

Colours: Regulation and Ownership

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Summary

Attempts to regulate or claim ownership of colours have met with limited success. A complicating factor has been the lack of clear definitions. There is more than one kind of colour – related, but distinct. In this paper, seven different kinds of colour are described together with the means used to identify individual colours. It is the means used to identify a colour which determine what kind of colour it is that is being identified. These definitions clarify the issues in a number of case histories, for example: why it was difficult to enforce the law against brides wearing crimson in Renaissance Florence; why his patent on a mauve dye was of limited value to William Henry Perkin; why disputes over colours as company trademarks are so prolonged and so inconclusive. These distinctions may also help to clarify the issues in the current debate about the desirability, or otherwise, of regulating colour in the built environment.

Introduction

Colours convey meanings in the social context. For this reason there have been attempts in the past to regulate the use of colour, especially the colours of clothing. There have also been attempts to claim ownership of particular colours, not least because of the value of colour in branding strategies.

The colours in Figure 1 have, at various times, been subject to attempts at regulation or claims of ownership. In Imperial China, vivid yellow robes could only be worn by the emperor



Figure 1 Colours that have been subject to attempts at regulation or claims of ownership

or empress [1]. In ancient Rome, Julius Caesar claimed exclusive rights to purple robes for himself and his family [2]. In Renaissance Italy, a law was passed by which brides were not allowed to wear crimson [3] (pp72-73). In Australia, Aboriginal artists have moral rights to the ochre that is mined where they are traditional owners of the land [4]. In France, in 1960, the artist Yves Klein was granted a patent for the paint that he called International Klein Blue [5] (p259). In England, in 1856, William Henry Perkin filed a patent for a revolutionary discovery, the first synthetic dye, that he called mauve [2]. In Australia, today, there are disputes between Cadbury and Darrell Lea over the right to use purple for the marketing of chocolate, and between BP and Woolworths over the right to use green to identify petrol service stations [6]. A similar dispute arose in the UK over use of the colour orange when the easyGroup entered the mobile phone business, as Orange is the name of a company already well established in that business [7]. In Japan, there is a call to extend current regulations to the whole city of Kyoto in order to eliminate the vivid yellow which is seen as an unwelcome intruder on hoardings in the streets of the city [8].

Colours can now be registered as stand-alone trademarks. The trademarking of colours raises philosophical issues as well as legal issues about ownership. Any attempt to regulate or claim ownership of particular colours calls into question the nature of colour itself: what exactly is it that is to be regulated or owned? The argument put forward in this paper is that colour is not one single kind of thing and that a clear definition of what it is that is to be regulated or owned must be established before anything can be regulated or any claim to ownership can be entertained. It is proposed that there are at least seven different kinds of colour and that the means used to identify a colour determine what kind of thing it is that is being identified. These distinctions will be used to clarify the issues in a number of case histories.

Different Kinds of Colour

An account of the theory of seven different kinds of colour has been published previously [9]. As it is central to the present argument, a brief account will be repeated here, along with the addition of a possible eighth kind of colour.

The existence of different kinds of colour can be appreciated in the different answers people might give when asked how many different colours there are in Figure 2. For most people, the answer would be five different colours, but some would say eight or, even, nine and one person has suggested that there were only two.

To clarify the distinctions between the different kinds of colour, they are given names as follows: conventional, substance, formula, spectral profile, psychophysical, inherent and perceived colour. The possible eighth kind of colour is referred to as 'biological colour'.



Figure 2 Design to illustrate the different kinds of 'thing' that can be identified as 'colours'

Conventional colour

Those who say that there are five different colours in Figure 2 do not see any change in the broad line which frames the design and traces four outline diamond shapes. For these people, this line

must be the same colour all along even though the outline diamonds appear different against the differently coloured background triangles. For most people, the 'dull red' of this line and the 'vivid red', 'maroon', 'reddish grey' and 'pink' of the triangles are names for objective physical properties of the printed surface as well as being names for the subjective visual experiences they have when they look at the design. Although an objective physical property is not the same kind of thing as a subjective visual experience, this conflation of physical property with visual experience does not get in the way of people's understanding in general conversation. Since it represents the common viewpoint, it is termed 'conventional colour'. The means used to identify conventional colours is observation, and the use of everyday language with colour names (e.g. red) and modifying adjectives (e.g. dull and vivid) that are widely understood.

Substance colour

The person who said there were only two different colours was referring to the inks that he guessed had been used to print the design – a red ink and a black ink. Each ink can be printed in little dots of varying density; when printed solid, the area covered by red ink looks red; and when printed in little dots on white paper, the red dots blend with the white spaces between the dots and it appears pink. Varying densities of red dots and black dots result in appearances of dull red, reddish grey and maroon. Although it plays a role in the appearance of the design, the white paper, for this person, did not count as a 'colour'. For him the colours were substances, in this case two inks, and so this kind of thing is termed 'substance colour'. Inks and paints get their colours from pigments and dyes which can be identified by chemical analysis. If chemical analysis is the means of identification it is the substance colour that is identified.

Formula colour

Closely related to substance colour is 'formula colour'. Chemical analysis might not be needed; the substances might already be known. That is the case for the inks used to print the design in Figure 2. More immediately interesting is the relative role played by each ink for each part of the printed design. A common desk-top printer has two cartridges which, together, contain four transparent inks, the so-called 'process colours', which are cyan (C), magenta (M), yellow (Y) and black (K), and this process is commonly referred to as CMYK. Each ink, printed in dots of varying density, can cover any percentage of the paper surface at any given point. Four percentages, one for each ink, constitute a formula for a coloured area in a print. For the dull red line in Figure 2, the formula is: C, 23%; M, 78%; Y, 62%; K, 7%. The four components of the formula, and the way they combine to produce the dull red, are shown in Figure 3.

