COLOUR
Art, Science & Power
(26 July 2022 - 23 April 2023)
Anita Herle
Introduction

Colour is all around us. It influences and reflects our understanding of the world, our emotions, creativity and relations with others. COLOUR: Art, Science & Power invites visitors to explore different ways that colours are perceived, experienced and given meaning.

COLOUR integrates insights from anthropology, the arts, humanities and social sciences, bringing together extraordinary objects and artworks from different times and places. The exhibition showcases remarkable and diverse collections from across the University of Cambridge museums, libraries and colleges. Exhibition preparations were developed in consultation with numerous specialists, including Indigenous colleagues from around the world as well as with local community and student groups.

*Kaleidoscope* was created by the Cambridge Yarn Collective especially for the entrance to the COLOUR exhibition. The explosive design was inspired by ideas about how humans perceive colour. These ideas are drawn from scientific debates around which colours should be included in the colour wheel, and the artist Georges-Pierre Seurat’s notion that colours are mixed by the eye when placed next to each other.

Left: *Kaleidoscope*, 2022. Cambridge Yarn Collective – Hilary Butler, Clare Collier, Sophie Neville and Dorothy Singer. Crocheted cotton yarn on calico, 150cm x 150cm. MAA MN0279

Cover: Feathered headdress (detail), Munduruku people, Rio Cadereyta, Brazil, 19th century. The golden feathers with bursts of red were produced by tapirage, a remarkable technique used by numerous Amazonian groups to change the colour of feathers on living parrots. MAA E 1903.442
Colour & Experience

Holi is one of the most vibrant and joyous celebrations of the Hindu calendar. This festival of colours ushers in the start of spring and celebrates the triumph of good over evil. People daub and drench each other with powdered paint and coloured water. Moments of fervour and exuberance bring people together who would otherwise lead separate lives.

Helen Frankenthaler experimented with colour mixing, using an innovative method which became known as ‘soak stain’. Her artwork traces the movement of liquid pigments across the saturated canvas and the bright hues that are created where different colours meet and overlap. The brilliant coloured and flat background contrasts with the thick lines and blobs of paint which appear to float above the surface. Freed from working in a representational context, colour becomes the subject of the painting.

Covent Garden Study, 1984. Helen Frankenthaler (1928-2011), USA. Acrylic on canvas, 73cm x 41cm. Kettles Yard HF1
Robert Yilarama’s bark painting depicts the land or ‘Country’ of the artist’s father and mother. It expresses the close relationship between place, kin and the experience and substance of colour. Different coloured ochres reside in the land, absorbing the history of the earth and referencing the movements of ancestral beings whose activities created the features of landscape. Contrasting shades of ochre and distinct styles of cross-hatching create a shimmering effect or ‘brilliance’ which is identified with ancestral power and refers to clan rights over the land.

*Mardayin Djang: Water Dreaming of my Father’s Country*, 1993. Roger Yilarama. Gunbalanya, Arnhem Land, Australia. Yellow and red ochre and clay with a PVC binder on stringybark, 180cm x 75cm

In the upper part of this bark painting is the stone country, where a freshwater crocodile has come out from under a rock. In the lower section are the plains where the saltwater crocodile and the barramundi fish live in the estuaries and billabongs (backwater pools). MAA 1994.234

Colour can be heard, felt and even tasted. A *Colour Symphony* by Arthur Bliss (1921-1922) was inspired by the symbolism associated with different colours in heraldry. Visitors can listen to the third movement, *Blue*, which has connotations of sapphires, deep water, skies, loyalty and melancholy. Trying to describe a colour through music is reminiscent of the experiences of some people with synaesthesia, where one sense impression stimulates another sense.
What is colour? The perception of colour is scientifically understood as the result of the brain’s interpretation of different light wavelengths. Rays of light are focused by the lens in our eye and projected upside down on the back of the eye or retina, which contains colour-sensitive cells called rods and cones.

Visible light, the colours seen by humans, is a tiny proportion of the electromagnetic spectrum.

