, the subjective experience cannot and therefore demands a more creative approach.

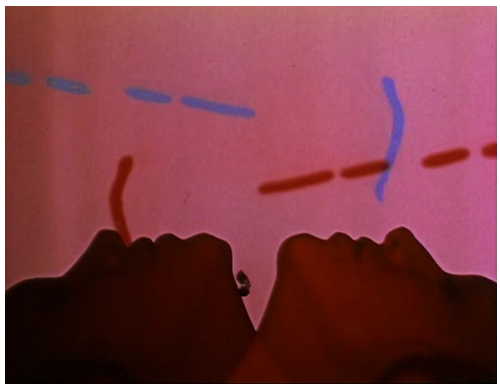
These experimental colour techniques found their way into the pornographic colour feature *Behind the Green Door* (USA 1972, Artie and Jim Mitchell), this time to illuminate the money shot. The shot is shown in slow motion; the filmmakers used double exposure and solarisation techniques to create a variety of psychedelic

35 The turn to affect during the 1990s is often connected to feminist film theory and to *The Piano* (*1993*), a film that was considered emblematic of both, or as Dana Polan (in Koivunen 2015: 97) states, as 'one of the supreme signposts of the art of feminine sensibility'. And indeed, during the 1990s, a critical re-orientation of feminist film theory occurred in which, as Koivunen (2015: 98) explains beautifully, 'the key concept of gaze was reconceptualized as touch'. Interestingly, as the above examples of *Sedmikrásky* and of Carolee Schneemann's *Meat Joy* and *Fuses* show, feminist artists from the 1960s also turned towards the haptic and touch, and used it as one of their major strategies to break through the conventions and norms of female behaviour.

36 Schneemann was not alone in using these technologies. Stan Brakhage had already started to use similar techniques to flatten the film image, emphasising the surface of the material in similar ways.

colours, turning the moment into something very close to an experimental-film experience. Similar to Brakhage and Schneemann, the colours indicate the subjectivity of the sexual experience. As previously mentioned, money shots have a strong relationship to the 'indexicality' of the photographic image. The fact that the shot is shown in slow motion increases the visibility of the ejaculation; however, it also stretches the objective time it takes for the semen to be ejaculated so that it also represents the subjective duration of the experience of an orgasm. Similarly, the techniques of repetition and the aesthetics of the experimental colour effects add the corporeal and subjective experience of orgasm to its objective photographic proof. In a way, this combines the female subjective side of the sexual experience with the male 'indexical' and 'objective' representation of ejaculation as indicative of the male orgasm[37] [Figs 8.29–8.30].

Figs 8.29 and 8.30 Experimental colour effects add the corporeal and subjective experience of orgasm to the objective photographic proof of ejaculation in the money shot of *Behind the Green Door* (USA 1972, Artie Mitchell; Jim Mitchell). DVD: 2004 Mitchell Brothers Film Group.



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Interestingly, 'haptic mimicry' is not exclusive to colour film of course. As we saw in the analysis of *Sedmikrásky*, the representation of food in black and white, can produce a very strong affective effect of, for example, disgust. However, colour in relation to 'haptic mimicry' does appear to have been used to increase the effect of subjectivity, strong affective experiences of pain and pleasure, and tension through contrasting surfaces and colours. Finally, the increasing dominance of colour in the cinemas in combination with the emancipation of women, seems to have found its way into pornographic film with a shift from black and white stag films for an exclusive and male audience, to pornography in colour shown in a presentation context that was much more open to a female audience.

37 A more recent example of the portrayal of sex in a multicoloured, saturated colour scheme can be found in *Amer* (FRA / BEL 2009, Hélène Cattet; Bruno Forzani): the image of the man experiencing orgasm is fractured into rainbow colours. What is most interesting, however, is the fact that the male orgasm is now represented with the signifiers of female orgasm—colour and a fractured image—with none of the characteristics of the (male) money shot.

Coda: Hallucinating Colours

> Words [...] are static, whereas the psychedelic experience is fluid and ever-changing. (Leary, 1964: 11)

So far we have seen how the 1950s and 1960s discourses on feelings and colours were embedded in the colour cultures and emotional regimes of the times. I explored the various ways we perceive the human body in relation to colour, starting with the eye and the way it is 'set in motion' by external stimuli, revealing the perception of colours as one rich in contrasts. Then, in the second part of the book, I discussed the belief, widely held in the 1950s and 1960s, that colours have a direct effect on the body, and as a result create feelings, moods and atmospheres. Finally, I investigated the cross-modal connections between the senses, which enable colour to enhance the bodily reactions of taste (pleasure or disgust) and touch.

I studied the use of feelings and colours in film through the implicit durées or time layers that showed relatively large variations, depending on the elements under scrutiny. This approach helped me to distinguish the more long-lasting ideas that were either based on the biology and physiology of the senses and perception, or on other discourses equally slow to change that also produced knowledge and ideas about the characteristics of colour perception. These biological elements or longer-lasting cultural beliefs frequently found their way into colour films, and I drew attention to several instances in which they appear as discernible aesthetic patterns and motifs, although the frequency, intensity and aesthetics of these occurrences vary from one period to another. To better understand their impact and function, I explored these patterns and motifs using the wider perspective of the visual and colour cultures of the 1950s and 1960s, zooming in on those that were most consistently manifest in films of that period. As a result, we saw that the flashing, blinding lights that appeared in some of these films were part of a larger visual culture that, at its peak, included the phenomena of flashlights and atomic tests, making their affective impact on contemporary audiences more intelligible, and maybe even palpable. Another example was the use of coloured lights in many of the horror films of the time. This characteristic becomes much more logical when viewed from the perspective of 1950s and 1960s discourses on colour therapy, which claimed that coloured lights affect the human organism. Finally, the awe and shock that audiences may have felt seeing a full colour image of Brigitte Bardot naked in the film *Et Dieu… créa la femme* in 1956, becomes more comprehensible once we take into account the ongoing transition from the dominance of black and

 https://doi.org/10.11647/OBP.0380.12

white cinema towards one that was increasingly colourful. Thus, by analysing the films and their aesthetic particularities in the cultural context of the time, I was able to gain a greater insight into and understanding of the way in which their audiences might have experienced emotions and embodied reactions when viewing them.

To conclude my study, I present the phenomenon of hallucinations as a particularly compelling example of the way Braudel's three durées can be used to study the history of feelings and emotions. Hallucinations, when considered in relation to colour in film, give us a definitive perspective on how colours and the body can interrelate in the most direct way, as an internal process, without the stimuli of light first 'stirring up' the eye. These sorts of colour perceptions are caused by our imagination and can occur for example in a state of psychosis or with the help of psychedelic drugs. The depiction of such hallucinatory colours is one of the characteristics of the cinema culture of the period, reaching a high point in the second half of the 1960s when psychedelic culture was at its peak.

Hallucinations derive from an overly excited nervous system operating in concert with the habitus (the cultural inscriptions in the human body that intertwine with these imaginary appearances). The clear combination of two embodied practices in the creation of colour perceptions make this the perfect example to revisit Fernand Braudel's historical layers or durées (see Chapter One) and show how and why they have been an especially helpful tool in my quest to establish an understanding of such an elusive topic as the interactions between embodiment, feelings and colour film. Whereas, throughout the book, the layers remained more of an implicit theoretical framework through which I addressed this complicated subject matter, in this Coda I will bring them to the surface. This means that the moments of transition from one layer to another become more visible, revealing in the process that the distinctions between them are often gradual and blurred; they are not clear-cut crossing-points. The analysis as such will move through the temporalities, from the temporality of the 'event' through to the cultural context, and from there to the temporality of the 'quasi-immobile' biology of colour perception.

The Event: Films

Since this study has colour cinema as its main topic of interest, the level of the event logically started with the films themselves. In order to delve deeper into the cinematic depiction of hallucinations in films in the 1950s and 1960s and their relationship to colour, I will look at a number of examples, using Roger Corman's *The Trip* (1967) as a starting point. This film was intended, almost entirely, as a depiction of LSD-induced hallucinations, and is therefore somewhat emblematic of the topic.

The Trip centres on Peter Fonda in the role of Paul Groves, a director of advertising films, who is going through a painful divorce. In an attempt to heal himself, he decides to take LSD in a therapeutic setting. The film focuses on the trip Paul experiences.

Another actor involved in the film was Jack Nicholson, who apparently wrote the scenario, although Chuck Griffith is also mentioned as the author of the 'original' script (Gray, 2004: 87–88). Both Nicholson and Griffith had taken LSD and were writing from experience. Dennis Hopper, another actor who dabbled in LSD, appears in the film as a hippy passenger in Paul's real life and in his hallucinatory trip.[1]

In fact, according to Corman, everyone involved in the production had taken LSD, including Corman himself, who tried it specifically for the film (Nasr, 2011: 88). According to sources recalling Corman's experience, he travelled to a picturesque seaside cliff in Big Sur, California, with his assistant Frances Doel as a 'guide' (someone who does not take the drug him/herself but is there to watch and assist the hallucinating individual). It appears that Corman had a magical experience, seeing spellbinding images. However, because he felt he obliged to give his audience the full story, he also talked to those who had experienced 'bad trips', and included their testimonies in the film (Aleksandrowicz, 2016). To transmit these experiences and testimonies through the medium of film, Corman 'relied on hallucinatory visual images in dazzling colour' (Gray, 2004: 87–88).

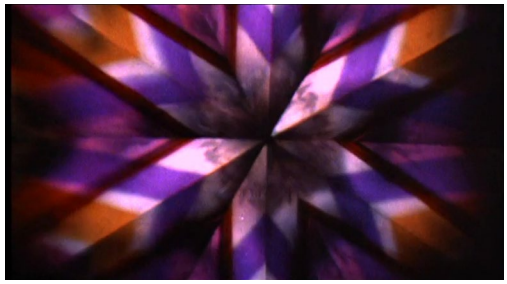
In the narrative exposition at the start of *The Trip* we are introduced to the main character, Paul (Fonda), his wife, Sally (Susan Strasberg), and John (Bruce Dern), who is there to guide Paul through his LSD experience. In passing, we encounter (mostly stoned) figures who will re-appear in Paul's hallucination, such as the archetypical hippy, Max (Hopper), and the beautiful blonde, Glenn (Salli Sachse). Towards the end of the film's opening sequence, Paul and John enter an apartment decorated in psychedelic colours, where John gives Paul the LSD and invites him to lie down on a couch, covering his eyes to help induce the psychedelic mode of perception. After a moment of darkness, when all we hear is the sound of Paul's beating heart, we start to hear music. At the same time, multicoloured abstract shapes appear, following each other in rapid succession, as in a kaleidoscope.

Soon after this first experience of abstract colours, what has been called the 'rainbow-love-scene' begins. This lyrical scene starts with the image of a flowery pink cloth dropping to the floor, unveiling the back of Paul's dark-haired ex-wife as she walks towards him as he lies on the couch. Coloured patterns dance over their bodies as they start kissing. The camera moves to the right, panning across the room to a fireplace covered in multicoloured projections of moiré patterns. It then moves back to the bed where we suddenly see a blonde woman sitting next to the couple, watching them make love. The film cuts to a series of shots of the embracing couple from various angles, focusing on different parts of their bodies, which are covered in shifting psychedelic colours and patterns, accompanied all the while by pulsing music. Throughout the scene, the two women repeatedly alternate, taking one another's place. Towards the end, the frame is split into several parts that circle

1 Nicholson, Fonda and Hopper also appeared together in Hopper's film *Easy Rider* that was released two years later in 1969.

around each other, giving the impression of a kaleidoscopic insect-eye view of the scene. The shifting colours playing over the moving bodies, combined with the pulsing soundtrack, render the sequence both sensual and erotic. The coloured light projections on the embracing bodies contain patterns that echo those of the earlier kaleidoscopic abstract images. Then, towards the end of the scene, the frame splits into four or more different parts, resulting in a multiplication of moving images, giving the kaleidoscopic effect of seeing the world through an insect's compound eyes [Fig. coda.1-coda.2].

Figs coda.1 and coda.2 Kaleidoscopic hallucinations in *The Trip* (USA 1967, Roger Corman) DVD: 2007 Metro-Goldwyn-Mayer Studios.



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With these and similar colourful, abstract, kaleidoscopic, dreamlike and sensually erotic (but also occasionally horrific and scary) images, the film tries to reproduce the experience of an LSD trip for a 1968 audience. This effect was anticipated by the film's poster, which referred to the intense colours as 'psychedelic', directly connecting its colours to LSD-induced hallucinations.[2] To see if the film did manage to have this effect, I briefly investigated Dutch newspapers from 1968 and 1969, and found a number of interesting critiques of *The Trip*. Most of the reviewers not only described the colours of the film as extraordinarily beautiful and 'crazy', but also claimed they indeed represented the LSD experience quite faithfully (Bertina, 1968: 9; Meyden, 1967: 15; Doolaard, 1968: 17; 'TRIP met LSD', 1968: 21; 'The trip. LSD-reis', 1969: 14; Berge, 1968: 13).[3]

One critic in particular also praised the film laboratories for their work in creating such colours (Doolaard, 1968: 17). In fact, in the 'rainbow-love-scene' with its coloured light projections, *The Trip* came close to the limits of what was possible with the colour film technology of the time. The film's special effects technician, Bob Beck, wrote an article in 1968 in *The American Cinematographer* on the making of the film. In this, he dwells extensively on the multicoloured love scene, discussing the technological problems they encountered when shooting it. The light sensitivity of the film material

2 For the film poster, see IMDB: https://www.imdb.com/title/tt0062395/mediaviewer/rm3665102336

3 All clippings were found in the amazingly rich digital newspaper archive of the *Koninklijke Bibliotheek* (the Royal Library of the Netherlands) called Delpher. See: https://www.delpher.nl/

available at the time was too low to film the gloomy atmosphere created by the projection of the coloured lights onto the moving bodies, and there was a risk that when creating the 'general mood effect' there would not be enough light to also create the 'projected psychedelic effect'. Beck explains:

> Even with extensive modifications, the amount of light on the subjects was only around 24-foot candles, which meant that our film, Eastman Color Negative, had to be processed to an ASA rating of 200 by the Pathé Laboratories. (Beck, 1968: 176–79)

The Eastmancolor 5251 negative stock that was available in 1967 had a light sensitivity of 50 ASA, which meant that the amount of pushing needed for exposure, although not extreme, was significant enough to potentially increase the visibility of the grain in the photographic image. The result is a relatively dark though still colourful image, full of movement and fluidity. Because of the increased graininess, the images may have become even more abstract than was originally intended.[4]

Even though the filmic portrayal of hallucinations occurred over the entire period we investigated, the 1960s showed an increased interest in this type of colourful imagery. Films from this decade that particularly stand out include *Marnie* (1964); *Rosemary's Baby; Barbarella: Queen of the Galaxy* (1968); *2001: A Space Odyssey; Psych Out* (Richard Rush, 1968), but also lesser-known films from the semi-professional field, such as *Hallucinations: Images du monde visionnaire* (Éric Duvivier, 1963) and *La perception et l'imaginaire* (FRA Duvivier, 1964) and of course B-movies such as *The Trip*.

The particular interest in such dreamlike imagery was obviously related to the boom in LSD use at the time, which even influenced the way films without such connotations were experienced. One of the better-known examples of this is *2001: A Space Odyssey*, which famously ends with a colourful sequence in which we witness astronaut Dave Bowman's experience of death and subsequent rebirth in an astral form (Trumbull, 1968: 452). Released in 1968, the film quickly drew large numbers of so-called hippies into the cinema, and a year on, the scene became known in these circles by the epithet, 'the trip' (Trumbull, 1969: 998). The fact that it was released at the highpoint of psychedelic culture almost certainly affected the way this colourful abstract scene, which was not intended to depict an LSD trip, started to be experienced as one by its spectators.

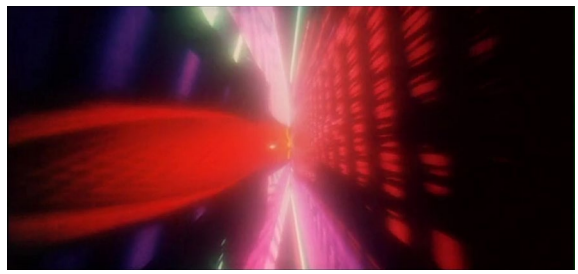
However, although the hallucinatory inferences of the scene were unintentional, the form and aesthetics of the film itself were inspired by psychedelic culture, specifically mirroring the ways in which it had begun to appear in experimental cinema. The sequence of abstract images and sounds that occurs immediately after the corridor scene in particular show great similarities to the work of Jordan Belson. In fact, it resembles his work so much, that the critic Pauline Kael (1969) did not hesitate to call it theft. Belson was known for having used peyote and other hallucinogens, which undoubtedly influenced his films. Since the *2001* sequence was inspired by Belson's

4 This might explain why many reviewers seemed to miss the fact that Paul is making love to two women instead of one (Bertina, 1968; Powell, 2012).

work and his hallucinatory visions, it may not be surprising that spectators interpreted it as the depiction of a psychedelic trip (Youngblood, 1970: 159).

The special effects for this sequence were indeed strongly influenced by experimental films of the time. The film's special effects specialist, Douglas Trumbull, himself acknowledged that he was inspired by the work of experimental filmmaker John Whitney, 'who, with his sons, has done some incredible things in combining completely abstract optical effects with computerized graphics' (Trumbull, 1969, p. 998). He was particularly impressed by Whitney's use of slit-scan technology, and used the technique in the scene that gives the impression of fast-forward movement through a corridor of abstract coloured images [Fig. coda.3]. However, whereas Whitney moved the slit across the frame to produce abstract coloured images, Trumbull gave the images depth by moving the camera towards the slit while photographing the moving images behind it (Trumbull, 1969: 998–99; Youngblood, 1970: 151–56). The result is a sequence full of highly colourful movement, giving the impression of flying with great speed through a corridor located somewhere in space. This is intercut with still images of Bowman's face.

Fig. coda.3 The corridor scene in *2001: A Space Odyssey* (USA 1968, Stanley Kubrick) was experienced as a trip by the audiences. DVD: 2001 Turner Entertainment, Warner Home Video.



Time code: 01:58:39

In all, it is clear that these types of moving images, which I have classified at the level of events, are also part of the visual and colour culture of the period. This shows just how blurry and indistinct the differentiation between the layer of events and the layer of the cultural context actually is. Hence, the main research problem here is to determine what part of the cultural context, manifesting itself as a constellation of discourses, should be analysed at the layer of events.

