

The Colour Revolution: Disney, DuPont and Faber Birren

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Meanings, like colors, express neither truth nor value if they are separated from the various modes in which they are 'given' or taken away. These modes are connected to forms, to techniques, to the manual history of production. In practice, colours subsist in a relationship of simple correspondence or cause, connecting how they are seen with how they are produced.

(Manlio Brusatin, *A History of Colours*)

Abstract

This paper explores the professional cross-connections between the Walt Disney studios, who pioneered the early adoption of Technicolor IV, DuPont, whose chemical research provided the colour pigments and Pyralin cels used in Disney's films, and Faber Birren, one of the most influential corporate American consultants in colour design and marketing. It considers several aspects of colour that have not previously been considered in colour or animation studies: first, the material history of cellulose nitrate and acetate and its structural and aesthetic relationship to colour and transparency in animation; second, the role that colour paints and pigments developed by the DuPont company played as part of its targeting of Hollywood as a strategic new market, and third, the ways in which colour production was aesthetically informed by colour consultants like Birren across multiple realms, from cinema to interior design and architecture. By considering how colour production and design was situated within larger corporate strategies at DuPont in which colour was key to its industrial and consumer markets, I hope to enrich our understanding of the role that Disney, DuPont and Faber Birren played in the colour revolution of the mid-twentieth century.

Colour cinematography and the Ink and Paint department were key attractions in Disney films, while also playing a spectacular narrative role in features like *Snow White and the Seven Dwarves* (Dave Hand, 1937) and *The Reluctant Dragon* (Alfred Werker, 1941). Celebrating its new colour range in Technicolor, Disney's promotional rhetoric emphasized its material colour production as expensive,

exotic and luxurious.¹ In a 1930s Disney press release, colour's aesthetic quality was emphasized: 'In seeking perfection in colour reproduction Disney technicians have [...] developed paints which in beauty and reliability excel all watercolours of the past',² and celebrated onscreen in *The Reluctant Dragon's* 'Rainbow Room', in a montage sequence devoted to the Disney Ink and Paint department's transformation of prodiegetic pigments and paints into the final colour image. From its first Silly Symphony in colour, *Flowers and Trees* (Burt Gillett, 1932), colour was a value that marked Disney's product as qualitatively different from earlier two-strip subtractive color processes in animation like Technicolor III, Multicolor or Harriscolor, or the later Cinecolor.³ With an exclusive contract for Technicolor IV between 1932–34, Disney produced cartoons with a new colour palette that no other cartoon studio could match.⁴ With complementary (red and green) and triadic colour schemes (red, blue and yellow) in narratives where toys, candy and Christmas were frequent devices for expressive display in its Silly Symphony series, like *The Night Before Christmas* (Wilfred Jackson, 1933) or *The Cookie Carnival* (Ben Sharpsteen, 1935), Disney also offered a more nuanced pastel palette in the feature film *Snow White*, with light browns, blues and greens.⁵ In its animated stories, the studio imagined colour's material production process as magical, even transgressive, with off-screen gender and labor practices sometimes shaping on-screen representational practices.⁶ For example, in *Snow White*, the Wicked Queen uses coloured liquids to transform her beautiful surface into an ugly hag, musing to herself: 'Now... a formula to transform my beauty into ugliness, change my queenly raiment to a

¹ For more information on Disney's Ink and Paint Department's use of colour paints and pigments, see Kirsten Moana Thompson, "'Quick—Like a Bunny!": The Ink and Paint Machine, Female Labour and Color Production', *Animation Studies*, 9 (February 2014), <<https://journal.animationstudies.org/kirsten-thompson-quick-like-a-bunny/>> [accessed 6 February 2019].

² 'Premium' (Walt Disney Studios Press Release, [n.d]). Walt Disney Clippings, 1938–1946, Publicity Ephemera, UCLA Performing Arts Collection.

³ James Layton and David Pierce, *The Dawn of Technicolor, 1915–1935* (Rochester, NY: George Eastman House, 2015), pp. 268–77.

⁴ Ted Eshbaugh made an important early Technicolor IV test cartoon, *Wizard of Oz* (1932–33), that was never theatrically released. John McElwee, 'A Cartoon Pioneer We've Forgotten', 21 October 2014, Greenbriar Picture Shows, <<http://greenbriarpictureshows.blogspot.com/2014/10/a-cartoon-master-weve-forgotten.html>> [accessed 6 February 2019].

⁵ A British writer described it this way: 'The new Technicolour [sic] gives clear full yellow, pale blue that is clean. Light browns as well as dark browns; rich ivy green besides emerald and olive. The lightest of colours are possible, shell pinks, the strange greens of layers of water, lily white.' Robert Herring, 'The Cartoon Color-Film', *Close Up*, 10, March 1933, p. 86.