Perception quizzes reveal the extent to which colour is in the mind. Yet colours are also material substances that we experience and interact with in our daily lives. Colour influences our emotions, activities and relations with others. People use colour to organise and make sense of the world around them. Colour has the power to enchant and transform people and things.

Left: Stare at the dot in the yellow circle for 20 seconds, then look at the black dot above. What do you see? For many people, the visual after-effect is bluish purple.
From 1664 Cambridge scholar Isaac Newton (1642-1727) conducted a series of famous experiments, where he directed a beam of sunlight to pass through a glass prism inside a darkened room. It cast a rainbow on the opposite wall, which Newton called a ‘spectrum’ and judged it to be composed of seven colours – violet, indigo, blue, green, yellow, orange. The experiment revealed that white light was composed of different colour-making rays that bend at different angles.

One of the best known and most vigorous critics of Newton’s ideas about colour was the poet, philosopher and statesman Johann Wolfgang von Goethe (1749-1832). He disagreed with Newton’s idea that white light was composed of exactly seven colours and argued that colours were the result of combinations of light and dark seen through different media.

For Goethe, Newton’s dark room was a kind of prison for the imagination. In contrast, Goethe studied the eye’s changing responses and highlighted the association between colour and emotion.
Scientists and artists have developed various methods and devices to measure and classify colour.

*Werner’s Nomenclature of Colour* (1814, 1821) by artist and naturalist Patrick Syme transformed Abraham Werner’s list of mineral colours into a field guide of the hues of the natural world. He aimed to provide a standard colour vocabulary, which could be communicated across distances and between disciplines. The classification of over 100 colours according to animal, vegetable and mineral is reminiscent of collector’s cabinets. Similarities between different types of things were believed to provide clues to the natural order. The compact size of *Werner’s Nomenclature* made it useful to those studying plants and animals in the wild. Charles Darwin consulted his own copy as he crossed the globe aboard HMS *Beagle* between 1831 and 1836.

Maxwell’s colour wheel was devised by the first head of the Cavendish Laboratory in Cambridge, James Clark Maxwell (1831-1879), to test colour perception. If all the elements of all the primary colours are included in equal proportions, when spun quickly the viewer would see white. Lovibond’s tintometer, devised to measure and compare the colour of substances, was originally used to estimate the quality of different beers. Instruments used to measure colour were also used to test people’s colour discrimination.

François Forichon, an artist and director of a French regional arts school in Clermont-Ferrand, aimed to train artists in standardised and exact systems of combining complementary colours. Drawing on the work of Maxwell, he developed a special Colour Wheel and Chromatic Circle to increase the precision of colour mixing. This mechanical approach to colour application differed from many contemporary painters, who used skill, experience and aesthetic judgement to produce balance and contrast.
Detail of Werner's classification of orange, 1841. Individual squares, cut from painted sheets of paper, were pasted onto the page to ensure colour consistency between books. Balfour & Newton Libraries, Department of Zoology, Newton misc 8

Maxwell's Colour Wheel, 41cm x 25cm. 19th century. Whipple Museum 4421

Colour Wheel and Chromatic Circle of Forichon, 14.5cm x 14.5cm, c. 1915. Whipple Museum 5342

Tintometer (colour comparator), by J. W. Lovibond Ltd., English, c. 1910. L. 36cm. Whipple Museum 4521
Throughout the nineteenth century scientists explored how humans perceive colour. When mixing and separating colours, a clear distinction was made between ‘additive colours’ or colours in light and ‘subtractive colours’ or colours in pigment. The combination of the colours of the spectrum in light rays produces white, whereas mixing different paint colours ultimately results in a muddy brown.