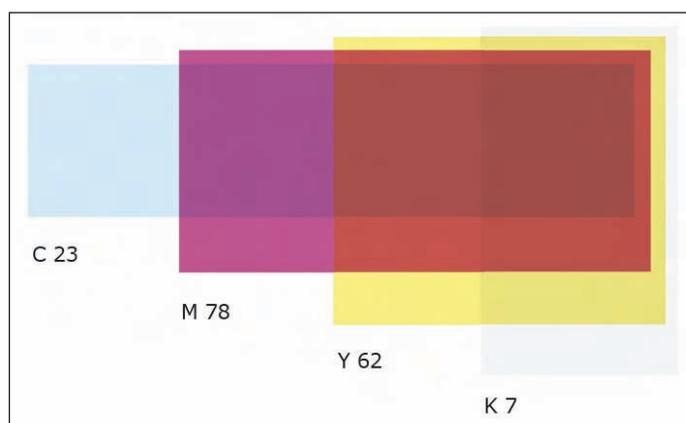


Figure 3 Diagram to show how the four components of the formula combine to produce the dull red line in Figure 2

There are occasions where the CMYK process is unsuitable, especially where colour consistency is important. In such cases, a colour can be produced by using a mixture of inks formulated according to the Pantone Matching System (PMS). The system makes use of fourteen separate inks and, to produce a desired colour, as many as four of these inks are premixed before being used on the press. The *Pantone Formula Guide* shows 1114 printed colours on coated, uncoated and matte stock together with the ink mixing formula required for each [10]. A reasonably close match for the dull red is PMS colour 1797U, with a formula of: Pantone Red 032, 98.5%; Pantone Black, 1.5%. (Note that if Pantone Red 032 and Pantone Black had been used to print the design, instead of cyan, magenta, yellow and black, a design very close to that in Figure 2 could have been produced with just those two 'colours'. In that sense, anyone who guesses that there are only two different colours in the design, might essentially be correct.)

House paints, for sale to members of the general public, are identified by names or numbers. For example, a close match for the dull red in Figure 2 is identified as Mars Red, or P06.F8, in the *Dulux Colour Specifier* [11] but for the sales staff in a paint supply store there are formulae for mixing the paints. The large range offered by paint companies, such as Dulux Australia, is made possible by the tinting machines. A paint formula will indicate how many 'shots' of the prescribed tinters, at 0.4 ml per shot, are to be added to 1 litre of the designated base. For Mars Red the formula is: G, 60; W, 40; EE, 68 in True Red Base. G is red oxide, W is titanium dioxide and EE is yellow oxide.

The concept of formula colours can be extended to the colours seen on a computer or television screen. The relative output of the red, green and blue phosphors (referred to as RGB) expressed as numbers, constitute a formula which can be used to identify a colour in the display. When the design in Figure 2 is displayed on a computer screen [using cathode ray tube (CRT) technology], the RGB values for the dull red are: R, 155; G, 62; B, 64. When people refer to RGB values for colours displayed on a computer screen, to the number of shots from tinters in the tinting machine or to CMYK values or PMS numbers for colours in a print, they are identifying formula colours. If necessary the kind of thing in question can be described more precisely as: formula colour (ink); formula colour (paint); formula colour (CRT display).

Spectral profile colour

A characteristic of materials, in their natural state or when coloured by pigments or dyes, is the way they respond to illumination – the different wavelengths of the spectrum are absorbed and reflected to a greater or lesser extent. This can be measured with a spectrophotometer and plotted as a graph, which can be used to identify the colour of the material and can be read as a spectral reflectance profile. Instruments can also be used to derive other kinds of spectral profiles – radiation profiles for sources of illumination and transmission profiles for transparent or translucent materials – in each case referring to the 'spectral profile colour'. For clarification, the term can be qualified: spectral profile colour (reflection); spectral profile colour (radiation); spectral profile colour (transmission). The spectral reflectance graph, or profile, of the dull red from Figure 2 is shown in Figure 4.

Connecting physical properties with visual experiences

Substance, formula and spectral profile colours all refer to objective physical properties, the concern of chemists and physicists. Most people, however, are more concerned with the consequent subjective visual experiences. If colours are understood to be visual experiences

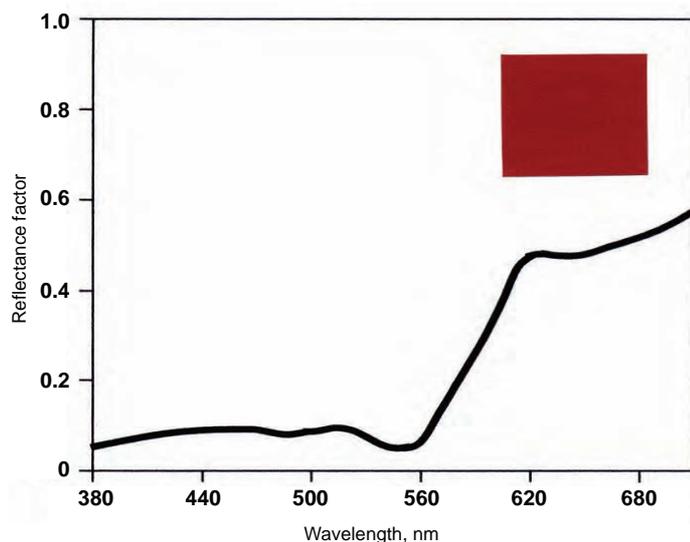


Figure 4 Spectral reflectance profile of the dull red; the vertical axis shows reflectance factors, the horizontal axis shows wavelengths (in nm)

rather than physical properties their identification must depend on the people who have the experiences. A link can be established between visual experiences and physical properties. People can use a process of colour matching to identify a colour.

Psychophysical colour

Psychophysics is the branch of science which links the physical world with phenomenal experience. Adjusting the output of three lights to achieve a match with a physical sample is the basis of colorimetry. In this way the colour of something can be measured, the measurement being expressed in terms of the relative output of the lights and recorded as 'tristimulus values'. These values establish particular locations in colour space. There is more than one colour space. The development of colorimetry and the derivation of different colour spaces are described by Roy Berns [12]. A colour space that is widely used today is that known as CIELAB [12] (pp66-70).

The development of colour measuring instruments – colorimeters and spectrophotometers – depended on a number of human observers making a number of judgements; these judgements were averaged to create the 'standard observer'. The instruments duplicate the judgements of the standard observer and assign positions in colour space accordingly.