The Longue Durée: Cultural Contexts

This brings us to the layer of cultural contexts, described as the longue durée in Braudel's study of the Mediterranean. Interestingly, this layer can (and should) be divided into several sub-layers of different durées, conforming to the complexity of social practices, beliefs and discourses that form the overall cultural context. In this

book, various sub-durées rose to the surface due to their important role in the topic under investigation. As I mentioned in Chapter One, one such sub-layer started around the beginning of the nineteenth century and continues to remain dominant to this day. This durée or layer is similar to the Foucauldian episteme of modernity. Foucault (1994 [1970]: 167) describes the episteme as the slowly changing constellation of discourses that 'defines the conditions of possibility of all knowledge, whether expressed in a theory or silently invested in practice'. The episteme of modernity is characterised by the idea that knowledge production is the result of the subjective activities of perception and understanding. Time and again, the case studies have shown its importance for how colours have been treated and conceived, since the interest in the subjectivity of perception necessarily implied that colours should also be studied in light of this belief. The conviction that colours are created by and within the human body then bled into more spiritual assumptions about colour, such as colour therapy and psychology, that are also part of this episteme. As we have seen throughout the book, these beliefs emerge in colour film practices in various ways, and these variations can be traced back, in part, to the shorter durées or contexts in which the films were made and seen.

One of these shorter durées was that of colour control, colour cards and colour psychology, all of which were promoted in the work of self-styled 'colour consultant' Faber Birren. Another such layer or durée was that of psychedelic culture, which began as a reaction to the rules and regulations of the earlier period of control. Psychedelic culture started hesitantly around the late 1950s, reaching its full strength during the second half of the 1960s. As I have already mentioned, *2001: A Space Odyssey* was rooted in this psychedelic culture; *The Trip* however, was part of its very ideology. For example, the film's poster not only referred to its colours as 'psychedelic', it also described the film itself as 'A Lovely Sort of Death' ('LSD'), a slogan that refers to *The Psychedelic Experience: A Manual Based on the Tibetan Book of Dead* (1964) by Timothy Leary, which Corman read before making *The Trip* (Di Franco, 1979: 48–49). In his book, Leary follows the structure and logic of *The Tibetan Book of the Dead*, which describes the soul's travels/experiences in the time between dying and reincarnation, in order to compare it to his idealised version of the LSD experience as a transformative form of rebirth.[5]

Leary was a psychologist with a doctorate from the University of California, Berkeley, and it was there that he developed his typology of personalities, a conceptual model that became known as the 'Rose of Leary'. After spending time working at universities in various countries, he started lecturing at Harvard in 1959, where he founded the Harvard Psilocybin Project with Richard Alpert. The project's

5 The reference to *The Tibetan Book of the Dead* in relation to hallucinations and drugs is also made in *Enter the Void* (FRA 2009, Gaspar Noé). Furthermore, it adds another connection between the LSD discourse and the 'trip' scene from *2001*, which also shows us the trajectory of dying and rebirth into a higher, astral form of existence.

aim was to research the effects of LSD and psilocybin on human consciousness.[6] In 1963, however, the project was halted by the university management, and Alpert and Leary were both fired. Although, today, the Harvard Psilocybin Project might seem a strange and dangerous experiment, the use of LSD in psychology, psychotherapy and psychiatry was a well-established practice at the time.[7] But, as the 1960s progressed, attitudes changed, and while the drug increasingly became part of psychedelic culture, its social acceptance decreased equally rapidly. Finally, in 1968, LSD was declared illegal in the US, except for occasional medical research.

After his dismissal from Harvard, Leary became renowned as a countercultural public figure. He continued his experiments, and defended the use of drugs as a mind-opening therapeutic method. His catch-phrase, 'Turn on, tune in, drop out', encouraged 'turning on' the psychedelic experience (like a TV set), 'tuning in' to the right experiential wavelength for it to become transformative, and then 'dropping out' from the experience itself and back into 'normal life', integrating this so-called psychedelic perception into everyday life. Leary propagated the notion that LSD inspired people to question social norms and thus had the power to transform society: 'LSD rearranged the "imprinting process" in the human mind and allowed people to rethink things they had previously taken for granted' (Stephenson, 2014). This discourse was part of a 1960s counterculture that was defined by its rejection of establishment mores—LSD use was prevalent amongst those who identified with the movement. The idea was that LSD would help to loosen the grip of existing rules and regulations that limit perception and imprison both body and mind, and in doing so would set perception free (Syder, 2009: 30). Psychedelic counterculture also entailed a huge shift in colour culture away from the colour standardisations, colour control and colour regulations of the 1940s and 1950s (as described throughout this book). Thus, in the 1960s, colours were unleashed. According to Andrew Syder, this was the necessary precursor to the political revolutions of the 1960s:

> [These political revolutions] could only occur after a revolution had taken place in how people use their sense organs; and central to this project were radical reconfigurations of both the eye and the central nervous system as loci of perception. (Syder, 2009: 6)

Psychedelic drugs such as LSD and psilocybin were considered the best tools for transforming standardised ways of viewing the world and 'opening the doors' to a clearer, 'reconfigured' perception. And even though this discourse became more widely distributed during the 1960s, it was Aldous Huxley who published his *Doors of Perception* in 1954, which made him one of the fathers of the psychedelic ideas and believes.

6 https://psychology.fas.harvard.edu/people/timothy-leary.

7 In fact, the use of MDMA and LSD in lower doses is currently being reintroduced in, for example, the treatment of PTSD (Mitchell at al., 2021). The Wikipedia page on LSD is a good starting point for those who want to know more about the history of LSD: https://en.wikipedia.org/wiki/History_of_lysergic_acid_diethylamide#

One of the practices in which the subversion of controlled colours by LSD culture became apparent was interior design. In *The Trip* we get a glimpse of the use of psychedelic colour in interior design when the main character enters the house where he is to have his LSD trip. The house and its decoration are in every aspect the opposite of the colour scheme shown in the film *Westinghouse all Electric Home*. The latter's carefully designed interiors, with their colour schemes following Birren's (or other so-called 'colour consultants') advice (see Chapter Five), were completely overturned in psychedelic culture. Instead of faithfully applying blue in the bedroom to encourage a good night's sleep, the house in *The Trip* is painted in gaudy, saturated, shimmering, glowing colours, with the room of Paul's guide the most excessive of all. This mirrors the more extreme forms interior design took during this period of unleashed colours; in some cases, colours went well beyond what Birren could have possibly imagined. What remained the same, however, was the belief that colours had an effect on the mind—an assumption that, as we saw, can be defined as characteristic of our modern episteme.

This belief can also be discerned in another practice of the 1960s, so-called 'LSD art', which attempted to reproduce, with the help of the projection of moving colours, the sort of psychedelic experiences that occurred when taking mind-expanding drugs (Junker, 1965; 'New Experience', 1966: 60–69; 'Wild New', 1966: 72–76). Probably the best exponent of this form of art was the media art collective USCO, which presented 'psychedelic theatre', and claimed that its art had the potential to function in similar ways to LSD. The group explicitly took as its philosophical basis the theories of media philosopher Marshall McLuhan, who argued that media influence how we shape and perceive the world. McLuhan was convinced that media technologies profoundly influence our lives, functioning as prosthetics that shape how we perceive the world and react to it. As such, he considered the media themselves to be 'the message'—the source of information for his research—more than the content they distributed (McLuhan, 1964; Rein and Horowitz, 2014).[8] Interestingly, this dovetailed with Leary's conviction that LSD could have such a strong effect on the human mind that it held the potential to change society.

USCO tried to put McLuhan's injunction into effect by reproducing the experience of an LSD hallucination in an immersive multimedia event: they employed projection techniques that used the entire space as a screen, including the bodies of the spectators, in order to study the ways in which these techniques shape perception. In all, USCO tried to replicate the LSD experience by immersing the spectator in the performance itself, 'bombing their senses' with light and sound. These beliefs were in line with contemporary ideas on the therapeutic power of coloured lights and their ability to create and steer feelings and emotions (Chapter Five and Six). USCO's aim, however, was not to produce emotion or reaction but a 'transformative' LSD-like experience, as described by Leary. As a result, we can find in its experiment a synthesis of Leary and

8 Leary even claimed that it was McLuhan, whom he knew and admired, who inspired him to use a catchphrase to promote his ideas (Rein and Horowitz, 2014).

McLuhan, combined with long-standing ideas on the psychological and therapeutic power of colours.[9]

'LSD art' was part of a larger cultural movement, comprising psychedelic music, immersive 'happenings', 'expanded cinema', and other cultural experiments, which took place in museums and art galleries, as well as discotheques, night clubs and other popular venues. With its colourful patterns projected on walls, furniture and naked bodies, the 'rainbow-love-scene' of *The Trip* mirrors this practice. In fact, Beck, who worked on the special effects of this scene, was also an active producer of coloured light shows on the West Coast of the United States. He was a self-made light engineer, developing and renting out equipment for light shows that were held with the help of overhead projectors, liquids and sometimes film. He even wrote a manual for do-it-yourself light shows called *Color Games Light Show Manual* (1966). One piece of advice he gave was that light shows should produce total immersion:

> Lights should contribute to the dissolution of the space frame of the entire environment of the audience; that is, the horizontal and vertical surfaces are broken up by the lights and the concept of spatial distances is deliberately made confusing. This helps the ego to let go and float freely, which is the artist's goal. (Beck, 1966: 17)

The 'rainbow-love-scene' depicts precisely such a disorienting dissolution of the characters' bodies and environment. The difference between the experience of someone immersed in a coloured light show and that of a spectator of *The Trip* is that the latter watched the LSD experience in a more classical way, seated in a cinema, and experienced the sensation of dissolution through an alignment with the bodies represented on the screen. The 'rainbow-love-scene' shows fluctuating colours in constant movement, combined with ceaselessly shifting camera angles and positions, people and shapes. The film presented the 'psychedelic vision as a burst of freedom and mobility' in a sensuous way, challenging 'normative modes of perception' and 'calling into question the rigid and repressive conceptions of reality and consciousness' (Syder, 2009: 30).[10]

However, even though the 1960s seemed to condense a huge number of coloured light shows into a short period, the techniques and ideas these shows employed had a longer lineage. Beck himself was well aware of the tradition of performances with coloured light:

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9 Another well-known example of this practice was the *Exploding Plastic Inevitable*, a sort of *Gesamtkunstwerk* installation art by Andy Warhol, the Velvet Underground and Nico. In 1967 Ronald Nameth made the film *Exploding Plastic Inevitable* based on registrations made during the shows. He filmed on Ektachrome, and encountered the same problems with the light sensitivity as did Beck in *The Trip*'s 'rainbow-love-scene'. Nameth also had the material pushed, which resulted in an increased graininess of the images (email exchange between myself and Ronald Nameth in 2017).

10 As already mentioned in Chapter Seven, in a similar way to psychedelic culture, what became known as 'the sexual revolution' was also focused on releasing and freeing the mind through abandoning 'old-fashioned' rules and regulations relating to sexuality, marriage and love. The sexual revolution and hippy culture clearly were intertwined for many ways, and this came to a climax in the 1968 'Summer of Love'.

> We were amazed to find that nearly all of today's instruments had their initial disclosures in the 1800s, and the most complex reductions to practice were in the 1920s and 1930s. Modernizations have not been made in the optical and mechanical systems; only in the electrical and lamp technology. (Beck, 1966: 16)

Beck refers here to the technology of colour organs, naming-checking such illustrious colour organists as Alexander Wallace Rimington, Mary Hallock-Greenwalt, Thomas Wilfred and Adrian Klein on the first page of his book. Another technology he dates back to the 1800s is kaleidoscope projection. Beck (1966: 6) describes these images as 'somewhat "psychedelic"' comparing them to the effects of psychedelic drugs.

Multicoloured kaleidoscopic moving images, such as those used in *The Trip*, do indeed recur throughout the nineteenth and twentieth centuries in various forms. An early example is the well-known nineteenth-century kaleidoscopic lantern slides that were manually cranked to produce colours that swirled around and over each other (Yumibe, 2012: 141). Interestingly, as film historian Joshua Yumibe (2009: 24) explains, these nineteenth-century toys were a form of entertainment that endeavoured '[...] to shape the viewers subjective perception to an orderly system that rationalized space, time, and color'. In other words, they were the result of contemporary scientific investigations into optics and perception, and were meant partly to test hypotheses on the senses and perceptions, and partly to re-educate and discipline those viewing the shows into becoming 'modern' observers. However, the fact that the kaleidoscopic, multicoloured images in *The Trip* were part of a strategy to show the inner perception of a hallucination turned this rationalising function on its head. Instead of ordering and rationalising, these images unleashed colours that were out of control, challenging chromatic vision. Another well-known example in colour studies is the kaleidoscopic films made by Loyd Jones and Tuttle (1928: 140) in collaboration with Kodak in the 1920s. Jones used these films to try and prove that moving images in colour had strong emotional effects, and in this sense, his films were more closely related to the non-rational depiction of hallucinations of the 1960s than to the lantern slides of the nineteenth century [Fig. coda.4].

In 1960s cinema, the use of such kaleidoscopic abstract imagery to represent hallucinatory and altered states was not specific to *The Trip*. For example, Éric Duvivier, who made medical films for pharmaceutical companies, also used kaleidoscopic images in some of his films of hallucinations, including *Images du monde visionnaire* (1963, Michaux and Duvivier). This film was a collaborative effort with Henri Michaux, and was based on Michaux's books *Miserable Miracle* (1956), *L'infini turbulent* (1957) and *Connaissance par les Gouffres* (1961), in which he describes his experiments with mescaline and hashish. Other examples are *Fahrenheit 451* (1966), in which kaleidoscopic images appear on TV sets, hypnotising their viewers. The British film *Curse of the Crimson Altar* (1968) also uses kaleidoscopic images to simulate the experience of hypnosis.[11].

Pascal Rousseau discusses in his book *Hypnose—art et hypnotisme de Mesmer à nos jours* (2020), that hypnosis during the 1950s and 1960s was a physical sensuousness

11 https://eastmancolor.info/2018/10/11/hypnosis-as-spectacle-in-british-horror/

that fed into a more overall optical aesthetics of the 1960s such as op art, cybernetica, flicker film, and psychedelic culture (Rousseau, 2020: 275–76).

The belief in the strong emotional effects of (kaleidoscopic) coloured moving images is also evident in the therapeutic use of the so-called 'crystal trip'. This consisted of moving images of ever-shifting crystal-shaped colours produced with the help of chemicals and crossed-polarised filters (Beck, 1966: 4). The technique was invented by psychologist and scientist Cecil Stokes in the 1940s, who used it to produce a series of films called *Auroratones*, with the aim of curing soldiers returning from the Second World War in severe mental distress. The technique was also used in Duvivier's *Hallucinations: Images du monde visionnaire* (1963) to create similar kaleidoscopic images of crystals representing hallucinations [Fig. coda.5].

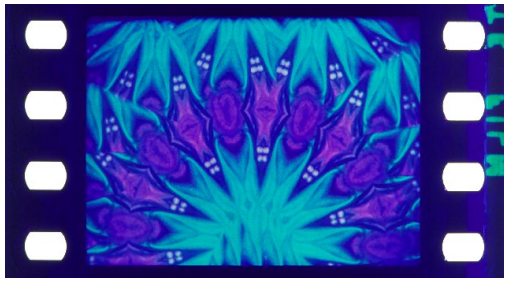

Fig. coda.4 [*Kaleidoscope*] by Loyd A. Jones. Credit: George Eastman House Moving Image Collection. Photograph of the nitrate positive by Barbara Flueckiger.

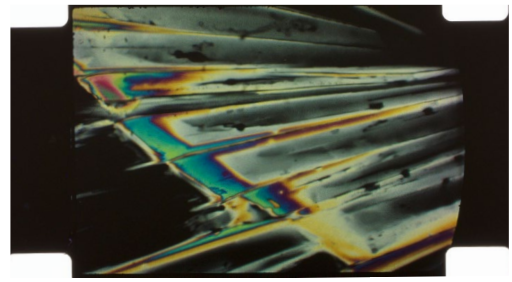

Fig. coda.5 *Hallucinations: Images du monde visionnaire* (FRA 1963, Éric Duvivier). Credit: Image'Est. Photographs of the Kodachrome II camera material by Bregt Lameris.

This recurrence of certain types of moving images over longer periods of time fits Erkki Huhtamo's (2011: 29) description of the concept, 'topos', mentioned in Chapter One (footnote 18). These kaleidoscopic images were used in various ways according to certain short-term contexts that were dominant at the time: for example, the education of the senses in the nineteenth century; the wish to cure traumatised soldiers during the Second World War; or the attempts to recreate a psychedelic experience with the help of coloured projections in the 1960s. These various contextual moments mean that similar types of moving colours were used to produce different meanings and perform different functions. However, the longue durée idea that colours can affect the human organism remains consistent throughout.

The Quasi Immobile: Biologies

These kaleidoscopic moving images, however, are also connected to the 'quasi-immobile' or slowly changing the pace of the physiology of hallucinations. This connection between discourse and biology is similar to the discussion of colour contrasts and cross-modal perceptions and the continuous and important role they play in colour

perception and aesthetics, which we encountered earlier in this book. Consequently, it is important to consider this last correlation between biological processes, colour film and colour culture (the central topic of this book): that is, between hallucinations, colour perception, visual representations and moving images.

The correlation between the experience of hallucinations and the transformation of everyday colours into uncanny and unexpected hues is an aspect that is often remarked on in the literature on the subject. In his book *Hallucinations* (2012), Oliver Sacks records multiple testimonies of hallucinatory experiences that mention strange, bright, saturated colours. For example, Sacks (2012: 143) quotes Daniel Breslaw, a subject in the LSD experiments undertaken at Columbia University in the 1960s, who claimed to have experienced colours that he had never seen before.

Indeed, a rather common type of visual hallucination takes the form of colourful abstract shapes similar to kaleidoscopic images. Sacks (2012: 26) even has a specific name for these apparitions: 'simple hallucinations'. Psychologist Heinrich Klüver, in the 1940s, had observed that these types of hallucinations are common in a variety of pathological and situational phenomena such as migraine (the migraine's 'aura'), sensory deprivation (the 'prisoner's cinema'), hypoglycaemia, fever and delirium, as well as the hypnagogic state directly before and after sleep. Of course, psychedelic drug use can also induce these types of hallucinations. Albert Hofmann, who was the first to synthesise LSD in 1938, accidentally testing it on himself, testified to what he saw as 'an uninterrupted stream of fantastic images of extraordinary plasticity and vividness and accompanied by an intense kaleidoscopic play of colors' (Hofmann in Sacks, 2012: 136).