European artists such as Georges-Pierre Seurat were strongly influenced by contemporary scientific views on colour perception. This study depicting bourgeois Parisians at leisure uses small touches of paint, which were intended to mix in the eye of the viewer. He believed that this technique, which became known as Pointillism, would create a more intense and pleasing effect than mixing colours together on a palette. The final painting used tight dot-like dabs of paint.
The substance of colour is highlighted by artist’s materials from the Roberson and Winsor & Newton archives, two of the most important art material suppliers or ‘colour men’ in London from the 1820s. Handwritten recipe books give insights into how colour manufacture was standardised. Hamilton Kerr Institute

Edward Wilson (1872-1912) was a medical doctor, zoologist and polar explorer. He was a member of Captain Scott’s two expeditions to Antarctica. He had an amazing gift for painting colours from memory.

Wilson’s watercolours would freeze outside, so he made preparatory pencil sketches annotating them with notes about colour. Back in the warmth of the expedition base, he created his paintings. His series of watercolours shows the expedition ship, the Discovery, frozen in pack ice. Recorded at noon from the same spot over several months, the paintings’ colours reveal changing atmospheric conditions.

Edward Wilson, 1903, Antarctica. Graphite sketch and watercolour, 26cm x 18cm. Polar Museum, SPRI N: 1803/80 & N: 1245
Colour & Desire

Over millennia people have put enormous effort into producing and obtaining particular colours. Colour has been laboriously extracted from the earth, plants and animals, squeezed from the glands of molluscs and from the 1850s produced from coal tar. The processes involved are often highly skilled, smelly and sometimes dangerous. Local economies have been built on the basis of colour production and undermined by shifts in fashion.

Colour travelled great distances along the trade routes of empire and commerce. The allure of specific colours has resulted in intense labour, fierce competition and soaring prices, at times leading to piracy and warfare.

Every colour has its own history. This section focuses on two particularly potent examples – the rich ultramarine blue extracted from lapis lazuli and the red derived from the bodies of scale insects.

Virgin and Child Enthroned with Two Attendants, 1400-1403. Lorenzo Monaco, Italy. 32.4cm x 21cm. Fitzwilliam Museum 555

Detail from Philip the Bold’s Book of Hours, late 14th to early 15th century. Paris and Bruges. Painted with ultramarine blue and insect-based red dye by the Master of the Grandes Heures. Fitzwilliam Museum MS3-1954 Folio 102r
The richest solid blue found on earth has been highly prized since antiquity. Laboriously extracted from mines in north-eastern Afghanistan, lapis lazuli travelled along distant trade routes into China, the Middle East and Egypt. Arriving in Europe, this most highly valued pigment was known as ultramarine from the Latin for ‘over the sea’. It became the favoured colour for Christian paintings’ most significant features, such as the Virgin’s robes.

Necklace (detail) with lapis beads. c. 3000 BCE. Ur, Mesopotamia. L. 34cm. MAA 1940.2079

Amulet. The goddess Maat. 16th–11th century BCE. Egypt. Lapis, 2cm x 1cm. MAA 1948.2730

Buddha. 20th century. China. Lapis, 11cm x 7.3cm. Fitzwilliam Museum 0.27-1938

The Renaissance painter Cennino Cennini’s recipe for purifying ultramarine from lapis lazuli was based on the medieval cosmology of four elements. According to this holistic view, the world was made of nested spheres, from solid earth through water and air to all-consuming fire. The blue in lapis (lazurite) had white streaks like clouds (calcite) and golden stars (pyrite).
Reckitt’s Blue

In 1828 a French chemist discovered how to produce synthetic ultramarine at a fraction of the cost of the original. French ultramarine was later used as an ingredient in laundry soap to enhance the optical properties of white. Laundry blue, marketed as Reckitt’s Blue in England, was exported to the colonies where it was subverted and transformed. The highly desired ultramarine colour was used by Indigenous artists across Africa, the Americas and the Pacific to decorate a wide variety of special items.

Egyptian Blue

The ancient Egyptians used lapis lazuli for amulets, jewellery and decorative inlay. Instead of using the stone to make ultramarine, they manufactured a rich and versatile pigment known from Roman times as Egyptian blue. The local word has been translated as *iryt* (artificial) *habd* (lapis lazuli). Manufactured from at least the Fourth Dynasty (about 2640-2505 BCE), its production was a remarkable technical accomplishment.