The appearance of surfaces depends, to some extent, on the illumination by which they are seen. Instruments for colour measurement have settings for different 'standard illuminants'. Surfaces that have been measured by an instrument, and given the same CIELAB coordinates, would be judged a match when seen under the specified illumination by the standard observer. Tristimulus values, and CIELAB coordinates, also serve the purpose of identification. If the identity of a colour has been established in terms of tristimulus values or CIELAB coordinates, by using a colorimeter or spectrophotometer, the thing being identified can be termed the 'psychophysical colour'. CIELAB coordinates for the dull red are: L^* , 46.06; a^* , 39.79; b^* , 18.55. The dots in Figure 5 indicate the positions of the dull red in CIELAB space.

Inherent colour

Another way of using colour matching to establish the identity of a colour does not require an expensive measuring instrument. The identification can be done by an individual observer making judgements based on visual experience alone. Instead of an instrument, a

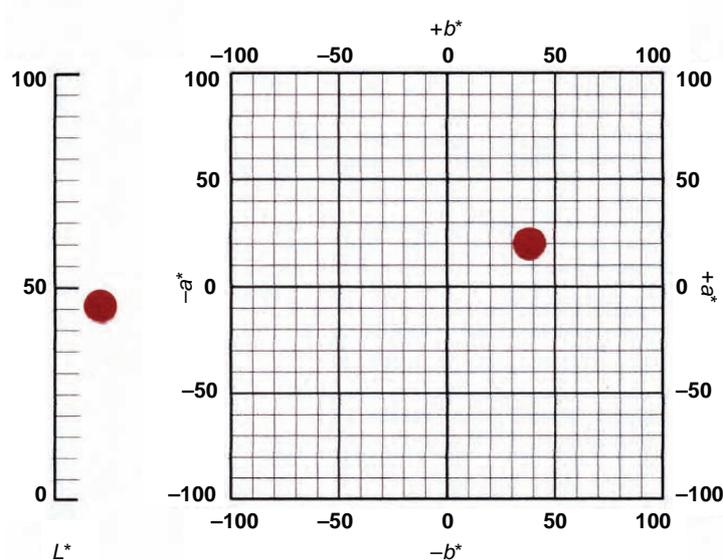


Figure 5 Location of the dull red in CIELAB space indicated with dots

comprehensive set of colour samples is needed such as those from a colour order system and displayed on a fan-deck or in a colour atlas. A match, or close match, can be found between a surface and a colour sample from the system. The name or number used to identify the sample can now be applied to the surface. This process requires that the sample be placed directly against the surface to be identified in such a way that both sample and surface receive the same illumination. This is essentially the means used by Karin Fridell Anter to establish what she calls the 'inherent colour' of something [13] (p24). Fridell Anter specifies the viewing conditions for determining what should be the precise inherent colour of something; this current study allows for a degree of latitude in viewing conditions.

When the identity of a colour is established by direct visual comparison between a surface and a sample colour chip, it is the inherent colour of that surface that is identified. The *Dulux Colour Specifier* is one of many systems that can serve the purpose of identifying inherent colours. Colour samples in the fan-deck can be placed directly on a surface and an acceptable match can be found; for Figure 2, the dull red was a close match for the Mars Red sample in the *Dulux Colour Specifier* fan-deck.

It could be expected that two surfaces having the same psychophysical colour would also have the same inherent colour. The difference between psychophysical colour and inherent colour is that the psychophysical colour of something is identified by using a measuring instrument while the inherent colour is identified by visual comparison of surfaces when they are placed in direct juxtaposition.

Perceived colour

It is not always possible to bring colour samples from an atlas or fan-deck into direct juxtaposition with a surface when the colour of that surface is to be identified. It is also the case that the apparent colour of a surface can vary depending on a number of circumstances. Two surfaces with the same inherent colour can look quite different from each other when seen in different contexts, especially under different conditions of illumination. Two walls of a building, which meet at a corner, can be painted with the same paint and so have the same inherent colour, but if one wall is in sunlight and the other is in shadow they will not look the same. Also, when the wall of a house painted with Mars Red is seen from across the street, it will not appear to be the same colour as a Mars Red paint sample held in the hand.

Faced with such facts, Fridell Anter makes a distinction between inherent colour and what she calls ‘perceived colour’. Fridell Anter describes a way of using the atlas of the Natural Color System (NCS) to establish the perceived colour of something [13] (pp69-71): in the case of the wall, the observer would compare the painted surface with the colour chips on the pages of the atlas and find the chip that looked most like the colour of the wall as seen from that viewpoint. To establish the perceived colour of the broad line in Figure 2, a personal judgement was made: a print-out of the design was compared with the colours in the NCS atlas and an NCS notation for the perceived colour of the line was identified as NCS 3040-Y80R.

Another study that makes the distinction between inherent colour and perceived colour is that undertaken by Monica Billger, who makes a further distinction between the overall colour impression and local variations [14]. Billger calls the overall colour impression the ‘identity colour’ which she defines as:

‘...the main colour impression of surfaces or parts of a room that are perceived to be uniformly coloured.’

Local variations can be seen as a result of contrast, reflections and differences in illumination. It was the identity colour of the broad line that was established as 3040-Y80R. It is true that the broad line is ‘perceived to be uniformly coloured’ and this is why most people would say that there are five different colours in the design, the other four being those of the triangular backgrounds. However, it is also true that the outline diamonds appear different against the different backgrounds. These are local variations. The difference in appearance, in this case, is due to the interaction between the outline diamond shapes and their different backgrounds. This kind of interaction is known as ‘simultaneous contrast’, a term coined by the French chemist M E Chevreul in 1839, who noted that [15]:

‘...when the eye sees at the same time two contiguous colours, they will appear as dissimilar as possible.’

In order for objects to be as easy to see as possible, the visual system operates in such a way that the contrast between a shape and its background is enhanced.

Where Billger’s distinction is important, the terms perceived colour (identity) and perceived colour (local variation) can be used as appropriate. When focusing attention on the colours of the outline diamonds against their separate backgrounds, new judgements were made. Against the vivid red background it was: in NCS notation, NCS 2050-Y80R; against the maroon background it was NCS 1060-Y80R; against the grey background it was NCS 1070-Y80R; against the pink background it was NCS 2060-Y80R. So those who said there were eight different colours in the design were referring to perceived colours (local variations) and those who said there were nine different colours included these local variations but also added the perceived colour (identity).