The persistent recurrence of descriptions of multicoloured, abstract, kaleidoscopic images over a larger time frame permits us to categorise them as examples of the quasi-immobile phenomenon of visual hallucinations. Some psychologists and researchers suggest that these visions have a universal biological origin (Sacks, 2012: 141–42, 190; Lawn and ffytche, 2021). For example, Klüver (1966 [1942]: 66–69), in his chapter 'Mechanisms of hallucination', suggests that 'such constants must reflect something about the organization, the functional architecture, of the visual cortex'. In other words, he claims that what we are witnessing in such an experience are our own nerves and synapses firing off electricity. Following Klüver, mathematicians and neuroscientists have continued to investigate potential connections between primary visual hallucinations and the way the visual cortex is shaped and functions (Ermentrout and Cowan, 1979: 137–50; Ouellette, 2018; Tkaczyk, 2001: 26; Bressloff, Cowan, Golubitsky and Wiener, 2002: 473–91).

This is a final example of how the quasi-immobile layer of colour perception has entered our visual culture. It is interesting to note that these types of colours are of course not related to light stimuli entering the eye; rather, they are the result of the activity of our brain, either under the influence of hallucinogenic substances, or as a result of a malfunction of the nervous system. The fact that these moving coloured shapes have found their way into our cultural expressions is not only fascinating, but

also confirms that representations of and the use of colours in our cultural utterances—film being a very important instance—are strongly connected both to stimuli from outside our bodies and to what happens inside them when we see, perceive, produce and process these miracles of perception.

Final Reflections

I have used this last case study, which has focused on hallucinations, to reveal the work processes involved in analysing colour in film from the perspective of a 'pluralité des durées'. This approach has indeed proved very productive for the analysis of embodied phenomena such as feelings, affects and emotions in relation to colour. What is particularly interesting is the fact that the biological elements of colour perception, feelings and affects continually interact with their cultural and discursive constraints, revealing that emotions and feelings are biocultural phenomena.

This means that the use of colour in film does affect the body and create feelings, be it through colour perception, cross-modal phenomena, or discourses that steer the way these embodied reactions function through their inscription in the body as habitus. This is especially the case with those discourses that continue to remain in the culture over a longer period of time, with the result that they appear 'natural' and produce certain 'given' emotional reactions. As we have seen, one example of this is the belief that colour and coloured lights influence our physical state—a belief that has become a semi-spiritual, almost religious conviction of the modern episteme.

I have also shown that the cultural discourses and constraints of shorter durées can also have relatively strong effects. For example, the restraining discipline of colour coding that followed the rules and regulations of colour psychology during the 1950s were slowly overturned, ending in the wild psychedelic colour patterns that simulated hallucinatory experiences in the 1960s. Hence, the method has proven to be effective only if the layer of the longue durée itself is divided into shorter analytical moments.

Finally, the analyses of the films, positioning them within their cultural contexts, remains the crucial part of this study. The elaborations on biology and physiology helped to give me a clearer understanding of certain problems that were difficult to solve from a humanities perspective. However, I realise that my abilities in this domain are limited, and many more interesting facts and ideas exist in relation to knowledge of the physiology and biology of colour perception and its role in the functioning of the body. As such, this study is an example of how this knowledge can enrich our studies of such biocultural phenomena as feelings, emotions and affects. I therefore hope this book will show that limited training in or experience of different fields of research should never stop any humanities scholar from trying to understand and work with other disciplines. After my long period of diving into the study of colours and feelings, I would strongly encourage such scholars to combine different types of knowledge, methodologies and approaches, in order to come to a more complete understanding of the cultural phenomena we create, experience and live.

Bibliography

'And God Created Woman'. 1957. Film Bulletin, October: 9.

'Down Movie Lane'. 1957. *Honolulu Record* 10,17 November: 6.

'Liz as Cleo. An Exclusive Unveiling of a Queen in a Taylor-Made Role'. 1963. *Playboy*, January: 80–87.

'MM Remembered. A Retrospective Tribute to a Hollywood Legend'. 1964. *Playboy*, January: 100–09.

'New Experience That Bombards the Senses. LSD Art'. 1966. *LIFE Magazine*.

L'Ouest Éclair (*Éd. de Caen*). 1929. 'Le Traitement par les Couleurs', 11 September 1929: 3.

'Memphis Bans "Woman"'. 1957. *Motion Picture Daily*, December: 3.

'Ons Restaurant krijgt een nieuw aspect!'. 1951. *Het Vaderland. Staat- en Letterkundig Nieuwsblad*, 12 January 1951: 16.

'Radioactive Fallout from Nuclear Testing at Nevada Test Site, 1950–60'. 1998. *GovInfo.* Washington DC: USA Government Printing Service, https://www.govinfo.gov/content/pkg/CHRG-105shrg44045/html/CHRG-105shrg44045.htm

'Reich, Wilhelm (1897–1957)'. n.d. *Www.Bpsi.Org* (blog), https://bpsi.org/library/archives/collections/reich-wilhelm-1897-1957/ 'Technicolor's 1945 Volume Sold out'. 1944. *Motion Picture Daily*, May: 1, 11.

'The First Two Dozen Playmates. Playboy Brings the Girls Back for a Bow'. 1956. *Playboy*, January: 51–59.

'The History of Food Colour Additives'. *Safefood*, https://www.safefood.net/food-colours/history

Total Electric Home Department. 1959. *The Total Electric Home... New and Wonderful Living for You and Your Family... Today*. Westinghouse Electric Corporation.

'TRIP met LSD. 't blijft bij een poging'. 1968. *Het Vrije Volk. Democratisch-Socialistisch Dagblad*. 11 August 1968.

'Two Pictures Classified under New Legion Plan'. 1957. *Motion Picture Daily*, November: 1–2.

'What Makes Marilyn?' 1953. *Playboy*, December: 17–19.

'Wild New Flashy Bedlam of the Discothèque'. 1966. *LIFE*. 27 May 1966: 72–76.

'Ze Drukken m'n Stukjes in de Verkeerde Kleur! Klein Beeld'. 1958. *Trouw*. 10 April 1958: 3.

Albers, Josef. 1963. *Interaction of Color*. 1971. Yale University Press.

Aleksandrowicz, Pawel. 2016. *The Cinematography of Roger Corman. Exploitation Filmmaker or Auteur?* Cambridge Scholars Publishing.

Allesch, G. J. v. 1925. 'Die Ästhetische Erscheinungsweise der Farben (2)'. *Psychologische Forschung*, 6 (1): 215–81.

Allyn, David. 2000. *Make Love, Not War. The Sexual Revolution: An Unfettered History*. Little, Brown and Company.

Alpert, Hollis and Arthur Knight. 1966. 'The History of Sex in Cinema. Part XIII. The Fifties. Sex Goes International'. *Playboy*, December: 232–58.

Amory, Dita. 2004. 'Georges Seurat (1859–1891) and Neo-Impressionism'. *Heilbrunn Timeline of Art History* (blog), https://www.metmuseum.org/toah/hd/seni/hd_seni.htm

Arnheim, Rudolf. 1956. *Art and Visual Perception. A Psychology of the Creative Eye*. Faber & Faber.

—. 1954. *Kunst und Sehen. Eine Psychologie des Schöpferischen Auges*. 1978. De Gruyter.

Arya, Rina and Nicholas Chare (eds). 2016. *Abject Visions. Powers of Horror in Art and Visual Culture*. Manchester University Press, https://doi.org/10.7228/manchester/9780719096280.001.0001

Aumont, Jacques. 1994. *Introduction à la couleur. Des discours aux images*. Armand Colin.

Aumont, Jacques (ed.). 1995. *La couleur en cinéma*. Mazzotta.

Avila, Eric. 2004. *Popular Culture in the Age of White Flight. Fear and Fantasy in Suburban Los Angeles*. University of California Press, https://doi.org/10.1525/9780520939714 (is 2019 edition)

Babbitt, Edward D. 1878. *The Principles of Light and Color*. Babbitt & Co.

Bagnall, Oscar. 1937. *The Origin and Properties of the Human Aura*. 1975. Samuel Weiser, Inc.

Balázs, Béla. 1924. *Der sichtbare Mensch. Oder, die Kultur des Films*. 2001 Suhrkamp.

Ball, Victoria K. 1965. 'The Aesthetics of Color. A Review of Fifty Years of Experimentation.' *The Journal of Aesthetics and Art Criticism, 23* (4, Summer 1965): 441–52.

Barber, X. Theodore. 1989. 'Phantasmagorical Wonders. The Magic Lantern Ghost Show in Nineteenth-Century America'. *Film History,* 3(2): 73–86.

Barker, Jennifer M. 2009. *The Tactile Eye. Touch and the Cinematic Experience*. University of California Press, https://doi.org/10.1525/9780520943902

Barth, Friedrich G., Patrizia Giampieri-Deutsch and Hans-Dieter Klein (eds). 2012. *Sensory Perception. Mind and Matter*. Springer-Verlag, https://doi.org/10.1007/978-3-211-99751-2

Barthes, Roland. 1964. 'Rhetoric of the Image'. In *Image-Music-Text*, translated by Stephen Heath, 1977 ed.: 32–51. Noonday Press.

Basten, Fred E. 1980. *Glorious Technicolor. The Movies' Magic Rainbow.* Barnes.

Batchelor, David. 2000. *Chromophobia*. Reaktion.

Baudry, Jean-Louis. 1975. 'Le dispositif'. *Communications, 23* (1): 56–72.

—. 1978. *L'effet cinéma*. Editions Albatros.

Bayat, Leyla, Mostafa Arab, Sasan Aliniaeifard, Mehdi Seif, Oksana Lastochkina and Tao Li. 2018. 'Effects of Growth under Different Light Spectra on the Subsequent High Light Tolerance in Rose Plants'. *AoB PLANTS, 10* (5), https://doi.org/10.1093/aobpla/ply052

Bazin, André. 1958. 'The Evolution of the Language of Cinema'. In *What Is Cinema*, 1967, Vol. 1. University of California Press.

Beauvoir de, Simone. 1959. *Brigitte Bardot and the Lolita Syndrome*. Four Square.

Beck, Robert C. 1966. *Color Games Light Show Manual*. (3rd ed.). Pericles Press.

—. 1968. 'Creating "Psychedelic" Visual Effects for "The Trip"'. *American Cinematographer, 151*(3): 176–79

Belton, John. 1990. 'Glorious Technicolor, Breathtaking Cinemascope and Stereophonic Sound'. In *Hollywood in the Age of Television*, edited by Tino Balio: 185–211. Unwin Hyman.

Benjamin, Walter. 1939. 'The Work of Art in the Age of Its Technological Reproducibility'. In *The Work of Art in the Age of Its Technological Reproducibility, and Other Writings on Media*, edited by Michael J. Jennings, Thomas Y. Levin and Brigid Doherty. 2008: 19–55. Belknap Press of Harvard University Press.

Berriatúa, Luciano (ed.). 1998. *Tutti i colori del mondo. Il colore nei mass media tra 1900 e 1930 — All the Colours of the World. Colours in Early Mass Media 1900−1930*. Immagini e documenti. Edizioni Diabasis.

Bezold, Wilhelm von. 1874. *Die Farbenlehre im Hinblick auf Kunst- Und Kunstgewerbe*. Mit 63 Figuren Und 9 Tafeln. Georg Westermann.

—. 1876. *The Theory of Color in Its Relation to Art and Art-Industry*. Translated by S.R. Koehler. L. Prang.

Bergdoll, Barry and Leah Dickerman (eds). 2009. *Bauhaus 1919–1933. Workshops for Modernity*. The Museum of Modern Art.

Berge Ten, Henk. 1968. 'Veel filmgeweld op de Cinemanifestatie. Peter Fonda werd "high"'. *De Telegraaf*, 2 July 1968: 13.

Bertina, Bob J. 1968. 'Cinemanifestatie Utrecht 68. LSD-trip'. *De Volkskrant*, 2 July 1968: 9.

Birren, Faber. 1937. *Functional Color*. The Crimson Press.

—. 1939. *The American Colorist. A Practical Guide to Color Harmony and Color Identification*. Crimson Press.

—. 1945. *Selling with Color*. McGraw-Hill.

—. 1950. *Color Psychology and Color Therapy. A Factual Study of the Influence of Color on Human Life*. McGraw-Hill.

—. 1956. *Du Pont Color Conditioning*. E.I. De Pont Nemours & Co.

—. 1961a. *Color Psychology and Color Therapy. A Factual Study of the Influence of Color on Human Life*. The Citadel Press.

—. 1961b. *Color, Form, and Space*. Reinhold Publishing Corporation.

—. 1962. *Color in Your World*. 1978. Macmillan.

—. 1963. *Color for Interiors, Historical and Modern. An Essential Reference Work Covering the Major Period Styles of History and Including Modern Palettes for the Authentic Decoration of Homes, Institutional and Commercial Interiors*. Whitney Library of Design.

Blaszczyk, Regina Lee. 2012. *The Color Revolution*. MIT Press, https://doi.org/10.7551/mitpress/8762.001.0001

Blaszczyk, Regina Lee and Uwe Spiekermann. 2017. *Bright Modernity. Color, Commerce, and Consumer Culture*. Palgrave Macmillan, https://doi.org/10.1007/978-3-319-50745-3

Boddice, Rob. 2018. *The History of Emotions*. Manchester University Press, https://doi.org/10.7765/9781526153388

Böhme, Gernot. 2006. *Architektur und Atmosphäre*. 2., 2013. München: Fink, Wilhelm.

Bon, Willem. 1932a. 'Experimenten in de Studio Ivens'. *Filmliga:* 57–59.

—. 1932b. 'Een en ander over "Klankfilm" Filmtechniek'. *Het Lichtbeeld, 10* (4): 55–57.

Bonah, Christian. 2017. 'Marketing Film. Audiovisuals for Scientific Marketing and Medical Training in Psychiatry: The Example of Sandoz in the 1960s'. In *The Development of Scientific Marketing in the Twentieth Century: Research for Sales in the Pharmaceutical Industry*, edited by Jean-Paul Gaudillière and Ulrike Thoms: 87–103. Routledge, https://doi.org/10.4324/9781315653709

—. 2023. 'Business and Art. Pharmaceutical Industries, Film Production and Circulation, and the French Film Production Company ScienceFilm, 1960–1980'. In *Films That Work Harder. The Global Circulations of Industrial Cinema*, edited by Vinzenz Hediger, Florian Hoof, Yvonne Zimmermann, and Anthony Scott. Amsterdam University Press, https://doi.org/10.5117/9789462986534

Bordwell, David and Kristin Thompson. 1979. *Film Art. An Introduction*. Addison-Wesley Pub. Co.

Bordwell, David and Kristin Thompson. 1986. *Film Art. An Introduction*. 2nd edition. Knopf: Distributed by Random House.

Bordwell, David, Kristin Thompson and Jeff Smith. 2017. *Film Art. An Introduction*. 11th Edition. McGraw-Hill.

Boucher, Marc. 2004. 'Kinetic Synesthesia. Experiencing Dance in Multimedia Scenographies'. *Contemporary Aesthetics*, *2*(1).

Bourdieu, Pierre. 1979. *La distinction. Critique sociale du jugement.* Les Éditions de Minuit.

—. 1984. *Distinction. A Social Critique of the Judgement of Taste*. Translated by Richard Nice. Harvard University Press.

—. 1990. *The Logic of Practice*. Stanford University Press.

Boyle, Robert. 1664. *Experiments and Considerations Touching Colours*. Harry Herringman.

Brandes, Heinrich Wilhelm. 1831. 'Neunte Vorlesung'. In *Vorlesungen über die Naturlehre*. Vol. 2. Georg Joachim Göschen.

Branigan, Edward. 1976. 'The Articulation of Color in a Filmic System'. *Wide Angle, 1*(3): 20–31.

—. 1979. 'Color and Cinema. Problems in the Writing of History'. *Film Reader*, *4*: 16–34.

Braudel, Fernand. 1949. *La Méditerranée et le monde méditerranéen a l'époque de Philippe II. 1. La part du milieu.* 9th Edition. Armand Colin Éditeur.

Bressloff, Paul C., Jack D. Cowan, Martin Golubitsky, Peter J. Thomas and Matthew C. Wiener. 2002. 'What Geometric Visual Hallucinations Tell Us about the Visual Cortex'. *Neural Computation, 14*(3): 473–91, https://doi.org/10.1162/089976602317250861

Brinckmann, Christine N. 2014. 'Filmische Farbe als Abbild und Artefakt'. In *Farbe, Licht, Empathie*. Edited by Britta Hartmann: 21−45. Zürcher Filmstudien 32. Schüren.

—. 2014. 'Dramaturgische Farbakkorde'. In *Farbe, Licht, Empathie*, edited by Britta Hartmann: 47–73. Zürcher Filmstudien 32. Schüren.

—. 2014. *Farbe, Licht, Empathie*. Schüren.

—. 2015. *Color and Empathy*. Amsterdam University Press, https://doi.org/10.1017/9789048523269.003

Brinkema, Eugenie. 2014. *The Forms of the Affects*. Duke University Press, https://doi.org/10.1515/9780822376774

Brun, Anne. 1999. *Henri Michaux et le corps halluciné*. Beaux Livres. Empecheurs de penser en rond.

Brown, Elspeth H. and Thy Phu (eds). 2014. *Feeling Photography*. Duke University Press, https://doi.org/10.1515/9780822377313

Brown, J. H. 1864. *Spectropia or Surprising Spectral Illusions. Showing Ghosts Everywhere, and of Any Colour*. James G. Gregory.

Bruno, Giuliana. 2014. *Surface. Matters of Aesthetics, Materiality, and Media*. The University of Chicago Press, https://doi.org/10.7208/chicago/9780226114835.001.0001

Bukatman, Scott. 1999. 'The Artificial Infinite. On Special Effects and the Sublime'. In *Alien Zone II. The Spaces of Science Fiction Cinema:* 249–75. Verso.

Bühler, Kathleen. 2009. *Autobiografie als Performance. Carolee Schneemanns Experimentalfilme*. Zürcher Filmstudien. Schüren Verlag.

Bühler, Karl. 1922. *Die Erscheinungsweisen der Farben*. Gustav Fischer.