Cartonnage, 332-30 BCE. Egypt. Mummy case fragment showing the sky goddess Nut in the form of a winged female figure, with yellow orpiment skin, and Egyptian blue and red cinnabar feathers. 46cm x 14cm. Right: Photograph. The Egyptian blue shows up as bright white using Visible Induced Luminescence. Fitzwilliam Museum E.GA.291.1949
Female scale insects produce the most vibrant and versatile range of red colours, prized throughout the Americas and Europe for over a millennium. Mesoamerican and Andean empires perfected their cultivation on Nopal cacti. In Nahuatl, the Aztec language, the insects are called ‘cactus blood’ (*nocheztli*) referencing the transformation of milky cactus juice to blood red inside the bodies of the insect. Cakes of dried insects were used as tithes and tribute for local rulers.

Spanish colonisers soon realised that the insect red produced in the Americas was superior to that found in Europe. They called the insect and the dye *cochinilla* (cochineal) and exploited the Indigenous production of this highly desired red, which soon became an international commodity. Millions of dried insects or ‘grains’ were exported from Peru and Mexico annually, with 72 tons shipped from Peru to Spain in 1578. English pirates seeking the dyestuff preyed upon Spanish galleons. The availability of large quantities of insect red changed traditional dyeing practices across Europe.

**Textile fragment, c. 700 BCE - 200 CE.** Peru, Paracas people. 18cm x 16cm. Humanlike figure on a rich scarlet background dyed with insect-based red. MAA 1935.326

**‘Cactus blood’ was incorporated into European taxonomy.** Etching by J. Pass, 1801. Wellcome Library Images

**Tapestry (detail) with three scenes from the biblical story of Tobias and the Angel, 16th century.** Insect red threads, probably cochineal from the Americas. 101cm x 52cm. Fitzwilliam Museum T.1-1953
The Power of Colour

The materials and allure of colour underlie its potency. Colour influences our emotions and behaviours. It helps us to understand and structure the world around us. The classification of colour is central to scientific analysis, philosophical traditions, fashion trends and global marketing.

Colour also has profound and far-reaching political implications. Particular colours are associated with and often restricted to political elites. Instruments and techniques designed to compare and categorise different hues have also been used to measure people. Differences in colour perception, skin and eye tones have been exploited to classify and discriminate against particular groups of people, and yet colour can also be used as a means of empowerment. Colour has the potential to transform people and things.

Throne back cover, Qing Dynasty, late 18th century. China. Silk embroidery on satin, 60cm x 63cm. Fitzwilliam Museum T-92-1977

Imperial Colour

The five-clawed dragon in golden metallic thread refers to the Emperor. Within the Five Elements Theory, yellow is the emblem of the Emperor, located at the centre of the five directions and represented by the element earth. Red is associated with summer and symbolises happiness and good fortune.
Murex Snails, 19th century. Naples, Italy. (l-r) 5cm x 4cm, 8cm x 5cm. These snails are the source of the world’s most expensive purple. Tyrian purple has been a symbol of power and royalty since the first millennium BCE. It was a laborious and smelly process, with the sea snail liquid fermented in vats of urine. The phrase ‘born in the purple’ still refers to being of royal or high birth. University Museum of Zoology

Saucer Dish, Ming Dynasty, 1506-1522. China. Jingdezhen porcelain, Dia. 17.6cm. The yellow tin over-glaze was reserved for imperial ceramics and played an important role in ceremonial rites. Fitzwilliam Museum C3-1965

Kingfisher headdress, Qing Dynasty, late 19th century. China. 33cm x 32cm. The right to wear this headdress, with iridescent blue kingfisher feather inlay, was conferred upon its owner by the imperial court. MAA Z 42505.1
Tapirage, the technique of changing the colour of feathers on living birds, is practised by numerous Amazonian groups. The process involves plucking the feathers of a domesticated parrot and covering the raw skin with a special formula. When the feathers grow back, they are transformed from green or blue into gold, sometimes with bursts of red.