An eighth kind of colour?

If, and when, the biology and neurology on which colour vision depends are fully understood, it might be possible to speak of ‘biological colour’; and it might be possible to identify colours in terms of the human nervous system. In 1989, Gunnar Tonnquist proposed a simple model which illustrates the relationships between the physics (the stimulus) and the psychology (the percept) of colour [16]. The model shows two ways in which the stimulus can be linked to the percept, one is through psychophysics and the other is through biology.

Although a great deal is now known about stimulation of the retinal cells in the eye and the consequent neurological processes, as Rolf Kuehni points out in his recent book on colour space [17]:

‘There continues to be a black box into which biologically produced correlates of physical stimuli disappear and out of which colour experiences appear.’

Since it is the means used to identify a colour that determines what kind of colour it is that is under consideration, it will only be possible to speak of ‘biological colour’ when there is a way to gain ready access to the nervous system of a conscious observer.

Same colours, different colours

Armed with the distinctions described above, it is possible to appreciate how each part of the design in Figure 2 has several different kinds of colour depending on the means used to identify the colours. If people disagree over the number of different colours in the design, it is not a case of one person being right and the other being wrong; they are simply counting different things.

Most people would be content to identify the colour of the broad line simply by looking at it and using everyday language. By identifying it in this way as ‘dull red’ they would be identifying its conventional colour, meaning a physical property and visual experience at the same time, the visual experience being a clue to the physical property. A chemist might analyse the ink and thereby identify the separate constituents of the ink (substance colours) which combine as its formula colour. Use of a spectrophotometer would make it possible to identify the spectral profile colour and also the psychophysical colour. Direct juxtaposition with samples from a colour system would make it possible to identify the inherent colour. Reference to a colour atlas would make it possible to identify the perceived colour (identity) and perceived colours (local variations).

In most instances, and for most people, such distinctions are of little concern, but the distinctions become critical if any attempt is to be made to regulate the use of particular colours or to claim ownership of a colour or colours.

Regulating the Use of Colours and Social Control

Colours have acquired a number of meanings in different cultures and in different periods of history. Colours have been used for indicating a person’s rank in a hierarchy and the social status of people could also be gauged from the colours of their clothes. For these reasons there have been attempts to control the use of colour and to limit the range of colours that could be worn in certain circumstances.

Colours for the exclusive use of emperors

In Imperial China, only the emperor, empress and empress dowager could wear robes of bright yellow. Bright yellow robes were worn on grand ceremonial occasions so the colour conveyed information about the wearer and the occasion [1]. In ancient Rome, the colour purple acquired similar meanings. Some 2000 years ago the natural dye known as Tyrian Purple – made from the glandular mucus of certain molluscs (*Murex brandaris* and *Murex trunculus*) – was by far the most expensive. Julius Caesar also claimed it for the exclusive use of himself and members

of his household [2]. It was the substance colour that was so expensive and the conventional colour that denoted high status. The colour would be identified as ‘purple’ and that word would have been understood as referring to a physical property of the cloth from which the emperor’s robes were made as well as the visual experience that people had when they looked at the robes. The equation between colour and status could hold as long as there was no other way of producing such an intense purple.

Forbidden colours is Renaissance Florence

By the time of the Italian Renaissance, there had been advances in dye technology and the meanings conveyed by the colour of clothing had become more subtle. In Florence, a man’s honour was at stake whenever he, or members of his family, appeared in public. In her book on this topic, Carol Collier Frick refers to the importance of honour in Florentine society and to the role of clothing as a means of displaying one’s honour. She explains how, in a society where one’s position was not so much inherited as earned [18] (p179):

‘...it was literally believed that clothes made (or could make) the man....clothing made social place a visual reality.’

Clothing, therefore, offered a great opportunity for a form of social climbing. This, in turn, led the authorities to introduce sumptuary laws which placed strict limitations on what people could wear. So clothing became a battleground with social aspiration and social control as protagonists. Joanna Woods-Marsden, in her essay on Renaissance portraits, refers to this tension and to how it was that [3] (p65):

‘...in a culture in which honour depended on the ostentatious display of material luxury, sumptuary laws were continually being enacted to curtail that very splendour.’



Figure 6 Domenico Ghirlandaio, *Portrait of a Lady*, tempera and oil on panel (ca. 1490) (© Sterling and Francine Clark Art Institute, Williamstown, Massachusetts, USA)

Sumptuary laws even extended to the choice of colour. ‘Cloth dyed crimson’ together with furs and ‘ornaments of gold or silver, jewels, or pearls’ were forbidden to brides in a law passed in the early 1470s [3] (pp72-73). It would have been reasonably easy for the officials to identify breaches of the law where excessive ornaments were concerned but not so easy if the offence was supposedly the wearing of cloth dyed crimson. Arguments in such a case might have turned on what it was that was referred to by the word ‘crimson’ and a clever lawyer could have exploited the different possible meanings to mount a successful defence.

A painting by Domenico Ghirlandaio from that era is listed simply as *Portrait of a Lady* (Figure 6). According to scholars, it is probably a marriage portrait of Giovanna degli Albizzi [19]. She is shown holding a sprig of orange blossom which was associated with the bride at her wedding. Its scent and white flowers were considered ‘symbols of

virtue, chastity and innocence' [20]. The date of the painting is given as *ca.* 1490 which is less than 20 years after the passing of the law referred to above. If that law were still in force, and applicable in this case, it is possible to imagine how a jury might have responded if presented with this portrait as evidence. Was Giovanna degli Albizzi breaking the law? Is she wearing 'ornaments of gold or silver, jewels, or pearls'? What about the three pearls on her breast? It might have been claimed that these were part of the fastening of her bodice and not, therefore, an 'ornament' in any strict legal sense. Attention might then be drawn to the colour of her dress. Was this made of 'cloth dyed crimson'? Now it would be necessary to know what kind of colour was under consideration and what was meant by 'crimson'.