Burch, Noël. 1973. *Theory of Film Practice*. Secker & Warburg.

Burrows, Adam. 2009. 'Palette of Our Palates. A Brief History of Food Coloring and Its Regulation'. *Comprehensive Reviews in Food Science and Food Safety, 8* (4): 394–408, https://doi.org/10.1111/j.1541-4337.2009.00089.x

Burton, D. and G. Ettlinger. 1960. 'Cross-Modal Transfer of Training in Monkeys'. *Nature*, *186* (June): 1071–72.

Bushnell, Emily W. 1994. 'A Dual-Processing Approach to Cross-Modal Matching. Implications for Development'. In *The Development of Intersensory Perception. Comparative Perspectives*, edited by David J. Lewkowicz and Robert Lickliter: 19–38. Lawrence Erlbaum Associates, Publishers.

Calinich, Margarete. 1910. 'Versuch einer Analyse des Stimmungswertes der Farbenerlebnisse'. *Archiv. f. d. Ges. Psych., 19*: 242–312.

Calkins, Mary Whiton. 1895. 'Synæsthesia'. *The American Journal of Psychology, 7*: 90–107.

Calvert, Gemma A. 2001. 'Crossmodal Processing in the Human Brain. Insights from Functional Neuroimaging Studies'. *Cerebral Cortex* 11 (12): 1110–23, https://doi.org/10.1093/cercor/11.12.1110

Carroll, Noël. 1990. *The Philosophy of Horror. Or, Paradoxes of the Heart.* Taylor & Francis.

Castaldo Lundén, Elizabeth. 2016. 'Barbarella's Wardrobe. Exploring Jacques Foneray's Intergalactic Runway'. *Film, Fashion & Consumption, 5* (2): 185–211, https://doi.org/10.1386/ffc.5.2.185_1

Cherchi Usai, Paolo. 2000. *Silent Cinema. An Introduction*. British Film Institute.

Chevreul, Michel Eugène. 1828. *Mémoire sur l'influence que deux couleurs peuvent avoir l'une sur l'autre quand on les voit simultanément*. Vol. XI. Mémoires de l'académie des sciences. Académie des sciences.

—. 1839. *De la loi du contraste simultané des couleurs.* Pitois-Levrault.

—. 1839. *The Principles of Harmony and Contrast of Colors and Their Applications to the Arts*. 1855. Van Nostrand Reinhold.

Chion, Michel. 1995. *La musique au cinéma*. Fayard.

Christie, Ian. 2010. 'Knight's Moves. Brecht and Russian Formalism in Britain in the 1970s'. In *Ostrannenie. On 'Strangeness' and the Moving Image. The History, Reception, and Relevance of a Concept*, edited by Annie van den Oever. Amsterdam University Press, https://doi.org/10.26530/oapen_605865

Classen, Constance. 1993. *Worlds of Sense. Exploring the Senses in History and Across Cultures*. Routledge.

Coates, Paul. 2010. *Cinema and Colour. The Saturated Image*. British Film Institute, https://doi.org/10.5040/9781838711665

Coëgnarts, Maarten and Peter Kravanja (eds). 2015. *Embodied Cognition and Cinema*. Leuven University Press.

Cole, M., S.L. Chorover and G. Ettlinger. 1961. 'Cross-Modal Transfer in Man', *Nature, 191*: 1225–26, https://doi.org/10.1038/1911225b0

Collins, Elle. 2016. 'Celebrating Jean-Claude Forest and "Barbarella"'. *ComicsAlliance* (blog). 12 September.

Connolly, Kevin. 2014. 'Multisensory Perception as an Associative Learning Process'. *Frontiers in Psychology, 5*, https://doi.org/10.3389/fpsyg.2014.01095

Conquer, Rey. 2019. *Reading Colour. George Rilke, Kandisnky, Lasker-Schüler*. Peter Lang GmbH Internationaler Verlag der Wissenschaften, https://doi.org/10.3726/b14732

Cornwell-Clyne, Adrian. 1939. *Colour Cinematography*. American Photographic Pub. Co.

Crary, Jonathan. 1992. *Techniques of the Observer. On Vision and Modernity in the 19th Century*. MIT Press.

Crary, Jonathan. 1995. 'Unbinding Vision. Manet and the Attentive Observer in the Late Nineteenth Century'. In *Cinema and the Invention of Modern Life*, edited by Vanessa R. Schwartz and Leo Carney: 46–71. University of California Press.

Cromby, John and Martin E.H. Willis. 2016. 'Affect. Or Feeling (after Leys)?' *Theory & Psychology, 26* (4): 476–95, https://doi.org/10.1177/0959354316651344

Curtis, Robin, Marc Glöde and Gertrud Koch (eds). 2011. *Synästhesie-Effekte. Zur Intermodalität der ästhetischen Wahrnehmung*. Wilhelm Fink Verlag, https://doi.org/10.30965/9783846745878

Dabout, Eugène. 1924. 'Chromothérapie / Héliochromothérapie'. In *Petite dictionnaire de médecine. Expressions technique. Termes médicaux*. Librairie J.-B. Bailliere et Fils.

Dall'Asta, Monica and Guglielmo Pescatore (eds). 1995. *Il colore nel cinema*. Clueb.

Dall'Asta, Monica, Guglielmo Pescatore and Leonardo Quaresima (eds). 1996. *Il colore nel cinema muto*. Clueb.

Dalle Vacche, Angela and Brian Price (eds). 2006. *Color. The Film Reader*. Routledge.

Darwin, Robert Waring. 1786. 'New Experiments on the Ocular Spectra of Light and Colours'. *Philosophical Transactions of the Royal Society, 76*: 313–48.

Davison, Kate, Marja Jalava, Giulia Morosini, Monique Scheer, Kristine Steenbergh, Iris van der Zande and Lisa Fetheringill Zwicker. 2018. 'Emotions as a Kind of Practice. Six Case Studies Utilizing Monique Scheer's Practice-Based Approach to Emotions in History'. *Cultural History, 7* (2): 226–38, https://doi.org/10.3366/cult.2018.0175

Deigh, John. 2009. 'Concepts of Emotions in Modern Philosophy and Psychology'. *The Oxford Handbook of Philosophy of Emotion*. 3 December 2009, https://doi.org/10.1093/oso/9780190878597.003.0002

Desmet, Noël and Paul Read. 1998. 'The Desmetcolor Method for Restoring Tinted and Toned Films'. In *Tutti i colori del mondo. Il colore nei mass media tra 1900 e 1930 — All the Colours of the World*, by Luciano Berriatúa, Manlio Brusatin, Noël Desmet, Enrico Fornaroli, Giovanna Fossati, Bertrand Lavedrine, Bob Mabberley et al.: 147–50. Edizione Diabasis.

Dewey, John. 1896. 'The Reflex Arc Concept in Psychology'. *Psychological Review, 3*(4): 357–70.

D'haeyere, Hilde. 2018. 'Ziegfeldized Slapstick, Useful Comedy. Mack Sennett's Slapstick Comedies Under the Influence of Natural Colour.' In *The Colour Fantastic. Chromatic Worlds of Silent Cinema*, edited by Giovanna Fossati, Victoria Jackson, Bregt G. Lameris, Joshua Yumibe and Sarah Street: 125–44. Amsterdam University Press, https://doi.org/10.1515/9789048532988-008

De Kuyper, Eric. 1992. 'La beauté du diable'. In *Ciné mémoire. Colloque international d'information (7–9 Octobre 1991)*, edited by Michel Ciment: 29–31. Femis.

Didiée, L. 1926. *Le film vierge Pathé. Manuel de développement et de tirage*. Pathé.

Diecke, Josephine. 2021. 'Qualitätsfilm aus Wolfen. Die Diskursive Konstruktion von Agfacolor und Orwocolor im Globalen Spannungsfeld, 1936–1990'. PhD Dissertation: University of Zurich.

Diecke, Josephine. 2020. 'Agfacolor in (Inter)National Competition'. *Color Mania. The Material of Color in Photography and Film*, edited by Barbara Flueckiger et al. Lars Müller; Fotomuseum Winterthur: 211–21.

Di Franco, J. Philip (ed.). 1979. *The Movie World of Roger Corman*. Chelsea House Publishers.

Donaldson, Lucy Fife. 2022. 'Tracing the Threads of Influence. George Hoyningen-Huene and Les Girls (1957)'. *Movie. A Journal of Film Criticism*, *10*. Vimeo, https://warwick.ac.uk/fac/arts/scapvc/film/movie/videographiccriticism/

Donaldson, Lucy Fife. 2014. *Texture in Film*. Palgrave Macmillan, https://doi.org/10.1057/9781137034809

Doolaard, C.B. 1968. 'Corman proeft aan LSD'. *Het Parool*, 3 January 1968.

Dootson, Kirsty Sinclair. 2023. *The Rainbow's Gravity. Colour, Materiality and British Modernity*. Paul Mellon Centre for Studies in British Art.

Dootson, Kirsty and Zhaoyu Zhu. 2020. 'Did Madame Mao Dream in Technicolor? Rethinking Cold War Colour Cinema Through Technicolor's "Chinese Copy"'. *Screen*, *61* (3): 343–67, https://doi.org/10.1093/screen/hjaa048

Dowling, J.E. and B.B. Boycott. 1966. 'Organization of the Primate Retina. Electron Microscopy'. *Proceedings of the Royal Society B, 166* (1002): 80–111.

Dyer, Richard. 1997. *White. Essays on Race and Culture*. Routledge.

Dymek, Anne and Vincent Lowy. 2018. 'Toucher aux limites du filmique. Images du monde visionnaire (1963)', edited by Laurent Jullier and Vincent Lowy. *Cahier Louis-Lumière. Le cinéma face aux histoires du regard, 11*: 65–75.

Eco, Umberto. 1985. 'How Culture Conditions the Colours We See'. In *On Signs. A Semiotics Reader*, edited by Marshall Blonsky: 157–75. Basil Blackwell.

Edensor, Tim. 2014. 'The Social Life of the Senses. Ordering and Disordering the Modern Sensorium'. In *A Cultural History of the Senses in the Modern Age*, edited by David Howes, *6*: 31–54. Bloomsbury Academic, https://doi.org/10.5040/9781474233187.ch-001

Eder, Jens. 2016. *Affekt und Emotion in audiovisuellen Medien*. Schüren Verlag.

Eder, Jens, Julian Hanich and Jane Stadler. 2019. 'Media and Emotion. An Introduction'. *NECSUS. European Journal of Media Studies, 8* (1): 91–104. DOI: 10.25969/mediarep/4170.

Ekman, Paul and Wallace V. Friesen. 1978. *Facial Action Coding System. A Technique for the Measurement of Facial Movement*. Consulting Psychologists Press.

Ekman, Paul and Erika L. Rosenberg (eds). 2005. *What the Face Reveals. Basic and Applied Studies of Spontaneous Expression Using the Facial Action Coding System*. 2nd Edition. Oxford University Press, https://doi.org/10.1093/oso/9780195104462.001.0001

Elias, Norbert. 1939. *The Civilizing Process*. Urizen Books.

Elliot, Andrew. 2015. 'Color and Psychological Functioning. A Review of Theoretical and Empirical Work'. *Frontiers in Psychology*, *6*, https://doi.org/10.3389/fpsyg.2015.00368

Ellis, Havelock. 1906. 'The Psychology of Yellow'. *Popular Science Monthly, 68*: 456–63.

Elsaesser, Thomas. 1972. 'Tales of Sound and Fury'. In *Film Theory and Criticism*, edited by Leo Braudy and Marshall Cohen: 244–58. Oxford University Press.

—. 2002. *Filmgeschichte und frühes Kino. Archäologie eines Medienwandels*. Edition Text + Kritik.

—. 2004. 'The New Film History as Media Archaeology'. *Cinémas. Revue d'études cinématographiques, 14* (2–3): 75–117, https://doi.org/10.7202/026005ar

—. 2016. *Film History as Media Archaeology. Tracking Digital Cinema*. Film Culture in Transition. Amsterdam University Press, https://doi.org/10.1017/9789048529964.002

Elsaesser, Thomas and Adam Barker (eds). 1990. *Early Cinema. Space, Frame, Narrative*. BFI.

Emery, Marguerite. 1942. 'Color Therapy'. *American Journal of Physical Medicine & Rehabilitation, 21* (1): 41–43.

Ermentrout, G. B. and J. D. Cowan. 1979. 'A Mathematical Theory of Visual Hallucination Patterns'. *Biological Cybernetics, 34* (3): 137–50.

Ernst, Wolfgang. 2011. 'Media Archaeography. Method and Machine versus History and Narrative of Media'. In *Media Archaeology. Approaches, Applications, and Implications*, edited by Erkki Huhtamo and Jussi Parikka. University of California Press, https://doi.org/10.1525/9780520948518-013

Ettlinger, George. 1977. 'Interaction Between Sensory Modalities in Nonhuman Primates'. In *Behavioral Primatology. Advances in Research and Theory, Volume 1*, edited by A. M. Schrier: 71–103. Lawrence Erlbaum Associates, Publishers.

Faden, Eric. 2019. 'Visual Disturbances. A Cinematic Blindness Video Essay'. *Directors Notes* (blog). 19 February.

—. 2018. *Visual Disturbances*. Video essay, https://vimeo.com/302106011

Farinelli, Nicola and Gian Luca Mazzanti (eds). 1994. *Il Cinema Ritrovato. Teoria e metodologia del restauro cinematografico*. Grafis Edizioni.

Fechner, Gustav Theodor. 1860. *Elemente der Psychophysik*. Breitkopf und Härtel.

Fehner, Terrence R. and F. G. Gosling. 2006. *Atmospheric Nuclear Weapons Testing 1951–1963*. USA Department of Energy.

Flueckiger, Barbara. 2001. *Sound Design. Die virtuelle Klangwelt des Films*. Vol. 6. Zürcher Filmstudien. Schüren Verlag, https://doi.org/10.23799/9783741002472

—. 2008. *Visual Effects. Filmbilder aus dem Computer*. Vol. 18. Zürcher Filmstudien. Schüren Verlag, https://doi.org/10.23799/9783741002281

—. 2012. 'Material Properties of Historical Film in the Digital Age'. *NECSUS. European Journal of Media Studies, 1* (2): 135–53, http://dx.doi.org/10.25969/mediarep/15053.

—. 2016. 'Color and Subjectivity in Film'. In *Subjectivity Across Media. Interdisciplinary and Transmedial Perspectives*, edited by Maike Sarah Reinerth and Jan-Noël Thon: 145–61. Routledge, https://doi.org/10.4324/9781315643625-18

—. 2017. 'A Digital Humanities Approach to Film Colors'. *The Moving Image, 17* (2): 71–94, https://doi.org/10.5749/movingimage.17.2.0071

—. 2020a. 'Spielformen der Figur/Grund-Interaktion im Farbfilm. Eine Typologische Bestimmung'. *Montage AV, 29* (2): 81–114, http://dx.doi.org/10.25969/mediarep/21705

—. 2020b. 'Farbe und Ausdrucksbewegung. Jacques Demys Musicals *Les parapluies de Cherbourg* und *Les demoiselles de Rochefort*'. *Film-Konzepte, 56*: 31–42.

—. 2022. 'Textures, Patterns and Surfaces in Color Films'. *Zora UZH,* Preprint: 3, https://doi.org/10.5167/uzh-226668.

Flueckiger, Barbara, Eva Hielscher and Nadine Wietlisbach (eds). 2020. *Color Mania. The Material of Color in Photography and Film*. Lars Müller; Fotomuseum Winterthur.

Flueckiger, Barbara and Gaudenz Halter. 2020. 'Methods and Advanced Tools for the Analysis of Film Colors in Digital Humanities'. *Digital Humanities Quarterly, 14* (4) (Special Issue: Digital Humanities and Film Studies. Analyzing the Modalities of Moving Images), https://www.digitalhumanities.org/dhq/vol/14/4/000500/000500.html

Fossati, Giovanna. 1998. 'When the Cinema Was Colored'. *Tutti i colori del mondo. Il colore nei mass media tra 1900 e 1930 — All the Colours of the World*, by Luciano Berriatúa, Manlio Brusatin, Noël Desmet, Enrico Fornaroli, Giovanna Fossati, Bertrand Lavedrine, Bob Mabberley et al.: 121–32. Diabasis.

—. 1996. 'Coloured Images Today. How to Live with Simulated Colours (and Be Happy)'. In *Disorderly Order. Colours in Silent Film*, edited by Nico De Klerk and Daan Hertogs: 83–89. Nederlands Filmmuseum.

—. 2009. *From Grain to Pixel. The Archival Life of Film in Transition*. Amsterdam University Press, https://doi.org/10.2307/j.ctv8bt181

Fossati, Giovanna, Victoria Jackson, Bregt Lameris, Joshua Yumibe and Sarah Street (eds). 2018. *The Colour Fantastic. Chromatic Worlds of Silent Cinema*. Amsterdam University Press, https://doi.org/10.1515/9789048532988

Foucault, Michel. 1966. *Les mots et les choses. Une archéologie des sciences humaines*. Gallimard.

—. 1969. *Archéologie du savoir*. Gallimard.

—. 1970. *The Order of Things. An Archaeology of the Human Sciences*. Vintage Books.

—. 1971. *L'ordre du discours*. Flammarion et Cie.

—. 1972. *The Archaeology of Knowledge*. Pantheon Books.

—. 1996. *De Orde van het Spreken*. Translated by C.P. Heering-Moorman. Boom.

Franco, F. Merlin. 2022. 'Ecocultural or Biocultural? Towards Appropriate Terminologies in Biocultural Diversity'. *Biology*, *11* (2), https://doi.org/10.3390/biology11020207

Freud, Sigmund. 1925. 'The "Uncanny"'. In *The Standard Edition of the Complete Psychological Works of Sigmund Freud*, edited by Anna Freud, translated by James Strachey, English translation, XVII (1917–1919): 218–53. The Hogarth Press and the Institute of Psycho-Analysis.