For many Amazonian peoples there is a close affinity between parrots and human beings. The golden feathers produced by tapirage are associated with the sun and used in headdresses worn during communal ritual dances. While the styles of headdresses and the details of belief systems vary between different Amazonian groups, there is a shared notion that dancing is like flying, and that parrots, like humans, have souls that are destined for the celestial world.

Feathered headdress, 19th century. Rio Cadereyta, Brazil, Munduruku people. Ht. 53cm. The golden feathers were produced by tapirage. MAA E 1903.442

Iridescence has the power to enchant and captivate. The effect is produced by minute structural variations in substances, which make light waves bouncing off the surface interfere with each other. The wing cases of jewel beetles display particularly pretty colour interferences.

Forehead ornament (detail) with jewel beetles, 20th century. Papua New Guinea, Buk people. 55cm x 35cm. MAA 1967.13
ʻAhu ʻula Hawaiian Feathered Cloak

ʻAhu ʻula means red garment. Red is associated with mana (spiritual power), warmth and kinship. ʻAhu ʻula are composed of hundreds of thousands of red and yellow feathers from ʻiʻiwi and ʻōʻō birds. They were worn by the chiefs and priests of the aliʻi class as an expression of prestige and veneration. They were also used as honorific gifts and to mark strategic alliances between aliʻi and with foreign dignitaries.

No two ʻahu ʻula are alike. The cloaks were created by experts and their manufacture was highly regulated by strict kapu (taboo). Individual families passed down the knowledge of making ʻahu ʻula, which is used in featherwork today.

ʻAhu ʻula, 19th century. Hawaiʻi.
174cm x 103cm. MAA Z 6140

(I-r) ʻiʻiwi (Drepanis coccinea), and ʻōʻō (Moho nobilis), late 19th century. Hawaiʻi. Ht. 11.5cm, 16.5cm. University Museum of Zoology 27/Dre/11/a/24 and 27/Mel/22/d/9

The feathers are wrapped into tiny bundles before being attached to the olonā fibre netted backing.
Classical Colour

Greek and Roman ‘classical’ sculpture has long been regarded as white. Centuries of weathering, deterioration and cleaning has stripped the polychrome from the original sculptures. The rise of neo-classicism in the eighteenth century and the fashion for plaster casts have reinforced the association with the colour white.

The notion that ancient Greece is the foundation of Western civilisation, and the association of whiteness with European ideas of purity, harmony and beauty have influenced stereotypes about colour and race. The real diversity of people and skin colours in classical antiquity has disappeared from the popular imagination.

Peplos Kore. Plaster casts of the original, c. 530 BCE. Athens, Greece. (l-r) 121cm x 36cm, 128cm x 42cm. The figure on the right has been refashioned to include an outstretched arm holding a spherical object and *meniskos* (a little umbrella) to protect the sculpture from the elements. Museum of Classical Archaeology 34 and 34a

The original sculpture, carved from Parian marble with traces of paint, was found on the Acropolis in Athens in 1886. Sculptures of *korai* (young women) were used to mark graves or as votive offerings to the gods. The cast on the right was painted at the Museum of Classical Archaeology in 1975 and again in 1996. The reconstruction challenged neo-classical notions of whiteness and provoked controversy among many scholars and members of the public.
Black & White?

The exact meaning of this intriguing vessel is uncertain. Two-handled cups, known as *kantharoi*, were used by the ancient Greeks for drinking and making offerings of wine. Double headed *kantharoi* tend to juxtapose distinct faces, so that the viewer is encouraged to compare and contrast them.

*Kantharos* cup, c. 470 BCE. Athens. 20cm x 20cm. Fitzwilliam Museum GR.2.1999

We don’t know how the ancient Greeks would have understood this cup, but we do know that they didn’t use ‘black’ or ‘white’ to describe people in the way that the terms are often used today. The idea that people can be classified by the oppositional colours of black and white emerged in Europe and America over the past four centuries. It developed in tandem with the artificial category of race.