Before the invention of spectrophotometers and colorimeters, crimson could not have been a spectral profile colour or a psychophysical colour. It is also unlikely that the officials on patrol would have been equipped with standard crimson colour chips which they could have used to identify the inherent colour of a garment. None of these objective measures would have been available. Members of the jury could have been asked to pass judgement on what they saw as a conventional colour. If the majority were to feel able to identify what they saw as 'crimson' a guilty verdict could be brought down accordingly.

As a conventional colour, the appearance would have been understood as an indication of the physical nature of the cloth and the dye that had been used. Presumably this is what concerned the authorities: the conventional colour and, therefore, the dye itself as the substance colour. Use of an expensive dye by someone of inferior status had to be suppressed. The clue would have been the intensity of the red. Red was the most popular colour for clothing in Florence at that time, according to Frick [18] (p101), and there was a 'visual hierarchy of reds' which enabled people to read each other's degree of honour. The most intense red, or crimson, was achieved with a dye made from dried insects (kermes) which also happened to be the most expensive process. Wealth was thereby displayed and maximum honour maintained [18] (pp101-102).

In a court of law it would have been much easier for the defence to insist that a garment had not been made from cloth dyed with kermes than it would have been for the prosecution to prove that it had. Furthermore, the Florentines used language to keep one step ahead of the law. New words were coined for things that were forbidden and 'neologisms tested the patience of the most determined communal officials' [18] (p188). A simpler alternative to denying that the cloth had been dyed with kermes would have been to give kermes a new name.

While sumptuary laws were directed at men as well as women, most were aimed at curbing extravagance in women's dress. It was a losing battle. Catherine Kovesi Killerby argues that sumptuary laws failed because they did not ban luxury as such but only particular manifestations of luxury [21]; what was banned had to be spelled out in the legislation and legislation could not keep up with fashion. As Dale Kent points out [22]:

'Women were indeed ingenious in finding ways to dress fashionably while avoiding prosecution, generally observing the letter, if grossly exceeding the spirit of the laws.'

Ownership of Colours and Artistic Integrity

The right of an individual, or organisation, to regulate the use of a colour, or colours, is made easier if there is some form of legal 'ownership'. There have been many instances where such ownership has been claimed or acknowledged. Once again, however, it is necessary to be clear about what it is, exactly, that is supposedly owned.

Ochres in Aboriginal art

Ochre is used by Australian Aborigines as a colouring agent and has been mined by them for more than 40 000 years [23]. Strictly, the term 'ochre' should be restricted to iron-oxide-based pigments. Tom Mixie Mosby describes the natural earth pigment palette used by Aboriginal artists as consisting of four basic natural colours: red and yellow (iron oxides), white (pipe clay, kaolin or gypsum) and black (charcoal) [24] (p121). When red and yellow are identified as iron-oxides, white as pipe clay, and black as charcoal, it is the substance colours that are being identified. These natural earth pigments are mixed with binders to produce paints in a process that includes crushing sap from trees and heating it with water to create the binder [24] (p120).

The patterns and images which the Aborigines paint on their bodies, on artefacts and on rock surfaces are central to the rituals and ceremonies which they perform to keep their culture and its stories alive. Particularly important is the relationship the Aborigines have to their environment, the plants, animals and spirit beings which inhabit their own country. The importance of country is reflected in the paint itself. As Victoria Finlay puts it, the ochre 'is not only from the land; it is the land' [25] (p40). Members of Aboriginal clans, who are the traditional owners of land where ochre is found, are also acknowledged to be owners of the ochre. It is the substances that they own so they own their ochres as substance colours.

The work of Aboriginal artists was valued for its role in their ceremonies by members of the Aboriginal communities but, as it came more and more to be noticed by the wider community, it was seen to have potential commercial value. Producing artworks for sale became a source of income for groups of Aborigines and, to support them, the Australian Government, in 1975, set up the Aboriginal Arts Board as part of the Australia Council. The new generation of Aboriginal artists drew on their cultural traditions while exploring new possibilities. While some artists continued to work with ochres, others began to work with new materials. Commercially produced paints gave them access to a much wider range of colours, far beyond the limits of the yellows, reds, browns, blacks and whites that could be produced with paints made from natural earth pigments. One artist who continued to work with traditional materials was Rover Thomas. Thomas used ochres from his own country.

Ochres vary according to where they are found and, according to Glenn Pilkington (curator of Aboriginal Art at the Art Gallery of Western Australia), the source of a particular ochre can be traced to within 50 km [4]. This can be very helpful to scholars when there is doubt about the authenticity of a given painting or uncertainty about the identity of the artist. It also presents a problem to conservators. For any restoration work on a painting it would be necessary to use the same materials. The right to use those materials belongs to the traditional owners. With this in mind, and before he died, Rover Thomas gave a quantity of his ochres to Gordon Hudson, who was head conservator at the Art Gallery of Western Australia at the time [26].

Many of the designs used by Aborigines in their ceremonies are secret and sacred and do not appear in paintings made for sale. However, it would seem that some of the power of the designs resides in the materials as much as in the patterns. Finlay explains how some of the artists, working in the central desert, preferred to use non-traditional paints rather than paints made from the ochres that were readily available in quarries nearby, which might have been in part [25] (p71):

'...because it made it less complicated for them to represent their dreaming stories for outsiders if the materials themselves were not sacred but only represented sacred colours – like images in a mirror.'

The synthetic polymer paints, that the artists preferred to use, could be mixed to match the colours obtainable with ochres.

Two versions of the same design could be painted, one with synthetic paints and the other with paints made from natural earth pigments. In each version, the colours might look the same; they might match the same standard samples and so have the same inherent colours. Measurement with a spectrophotometer might also show that the colours would be judged a match by the 'standard observer', have the same location in CIELAB space, and so have the same psychophysical colours. However, a chemist and a physicist could still tell the difference. Analysis would enable the chemist to identify the substances that had been used in the painting and so could show that the substance colours were different. A physicist, using a spectrophotometer, could identify the locations of colours in CIELAB space, but could also measure the way that a painted surface absorbed and reflected the different wavelengths of light and so could identify the spectral profile colour.