Frings, Stephan. 2012. 'Sensory Cells and Sensory Organs'. In *Sensory Perception. Mind and Matter*, edited by Friedrich G. Barth, Patrizia Giampieri-Deutsch and Hans-Dieter Klein: 5–21. Springer-Verlag, https://doi.org/10.1007/978-3-211-99751-2_1

Frith, Paul. 2018. 'Hypnosis as Spectacle in British Horror Cinema'. 11 October 2018, https://eastmancolor.info/2018/10/11/hypnosis-as-spectacle-in-british-horror/

Fulkerson, Matthew. 2014. 'Rethinking the Senses and Their Interactions. The Case for Sensory Pluralism'. *Frontiers in Psychology, 5*, https://doi.org/10.3389/fpsyg.2014.01426

Ganczarek, Joanna, Thomas Hünefeldt and Marta Olivetti Belardinelli. 2018. 'From "Einfühlung" to Empathy. Exploring the Relationship between Aesthetic and Interpersonal Experience'. *Cognitive Processing, 19* (2): 141–45, https://doi.org/10.1007/s10339-018-0861-x

Gage, John. 1999. *Die Sprache der Farben. Bedeutungswandel der Farbe in der Wissenschafts- und Kunstgeschichte.* University of California Press.

—. 2012. 'Colour Ordered and Disordered'. In *Sensory Perception. Mind and Matter*, edited by Friedrich G. Barth, Patrizia Giampieri-Deutsch and Hans-Dieter Klein. Springer-Verlag, https://doi.org/10.1007/978-3-211-99751-2_17

Gallese, Vittorio. 2016. 'Finding the Body in the Brain'. *Goldman and His Critics.* John Wiley & Sons: 297–317, https://doi.org/10.1002/9781118609378.ch14

Gallese, Vittorio and Michele Guerra. 2022. 'The Neuroscience of Film'. *Projections*, *16* (1): 1–10, https://doi.org/10.3167/proj.2022.160101

Gammerl, Benno. 2012. 'Emotional Styles—Concepts and Challenges'. *Rethinking History, 16* (2), https://doi.org/10.1080/13642529.2012.681189

Gavin, Arthur. 1963. 'Photographing "Cleopatra"'. *American Cinematographer, 44* (7): 396–98, 420–22.

Gieck, Jack E. 1952. 'Using Color Creatively'. *Movie Makers. The Magazine of the Amateur Cinema League, Inc.*, November: 295 and 305.

Godard, Jean-Luc. 1957. 'Des Épreuves Suffisantes'. *Cahiers du cinéma, XIII* (73) (July): 35–37.

Goethe, Johann Wolfgang von. 1774. *Die Leiden des jungen Werther*. Carpe Librum.

—. 1810. 'Farbenlehre'. In *Sämtliche Werke.* Vol. 16. Artemis Verlag.

—. 1840. *Theory of Colours*. Translated by Charles Lock Eastlake. John Murray.

Goldstein, Kurt. 1942. 'Some Experimental Observations Concerning the Influence of Colors on the Function of the Organism'. *American Journal of Physical Medicine & Rehabilitation, 21* (3): 147–51.

Gordon, James and Israel Abramov. 2001. 'Color Vision'. In *Blackwell Handbook of Sensation and Perception.*, edited by E. Bruce Goldstein, 2005 Ed.: 92–127. Blackwell Publishing Ltd, https://doi.org/10.1002/9780470753477.ch4

Graham, Sheilah. 1958. 'Sheilah Graham's Hollywood Lowdown'. *Screenland plus TV-Land*, March: 6, 8, 74.

Gray, Beverly. 2004. *Roger Corman. Blood-Sucking Vampires, Flesh-Eating Cockroaches, and Driller Killers*. Thunder's Mouth Press.

Grodal, Torben. 1997. *Moving Pictures. A New Theory of Film Genres, Feelings, and Cognition*. Oxford University Press.

Gunning, Tom. 1994. 'Colorful Metaphors. The Attraction of Color in Early Silent Cinema'. *Fotogenia, 1*: 249–55.

Hailwood, Mark. 2015. 'Food for Thought II. Sociology—Civility and Habitus'. Blog. *The Many-Headed Monster*. 6 April 2015, https://manyheadedmonster.wordpress.com/2015/04/06/food-for-thought-ii-sociology-civility-and-habitus/

Halter, Gaudenz, Rafael Ballester-Ripoll, Barbara Flueckiger and Renato Pajarola. 2019. 'VIAN. A Visual Annotation Tool for Film Analysis'. *Computer Graphics Forum, 38* (3): 119–29, https://doi.org/10.1111/cgf.13676

Hamery, Roxane. 2013. 'Le cinéma scientifique et l'enregistrement des couleurs naturelles. Des expériences pionnières à la norme'. *1895. Mille huit cent quatre-vingt-quinze. Revue de l'association française de recherche sur l'histoire du cinéma*, *71* (December): 229–52, https://doi.org/10.4000/1895.4793

Hanich, Julian. 2010. *Cinematic Emotion in Horror Films and Thrillers. The Aesthetic Paradox of Pleasurable Fear.* Routledge, https://doi.org/10.4324/9780203854587

—. 2017. *The Audience Effect. On the Collective Cinema Experience*. Edinburgh University Press, https://doi.org/10.1515/9781474414968

Hansen, Miriam. 1993. '"With Skin and Hair". Kracauer's Theory of Film, Marseille 1940'. *Critical Inquiry, 19* (3): 437–69.

Haustrate, Gaston. 1969. 'Les contradictions font la loi'. *Cinéma* [*CO*], March: 78–80.

Heckman, Heather. 2015. 'We've Got Bigger Problems. Preservation during Eastman Color's Innovation and Early Diffusion'. *The Moving Image, 15* (1): 44–61, https://doi.org/10.5749/movingimage.15.1.0044

Heesen, Remco. 2015. 'The Young-(Helmholtz)-Maxwell Theory of Color Vision'. *PhilSci Archive*. Preprint, http://philsci-archive.pitt.edu/11279/

Heller, Franziska. 2020. *Update. Film- und Mediengeschichte im Zeitalter der Digitalen Reproduzierbarkeit*. Wilhelm Fink, https://doi.org/10.30965/9783846764602

—. 2016. 'Warum Filmgeschichte? Wie die Digitalisierung unser Bild der Vergangenheit verändert'. *Cinema*, *61*: 12–24.

—.2010. *Filmästhetik des Fluiden. Strömungen des Erzählens von Vigo bis Tarkowskij, von Huston bis Cameron*. Fink.

Helmholtz, Hermann von. 1852. Über die Theorie der Zusammengesetzten Farben. Physiologisch-Optische Abhandlung. Gebrüder Unger.

—. 1867. *Handbuch der physiologischen Optik*. Leopold Voss.

—. 1881. 'On the Relation of Optics to Painting'. In *Science and Culture. Popular and Philosophical Essays.* University of Chicago Press.

Hering, Ewald. 1878. *Zur Lehre vom Lichtsinne*. 2., Unveränderte Auflage. Gerold.

Hertogs, Daan and Nico de Klerk (eds). 1996. *Disorderly Order. Colours in Silent Film*. The 1995 Amsterdam Workshop. Stichting Nederlands Filmmuseum.

Hessey, J. Dodson. 1920. *Colour in the Treatment of Disease*. Rider & Co.

Higgins, Scott. 2007a. *Harnessing the Technicolor Rainbow. Color Design in the 1930s.* University of Texas Press, https://doi.org/10.7560/716278

—. 2007b. 'Technicolor Confections'. *Journal of Visual Culture, 6* (2): 274–82, https://doi.org/10.1177/1470412907078569

—. 2013. 'Chromo-Drama. Innovation and Convention in Douglas Sirk's Color Designs'. In *Color and the Moving Image. History, Theory, Aesthetics, Archive*, edited by Simon Brown, Sarah Street and Liz Watkins: 170–78. Routledge.

Hitchman, Simon. 2013. 'New Hollywood. American New Wave Cinema (1967–69)'. *New Wave Film* (blog), http://www.newwavefilm.com/international/new-hollywood.shtml

Huhtamo, Erkki and Jussi Parikka. 2011. *Media Archaeology. Approaches, Applications and Implications*. University of California Press, https://doi.org/10.1525/9780520948518

Huhtamo, Erkki. 2011. 'Dismantling the Fairy Engine. Media Archaeology as Topos Study'. In *Media Archaeology. Approaches, Applications and Implications*, edited by Jussi Parikka: 27–47. University of California Press, https://doi.org/10.1525/9780520948518-004

Hunt, Robert. 1844. *Researches on Light*. Longman, Brown, Green and Longmans.

Hurlbert, Anya. 2013. 'The Perceptual Quality of Color'. In *Handbook of Experimental Phenomenology. Visual Perception of Shape, Space and Appearance*, edited by Liliana Albertazzi: 369–94. John Wiley & Sons, https://doi.org/10.1002/9781118329016.ch15

Hölzel, Adolf. 1919. *Einiges über die Farbe in ihrer Bildharmonischen Bedeutung und Ausnützung*. Presented at the erster Deutscher Farbentag auf der 9. Jahresversammlung des Deutschen Werkbundes in Stuttgart am 9. September 1919.

Holm, Wilton R. and Society of Motion Picture and Television Engineers. 1957. *Elements of Color in Professional Motion Pictures*. Society of Motion Picture and Television Engineers.

Horak, Jan-Christopher. 2014. *Saul Bass. Anatomy of Film Design*. University Press of Kentucky, https://doi.org/10.5810/kentucky/9780813147185.001.0001

Howes, David. 2014. 'Introduction. "Make It New!"-Reforming the Sensory World'. In *A Cultural History of the Senses in the Modern Age*, edited by David Howes, *6*:1–30. Bloomsbury Academic, https://doi.org/10.5040/9781474233187.0006

Hubner, Laura. 2012. 'Summer with Monika. Summer Dreaming'. *The Criterion Collection—Essays*, May. https://www.criterion.com/current/posts/2314-summer-with-monika-summer-dreaming

Huxley, Aldous. 1954 / 1956. *The Doors of Perception and Heaven and Hell*. Harper & Row.

Hevrdejs, Judy. 2000. 'An Eye for Color. Foodmakers Tempt Our Palates with Their Palettes'. *Chicago Tribune*, 14 July 2000.

Heyes, Cecilia and Caroline Catmur. 2022. 'What Happened to Mirror Neurons?' *Perspectives on Psychological Science*, *17* (1): 153–68, https://doi.org/10.1177/1745691621990638

Hyppolyte, Baraduc. 1904. 'Chromothérapie'. In *Les vibrations de la vitalité humaine. Méthode biométrique appliquée aux sensitifs et aux névrosés*. Librairie J.-B. Bailliere et Fils.

Itten, Johannes. 1961a. *Kunst der Farbe. Subjektives Erleben und Objektives Erkennen als Wege zur Kunst*. Otto Maier Verlag.

—. 1961b. *The Art of Color. The Subjective Experience and Objective Rationale of Color*. Translated by Ernst van Haagen. Van Nostrand Reinhold.

—. 1970a. *Kunst der Farbe. Studienausgabe*. Ravensburger Buchverlag.

—. 1970b. *The Elements of Color*. Translated by Ernst van Haagen. Van Nostrand Reinhold Company.

—. 1973. *The Art of Color. The Subjective Experience and Objective Rationale of Color*. Translated by Ernst van Haagen. 2nd edition. Van Nostrand Reinhold.

Jentsch, Ernst. 1906. 'Zur Psychologie des Unheimlichen'. Translated by Roy Sellars. *Pscyhiatrisch-Neurologishe Wochenschrift 8.22 & 8.23*: 195–98 & 203–05.

Jewanski, Jörg, Julia Simner, Sean A. Day, Nicolas Rothen and Jamie Ward. 2019. 'The "Golden Age" of Synesthesia Inquiry in the Late Nineteenth Century (1876–1895)'. *Journal of the History of the Neurosciences*, https://doi.org/10.1080/0964704x.2019.1636348

Jones, Loyd Ancile. 1929. 'Tinted Films for Sound Positives'. *Transactions of the Society of Motion Picture Engineers, 13* (37) (May): 199–226.

—. 1930. *New Color Moods for the Screen. A Spectrum of Sixteen Delicate Atmospheric Colors, Keyed to the Moods of the Screen, in the New Series of Eastman Sonochrome Tinted Positive Films for Silent or Sound Pictures*. Eastman Kodak Company.

Jones, Lloyd A. and L.M. Townsend. 1925. 'The Use of Color for the Embellishment of the Motion Picture Program'. *Transactions of the Society of Motion Picture Engineers, 21*: 38–66.

Jones, Lloyd A. and Clifton Tuttle. 1928. 'The Reproduction of Mobility and Form and Color by the Motion Picture Kaleidoscope'. *Transactions of the Society of Motion Picture Engineers, 12* (33) (April): 140–56.

Jones, Tom Douglas. 1972. *The Art of Light and Color*. Van Nostrand Reinhold.

Junker, Howard. 1965. 'LSD. "The Contact High"'. *The Nation*, 5 July 1965.

Kael, Pauline. 1969. 'Trash, Art, and the Movies'. *Harper's Magazine*, February.

Kalmus, Herbert T. 1953. 'Technicolor and New Screen Techniques'. *New Screen Techniques*, edited by Martin Quigley: 78–81.

Kalmus, Natalie M. 1935. 'Color Consciousness'. *International Projectionist, 8* (6): 15–17.

Kane, Carolyn L. 2014. *Chromatic Algorithms. Synthetic Color, Computer Art, and Aesthetics after Code*. University of Chicago Press, https://doi.org/10.7208/chicago/9780226002873.001.0001

Kant, Immanuel. 1781. *Kritik der reinen Vernunft* (*erste Fassung 1781*). Project Gutenberg, https://www.gutenberg.org/ebooks/6342

Kappelhoff, Hermann. 2004. *Matrix der Gefühle. Das Kino, das Melodrama und das Theater der Empfindsamkeit*. Vorwerk 8.

Katz, David. 1911. *Die Erscheinungsweisen der Farben und ihre Beeinflussung durch die individuelle Erfahrung*. Kegan Paul, Trench, Trubner & Co. Ltd.

—. 1930. *Der Aufbau der Farbwelt*. Johann Ambrosius Barth.

—. 1935. *The World of Colour*. Translated by R.B. MacLeod and C.W. Fox. Kegan, Paul, Trench, Trubner & Co., Ltd.

Kaufmann, Robert C. 1974. 'A Biographical Note on Faber Birren'. *The Yale University Library Gazette, 49* (1): 73–75.

Keating, Patrick. 2010. *Hollywood Lighting from the Silent Era to Film Noir*. Columbia University Press.

Kilner, Walter J. 1911. *The Human Atmosphere*. Rebman Co.

Kittler, Friedrich. 1986. *Grammophon, Film, Typewriter*. Brinkmann & Bose.

Klein, Christopher. 2017. 'Live from Nevada… It's an A-Bomb Test!' *History,* 21 April, https://www.history.com/news/live-from-nevada-its-an-a-bomb-test

Klüver, Heinrich. 1942. *Mescal and Mechanisms of Hallucinations*. University Of Chicago Press.

Ko, Hee-kyoung, D. Max Snodderly and Martina Poletti. 2016. 'Eye Movements Between Saccades. Measuring Ocular Drift and Tremor'. *Vision Research, 122* (May): 93–104, https://doi.org/10.1016/j.visres.2016.03.006

Koch, Gertrud. 2011. 'Vorwort'. In *Synästhesie-Effekte. Zur Intermodalität der ästhetischen Wahrnehmung*, edited by Marc Glöde, *1*: 7–11. Wilhelm Fink Verlag, https://doi.org/10.30965/9783846745878_002

Koivunen, Anu. 2015. 'The Promise of Touch. Turns to Affect in Feminist Film Theory'. In *Feminisms*, edited by Laura Mulvey and Anna Backman Rogers: 97–110. Amsterdam University Press, https://doi.org/10.1515/9789048523634-011

Kolnai, Aurel. 2007. *Ekel, Hochmut, Hass. Zur Phänomenologie feindlicher Gefühle*. Suhrkamp Verlag.

Koshofer, Gert. 1965. 'Jubiläum für einen Farbfilm. 30 Jahre Kodachrome'. *FM*, 9: 40–42.

Kracauer, Siegfried. 1960. *Theory of Film. The Redemption of Physical Reality*. Oxford University Press.

Kramer, Richard H. and Christopher M. Davenport. 2015. 'Lateral Inhibition in the Vertebrate Retina. The Case of the Missing Neurotransmitter'. *PLoS Biology, 13* (12), https://doi.org/10.1371/journal.pbio.1002322

Krug, Kristine. 2012. 'Principle of Function in the Visual System'. In *Sensory Perception. Mind and Matter*, edited by Friedrich G. Barth, Patrizia Giampieri-Deutsch and Hans-Dieter Klein: 41–56. Springer-Verlag, https://doi.org/10.1007/978-3-211-99751-2_3

Kuehni, Rolf. 2002. 'The Early Development of the Munsell System'. *Color Research & Application, 27* (February): 20–27, https://doi.org/10.1002/col.10002

Kuehni, Rolf G. and Andreas Schwarz. 2008. *Color Ordered. A Survey of Color Systems from Antiquity to the Present*. Oxford University Press, https://doi.org/10.1093/acprof:oso/9780195189681.001.0001

L'Abbate, Anthony. 2013. 'L'aventure des films sonores teintés et virés aux États-Unis'. *1895. Mille huit cent quatre-vingt-quinze. Revue de l'association française de recherche sur l'histoire du cinéma*, 71 (December): 133–43, https://doi.org/10.4000/1895.4777

La Berge, Anne. 1999. 'The History of Science and the History of Microscopy'. *Perspectives on Science, 7* (1): 111–42, https://doi.org/10.1162/posc.1999.7.1.111

Laine, Tarja. 2011. *Feeling Cinema. Emotional Dynamics in Film Studies*. Continuum International Publishing Group, https://doi.org/10.5040/9781628928693

—. 2015. *Bodies in Pain. Emotion and the Cinema of Darren Aronofsky*. Berghahn Books, https://doi.org/10.1515/9781782385769

Lameris, Bregt. 2015. 'On the Restoration History of Colored Silent Films in Germany. An Interview with Martin Koerber'. *The Moving Image, 15* (1): 103–8, https://doi.org/10.5749/movingimage.15.1.0103

—. 2017. *Film Museum Practice and Film Historiography. The Case of the Nederlands Filmmuseum (1946–2000)*. Amsterdam University Press, https://doi.org/10.5117/9789089648266

—. 2018. 'La Ligue Du Noir et Blanc. French Debates on Natural Colour Film and Art Cinema 1926–1927'. In *The Colour Fantastic. Chromatic Worlds of Silent Cinema*, edited by Giovanna Fossati, Victoria Jackson, Bregt G. Lameris, Joshua Yumibe and Sarah Street: 219–35. Amsterdam University Press, https://doi.org/10.1017/9789048532988.013

—. 2019. 'Hallucinating Colours. Psychedelic Film, Technology, Aesthetics and Affect'. *Cinéma & Cie. Special Issue Cinema and Mid-Century Colour Culture, 32* (19): 85–97, http://digital.casalini.it/5064591

—. 2020. 'Die Ästhetik der Zwei-Farben-Verfahren. Historiografische Überlegungen zu Leiblichkeit, Farbe und Film'. Edited by Noemi Daugaard, Bregt Lameris, and Evelyn Echle. Translated by Frank Kessler. *Montage AV. Filmfarben:* 57–80, http://dx.doi.org/10.25969/mediarep/21697.