‘Every time I think about colour it’s a political statement’. Emma Amos used colour as a tool to address discrimination. She sought to blur the lines that separate black and white, male and female. Her face can be perceived as a whole or as two halves, each with a different eye colour and skin tone. The work raises questions about how we perceive and experience difference, both within ourselves and as a wider society.

*Identity*, 2006, Emma Amos (1937-2020). USA. Print with hand lithography, 30cm x 30cm. The Women’s Art Collection, Murray Edwards College
Humanæ is a photographic work in progress. The background for each portrait is colour matched to a sample of pixels taken from the nose of each participant. So far over 4,500 people have volunteered to be included. The project eloquently demonstrates the impossibility of dividing people into categories based on the colour of their skin.

Humanæ, 2022. Angélica Dass (b. 1979), Spain. Digital print, 57cm x 42cm. MAA MN0269

White Comedy
‘I waz whitemailled, By a white witch, Wid white magic, An white lies...’
(excerpt from White Comedy, Benjamin Zephaniah, Propa Propaganda, 1996)

A poem by the acclaimed British-Jamaican poet plays with the binary opposites of black and white to reveal how racist stereotypes and ideology are embedded in language. It prompts the reader to consider how words influence the way we think about other people and the world around us.

Beyond Rainbow Flags
In 1978 Gilbert Baker designed a rainbow flag to represent the gay community. As groups within the LGBTQ+ community continue to flourish and advocate for their specific rights, new flags are created. The different colours have strong symbolic meanings.

The seven flags on display were chosen by Rosa Colaço, Ange La Furcia and Jade Pollard-Crowe, Cambridge-based Queer People of Colour.
The Explosion of Colour

In 1856 William Perkin, an aspiring London chemist, accidentally produced a rich purple dye when experimenting with aniline, an oily liquid found in coal tar. Patented as mauve, it soon became a fashion craze.

The race to develop new aniline colours marked the beginning of the chemical dye industry. Colour production developed alongside other industrial applications from fertilizers to explosives. A growing range of colours was marketed worldwide by competing chemical companies. New colours were quickly embraced by artists and textile designers for their own uses and aesthetics.

Following the discovery of aniline dyes, European chemical companies competed to develop and market new colours worldwide. By the late nineteenth century German firms dominated the market.

Colour advertising poster, 1956. L.A. Joshi, India, Bombay, Pravin Colour Company. 75cm x 48cm. Produced for the German colour-manufacturing company Bayer. The poster features a painting of the goddess Durga/Amba and reproductions of some of the labels used to market Bayer’s chemical colours in India. Chris Pinney collection.

Today most people have access to a seemingly infinite range of colours produced cheaply and sold globally. In some ways colour has become democratised, but it has also become systematised for reproduction according to industry standards. New colours are continuously created to influence fashion and stimulate sales.

Our lives are saturated with colour
What does colour mean to you?
COLOUR: Art, Science & Power was curated and designed by Anita Herle with Research Assistant Tom Crowley. Graphic design by Deborah Wickham. Exhibition preparations were developed in consultation with local community and student groups as well as with Indigenous colleagues from around the world. Colleagues from the University of Cambridge and beyond generously provided advice and technical assistance.

COLOUR draws on remarkable and diverse collections from the University of Cambridge museums, libraries and colleges, including: the Fitzwilliam Museum, Hamilton Kerr Institute, King’s College, Kettle’s Yard, Museum of Archaeology & Anthropology (MAA), Museum of Classical Archaeology, Polar Museum – Scott Polar Research Institute, Sedgwick Museum of Earth Sciences, Murray Edwards College - The Women’s Art Collection, University Museum of Zoology, Whipple Museum of the History of Science, Zoology (Balfour and Newton) Library.

Support for the exhibition was provided by a Cambridge Humanities Research Grant and MAA’s Crowther-Beynon Fund.

A full list of acknowledgements is available on MAA’s webpages and via the virtual tour.

maa.cam.ac.uk/whats_on/exhibitions/colour-art-science-and-power

www.museums.cam.ac.uk/story/colour-art-science-and-power