It can happen that two surfaces, that would be judged a match by the 'standard observer' under a given light source, might have different spectral profiles. The significant factor here is the light source. Under a different light source the surfaces might no longer appear exactly the same; they would be what is known as a 'metameric pair'. Metamerism is described by Berns as 'the single most important aspect of colour vision, particularly from the standpoint of colour technology' [12]. In this study, it is enough to know that two surfaces can have the same psychophysical colour but different spectral profile colours. Aborigines own their ochres as substance colours, but because the substances can be identified in terms of their spectral profiles they also own the ochres as spectral profile colours.

International Klein Blue

Yves Klein had a brief, but controversial, career as an artist. He died in Paris, in 1962, at the age of 34. He is best known for his 'monochromes' – rectangular paintings of a single colour. For Klein, a colour was self-sufficient; a colour should not be required to play a role in representation, symbolism or expression, or be related to other colours in an abstract composition. An exhibition of Klein's monochromes, in 1956, was the setting for a debate about the artist's work. Klein's response to a question about his preoccupation with monochromes is recorded, by Sidra Stich, as [5] (p66):

'I seek to put the spectator in front of the fact that colour is an individual, a character, a personality.'

Stich explains how Klein wanted to 'deobjectify the work of art. He conceived of his paintings as living presences, not as material things with restrictive boundaries' [5].

Klein had been struck by the fact that pure pigment powder, before it was mixed with a binder to become paint, had a power and intensity that no paint currently available could match. While he could simply spread the pigment powder on a horizontal surface he wanted to find a way of fixing it to a vertical surface without losing any of its power or intensity. He discovered that he could mix the pigment with *Rhodopas M.*, a product of the Rhône Poulenc Corporation [5] (pp59-60) and subsequently he painted monochromes in several different colours and also produced 'monogolds' using gold leaf. But the colour that he adopted as a kind of 'brand identity' was ultramarine blue.

Now that he had a way of preserving the intensity of the pigment powder he decided to take out a patent on what he called 'International Klein Blue' (IKB), and the patent application is reproduced word for word by Stich [5] (p259). Klein was a master of self-promotion. His motive

in taking out the patent was not to make money from selling IKB but to proclaim the colour 'as his grandiose territory, his identity, his official and celebrated sign' [5] (p78).

The ultramarine blue rectangle in Figure 7 could be seen as a reproduction of one of Klein's monochrome paintings. For an art critic or historian no caption would be needed to identify the artist; the colour alone would be enough. The colour of the rectangle in Figure 7 might be a close match for IKB but Klein would not have been able to claim that this reproduction

has infringed his original patent. The wording of the patent makes it clear that IKB was a formula colour and the formula was for the paint itself. Only a surface painted with this paint could be identified as IKB. This means that wherever Klein's IKB monochrome paintings are reproduced, in print or on a computer screen, the colour in the reproduction cannot be identified as IKB. A search on the Internet for International Klein Blue can lead to a site where the entire screen is filled with a deep blue [27]. Giordano Beretta has visited this site and rightly observes, 'This is not International Klein Blue' [28].



Figure 7 'Reproduction' of a hypothetical painting by Yves Klein

Ownership of Colours and Commercial Profit

While Yves Klein's main concern was promoting himself as an artist, others have developed new substance colours and formula colours with a view to making money.

Mauve

Perkin's accidental discovery, in 1856, of the first synthetic dye revolutionised the industry. At first the dye was marketed under the name 'Tyrian purple' but the name was soon changed to 'mauve' – the French name for the mallow plant – because, as Philip Ball points out, 'there was more benefit to be had from an association with Parisian haute couture than with antiquity' [29]. Perkin's business was very profitable and many young chemists were attracted to the dye trades.

As new dyes were developed, the manufacturers took out patents to protect their recipes. This often led to bitter disputes because it was difficult to prove that a patent had been infringed [2]:

'The problem for the courts was that the colours often looked exactly the same; the more skilled the dyers in copying a patented recipe, the harder to distinguish between, say, six shades of blue. There was no colour chart to which experts could refer and make distinctions, and molecular analysis was still in its most primitive form.'

Little had changed since the 15th century; proving that cloth had been dyed with Perkin's mauve would have been no easier than proving that it had been dyed with kermes (crimson).

Things are different today with sophisticated analytical techniques that could show, in a clear-cut way, whether or not a rival company had copied the recipe for Perkin's mauve. Chemical analysis could show whether or not the substance colours and formula colours were the same. If the same dye had been used the spectral profile colours of two pieces of cloth would also be the same, so use of a spectrophotometer could be added to chemical analysis as a means of exposing infringement of a patent. But cloth dyed with Perkin's mauve would also have other kinds of colour: a psychophysical colour and an inherent colour. Even though it had been demonstrated that the substance colours, formula colours and spectral profile colours were different the two pieces of dyed cloth could still appear to be the same colour. They might have the same psychophysical colour under certain conditions of illumination and the same inherent colour. They would be a 'metameric pair'. If a rival company had used a different recipe to produce a dye which could be used to produce cloth with the same inherent colour as cloth dyed with Perkin's mauve, that company would be safe from prosecution provided that Perkin's patent applied only to the recipe. However, the value of a dye surely lies in the appearance of the dyed cloth. As long as others can match that appearance with a different recipe the value of the patent would be greatly diminished.

Colours as trademarks

If the value of a colour lies in its appearance (inherent colour, perceived colour), and if appearances can be matched with different recipes (formula colours), the next step for those who stand to benefit from 'owning' a particular colour must be to stake a claim to the appearance of that colour. This is very different from claiming ownership of a recipe; colours as appearances surely belong to everyone. Nevertheless, at a congress of the International Association for the Protection of Intellectual Property (AIPPI), held in Geneva in 2004, it was resolved that a colour *per se* can be capable of registration as a trade mark [30]. No definition of 'colour *per se*' seems to have been considered necessary. Of more concern for those interested in the registration of colours as trademarks is not the question of what it is that is to be registered but how it is to be registered.