Langer, Susanne Katherina. 1967. *Mind. An Essay on Human Feeling*. Vol. 1. Johns Hopkins Press.

Lawn, Timothy, and Dominic Ffytche. 2021. 'Cerebellar Correlates of Visual Hallucinations in Parkinson's Disease and Charles Bonnet Syndrome'. *Cortex, 135* (February): 311–25, https://doi.org/10.1016/j.cortex.2020.10.024

Layos, Larry E. 1948. 'Color Dupes Require Careful Filming'. *American Cinematographer*, November: 381 and 387–88.

Layton, James, and David Pierce. 2015. *The Dawn of Technicolor*. George Eastman House.

Leary, Timothy. 1964. *The Psychedelic Experience. A Manual Based on the Tibetan Book of the Dead*. University Books.

Lee, Barry B. 2008. 'The Evolution of Concepts of Color Vision'. *Neurociencias, 4* (4): 209–24.

Leezenberg, Michiel and Gerard de Vries. 2007. *Wetenschapsfilosofie voor Geesteswetenschappen*. 5th ed. Amsterdam University Press.

Lefebvre, Thierry and Cécile Raynal. 2010. *Les solariums tournants du Dr Jean Saidman*. Editions Glyphe, https://doi.org/10.3406/edyte.2009.1104

Lenning, Arthur. 1975. 'A History of Censorship of the American Film'. In *Sexuality in the Movies*, edited by Thomas R. Atkins. Indiana University Press.

Leslie, Esther. 2006. *Synthetic Worlds*. University of Chicago Press.

Lewkowicz, David J. and Robert Lickliter. 1994. *The Development of Intersensory Perception. Comparative Perspectives*. Lawrence Erlbaum Associates, Publishers.

Leys, Ruth. 2011. 'The Turn to Affect. A Critique'. *Critical Inquiry, 37* (3): 434–72, https://doi.org/10.1086/659353

Lightman, Herb A. 1966. 'The Cameraman Becomes the "Star" of "Fantastic Voyage"'. *American Cinematographer, 47* (2): 98–101, 122–23.

Lightman, Herb A. 1961. '"The Pit and the Pendulum"... A Study in Horror Film Photography'. *American Cinematographer, 42* (10): 612–13, 623–24.

Lim, Bliss Cua. 2001. 'Dolls in Fragments. Daisies as Feminist Allegory'. *Camera Obscura, 46* (16.2): 37–77, https://doi.org/10.1215/02705346-16-2_47-37

Lötscher, Christine. 2018. 'Unerhörte Philosophien. Utopie, Feminismus und Erotik in Roger Vadims BARBARELLA'. In *Filmische Seitenblicke: Cinepoetische Exkursionen ins Kino von 1968*, edited by Hermann Kappelhoff, Daniel Illger, and Christine Lötscher: 303–16. Cinepoetics 7. De Gruyter, https://doi.org/10.1515/9783110618945-015

Lomax, Cathy. 2023. 'Dorothy Dandridge. The Invisible Star. Racial Segregation in Hollywood Fan Magazines in the 1950s'. *Stars, Fan Magazines and Audiences.* Edinburgh University Press: 75–96, https://doi.org/10.3366/edinburgh/9781399505901.003.0005

—. 2021. 'The Invisible Star. Dorothy Dandridge and Fan Magazines'. *Performance and Stardom*, 14 Apr, https://performanceandstardom.wordpress.com/2021/04/14/the-invisible-star-dorothy-dandridge-and-fan-magazines/

Long, Robert Emmet (ed.). 2001. *John Huston. Interviews*. University Press of Mississippi.

Lucas, Tim. 2007. *Mario Bava. All the Colors of the Dark*. Video Watchdog.

Luckiesh, Matthew. 1917. *The Lighting Art. Its Practice and Possibilities*. McGraw-Hill Book Co.

—. 1918. *The Language of Color*. Dodd, Mead and Co.

—. 1927. 'Light as an Aid to Your Happiness. New and Useful Secrets of Colored Illumination in the Home. How Lights Depress and Cheer, Subdue and Stimulate You'. *Popular Science Monthly*, October: 56–57, 153.

—. 1938. *Color and Colors*. D. Van Nostrand Company, Inc.

Ludwig, Vera U. and Julia Simner. 2013. 'What Colour Does That Feel? Tactile–Visual Mapping and the Development of Cross-Modality'. *Cortex*, *49* (4): 1089–99, https://doi.org/10.1016/j.cortex.2012.04.004

Lüdzow, Manfred. 2006. 'Food Additives in the European Union. Changes in Their Evaluation and Regulation'. In *Food Is Life*. EDP Sciences, https://doi.org/10.1051/iufost:20060001

Mack, Adam. 2014. 'The Senses of the Marketplace. Commercial Aesthetics for a Suburban Age'. In *A Cultural History of the Senses in the Modern Age*, edited by David Howes, 2019 ed., 6: 77–100. Bloomsbury Academic, https://doi.org/10.5040/9781474233187.ch-003

Mallonee, Laura. 2015. 'Eerie Photos Trace the Strange History of Nukes'. *Wired*, 7 October.

Mamoulian, Rouben. 1960. 'Color and Light in Films. The Esthetics of Colour'. *Film Culture, 21*: 68–79.

Marcuse, Herbert. 1955. *Eros and Civilization. A Philosophical Inquiry into Freud*. Beacon Press.

Mari, Pauline. 2018. *Le voyeur et l'halluciné. Au cinéma avec l'op art*. 'Le spectaculaire'. Série Cinéma. Presses universitaires de Rennes.

Marks, Laura U. 2000. *The Skin of the Film. Intercultural Cinema, Embodiment, and the Senses.* Duke University Press.

—. 2002. *Touch. Sensuous Theory and Multisensory Media.* University of Minnesota Press.

Marschall, Susanne. 2005. *Farbe im Kino*. Schüren Verlag.

Marzola, Luci. 2015. 'Better Pictures Through Chemistry. DuPont and the Fight for the Hollywood Film Stock Market'. *The Velvet Light Trap*, *76*: 3–18, https://doi.org/10.7560/vlt7602

Maurer, Daphne and Charles Maurer. 1988. *The World of the Newborn*. Basic Books.

Maurer, D. 1993. 'Neonatal Synesthesia. Implications for the Processing of Speech and Faces'. *Developmental Neurocognition. Speech and Face Processing in the First Year of Life*, edited by Bénédicte de Boysson-Bardies et al.: 109–24. Springer Netherlands.

Mazzanti, Nicola. 1998. 'The Colours of the Film d'Arte Italiana'. In *Tutti i colori del mondo. Il colore nei mass media tra 1900 e 1930 — All the Colours of the World*, edited by Luciano Berriatúa: 141–46. Edizioni Diabasis.

McDonagh, Antony F., Lucita A. Palma and David A. Lightner. 1980. 'Blue Light and Bilirubin Excretion'. *Science, 208* (4440): 145–51.

McLuhan, Marshall. 1964. *Understanding Media. The Extensions of Man*. 5th ed. MIT.

Merleau-Ponty, Maurice. 1948. 'Le cinéma et la nouvelle psychologie'. In *Sens et non-sens*, 15th edition: 85–106. La Collection Pensées. Edition Nagel.

—. 1964. 'The Philosopher and His Shadow'. In *Signs*, translated by Richard C. McCleary: 159–81. Northwestern University Press.

Merritt, Russell. 2008. 'Crying in Color. How Hollywood Coped When Technicolor Died'. *Journal of the National Film and Sound Archive, Australia*, *3* (2/3): 1–16.

Metz, Christian. 1977. *Le signifiant imaginaire. Psychanalyse et cinéma*. Union générale d'éditions.

—. 1995. *L' énonciation impersonelle, ou le site du film*. Méridians Klincksieck.

Meyden van der, Henk. 1967. 'Ontkleed meisje op VPRO-scherm/Start nieuwe stijl maar: WAT GEBEURT ER MET "DE TRIP" IN NEDERLAND'. *De Telegraaf*, 10 October 1967.

Michaux, Henri. 1956. *Miserable miracle*. Gallimard.

—. 1957. *L'infini turbulent*. Mercure de France.

—. 1961. *Connaissance par les gouffres*. nrf. le point du jour.

Michelis de, Marco. 2009. 'Color Plans for Architecture. 1925–26'. In *Bauhaus 1919–1933. Workshops for Modernity*, edited by Barry Bergdoll and Leah Dickerman: 184–95. The Museum of Modern Art.

Middleman, Rachel. 2018. *Radical Eroticism. Women, Art, and Sex in the 1960s*. Illustrated Auflage. University of California Press, https://doi.org/10.1525/9780520356153

Misek, Richard. 2010. *Chromatic Cinema. A History of Screen Color*. John Wiley & Sons, https://doi.org/10.1002/9781444320077

Mitchell, Jennifer M. 2021. 'MDMA-Assisted Therapy for Severe PTSD. A Randomized, Double-Blind, Placebo-Controlled Phase 3 Study'. *Nature Medicine, 27* (6): 1025–33.

Mitchell, Robert A. 1951. 'The Magic of Color (3). The Projection of Color Films'. *International Projectionist, XXVI* (9): 5–6, 30.

—. 1956. *Manual of Practical Projection*. International Projectionist Pub. Co.

—. 1963. 'A Neglected Asset. Tinted Release-Print Film. Part 1'. *International Projectionist, 38* (12) (December): 4–9.

—. 1964. 'A Neglected Asset. Tinted-Release-Print Film. Part 2'. *International Projection, 39* (1) (January): 4–7 & 12.

Moholy-Nagy, László. 1925. *Painting, Photography, Film*. Translated by Janet Seligman. Bauhaus Book. Lund Humphries.

Mollon, J.D. 2003. 'The Origins of Modern Color Science'. In *The Science of Color*, edited by Shevell: 1–40. Elsevier, https://doi.org/10.1016/b978-044451251-2/50002-7

Morin, Edgar. 1956. Le cinéma ou l'homme imaginaire. Essai d'anthropologie sociologique. Éditions de minuit.

—. 2005. *The Cinema, or the Imaginary Man*. Translated by Lorraine Mortimer. University of Minneapolis Press.

Mroczko-Wąsowicz, Aleksandra. 2016. 'Editorial. Perception–Cognition Interface and Cross-Modal Experiences: Insights into Unified Consciousness'. *Frontiers in Psychology, 7*, https://doi.org/10.3389/fpsyg.2016.01593

Mulder, Arjen. 2017. 'Now Online. Turning Photography—Exploring the Edges of Belgian Contemporary Photography Through a Curated Selection of Essays and Artists' Portraits'. *Dominique Somers*. 7 May 2017, http://www.dominiquesomers.com/blog/2017/5/7/now-online-turning-photography-turning-photography-exploring-the-edges-of-belgian-contemporary-photography-through-a-curated-selection-of-essays-and-artists-portraits

Müller, Werner A., Stephan Frings and Frank Möhrlen. 2019. 'Der Sehsinn'. In *Tier- und Humanphysiologie*, edited by Werner A. Müller, Stephan Frings and Frank Möhrlen: 601–65. Springer Berlin Heidelberg, https://doi.org/10.1007/978-3-662-10555-9_22

Müller-Freienfels, Richard. 1907. 'Zur Theorie der Gefühlstöne der Farbenempfindungen'. *Zeitschrift für Psychologie, 46*: 241–74.

Mulvey, Laura. 1975. 'Visual Pleasure and Narrative Cinema'. *Screen, 16* (3): 6–18.

Münsterberg, Hugo. 1916. *The Photoplay. A Psychological Study*. D. Appleton and Company.

Nakshian, Jacob S. 1964. 'The Effects of Red and Green Surroundings on Behavior'. *Journal of General Psychology. 70*: 143–61.

Nasr, Constantine. 2011. *Roger Corman. Interviews*. University Press of Mississippi.

Neale, Steve. 1985. *Cinema and Technology—Image, Sound, Colour*. Macmillan Education.

Nelson, Ralph. 2007. 'Ganglion Cell Physiology by Ralph Nelson—Webvision'. 10 April 2007, https://webvision.med.utah.edu/book/part-ii-anatomy-and-physiology-of-the-retina/ganglion-cell-physiology/

Neupert, Richard. 1990. 'Technicolor and Hollywood. Exercising Color Restraint'. *Post Script, 10* (1): 21–29.

Newton, Isaac. 1704. *Opticks. Or a Treatise of the Reflexions, Refractions, Inflexions and Colours of Light. Also Two Treatises of the Species and Magnitude of Curvilinear Figures*. Smith and Walford.

Niewenglowski, Gaston-Henri. 1921. 'Photothérapie'. *Dictionnaire pratique de médecine et d'hygiène*, edited by Desesquelle and Niewenglowski, Librairie Garnier Frères: 616. Gallica. bnf.fr, https://gallica.bnf.fr/ark:/12148/bpt6k6461322r.

Noël, Benoît. 1995. *L'histoire du cinéma couleur*. Presses Communications.

O. v., A. 1969. 'The trip. LSD-reis als te mager thema'. *Niewsblad van het Noorden*, 31 January: 14.

Oever, Annie van den (ed.). 2010. *Ostrannenie. On 'Strangeness' and the Moving Image. The History, Reception, and Relevance of a Concept*. Amsterdam University Press, https://doi.org/10.26530/oapen_605865

Olson, James Stuart. 2000. *Historical Dictionary of the 1950s*. Greenwood Publishing Group, https://doi.org/10.5040/9798400663963

Osterweil, Ara. 2014. *Flesh Cinema. The Corporeal Turn in American Avant-Garde Film*. Rethinking Art's Histories. Manchester University Press.

Ouellette, Jennifer. 2018. 'A Math Theory for Why People Hallucinate'. *Quanta Magazine*. 30 July 2018.

Paige, Nicholas. 2004. 'Bardot and Godard in 1963 (Historicizing the Postmodern Image)'. *Representations, 88* (1): 1–25, https://doi.org/10.1525/rep.2004.88.1.1

Pancoast, S. 1877. *Blue and Red Light. Or, Light and Its Rays as Medicine*. J. M. Stoddart & Co.

Pantenburg, Volker. 2015. *Farocki/Godard. Film as Theory*. Translated by Michael Turnbull. Amsterdam University Press, https://doi.org/10.1515/9789048527557

Parikka, Jussi. 2012. *What Is Media Archaeology?* Polity Press.

Parish, Nina. 2007. *Henri Michaux. Experimentation with Signs*. Rodopi, https://doi.org/10.1163/9789401204927

Pellegrino di, G. et al. 1992. 'Understanding Motor Events. A Neurophysiological Study'. *Experimental Brain Research*, *91* (1): 176–80.

Penning, Lars. 1990. 'Die Farbgestaltung in "Funny Face" (Stanley Donen, USA 1957)'. In *2. Film- Und Fernsehwissenschaftliches Kolloquium*, edited by Hans J. Wulff: 65–75. MAkS.

Perinelli, Massimo. 2015. *Fluchtlinien des Neorealismus. Der organlose Körper der italienischen Nachkriegszeit, 1943–1949*. Bielefeld Verlag, https://doi.org/10.14361/9783839410882

Pierotti, Federico. 2020. *La couleur. Une passion cinématographique*. Classiques Garnier.

—. 2019. 'Biopolitics of Colour in Mid-Century Italian Visual Culture'. Edited by Josh Yumibe and Elena Gipponi. *Cinéma & Cie. Special Issue Cinema and Mid-Century Colour Culture, XIX* (32): 53–67.

—. 2016. *Un'archeologia del colore nel cinema italiano. Dal Technicolor ad Antonioni*. Edizioni ETS.

—. 2012. *La seduzione dello spettro. Storia e cultura del colore nel cinema*. Le Mani-Microart.

Plamper, Jan. 2015. *The History of Emotions. An Introduction*. Oxford University Press.

Plantinga, Carl. 2009. *Moving Viewers. American Film and the Spectator's Experience*. University of California Press, https://doi.org/10.1525/9780520943919

Plassart, Anna and Rebekah C. White. 2017. 'Théodore Flournoy on Synesthetic Personification'. *Journal of the History of the Neurosciences. Basic and Clinical Perspectives, 26* (1): 1–14, https://doi.org/10.1080/0964704x.2015.1077542

Pleasonton, Gen. A. J. 1876. *Blue and Sun Lights Their Influence Upon Life, Disease*. Claxton, Remsen & Haffelfinger.

Polyak, Stephan. 1941. *The Retina. The Anatomy and the Histology of the Retina in Man, Ape, and Monkeys.* University of Chicago Press.

Pope, Norris. 2016. 'Kodachrome and the Rise of 16mm Professional Film Production in America, 1938–1950'. *Film History. An International Journal, 28* (4): 58–99, https://doi.org/10.2979/filmhistory.28.4.03

Powell, Anna. 2012. *Deleuze, Altered States and Film*. Edinburgh University Press, https://doi.org/10.3366/edinburgh/9780748632824.001.0001

Prescott, Blake Daniels. 1942. 'The Psychological Analysis of Light and Color'. *Occupational Therapy & Rehabilitation, 21* (3): 135–46, https://doi.org/10.1097/00002060-194206000-00001

Pressey, Sidney L. 1921. 'The Influence of Color upon Mental and Motor Efficiency'. *The American Journal of Psychology, 32* (July).

Reddy, William. 2002. *The Navigation of Feeling. A Framework for the History of Emotions*. Cambridge University Press, https://doi.org/10.1017/cbo9780511512001

Reich, Wilhelm. 1932. *Der Sexuelle Kampf der Jugend*. Verlag für Sexualpolitik.

—. 1945. *The Sexual Revolution. Toward a Self-Governing Character Structure*. Translated by Theodore P. Wolfe. Orgone Institute Press.

Rein, Lisa and Michael Horowitz. 2014. 'Timothy Leary and Marshall McLuhan, Turned on and Tuned in' *Boing Boing*. 3 June 2014.