⁶ See Thompson, 'Colorful Material Histories: the Disney Paint Formulae, the Paint Laboratory and the Ink and Paint Department', *Animation Practice, Process and Production*, 4.1 (2014), 45–66. For an expanded discussion of the gendered labor practices of colour production as transgressive femininity, see Thompson, "'Quick—Like a Bunny!": Like *Snow White*, contemporary artist Sarah Maple's photographic installation *Snow White the Scientist* (2011) underscores the transgressive connection between femininity and colour production as part of her *Princess Series*, which reimagines Disney heroines in modern workplaces, <<https://www.sarahmaple.com/paintings-2/#/new-gallery-4>> [accessed 6 February 2019].

peddler's cloak. Mummy dust to make me old; to shroud my clothes, the black of night; to age my voice, an old hag's cackle; to whiten my hair, a scream of fright; a blast of wind to fan my hate; a thunderbolt to mix it well; now begin thy magic spell.' The Wicked Queen's spell showcases colour's materiality as transformative agent, while it also alerts us to the connection between cosmetic surface and normative ideas of femininity and beauty. As she bathes a red apple in a poisonous cauldron of sickly green colour, advising us: 'Look on the skin! The symbol of what lies within!', her transformation has also exposed the Queen's literal and metaphorical ugliness. This diabolical corruption by means of colour links the scene to a long philosophical tradition (*disegno vs colore*) in which colour was considered to be a lapse from normative classicism and in which form and line were privileged over hue. In a parallel laboratory scene in *The Worm Turns* (Ben Sharpsteen, 1937), Mickey Mouse, wearing bright red gloves and a white lab coat, is working late at night on a secret formula called the Courage Builder ('The Weak Made Strong'). In striking staging with dramatic shadows and meticulous attention to shadow and light, Mickey is surrounded by flasks, beakers and test tubes in highly saturated hues of reds, greens, blues and purples. In pursuit of his magic formula, Mickey pours coloured liquids from beaker to test tube, each time producing bubbling, sputtering and sparking puffs of colour (with automobile sound effects) as the experiment progresses. While colour is certainly verisimilitudinous, marking Disney's distinctive attention to the lighting and materiality of liquids and glass, what is ultimately staged is the spectacular relay of transforming colours, the sensual seduction of Technicolor candy ready for us to visually consume. Here the supernatural storyline is a narrative pretext to foreground colour *as colour*, as transparent as the laboratory glassware. From the scintillating gems in the Seven Dwarves' diamond mine to the Wicked Queen's poisonous-red apple in its bubbling cauldron, colour was in constant transformational movement, from liquid to gas to solid: it was *animated*.

In pioneering the early adoption of Technicolor IV in the film industry, well before most major studios took up the new colour process, the Disney studio played a vital role in the colour revolution,⁷ as a key site for the increasing dissemination of colour in many aspects of popular culture and everyday life.⁸ In a similar fashion, the DuPont Corporation also played a critical role through its research and manufacture of synthetic dyes, pigments, plastics and paints for industrial and consumer use, that in turn helped reshape business and retail in the late nineteenth and early twentieth century. Beginning in the early 1920s, and as part of its strategic targeting of Hollywood as an important market, DuPont

⁷ Regina Lee Blaszczyk, *The Color Revolution* (Cambridge, MA: MIT Press, 2012).

⁸ Of the extensive body of literature on Disney, key texts on colour include Richard Neupert, 'Painting a Plausible World: Disney's Color Prototypes', in *Disney Discourse: Producing the Magic Kingdom*, ed. by Eric L. Smoodin (New York: Routledge, 1994), pp. 106–17; 'A Studio Built of Bricks: Disney and Technicolor', *Film Reader*, 6 (April 1985), 33–40; J. P. Telotte, *The Mouse Machine: Disney and Technology* (Urbana: University of Illinois, 2008), and Esther Leslie, *Hollywood Flatlands: Animation, Critical Theory and the Avant-Garde* (London: Verso, 2002).

provided two key materials to Disney as the studio produced its cel animation and later expanded into colour in 1932: first, the transparent nitrate (and later acetate and plastic) cels under the name of Pyralin, and second, Monastral pigments used by Disney to manufacture its in-house paint for the final artwork produced on these cels. Led by colour consultants like Howard Ketcham and Faber Birren, whose philosophical and psychological understandings of colour informed the range and palette of its product line, as well as its marketing to consumers, business and government, DuPont in turn helped transform twentieth century colour, from interior design to textiles, lighting and architecture. As two leading corporations in American manufacturing and entertainment, DuPont and Disney offer a useful case study for understanding the complex intersections of material history and aesthetic design that shaped visual culture in the colour revolution.

As with live action cinema, the role of colour in cel animation is a complicated one. The luminosity, hue and saturation of animated colours on screen was shaped by the use of specific prodiegetic materials, from the types of nitrate or acetate cels used as inked and painted surfaces for the artwork, to the pencils, pastels, chalks, watercolour or oil paints. The lighting conditions employed to photograph the cels and the type of platen glass under which they were photographed, all affected the clarity, value and saturation of the artwork's colours, as did the cinematographic processes in which these cels were then photographed and printed, from Cinecolor to Technicolor IV. The conditions under which the films were projected, from ambient illumination to the light bulbs, lens and focus of the projector, also affected the sharpness and brilliance of the colours exhibited, as Disney was all too aware.⁹ Finally, the specific properties of the production materials manufactured by DuPont also enabled or restricted the colour range of Disney's prodiegetic artwork.