Practice Amendment Notice PAN 2/07, published by the Intellectual Property Office [31], refers to a ruling by the European Court of Justice about how colours should be presented graphically for registration as trademarks. The presentation should be 'clear, precise, self-contained, easily accessible, durable and objective' and according to PAN 2/07 [31]:

'...marks consisting of colour alone will be considered to be graphically represented if they are filed in the form of a written description of the colour(s) (e.g. dark blue) and are accompanied by the relevant code(s) from an internationally recognised colour identification system. There are a number of colour identification systems in existence, e.g. Pantone®, RAL and Focoltone®. Applications filed electronically may also use an RGB profile to define the colour when filed in association with an electronic image of the colour.'

PAN 2/07 allows for a requirement that reference be made to an identification system by anyone checking to see whether or not a given colour has been registered but warns against making demands that would conflict with the criterion that a representation be 'easily accessible'. An example is given of an application that was rejected on such grounds. Ty Nant Spring Water Ltd had applied to register as a mark 'a blue bottle of optical characteristics such that if the wall thickness is 3 mm the bottle has, in air, a dominant wavelength of 472 to 474 nm, a purity of 44 to 48%, an optical brightness of 28 to 32%' [31]. It would not be possible

for other suppliers of spring water to check their own bottles for possible violation of Ty Nant's trademark without the aid of specialist expertise and a spectrophotometer.

The means used to identify a colour determine what kind of thing it is that is being identified. Ty Nant's application focussed on the physical properties of the bottle. Use of a spectrophotometer could identify the bottle's spectral profile colour. By recording values for dominant wavelength, purity and brightness it would also indicate a position in CIELAB colour space and so identify the bottle's psychophysical colour. It might be appropriate to use psychophysical colour in an application for registration but the need for using expensive instruments rules this out. If a colour is to be registered as a trademark the most appropriate kind of colour to register is inherent colour which can be identified by juxtaposition with a colour sample from a standard range.

The Pantone, RAL and Focoltone systems, as suggested in PAN 2/07, could be used to identify inherent colours. Other internationally recognised colour identification systems that might be used are the Munsell System, as well as NCS. Strictly, from this group, the only true systems for inherent colours are the RAL and Munsell systems. In these, the colour samples are organised according to the appearance characteristics of hue, lightness (Munsell value) and chroma and the notations belong to the samples themselves. NCS is a system for perceived colours, but NCS samples are also organised according to appearance characteristics and, since colour samples are available, the system could still be used to identify inherent colours. Pantone and Focoltone could also be used although they are systems for formula colours; each has a large range of colour samples. The order of colour samples in the Pantone fan-deck is determined by ink mixing formulae and there are areas of colour space that are not well represented. Nevertheless, the Pantone system is very widely used in the printing industry and the selection of colours for possible use as trademarks will often be made from the Pantone fan-deck.

If the Pantone system is to be used, the application should be for an inherent colour that matches the Pantone sample rather than an application for the Pantone colour itself. Pantone colours, being formula colours defined by their recipes, surely can only belong to Pantone much as the formula for Perkin's mauve belonged to Perkin. In the same way, if the Focoltone system is to be used, the application should be for an inherent colour that matches a Focoltone sample, Focoltone being a system for managing process ink formulae for accurate colour reproduction.

RGB colours are also formula colours but they do not belong to anyone in the way that Pantone colours belong to Pantone. A significant problem associated with RGB colours is the inconsistency of computer monitors; colours with the same RGB values could appear different on different screens. There would also be the matter of how the colour is to be displayed. Even if it fills the screen there will always be a background against which it is seen and the appearance of the colour will be subject to the influence of simultaneous contrast, the phenomenon responsible for the different appearances of the dull red in fig 2 against the different backgrounds. So, for more than one reason, the same RGB values will not necessarily equate with the same colour appearances.

Of course, the influence of simultaneous contrast also applies to inherent colours. The dull red line in Figure 2 has one inherent colour but the perceived colour changes as the outline diamond shapes appear different against differently coloured backgrounds. So it is not really possible to register a single colour appearance as a trademark. This was recognised by Ty Nant in that the application was for a range of colours that would fall between certain limits of dominant wavelength, purity and brightness. It was also recognised by Cadbury with their application to register a purple that would correspond with one of 16 neighbouring samples in the *Pantone Formula Guide* [32].

Ownership of green and purple

There have been cases where companies have registered colours as trademarks and found themselves in dispute with other companies. In Australia, the ruling that gave BP exclusive use of green as an identifying colour for their petrol service stations has been contested by Woolworths, while Cadbury has challenged Darell Lea for their use of purple in connection with the marketing of chocolate, purple being a colour which Cadbury claims as its own trademark. In his account of these two cases, Joe Lederman explains how the Federal Court had ruled that Cadbury did not own purple while the same court had earlier ruled that BP did own green [6]. Colour samples had been used in connection with each company's application for a trademark. These samples could be used for identifying inherent colours with precision but there is no precision when colours are described with words like 'purple' or 'green'. Purple and green are each used to describe a very large range of different colours, way beyond the particular shades claimed by Cadbury and BP. A colour may not be 'Cadbury Purple' but it could still be purple.

An indication of the range of different colours that might be identified by the same name is shown in Figure 8, as evidenced by the choices of a three-year old girl. At the time, her vocabulary was limited to the 'Basic Colour Terms'. The notion of Basic Colour Terms was first discussed by Brent Berlin and Paul Kay in 1969, with the classifications in Figure 8 being roughly similar to that recorded by Berlin and Kay for speakers of English [33]. People with a more extensive vocabulary might further subdivide the greens and identify some as 'lime' and others as 'olive'. They might also subdivide the purples and identify some as 'magenta', some as 'mauve' and some as 'violet'. And they might re-position the borders which separate the greens from the blues, yellows and browns and the borders which separate the purples from the blues, reds and pinks. But there would be considerable disagreement about

the choice of additional names and the placement of the borders. None of these namings or border adjustments would carry any kind of authority that could be cited in a court of law.

Woolworths are in partnership with Caltex for the selling of petrol. The receipt from a purchase of groceries at Woolworths includes a discount voucher that can be used when buying petrol from a Caltex/Woolworths service station. It would appear that Woolworths have yet to concede the ownership of green to BP since Caltex/Woolworths service stations are still identified by the green for Woolworths and the red for Caltex (Figure 9). Woolworths green is certainly very similar to BP green as can be seen by comparing Figure 9 with Figure 10.