Rhys-Taylor, Alex. 2014. 'Urban Sensations. A Retrospective of Multisensory Drift'. In *A Cultural History of the Senses in the Modern Age*, edited by David Howes, 2019 ed., 6: 55–76. Bloomsbury Academic, https://doi.org/10.5040/9781474233187.ch-002

Ribbat, Christoph. 2013. *Flickering Light. A History of Neon*. Reaktion Books.

Rickey, George. 1967. *Constructivism. Origins and Evolution*. G. Braziller.

Rieke, Timo. 2008. *Haptic Visuals. Oberfläche und Struktur. Farbe und ihre Beziehung zur Tastwahrnehmung.* Verlag Farbe und Gesundheit.

Riley, Charles A. 1995. *Color Codes. Modern Theories of Color in Philosophy, Painting and Architecture, Literature, Music, and Psychology*. University Press of New England.

Rizzolatti, Giacomo et al. 1996. 'Premotor Cortex and the Recognition of Motor Actions'. *Cognitive Brain Research*, *3* (2): 131–41.

Rohm, Guido. 2012. 'Tausendschönchen'. *Hard Sensations*, October 18, https://www.hardsensations.com/2012/10/dvd-tausendschonchen/

Ronetti, Alessandra. 2019. 'Psychotechniques de la couleur. Publicité expérimentale et attention visuelle en France autour de 1900'. *Mind control. Art et conditionnement psychologique* (*XIXe–XXIe siècles*), edited by Pascal Rousseau. Éditions de la Sorbonne: 27–46, https://doi.org/10.4000/books.psorbonne.108136

Roodenburg, Herman. 2004. 'Pierre Bourdieu. Issues of Embodiment and Authenticity'. *Etnofoor. Authenticity, 17* (1/2): 215–26.

Rosenwein, Barbara H. (ed.). 2006. *Emotional Communities in the Early Middle Ages*. Cornell University Press.

Ross, Anamaria I. 2014. 'Medicine and the Senses. Bodies, Technologies, and the Empowerment of the Patient'. In *A Cultural History of the Senses in the Modern Age*, edited by David Howes, 6: 149–72. Bloomsbury Academic, https://doi.org/10.5040/9781474233187.ch-006

Rossi, Michael. 2019. *The Republic of Color. Science, Perception, and the Making of Modern America.* University of Chicago Press, https://doi.org/10.7208/chicago/9780226651866.001.0001

Röthke, Ulrich. 2013. '"Die Farbe ist das Complicierteste..." Hölzels Farbenlehre im Kontext seines Kunstunterrichts'. *Kunstgeschichte, Open Peer Reviewed Journal*, April.

Rousseau, Pascal. 2020. *Hypnose—art et hypnotisme de Mesmer à nos jours*. École nationale supérieure des Beaux-Arts.

Rubin, Herbert E. and Elias Katz. 1946. 'Auroratone Films for the Treatment of Psychotic Depressions in an Army General Hospital'. *Journal of Clinical Psychology, 2* (4): 333–40.

Ruedel, Ulrich. 2020. 'Tinting and Toning. The Luminous Beauty of Chemistry from Silent to Sound Film'. In *Color Mania. The Material of Color in Photography and Film:* 133–41. Lars Müller, Fotomuseum Winterthur.

Sacks, Oliver. 2012. *Hallucinations*. Picador/Pan Macmillan.

Sagiv, Noam and Jamie Ward. 2006. 'Crossmodal Interactions. Lessons from Synesthesia'. *Progress in Brain Research, 155*: 259–71, https://doi.org/10.1016/s0079-6123(06)55015-0

Saidman. 1929. 'Informations—semaine internationale de la lumière thérapeutique. Paris, 22–27 juillet 1929'. *La revue philanthropique*, 15 January 1929.

Salt, Barry. 1983. *Film Style and Technology. History and Analysis*. Starword.

Scheer, Monique. 2012. 'Are Emotions a Kind of Practice (And Is That What Makes Them Have a History)? A Bourdieuan Approach to Understanding Emotion'. *History and Theory, 51*: 193–220.

Sharits, Paul. 1969. 'Notes on Films/1966/1968', In Film Culture, *47*: 13–16.

Shklovsky, Victor. 1917. 'Art as Technique'. In *Russian Formalist Criticism. Four Essays, Translated and with an Introduction*: 3–24. University of Nebraska Press.

Schopenhauer, Arthur. 1816. *Ueber das Sehn und die Farben. Eine Abhandlung*. Johann Friedrich Hartknoch.

Schopenhauer, Arthur. 1870. *Ueber das Sehn und die Farben. Eine Abhandlung*. 3rd. edition. F.A. Brockhaus.

Schopenhauer, Arthur and Philipp Otto Runge. 1816. *On Vision and Colors and Color Sphere*. Translated by George Stahl. Princeton Architectural Press.

Seitz, William C. 1965. *The Responsive Eye*. The Museum of Modern Art.

Shapiro, Alan E. 1994. 'Artists' Colors and Newton's Colors'. *Isis, 85* (4): 600–630.

Shaviro, Steven. 1993. *The Cinematic Body*. University of Minnesota Press.

Shaw, Elizabeth. *No. 4*. 26 Jan. 1955, https://www.moma.org › MOMA_1955_0008_4 PDF.

Shepherd, Gordon M. 2015. *Foundations of the Neuron Doctrine*. Oxford University Press, https://doi.org/10.1093/oso/9780195064919.001.0001

Sheppard, Dick. 1957. 'What Has She Got That Hollywood Hasn't?' *Photoplay, 52* (2) (August): 33–35, 77–79.

Sherrington, Charles Scott. 1906. *The Integrative Action of the Nervous System*. Yale University Press.

Shonfield, Katherine. 2000. *Walls Have Feelings. Architecture, Film and the City.* Routledge, https://doi.org/10.4324/9780203165492

Signac, Paul. 1898. *D'Eugène Delacroix au néo-impressionnisme*. 2nd ed. H. Floury.

Smith, Linda B. 1994. 'Foreword'. In *The Development of Intersensory Perception. Comparative Perspectives*, edited by David J. Lewkowicz and Robert Lickliter: ix–xix. Lawrence Erlbaum Associates, Publishers.

Smith, Murray. 1994. 'Altered States. Character and Emotional Response in the Cinema'. *Cinema Journal, 33* (4): 34–56.

—. 1995. *Engaging Characters. Fiction, Emotion, and the Cinema*. Oxford University Press.

Sobchack, Vivian. 1992. *The Address of the Eye. A Phenomenology of Film Experience*. Princeton University Press.

—. 2004. *Carnal Thoughts. Embodiment and Moving Image Culture*. University of California Press, https://doi.org/10.1525/9780520937826

—. 2004. 'Breadcrumbs in the Forest. Three Meditations on Being Lost in Space'. In *Carnal Thoughts. Embodiment and Moving Image Culture:* 13–35. University of California Press, https://doi.org/10.1525/9780520937826

Spence, Charles, Daniel Senkowski and Brigitte Röder. 2009. 'Crossmodal Processing'. *Experimental Brain Research, 198* (2): 107, https://doi.org/10.1007/s00221-009-1973-4

Spiegel, Simon. 2013. 'Science Fiction'. In *Filmwissenschaftliche Genreanalyse. Eine Einführung:* 245–65. De Gruyter Studium, https://doi.org/10.1515/9783110296990.245

Spillmann, Werner, ed. 2009. *Farb-Systeme 1611–2007. Farb-Dokumente in Der Sammlung Werner Spillmann*. Schwabe.

Stahl, George. 2010. *Introduction to On Color Vision and Color Sphere*. Princeton Architectural Press.

Stearns, Peter N. and S.C. Stearns. 1986. *Anger. The Struggle for Emotional Control in America's History*. University Of Chicago Press.

—. eds. 1988. *Emotion and Social Change. Toward a New Psychohistory*. Holmes and Meier.

Stell, W.K. 1972. 'The Morphological Organization of the Vertebrate Retina'. In *Handbook of Sensory Physiology*, edited by M.G.F. Fuortes, II: 111–213. Springer-Verlag.

Stephenson, Scott. 2014. 'LSD and the American Counterculture. Comrades in the Psychedelic Quest'. *Burgmann Journal, III*.

Stern, Daniel N. 1985. *Interpersonal World of The Infant. A View from Psychoanalysis and Developmental Psychology*. Basic Books.

Story, W.E. 1921. 'Tentative Report of Optics Committee'. *Transactions of the Society of Motion Picture Engineers*, *12* (May): 25–33.

Street, Sarah. 2009. '"Colour Consciousness". Natalie Kalmus and Technicolor in Britain'. *Screen, 50* (2): 191−215, https://doi.org/10.1093/screen/hjp010

—. 2011. 'Negotiating the Archives. The Natalie Kalmus Papers and the "Branding" of Technicolor in Britain and the United States'. *The Moving Image. The Journal of the Association of Moving Image Archivists, 11* (1): 1–24, https://doi.org/10.1353/mov.2011.0022

—. 2012. *Colour Films in Britain. The Negotiation of Innovation 1900–55*. Palgrave Macmillan.

—. 2018a. 'The Monopack Revolution, Global Cinema and Jigokumon/Gate of Hell (Kinugasa Teinosuke, 1953)'. *Open Screens*, *1* (1) (June): 1–29, https://doi.org/10.16995/os.2

—. 2018b. 'The Colour of Social Realism'. *Journal of British Cinema and Television*, *15* (4) (September): 469–90, https://doi.org/10.3366/jbctv.2018.0438

—. 2020. 'Colour Costume Design'. *The Eastmancolor Revolution and British Cinema 1955–85* (blog). 24 August 2020, https://eastmancolor.info/2020/08/24/colour-costume-design/

Street, Sarah and Joshua Yumibe. 2019. *Chromatic Modernity. Color, Cinema, and Media of the 1920s*. Columbia University Press, https://doi.org/10.7312/stre17982

Street, Sarah, Keith M. Johnston, Paul Frith and Carolyn Rickards. 2022. *Colour Films in Britain. The Eastmancolor Revolution*. British Film Institute.

Schweinitz, Jörg. 2012. 'Von Transparenz und Intransparenz. Über die Atmosphäre historischen Filmmaterials'. In *Filmische Atmosphären*, edited by Philipp Brunner and Margrit Tröhler: 39–52. Schüren Verlag GmbH.

Syder, Andrew. 2009. "*Shaken out of the Ruts of Ordinary Perception". Vision, Culture and Technology in the Psychedelic Sixties*. PhD Thesis. University of Southern California.

Tan, Ed S. 1996. *Emotion and the Structure of Narrative Film. Film as an Emotion Machine*. Lawrence Erlbaum Assoc Inc.

Taoka, Yasuko. 2012. '(Be)Coming Home(r). Nostalgia in Jean-Luc Godard's Contempt'. *Arethusa, 45* (2): 243–58.

Taussig, Michael. 2006. 'What Color Is the Sacred?' *Critical Inquiry*, *33* (1): 28–51, https://doi.org/10.1086/509745

Tenenoff Reich, W. 1963. 'Now Liz Poses Nude!' *Photoplay*, April: 37–39, 96–98.

Tkaczyk, Eric. 2001. 'Pressure Hallucinations and Patterns in the Brain'. *Morehead Electronic Journal of Applicable Mathematics*, *1*: 26.

Thompson, Kirsten Moana. 2015. 'Falling in (to) Color. Chromophilia and Tom Ford's A Single Man (2009)'. *The Moving Image, 15* (1): 62–84, https://doi.org/10.5749/movingimage.15.1.0062

Tomkins, Silvan S. 1962. *Affect Imagery Consciousness. Volume I: The Positive Affects*. Springer Publishing Company.

Tomkins, Silvan S. and Robert McCarter. 1964. 'What and Where Are the Primary Affects? Some Evidence for a Theory'. *Perceptual and Motor Skills:* 119–58.

Tröhler, Margrit. 2012. 'Einleitung. Filmische Atmosphären—eine Annäherung'. In *Filmische Atmosphäre*, edited by Jörg Schweinitz, Philipp Brunner and Margrit Tröhler: 11–21. Zürcher Filmstudien 30. Schüren Verlag.

Tröhler, Margrit, Jörg Schweinitz and Philipp Brunner (eds). 2012. *Filmische Atmosphären*. Schüren Verlag.

Troland, Leonard T. 1918a. 'The Psychology of Color—I. Color as a Form of Consciousness'. *Scientific American Supplement, 86* (2225): 114–15.

—. 1918b. 'The Psychology of Color. II. Color as a Form of Consciousness'. *Scientific American Supplement, 86* (2226): 134–35.

—. 1927. 'Some Psychological Aspects of Natural Color Motion Pictures'. *Transactions of the Society of Motion Picture Engineers, 11* (32): 680–98.

Truffaut, François. 1954. 'Une certaine tendance du cinéma français'. *Cahiers du cinéma, VI* (31): 15–29.

Truffaut, François and Alfred Hitchcock. 1967. *Hitchcock*. Simon and Schuster.

Trumbull, Douglas. 1968. 'Creating Special Effects for *2001: A Space Odyssey*'. *American Cinematographer, 49* (6): 416–19, 451–53.

—. 1969. 'The "Slit-Scan" Process as Used in *2001: A Space Odyssey* and Beyond'. *American Cinematographer, 50* (10): 998–1001, 1012–13, 1016–17, 1020–22, 1024–26.

Vincendeau, Ginette. 1992. 'The Old and the New. Brigitte Bardot in the 1950s France'. *Paragraph, 15* (1) (March): 73–96.

Visscher, dr. H.S. 1969. 'Kunst Abnormaal. Filmkroniek'. *Trouw*, June: 15.

Wagner, Christoph, Monika Schäfer, Matthias Frehner and Gereon Sievernich. 2013. *Itten—Klee. Kosmos Farbe*. Regensburg.

Wallace, Mark T. 2004. 'The Development of Multisensory Processes'. *Cognitive Processing, 5* (2): 69–83, https://doi.org/10.1007/s10339-004-0017-z

Wellbery, David E. 2003. 'Stimmung'. In *Ästhetische Grundbegriffe. Historisches Wörterbuch in Sieben Bänden*, edited by Karlheinz Barck, 5: 703–33. J.B. Metzler, https://doi.org/10.1007/978-3-476-98611-5_22

Wells, H. G. 1898. *The War of the Worlds*. 2008 ed. Phoenix Pick, https://www.gutenberg.org/files/36/36-h/36-h.htm

—. 1914. *The World Set Free. A Story of Mankind*. E.P. Dutton.

Welsch, Norbert, and Claus Christian Liebmann. 2004. *Farben. Natur, Technik, Kunst*. Elsevier Spektrum Akademischer Verlag.

White, George Starr. 1928. *The Story of the Human Aura*. George Starr White.

Whitfield, T.W. Allan. 2015. 'Feelings in Design. A Neuroevolutionary Perspective on Process and Knowledge'. *The Design Journal, 10* (3): 3–15, https://doi.org/10.2752/146069207789271939

Whitfield, T.W. Allan and Jianne Whelton. 2013. 'The Arcane Roots of Color Psychology, Chromotherapy, and Colour Forecasting'. *Color Research & Application, 40* (1): 99–106, https://doi.org/10.1002/col.21862

Williams, Linda. 1989. *Hard Core. Power, Pleasure, and the 'Frenzy of the Visible'.* University of California Press.

—. 1991. 'Film Bodies. Gender, Genre, and Excess'. *Film Quarterly*, *44* (4): 2–13.

—. 2008. *Screening Sex*. Duke University Press, https://doi.org/10.1515/9780822388630

Wilson, Robert F. 1946. *Colour and Lighting in Factories and Offices*. British Colour Council.

Wise, Barbara K. and James A. Wise. 1988. 'The Human Factors of Color in Environmental Design. A Critical Review'. *NASA Contractor Report 177498.* National Aeronautics and Space Administration. University of Washington.

Wundt, Wilhelm Max. 1910. *Principles of Physiological Psychology*. 2nd ed. Swan, Sonnenschein.

Wulff, Hans Jürgen. 2012. 'Prolegomena zu einer Theorie des Atmosphärischen im Film'. In *Filmische Atmosphären*, edited by Margrit Tröhler, Jörg Schweinitz, and Philipp Brunner: 109–32. Zürcher Filmstudien. Schüren Verlag GmbH.

Wyszecki, Günter and Walter Stanley Stiles. 1982. *Color Science. Concepts and Methods, Quantitative Data and Formulae*. Wiley.

Young, Thomas. 1802. 'On the Theory of Light and Colors'. *Philosophical Transactions of the Royal Society*, *91*: 12–49.

Youngblood, Gene. 1970. *Expanded Cinema*. Studio Vista.

Yumibe, Joshua. 2009. '"Harmonious Sensations of Sound by Means of Colors". Vernacular Colour Abstractions in Silent Cinema'. *Film History. An International Journal, 21* (2): 164–76, https://doi.org/10.2979/fil.2009.21.2.164

—. 2012. *Moving Color. Early Film, Mass Culture, Modernism.* Rutgers University Press.

—. 2013. 'L'espace de la couleur comme espace de jeu dans la littérature enfantine, le cinéma des premiers temps et les féeries'. *1895. Revue d'histoire du cinéma*, *71*: 33–46, https://doi.org/10.4000/1895.4767

Zeitlin-Wu, Lida. 2023. 'What's Your Color? Mood Conditioning the Postwar Domestic Interior'. *Camera Obscura. Feminism, Culture, and Media Studies*, *38*(3): 35–75, https://doi.org/10.1215/02705346-10772575

Zielinski, Siegfried. 2002. *Archäologie der Medien. Zur Tiefenzeit des technischen Hörens und Sehens*. Rowohlt Taschenbuch Verlag.

—. 2003. 'Einige historische Modi des audiovisuellen Apparats'. In *Der Kinematographische Apparat. Geschichte und Gegenwart einer Interdisziplinären Debatte*, edited by Robert F. Riesinger: 159–74. Film und Medien in der Diskussion 11. Nodus Publikationen.

Websites

NASA AMAS RESEARCH LAB. 'Simultaneous and Successive Contrast'. *Using Color in Information Display Graphics,* https://colorusage.arc.nasa.gov/Simult_and_succ_cont.php

Filmography

2001: A Space Odyssey
(USA / GBR 1968, Stanley Kubrick, Technicolor / Metrocolor)
DVD: 2001 Turner Entertainment, Warner Home Video

All That Heaven Allows
(USA 1955, Douglas Sirk, Technicolor V)
DVD: 2001 The Criterion Collection

A Matter of Life and Death
(GBR 1946, Michael Powell and Emeric Pressburger, Technicolor IV)
DVD: 2009 Sony Pictures Home Entertainment.