DuPont and Disney's Material Relationships

Founded on the gunpowder mills established on the Brandywine River by E. I. du Pont de Nemours in Wilmington, Delaware in 1802, the DuPont corporation would become a huge conglomerate by the twentieth century, developing or buying the patents for Nylon, Kevlar, Teflon, Lycra and hundreds of other chemicals, and establishing major industrial and consumer lines in explosives, insecticides and fungicides, rubber chemicals, dyestuffs, paints and pigments.¹⁰ Many DuPont products stemmed from similar roots, beginning with a twentieth

⁹ For Disney's efforts to educate projectionists, see Paul Cramer, 'Cooperative Job Ahead', *Projection*, 10 (1938), 22–26.

¹⁰ E. I. Du Pont de Nemours & Company, *DuPont: The Autobiography of An American Enterprise: The Story of E. I. Du Pont de Nemours & Company* (New York: Scribner/Simon and Schuster, 1952) and Alfred Du Pont Chandler and Stephen Salisbury, *Pierre S. Du Pont and the Making of the Modern Corporation* (New York: Harper, 1971).

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Fig. 1: *Better Living Through Chemistry* (Hagley Library, 1946 Pamphlet)

century expansion shaped by the huge range of products derived from one key raw material, cellulose, or the fibre from the cell walls of plants. Different treatment methods of cellulose with nitric (and later, acetic) acid led to a huge range of diverse products, encapsulated by its slogan 'Better Things for Better Living... Through Chemistry', including DuPont cellophane, celluloid film, Duco (an enamel that coated colours to cars), Rayon and Pyralin (fig. 1).

In 1915 DuPont acquired the Arlington company, a manufacturer of tortoise shell combs who had created a synthetic plastic called Pyralin in 1883. With the acquisition of the Viscoloid Co. in 1925, together these would form the core of DuPont's Plastics division (founded in 1936), which specialized in manufacturing a wide variety of consumer goods, from women's hairbrushes to war munitions and cellophane.¹¹ Around 1911, as an effect of the popularity of bobbed hair,

¹¹ Viscoloid Co. 1926–1928. Trade Catalogues, Box 4 and Public Affairs Department Records, 1915–1981, Hagley Library.

the combmaking industry faced declining sales, and with the First World War faced additional shortages in raw materials. In 1912, DuPont's monopoly on the explosives industry ended with an antitrust decision that forced the company to diversify, and, for all these reasons, DuPont started to expand its products to new markets and users, particularly the film industry.¹²

DuPont Pyralin

Like both Kodak and Technicolor, DuPont's research laboratory was key to the company's growth,¹³ and with selective poaching of British chemists from its competitors, DuPont began manufacturing positive film, as well as panchromatic and orthochromatic negative film in 1925. DuPont base film stock was developed from nitrocellulose, but its gelatin film emulsion was created from animal products like ossein (the collagen produced from cattle and buffalo bones), splits (the inside layer of cattle skin), calfskin and porkskin. In other words, the materiality of DuPont cinematic products had a direct, indeed structural relationship to the plant and animal worlds through their simulation or literal incorporation of plant or animal products into their material bases, but also in their use as aesthetic surface for the representation of flora and fauna in films like *Fantasia* (Wilfred Jackson, 1940), *Dumbo* (Ben Sharpsteen, 1941) and *Bambi* (Dave Hand, 1942). DuPont's transparent Pyralin or Pyroxylin plastic film (without the gelatin emulsion) was marketed in 1920 as the 'material of a thousand uses',¹⁴ and was a new synthetic plastic which could mimic dozens of natural products from ivory to tortoiseshell and leather, a distinctive feature of what Jeffrey Mickle calls 'celluloid's powers of mimicry'.¹⁵ Pyralin was manufactured in tubes, rods or sheets and could be bonded to metal, wood, plastic and glass. Providing insulation against heat, cold and sound, it had a high structural strength. Pyralin and the later acetate plastic or 'Plastacele' were non-flammable and were widely used in consumer devices from fountain pens to toothbrushes, combs, piano keys, poker chips, eyeglasses and toiletry products. In its transparent form, it was used in lantern slides, automobile safety glass and lampshades, while the company also boasted that 'Pyralin is available [...] — in hundreds of colour effects and colour combinations — Ivories, Jades, Shells, Pearls, Mahoganies — all are truly duplicated in Pyralin'.¹⁶ In the form of

¹² Luci Marzola, "Better Pictures Through Chemistry": DuPont and the Fight for the Hollywood Film Stock Market', *Velvet Light Trap*, 76 (Fall 2015), 3–18 (p. 7).

¹³ Marzola, pp. 8 and 10.

¹⁴ *DuPont Advertisements* (Wilmington, DE: Du Pont de Nemours, 1920), p. 6, 'Collection of Nine Folders Illustrating the Advertisements of Pyralin', Hagley Library.

¹⁵ Cited in Nicole Shukin, *Animal Capital: Rendering Life in Biopolitical Times* (Minneapolis: University of Minnesota Press, 2009), p. 108.

¹⁶ 'What Next Will Be Made of Pyraline?' Pamphlet (Arlington, NJ: DuPont Nemours, c.1920), Pyralin Dept, Trade Literature, 1926–1928, Hagley Library.

thin sheets called cels, Pyralin was lightweight and abrasion resistant, offering a temporary surface on which artwork could be painted and then photographed frame by frame, to create the illusion of movement in animation. Colourlessness and transparency were essential properties ensuring maximal legibility of the vibrancy of the colours painted on the palimpsest of cels and background paintings, while the additional benefits of flexibility and durability afforded by plasticizers ensured that the cels could withstand the manipulations of inkers, painters and camera operators.¹⁷

Not only was Hollywood a market for DuPont products like Pyralin, but it was also a means by which DuPont promoted the value of its products to other potential customers. In February 1923, 'Pyralin's Unique Use in the Movies' appeared in *The DuPont Magazine* featuring Bud Fisher's popular animated characters Mutt and Jeff from DuPont's client, the Raoul Barré studio, along with illustrations provided by *Scientific American* editor and author of the *Cinema Handbook* A. C. Lescaboura.¹⁸ Although Disney is not mentioned at this early stage, Laugh-o-Gram bankruptcy records show that at least as early as 30 November 1923 DuPont was already a supplier, with Disney invoiced for an unpaid bill for 200 20" x 50" sheets of Pyralin.¹⁹ By December 1934 in *The DuPont Magazine*, Hazel Sewell, head of Disney's Ink and Paint department, appeared in a photo promoting a Pyralin cel of Mickey Mouse, and in the very next issue in February 1935, in 'Behind the Scenes with Mickey Mouse', DuPont used Disney's popular new character to advertise Pyralin's suitability for animation. By 6 September 1938 in another trade magazine, DuPont advertised Pyralin through its use on the recently released feature *Snow White*, with the company also offering customer service teams to 'cooperate with you in determining how Pyralin may be used practically and usefully applied in solving problems pertaining to your business'.²⁰ Meanwhile, correspondence in the 1930s between Disney and DuPont show the studio's increasing production demands of *Snow White*, with DuPont accommodating them by decreasing the size and width of the Pyralin plastic cels to 10" x 12" x 1/16" at Disney's request.²¹

¹⁷ Because of these plasticizers, the surface of the artwork eventually became an unstable chemical compound subject to cracking, chipping and degassing. Kristen McCormick and Michael R. Schilling, 'Animation Cels: Preserving a Portion of Cinematic History', *Conservation of Plastics* (Spring 2014), 1–7.

¹⁸ 'Pyralin's Unique Use in the Movies', *The DuPont Magazine*, 17.2, February 1923, p. 5.

¹⁹ Michael Barrier, *The Animated Man: A Life of Walt Disney* (Los Angeles: University of California Press, 2007), p. 335n; Timothy Susanin, *Walt Before Mickey: Disney's Early Years, 1919–1928* (Jackson: University of Mississippi, 2011), p. 242n. Animator Rudy Ising confirmed DuPont decreased cels to 1/16".

²⁰ Photo in *The DuPont Magazine*, 28.12, December 1934, p. 10; R. T. Ellis, 'Behind the Scenes with Mickey Mouse', *The DuPont Magazine*, 29.1–2, February 1935, p. 5; Advertisement for *Snow White*, 6 September 1938, courtesy Russell Merritt, 2015.

²¹ 'Animation's Volatile Relationship With Plastic', 1 June 2015, <<https://d23.com/getty-animation-research-library/>> [accessed 6 February 2019].

DuPont Colour

DuPont also promoted its other nitrocellulose products to the film industry, from nitrate and replacement safety film to explosives for clearing land for movie production, and even lacquer paint for set design and movie props.²² In 'Lacquer's Screen Career', DuPont's trade literature suggested that its colour paint on the sets of Cecil B. DeMille's 1934 production *Cleopatra* signified quality and luxury, and by extension, that DuPont colour was part of the glamour of Cleopatra's court and of Hollywood.²³ Even though *Cleopatra* was shot in black and white, the high sheen of DuPont's expensive colour paint offered high production values, and as its advertising suggested, transformed cheap props and sets into expensive objects. DuPont even developed a tool to ensure this glossiness and measure the reflection of light in its paints, lacquers and varnishes with the Pfund Glossimeter. Additionally, *The DuPont Magazine* noted that, even though the lacquer was not visible as colour *on film*, it nonetheless helped promote a psychological effect of 'realness' in the actors: 'Realistic backgrounds and "props" assist the players to throw themselves into their roles, to get the feel of their parts. The rich trappings, glittering colours and highlighted accoutrements of the Romans all served to intensify the mood of pageantry in pictures like *Cleopatra*.'²⁴ In this respect, DuPont trade ads repeatedly emphasized Pyralin and Duco paints' quality to justify their expensive pricetag: 'best — because they have no settling in the can, the pigment being permanently suspended in the solution', said one 1920s ad for Pyralin Enamels.²⁵