A Star is Born
(USA 1954, George Cukor, Technicolor V)
DVD: 2003 Alpha Video Distributors

Alien
(USA 1979, Ridley Scott)
DVD: 2003 Twentieth Century Fox Home Entertainment

Aliens
(USA / GBR 1986, James Cameron)
DVD: 2003 Twentieth Century Fox Home Entertainment

Amer
(FRA / BEL 2009, Hélène Cattet and Bruno Forzani)
DVD: 2012 Koch Media

Arnulf Rainer
(AUSA 1960, Peter Kulbelka)
https://www.youtube.com/watch?v=vfy1cdRrAFU&t=15s

Bachelor in Paradise
(USA 1961, Jack Arnold, Metrocolor)
DVD: 2011 Turner Entertainment, Warner Bros. Entertainment

Barbarella: Queen of the Galaxy
(FRA / ITA 1968, Roger Vadim, Technicolor V)
DVD: 1999 Paramount Home Video

Becky Sharp
(USA 1935, Mamoulian)
DVD: 2019 Kino Lorber, Paramount Pictures

Behind the Green Door
(USA 1972, Artie and Jim Mitchell)
DVD: 2004 Mitchell Brothers Film Group

Black Hawk Down
(USA / GBR 2001, Ridley Scott)
DVD: 2010 Universum Film

Black Narcissus
(GBR 1947, Michael Powell and Emeric Pressburger, Technicolor IV)
DVD: 2010 The Criterion Collection

Blade Runner
(USA 1982, Ridley Scott)
DVD: 2007 Warner Brothers Entertainment

Bridget Jones's Diary
(UK 2001, Sharon Maguire)

Broken Arrow
(USA 1950, Delmer Daves, Technicolor IV)
DVD: 2007 Twentieth Century Fox Home Entertainment

Cat's Cradle
(*USA 1959,* Stan Brakhage)
https://www.youtube.com/watch?v=Cur2P5Ym3Yw

Christmas on Earth
(USA 1963, Barbara Rubin)

Cinéma Paradiso
(ITA/FRA 1988, Guiseppe Tornatore)
DVD: 2007 Arrow Films

Cleopatra
(USA / SUI /GBR 1963, Joseph L. Mankiewicz, Technicolor IV)
DVD: 2002 Twentieth Century Fox Home Entertainment

Close Encounters of the Third Kind
(USA 1977, Stephen Spielberg, Metrocolor)
DVD: 2001 Columbia TriStar Home Entertainment

Couch
(USA 1964, Andy Warhol)
https://archive.org/details/youtube-aI_A7-TnakA

Das Parfum: Die Geschichte Eines Mörders
(GER 2006, Tom Tykwer)
DVD: Constantin Film

Der Himmel über Berlin
(GER/FRA 1987, Wim Wenders)
DVD: 2003 MGM Home Entertainment

Der Schweigende Stern
(GDR 1960, Kurt Maetzig, Agfacolor)
DVD: 2009 Icestorm Entertainment

Designing Woman
(USA 1957, Vincente Minnelli, Metrocolor)
DVD: 2007 Süddeutsche Zeitung Cinemathek

Destination Moon
(USA 1950, Irving Pichel, Technicolor IV)
DVD: 1999 Image Entertainment

Die Abenteuer des Prinzen Achmed
(GER 1925, Lotte Reiniger; Carl Koch)
DVD: Absolut Medien

En effeuillant la marguerite
(FRA 1956 Marc Alégret)

Et Dieu… créa la femme
(FRA 1956, Roger Vadim, Eastmancolor)
DVD: 2000 The Criterion Collection

Fahrenheit 451
(GBR 1966, François Truffaut, Technicolor V)
DVD: 2005 Süddeutsche Zeitung Cinemathek

Fantasia
(USA 1940, James Algar et al., Technicolor IV)
DVD: Buena Vista Home Entertainment

Fantastic Voyage
(USA 1966, Richard Fleischer, Eastmancolor)
DVD: 2007 Twentieth Century Fox Home Entertainment

Flaming Creatures
(USA 1962–1963, Jack Smith)

Flying Leathernecks

(USA 1951, Nicholas Ray, Technicolor IV and Technicolor Monopack using Kodachrome)

Funny Face
(USA 1957, Stanley Donen, Technicolor V)
DVD: 2007 Paramount Pictures

Funny Little Bunnies
(USA 1934, Wilfred Jackson, Technicolor IV)

Fuses
(USA 1964–1967, Carolee Schneemann)
https://vimeo.com/512695159

Gigi
(USA 1958, Vincente Minnelli, Metrocolor)
DVD: 2007 Turner Entertainment, Warner Bros. Entertainment

Glas
(NDL 1958, Bert Haanstra, Technicolor for 16mm)

Goldfinger
(GBR 1964, Guy Hamilton, Technicolor V)
DVD: 2012 Metro-Goldwyn-Mayer Studios

House of Usher
(USA 1960, Roger Corman, Eastman Color)
DVD: 2004 MGM Home Entertainment

I tre volti della paura
(ITA 1963, Mario Bava, Technicolor V / Eastmancolor)
DVD: 2007 Anchor Bay

Il deserto rosso
(ITA / FRA 1964, Michelangelo Antonioni, Technicolor V)
DVD: 2010 The Criterion Collection

Inside Out
(USA 2015, Pete Docter)

Is er overeenkomst tusschen klank, rhythme en kleurafwisseling? (*Is there similarity between sound, rhythm and changing colors?*)
(NL 1932, Willem Bon)
Print at EYE Filmmuseum

Johnny Guitar
(USA 1954, Nicholas Ray, Trucolor)

Kean ou désordre et génie
(FRA 1924, Alexandre Volkoff)
Restoration Cinémathèque française

Kid Millions
(USA 1934, Roy Del Ruth, Technicolor IV)
DVD: 2013 Warner Brothers Entertainment

Kleur en vormafwisseling op 'Choo-choo' Jazz
(NLD 1932, Willem Bon)
Print at EYE Filmmuseum

Konchu Daisenso (*Genocide*)
(JAP 1968, Kazui Nihonmatsu, Fujicolor)
DVD: 2012 The Criterion Collection

Kyuketsuki Gokemidoro (*Goke, Body Snatcher from Hell*)
(JAP 1968, Hajime Sato, Fujicolor)
DVD: 2012 The Criterion Collection

La frustra e il corpo
(ITA 1963, Mario Bava, Technicolor V)

La lumière d'en Face (*The Light Across The Street*)
(FRA 1955 Georges Lacombe)

La prisonnière
(FRA 1968, Henri-Georges Clouzot, Eastmancolor)
DVD: 2014 Studio Canal

Lassie Come Home
(USA 1943, Fred M. Wilcox, Technicolor IV and Technicolor Monopack using Kodachrome)
DVD: 2006 Turner Entertainment. Warner Bros.

L'enfer
(FRA 1964, Henri-Georges Clouzot)

Le mépris
(FRA 1963, Jean-Luc Godard, Technicolor V)
DVD: 2002 The Criterion Collection

Leave Her to Heaven
(USA 1945, John M. Stahl, Technicolor IV)
DVD: 2004 Twentieth Century Fox Home Entertainment

Les parapluies de Cherbourg
(FRA 1964, Jacques Demy, Eastmancolor)
DVD: 2004 Koch Lorber

Les aventuriers
(FRA 1967, Robert Enrico, Eastmancolor)
DVD: 2011 Concorde Home Entertainment

Les choses de la vie
(FRA / JAP / CHE 1969, Claude Sautet, Eastmancolor)
DVD: 2001 StudioCanal

Les demoiselles de Rochefort
(FRA 1967, Jacques Demy, Eastmancolor)
DVD: Buena Vista Home Entertainment

Lover, Come Back
(USA 1961, Delbert Mann, Eastmancolor).
DVD: 2006 Universal Studios

Loving
(USA 1957, Stan Brakhage)

Manina (*The Girl in the Bikini*)
(FRA 1952 Willy Rozier)

Marnie
(USA 1964, Alfred Hitchcock, Technicolor V)
DVD: Collector's Edition

Moby Dick
(USA / GBR 1956, John Huston, Technicolor desaturation process)
DVD: 2001 MGM Home Entertainment

Modesty Blaise
(UK 1966, Joseph Losey, Eastmancolor)
DVD: 2002 Twentieth Century Fox Home Entertainment

Mon oncle
(FRA 1958, Jacques Tati, Eastmancolor)
DVD: 2001 The Criterion Collection

Moulin Rouge
(GBR 1952, John Huston, Technicolor IV)
DVD: 2007 NewKSM

N:O:T:H:I:N:G
(USA 1968, Paul Sharits)

Niagara
(USA 1953, Henry Hathaway, Technicolor IV)
Blu ray: 2013 20th Century Fox

North by Northwest
(USA 1959, Alfred Hitchcock, Technicolor V)
DVD: 2009 Turner Entertainment, Warner Bros. Entertainment

Pal Joey
(USA 1957, George Sidney, Technicolor V)
DVD: 1999 Columbia TriStar Home Entertainment

Peeping Tom
(GBR 1960, Michael Powell, Eastmancolor)
DVD: 1999 The Criterion Collection

Piece Mandala/End War
(USA 1966, Paul Sharits)

Pierrot le fou
(FRA 1965, Jean-Luc Godard, Eastmancolor)
DVD: 2007 The Criterion Collection

Playtime
(FRA 1967, Jacques Tati, Eastmancolor)
DVD: 2001 The Criterion Collection

Pleasantville
(USA 1998, Gary Ross)

Ray Gun Virus
(USA 1966, Paul Sharits)

Rear Window
(USA 1954, Alfred Hitchcock, Technicolor V)
DVD: 2001 Universal Studios

Rebel Without a Cause
(USA 1955, Nicholas Ray, Eastmancolor)
Blu ray 2013 Warner Home Video

Riso amaro
(ITA 1949, Giuseppe De Santis)

Rope
(USA 1948, Alfred Hitchcock, Technicolor IV)
DVD: 2006 Universal Studios

Rosemary's Baby
(USA 1968, Roman Polanski, Eastmancolor)
DVD: 2012 The Citerion Collection

Sedmikrásky (*Daisies*)
(ČSSR 1966, Vera Chytilová, Eastmancolor)
DVD: 2013 Bildstörung/2012 Criterion

Sei donne per l'assassino
(ITA / FRA / GER 1964, Mario Bava, Estmancolor)
DVD: 2015 Arrow Films

Separation
(UK 1968, Jack Bond)
DVD: 2009 BFI

She Wore a Yellow Ribbon
(USA 1949, John Ford, Technicolor IV)
DVD: 2002 Warner Home Video

Shock Corridor
(USA 1963, Samuel Fuller, Kodachrome)
DVD: 1998 Criterion

Singin' in the Rain
(USA 1952, Stanley Donen; Gene Kelly, Technicolor IV)
DVD: 2007 Turner Entertainment, Warner Bros. Entertainment

Spartacus
(USA 1960, Stanley Kubrick, Technicolor V)
DVD: The Criterion Collection

Star Wars: Episode V—The Empire Strikes Back
(USA 1980, Irvin Kershner)
DVD: 2004 Twentieth Century Fox Home Entertainment

Summer with Monika
(SWE 1953, Ingmar Bergman)

T,O,U,C,H,I,N,G
(USA 1969, Paul Sharits)

Taxi Driver
(USA 1976, Martin Scorsese, Metrocolor)
DVD: 2007 Sony Pictures Home Entertainment

The Black Swan
(USA 1942, Henry King, Technicolor IV)
DVD: 2006 Twentieth Century Fox Home Entertainment

The Cook, the Thief, his Wife and her Lover
(GBR 1989, Peter Greenaway)
DVD: 2003 Universal Studios

The Cookie Carnival
(USA 1935, Ben Sharpsteen, Technicolor IV)

The Flicker
(UK 1966, Tony Conrad, Black and white)

The Graduate
(USA 1967, Mike Nichols, Technicolor V)
DVD: 2016 Criterion Collection

The King of Jazz

(USA 1930, John Murray Anderson, Technicolor III)

The Little Colonel
(USA 1935, David Butler)
DVD: 2005 Twentieth Century Fox Home Entertainment

The Living Daylights
(GBR 1987, John Glen)
DVD: 2012 Metro-Goldwyn-Mayer Studios

The Long, Long Trailer
(USA 1953, Vincente Minnelli, Ansco Color)
DVD: 2011 Turner Entertainment, Warner Bros. Entertainment

The Piano
(FRA / NZL / AUSA 1993, Jane Campion)
DVD: 2003 Kinowelt Home Entertainment

The Pit and the Pendulum
(USA 1961, Roger Corman, Eastmancolor)
DVD: 2004 MGM Home Entertainment

The Responsive Eye
(USA 1965, Brian De Palma)
https://www.youtube.com/watch?v=vaUme6DY8Lk

The Rocky Horror Picture Show
(USA 1974, Jim Sharman)
DVD: 2002 Twentieth Century Fox Home Entertainment

The Tales of Hoffmann
(GBR 1951, Michael Powell; Emeric Pressburger, Technicolor IV)
DVD: 2005 The Criterion Collection

The Trip
(USA 1967, Roger Corman, Eastmancolor)
DVD: 2007 Metro-Goldwyn-Mayer Studios

The Quiet Man
(USA 1952, John Ford, Technicolor IV)
DVD: 2008 Süddeutsche Zeitung Cinemathek

The War of the Worlds
(USA 1953, Byron Haskin, Technicolor IV)
DVD: 1999 Paramount Pictures

To Catch a Thief
(USA 1955, Alfred Hitchcock, Technicolor V)
DVD: 2012 Paramount

To Spring
(USA 1936, Hugh Harman; Rudolf Ising, Technicolor IV)

Une femme est une femme
(FRA 1961, Jean-Luc Godard, Eastmancolor)
DVD: 2004 The Criterion Collection

Ur Kärlekens Språk (*Language of Love*)
(SWE 1969, Torgny Wickman)

Vertigo
(USA 1958, Alfred Hitchcock, Technicolor V)
DVD: 1999 Universal Studios

West Side Story
(USA 1961, Jerome Robbins and Robert Wise, Technicolor V)
DVD: 2005 MGM Home Entertainment

Westinghouse all Electric House
(*1959*)
https://www.youtube.com/watch?v=jyrTgtPTz3M

Wilson
(USA 1944, Henry King, Technicolor IV)
DVD: 2013 Fox

Written on the Wind
(USA 1956, Douglas Sirk, Technicolor V)
DVD: 2005 Universal

List of Illustrations

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About the Team

Alessandra Tosi was the managing editor for this book.

Fran Cetti proof-read an early version of the manuscript; Rosalyn Sword proof-read the final version; Annie Hine compiled the index; Laura Rodriguez created the Alt-text.

Jeevanjot Kaur Nagpal designed the cover. The cover was produced in InDesign using the Fontin font.

Cameron Craig typeset the book in InDesign and produced the paperback and hardback editions. The main text font is Tex Gyre Pagella and the heading font is Californian FB.

Cameron also produced the PDF and HTML editions. The conversion was performed with open-source software and other tools freely available on our GitHub page at https://github.com/OpenBookPublishers.

Jeremy Bowman created the EPUB.

Raegan Allen was in charge of marketing.

This book was peer-reviewed by Kirsty Dootson and two anonymous referees. Experts in their field, these readers give their time freely to help ensure the academic rigour of our books. We are grateful for their generous and invaluable contributions.

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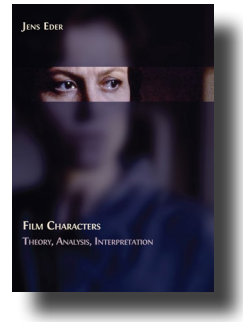

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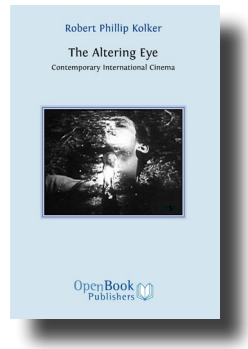

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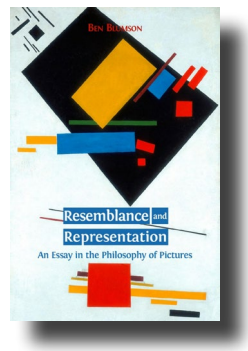

Feeling Colour
Chromatic Embodiment in Film Culture (1950s-1960s)

Bregt Lameris

Lameris's Feeling Colour *is a remarkable work of media archeology that traces concerns about colour and embodiment through the material fabric of cinema at midcentury. Ranging across mainstream and new wave films to b-movies and erotic works, the way in which Lameris pivots from close analyses of the colours of these films to their theoretical and historical implications is a model within the field.*

Prof. Joshua Yumibe, Director of Film Studies, Michigan State University

The shift from monochrome to coloured motion picture famously provided moviegoers the dazzling opportunity to more fully engage their senses, all the while opening new modes of affective possibilities for filmmakers. Set against the intersection of media studies, emotion theory, biology, and digital humanities, *Feeling Colour: Chromatic Embodiment in Film Culture (1950s-1960s)* delves into the role colour played in the oft-fraught relationship between cinema and its audiences. This transnational analysis of an extensive range of midcentury cinematography examines the multilayered effects which extend beyond the silver screen, offering a high-level theoretical elaboration and in-depth historical exploration of both experimental and mainstream movies.

Lameris takes an interdisciplinary perspective, examining the different ways colour creates—or was believed to create—embodied reactions. From perception theory and 'putting the nerves in motion', to colour psychology and how to 'steer' the spectator, to cross-modal perception (or'synaesthesia'), Lameris asks how how colours and feelings in film are entangled in the colour cultures, discourses and beliefs of a particular historical context.

With its influential cultural scholarly contribution and accessible writing style, this book will delight both students and specialists in film and media studies. In addition, those interested in the history and use of color in advertising, neuroscience, gender studies, and emotion will find the book engaging and useful.

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The cover combines two images of the film *La perception et l'imaginaire* (FRA 1964, Éric Duvivier). Credit: Image'Est. Photographs of the Kodachrome II camera material by Bregt Lameris, ERC Advanced Grant FilmColors, https://filmcolors.org/galleries/la-perception-et-limaginaire-1964-2/#/image/19741 and https://filmcolors.org/galleries/la-perception-et-limaginaire-1964-2/#/image/19742.
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