Supervising colour design of a number of DuPont divisions, including Duco paint from 1927 to 1935, was DuPont's 'colour engineer' Howard Ketcham, before he became a freelance colour consultant to Pan Am, General Electric and other corporations. Ketcham standardized and simplified DuPont's automotive Duco colour line, radically reducing it from 11,500 down to 290 colours, adopting Munsell's colour system of hue, chroma and value and reinforcing DuPont's promotion of colour with quality. Between 1935 and 1940, Ketcham consulted with DuPont to design coloured plastic Pyralin for bathroom products like mirrors, combs and makeup containers. In 'Rare Colors Revived', *DuPont Magazine* explicitly linked Ketcham's designs with craft traditions of luxury and quality in English and American marble glass, observing that 'Regency period "Pyralin" faithfully simulates in color and tone value this early American glass, a triumph for Howard Ketcham and

²² 'How Mighty is Dynamite?', *The DuPont Magazine*, 28.11, November 1934, pp. 1 and 16.

²³ Laing, 'Lacquer's Screen Career', *The DuPont Magazine*, 29.1–2, February 1935, pp. 8–9 and 24; D.V. Gregory and A.V. Wetlaufer, 'How Glossy is Glossy?', *The DuPont Magazine*, 24.4, April 1930, p. 18.

²⁴ Laing, pp. 9 and 24.

²⁵ 'DuPont Pyralin Enamels: Best for Non Breakables', *DuPont Advertisements*, Group A, papers 4 & 5, Hagley Library.

the craftsmen of the DuPont Viscoloid Co. Inc. for they have reproduced in boudoir accessories the most prized colors'.²⁶

Ketcham's colour design across the DuPont product line was in keeping with the corporation's transmedial promotion of its plastics, pigments and textiles as quality and luxury goods. Pyralin's toughness and durability, as well as the brilliancy of DuPont Duco enamel paint made it particularly suitable for quick-drying automotive paint finishes, but also as lamination on superior toys for children. In an advertisement for Pyralin enamel toys in 1920, DuPont acknowledged that 'they cost more than any enamels made — but they deliver more in quality and covering, most per dollar of cost'.²⁷ Similarly, rubber toys of Disney characters like Pluto, Ferdinand the Bull and the Three Little Pigs, made by Seiberling Latex Co. of Akron, OH, also used DuPont chemicals and laminated colours and were featured in trade literature, demonstrating the embedded material continuum between on- and offscreen Disney characters and the DuPont corporation.²⁸

DuPont and Disney's material relationship extended from plastics into black-and-white and colour pigments. Disney established an Ink and Paint department in its very first studio in Kingswell in 1923, led by supervisor Hazel Sewell. A problem encountered by all animation studios was that off the shelf Grumbacher paints failed to adhere to the slippery surface of the DuPont nitrate cels, and eventually specialized manufacturers like the Catalina Color Co. (later Cartoon Colour Co.) would emerge to supply the animation industry with speciality paints that would adhere to these surfaces. However, unlike Warner Bros. and MGM, the Disney studio shifted to manufacturing its own paint as it was cheaper to buy the pigments from suppliers like DuPont and produce in bulk on the studio lot.

Made by the women of the Ink and Paint department with the assistance of a specialized laboratory, paint was manufactured following colour formula index cards, together with their specific 'letdowns', or lighter or darker tints which compensated for the multiple cel layers that made up the composite artwork of cel animation. Comparisons between the paint product codes on Disney's colour formula cards and *DuPont's Standard Pigment Colours* (Wilmington, DE: Du Pont Nemours, 1941), reveal these pigment preferences. Having acquired the Krebs Company in 1929 which specialized in lithopone and titanium dioxide, DuPont specialized in the bulk of Disney's most vibrant colours.²⁹ The brilliancy of DuPont pigments included chrome yellows, chrome greens, iron blues,

²⁶ 'Rare Colors Revived', *The DuPont Magazine*, 29.10, October 1935, p. 20.

²⁷ *DuPont Advertisements* (Wilmington, DE: DuPont Nemours, 1920), Hagley Library.

²⁸ 'Toyland Telegraph' Advertisement for Seiberling Latex Co., *The DuPont Magazine*, 31.11, November 1937, p. 1; *The DuPont Magazine*, 33.1–2, February 1939, p. 15; *The DuPont Magazine*, 33.12, Holiday issue, 1939, p. 12.

²⁹ The formula cards also indicate other suppliers, including Hoover, especially for browns and blacks; SCM (for yellows, and cadmium reds); Harcros/Pfizer (for the oxide reds, yellows and greens) and Mobay (formerly Harmon) and Imperial/Harshaw for certain reds (MV6606 or Red 88; MX686 or Red 83).

organic lakes and toners, particularly Pthalocyanine blue (BT-297 D) or Platinum Violet (BP-273-D) or Monastral blue, which were used for rich detailing like the Queen's and Snow White's purple and blue costumes in *Snow White*.³⁰ By 1953 DuPont also offered new pastel hues derived from titanium dioxide, such as blue-green, copper, pink and rose that cut across product lines, from automobiles to telephone handsets, printing inks, floor coverings and textile fibres.³¹

Disney's initial colour formula recipes were based on the Munsell colour system. After the shift in 1939 to the new Burbank studio, the Color Paint Lab, headed by Mary Weiser and Production Process Laboratory headed by Emilio Bianchi, were established. Disney employee Herman Schultheis described the colour production process in this way:

The paints are mixed in the paint lab at the studio from formulas by trained chemists. Pigments (animal, vegetable and mineral) are ground and mixed. Several hundred hues with 7 values each (from dark to light) are kept here. Inharmonious colours are avoided and pastel shades are used mostly. Color schemes have to be changed when character moves from sun into shadow, etc.³²

Disney's opaque paint had a much higher quotient of gum arabic, in comparison to Warner Bros.' unstable casein-based paint. Its textural thickness made the paint adhere to the cel and gave it a jewel-like quality because the pigments would sink to the bottom adhering to the cel, with the paint above it, so the colour was against the cel, enhancing its intensity.³³ As my previous research has shown, the colour formulas confirm that there was a qualitative difference in Disney paint: its colours were more brilliant because of its vibrant DuPont pigments, while its technical application was easier because of its greater viscosity and elasticity.³⁴ Not only did DuPont supply key materials that helped create Disney characters both on- and offscreen, and also use the animation industry to cross promote its own product lines, it also influenced Disney colour aesthetics through its own colour consultant. Thus far, we have seen that Disney's use of DuPont Pyralin, pigments and paints demonstrated the studio's insistence on quality and vibrancy in its prodiegetic materials, enriching the artwork photographed by its Technicolor cameras that would in turn position

³⁰ Colour Laboratory and Ink and Paint Department Historical Material. Personal Collection, Lew Stude and interviews 1 May 2014, transcript, pp. 1–30, and 1–3 August 2015, transcript, pp. 1–72, Burbank, CA.

³¹ Emily Heine, 'Color Sells Itself', *The DuPont Magazine*, 51.2, April–May 1957, pp. 2–5.

³² John Canemaker, *The Last Notebook: Herman Schultheis and the Secrets of Walt Disney's Movie Magic* (Los Angeles: Walt Disney Family Foundation Press, 2014). All paint consists of three major ingredients: the pigment (or hue), the vehicle or base in which the pigment is suspended (oil or water), and the binder, which can offer gloss, elasticity or strength. In addition there are often softeners for pliability and humectants to attenuate drying.

³³ Stephen Worth interviews 30 April 2014, transcript, pp. 1–37, and 13 August 2015, transcript, pp. 1–28 and correspondence, Pacoima, CA.

³⁴ Thompson, 'Colourful Material Histories', p. 55.

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Disney as an innovative technological leader in the use of colour in Hollywood and animated film markets. Manufacturing its paints in bulk from DuPont pigments not only saved Disney money, but also afforded it creative control to broaden and nuance its rich colour palette for its feature films, while also using colour as an important brand signifier of aesthetic value and spectacle. Similarly, DuPont's targeting of the Hollywood film industry was an important part of the company's broader diversification of its products, from celluloid to lacquer paint, in which DuPont marketed its goods as indices of aesthetic luxury and value, while also using the glamour of its association with stars like Mickey Mouse to cross promote itself to other business. For both Disney and DuPont, colour played a central role in their promotional strategies to differentiate themselves in the marketplace. DuPont was a leading producer of the synthetic raw materials for the consumer goods and services that would feed the colour revolution, from interior design to architecture, textiles and printing, while Disney's early adoption of synthetic colour marked them out as an innovative producer of the entertainment industry in colour. Each company would come to use the services of a leading colour engineer, designer and philosopher in that colour revolution named Faber Birren (1900–1988).

Faber Birren and Colour at Work

As part of Walt Disney Studio's newly established internal training program, in which notable scholars, artists and teachers offered lectures for its animation workers, leading colour consultant Faber Birren delivered ten talks at the studio over two weeks in early 1939, which discussed 'the history, science, psychology and modern applications of colour'.³⁵ The author of forty books and 254 articles on colour, Birren founded American Color Trends, a notable pioneer in industrial colour design that consulted for factories, hospitals, schools and companies, including DuPont, Monsanto, Allied Chemical and General Electric. To enhance productivity and safety in factories, Birren developed a colour coded system (orange for alerts, green for safety equipment, yellow for hazards, blue for caution, and so on) and also produced similar colour protocols for the US Navy, Army and Coastguard. His pioneering work understood that functionalist colour design minimised eye fatigue, maximised visibility and directed visual attention, producing an unconscious form of automatic response in the worker: 'the trick is to establish a seeing condition that automatically, in and of itself, makes the task easier'.³⁶ Birren also specialized in the psychological effects of colour design, advising how changing hues could help advertising and businesses

³⁵ Birren, 'Color Preferences', 20 April 1939, Disney Development Program, 7 pages, in Don Hahn and Tracy Miller-Zarnecke, *Before Ever After: The Lost Lectures of Walt Disney's Animation Studio* (Los Angeles: Disney Editions, 2016), pp. 286–293 (p. 286).

³⁶ Birren, 'Color in the Plant', *The DuPont Magazine*, 39.4, 1945, pp. 10–16.

through guest talks, trade literature and journalism.³⁷ Citing Matthew Luckiesh, an expert on the relationship of colour and light, Birren noted that colour design must account for the reflection of light: ‘As Dr Luckiesh, a noted authority in the lighting field phrases it: “High visibility, ease of seeing and good seeing conditions are overwhelmingly the result of good brightness engineering”.’³⁸ Designing a ‘Color Conditioning’ program for DuPont that examined the psychological effects of colour in industrial and consumer spaces like factories and offices,³⁹ Birren made specific recommendations for changes in hue, in order to enhance consumer appetite and increase spending; in his words, ‘color has become a valuable *worker* on the plant pay roll [sic]’ [emphasis added].⁴⁰ He even suggested pigment shades like a purple colour for a fertilizer spreader to look ‘appropriately springlike in a home garden setting’⁴¹ (fig. 2).

Once a student at the Art Institute of Chicago, Birren’s colour preferences were strongly influenced by the theories of Ewald Hering and Wilhelm Ostwald, and his consulting for both Disney and DuPont emphasized the ways in which colour perception played an active role in colour preferences that was rooted in our own physiology.⁴² Like Howard Ketcham, Birren is an important figure who links the corporate world of industrial and consumer mass production to art, through his close focus on psychology and cultural and historical understandings of colour aesthetics. Birren’s lecture ‘Color Preferences’ delivered on 20 April 1939 at Disney drew from his recently published *Monument to Color* (1938) and was supplemented by demonstrations to the Disney artists of ‘paints, lights, and other materials, making his teachings visible, memorable, and most importantly, true to color’.⁴³ Birren’s colour theories built from his training in art history, discussing, for example, how the chiaroscuro work of da Vinci or Rembrandt revealed their intuitive understanding of hue, light and shadow. From these artistic practices, Birren developed his own theories of colour harmonies that were built around tints, tones and shades. Influenced by Hering’s triangular chart of colour, which placed hue on one angle, white on the second and black on the third, as well as theories by Ostwald, who distinguished between colour as light and colour as surface pigment, Birren developed a colour chart that mapped these principles in a triangle made up of seven forms (hue, white, black, tint, shade, tone, gray), for his ultimate goal was the systematization of colour harmonies that could be deployed in mass culture: ‘Good color in industry, in products and commodities of everyday consumption, is high art. It is art spread

³⁷ Birren, ‘Color and You’, *The DuPont Magazine*, 42.3, March 1948, pp. 16–17.

³⁸ Matthew Luckiesh, *Light and Colour in Advertising and Merchandising* (New York: D. Van Nostrand, 1923), cited in Birren, ‘Color in the Plant’, p. 11.

³⁹ Birren, ‘Color and You’, p. 17.

⁴⁰ Birren, ‘Color in the Plant’, p. 16.

⁴¹ Heine, ‘Color Sells Itself’, p. 4.

⁴² *The Enjoyment and Use of Color* (New York: Scribner, 1924); Birren, *Monument to Color* (New York: McFarland, 1938), pp. 34–35.

⁴³ Hahn and Miller-Zarnecke, p. 286.

The Colour Revolution: Disney, DuPont and Faber Birren

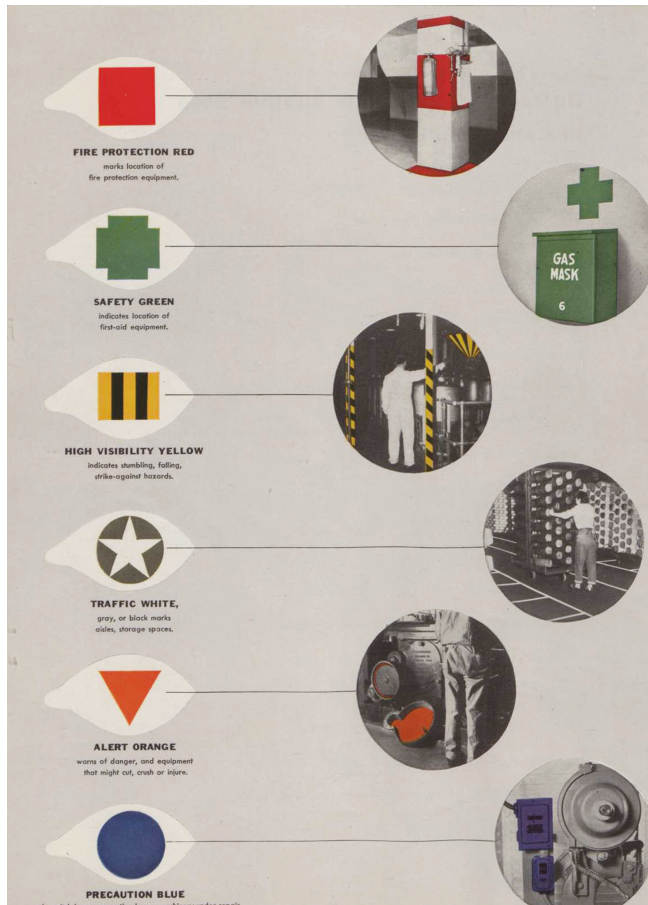


Fig. 2: *Functional Color Design for Safety and Productivity* (Hagley Library, 1946 Pamphlet)

everywhere among people and applied to the things they need and the things that answer their human wants. It is vital art which people eagerly accept and which is mighty good for them and for society.⁴⁴

In his lecture to the Disney artists, Birren pointed out the role of colour preferences in consumer attention and retail, describing research by 'a manufacturer of toilet articles', that 'found that people like red and blue; next is purple, then green, with orange and yellow last'.⁴⁵ Birren's observations around colour preferences drew upon certain chromophobic and gendered cultural assumptions, asserting that 'The negro ranks red and blue highest', along with

⁴⁴ Birren, *Monument*, p. 50.

⁴⁵ Hahn and Miller-Zarnecke, pp. 289–90. Although Birren doesn't state who the manufacturer is, I believe it's likely to be DuPont, given his prior relationship with the company. As the manufacturer's research revealed that '75% of all toilet articles were given away as presents', Birren stressed that colour design of these products must account for this fact.

‘children, Indians and primitive peoples’, and ‘Even in insane asylums the greatest response will be to red and blue — they are the two big thrills’.⁴⁶ Yet irregardless of what people claimed (‘what people say they like isn’t always the thing they will respond to’), Birren argued that, ‘In most everything we studied so far there is a consistent reminder that it is the simple things that people respond to — red, blue and green’.⁴⁷ Birren’s approach to colour understood it as sensation, but one that could be scientifically studied: in *Monument to Color*, he said, ‘Argue all you want that color is emotional and therefore beyond rule and law — the fact remains that even emotion can be sensibly analysed.’⁴⁸ Concluding his address to the Disney animators, Birren emphasized that the important thing was to think in terms of the mass: ‘you’re not concerned with “functional” colour schemes’, but with ‘the mass of people with the absolute type of color preferences’ and elsewhere noted that ‘it is always the mass reaction that counts’.⁴⁹ After a lengthy discussion of the history of colour symbolism, he emphasized ‘really, when it comes to color preferences your guess is as good as mine. I have tried to play with color freely [...] hoping that out of this will grow an attitude on your part that will make you think of all people, of audiences rather than individuals’.⁵⁰ Insisting that as artists they were critical shapers of colour preferences, ‘I think it is your problem not to ask people what they like, but to *know* what they like’.⁵¹

Birren’s philosophies of colour shaped the industrial palette through his functional colour design for DuPont finishes, textiles, paints and plastics divisions while his focus on blue, red, and green and contrasting colour schemes in his lectures for the Disney company emphasized mass appeal in colour preferences. Like his work in industrial colour design as the *automatization* of the attention and energy of the worker by minimizing eyestrain and directing visual attention, Birren’s approach to the cultural aesthetics of colour return repeatedly to a focus on mass preferences, whereby the artist’s role should be to mediate these mass preferences. In this focus on the mass, the colour consultants, or colour ‘engineers’ as they were called, exemplify the mid-century design principles of the corporations for whom they worked, in which colour could be scientifically measured, understood and reverse engineered.

Animated colour was a material product of corporate modernity. From the industrial research of corporate laboratories that produced new synthetic pigments and plastics, to the new aesthetic philosophies of colour consultants, the professional ties between Disney and DuPont reveal a colour revolution that was manufactured, designed and consumed to order: in the words of Faber Birren, ‘Color is a modern art, built upon modern progress.’⁵²

⁴⁶ Ivi, p. 289.

⁴⁷ Ivi, p 291–92.

⁴⁸ Birren, *Monument*, pp. 11, 27.

⁴⁹ Hahn and Miller-Zarnecke, pp. 289, 291.

⁵⁰ Ivi, p. 293.

⁵¹ Ibid.

⁵² Birren, *Monument*, p. 27.