The legal debate over the ownership of colours does not seem to have dealt with the

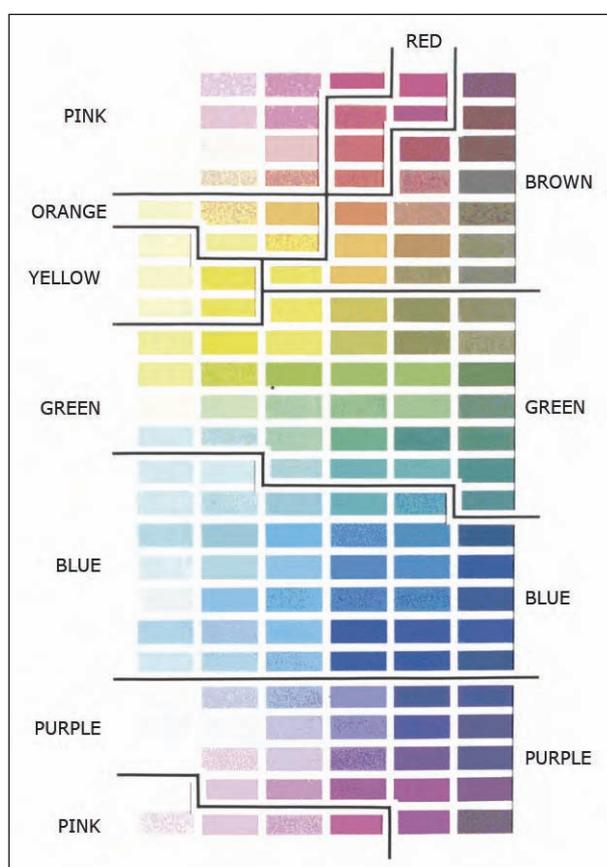


Figure 8 Colour array with borders to show the ranges of colours named by the Basic Colour Terms



Figure 9 Service station operated by Caltex which offers customers of Woolworths a discount when buying petrol

Figure 10 Service station operated by BP



possibility of a border dispute. Even if Cadbury ‘owns’ 16 of the purple Pantone colours, there are a great many more Pantone purples. If Cadbury owns Pantone 2597 but not Pantone 2593 it would be reasonable for a rival company, such as Darrell Lea, to claim the right to use Pantone 2593 even though Pantone 2593 and Pantone 2597 are so similar that one could easily be mistaken for the other. It



Figure 11 Chocolate products packaged by Cadbury, Darrell Lea and Nestlé

It would not help to extend the range of Cadbury colours because a similar situation would arise with colours at the border of that extended range. Cadbury would have to push their claim a long way before they had collected all the colours that would be described as ‘purple’ and surely this would never be accepted. Meanwhile Cadbury has to contend with other companies. Not only does Darrel Lea use a bluish purple, but Nestlé has a well established product called ‘Violet Crumble’ (Figure 11).

Limits to the application of trademarked colours

An important feature of the law relating to the trademarking of colours is that the trademark would be limited to specific goods or services. Woolworths might claim green for the company's supermarkets but green for petrol belongs to BP.

An interesting case arose in 2004 in the UK, when the easyGroup – with the colour orange well established as part of its brand identity – announced plans to enter the mobile phone market. The easyGroup brand was built on the success of easyJet, and today contains 17 companies, which vary greatly in the goods and services offered, e.g. easyCar, easyHotel, easyPizza, easyMusic and easyCruise, all identified by the colour orange [34]. The prospect of the colour orange being used for easyMobile drew the attention of Orange, a company already established in the mobile phone market. Orange objected and claimed sole rights to the use of the colour in the mobile phone market and argued that the use of orange for easyMobile would confuse customers [35]. The easyGroup has published its Brand Manual which states [34] (p21):

‘Orange is one of our greatest distinguishing features. It is an essential part of our brand identity and heritage.’

Pantone 021 is registered as an element of the easyGroup trademark. Pantone 151 is registered as an element of the Orange trademark. The formula for Pantone 151 is 75% Pantone Yellow and 25% Pantone Warm Red. Pantone 021 is a single pigment ink and appears slightly more vivid than Pantone 151, but neither is more reddish nor more yellowish than the other and it would take an experienced observer to identify either with confidence in circumstances where direct comparison were not possible.

Leaving aside philosophical objections to the notion that anyone should be able to ‘own’ a colour on the basis of its appearance alone, the AIPPI could be advised to adopt the following approach: The kind of colour to be registered as a trademark should be an inherent colour, its identity to be established by direct juxtaposition with a standard sample from an internationally-recognised system. A company should be required to provide the identification code for this single colour but they would also be given rights to neighbouring colours to cover the range of perceived colours (local variations) related to the specified inherent colour. This range should be extensive enough to cover the differences in appearance that are illustrated for the dull red in Figure 2. Beyond this range there should be a kind of no-man's land; a range of colours that could not be claimed by any other company that offered similar goods or services, so that the owner of the registered colour would be safe from mistaken identity and the kind of border raid suggested above for purple. If this proposal were in force, rights to Pantone 021 would cover similar colours, including Pantone 151, and rights to Pantone 151 would include Pantone 021. If the easyGroup and Orange were both to apply for registration of their colours as stand-alone trademarks their rival claims could lead to a definitive test case.

Private Colours in Public Spaces

Even where companies do not own colours as trademarks they make extensive use of colours as part of their corporate identity programmes. They also use every opportunity to raise public awareness of their existence by using their colours on their products, packaging, uniforms, vehicles, buildings and in all forms of advertising including billboards. Cadbury, for example, has created islands of purple in our supermarkets (Figure 12).

Figure 12 Display of Cadbury products in a supermarket



The interior of a supermarket is a fair arena for competition by colour; the company which owns the supermarket can take care of its own interests and impose any restrictions it sees fit. The use of colour outside, in the streetscape and countryside, raises more complex issues. BP has invaded our towns and countryside with the green of their service stations, but the sight of BP green can be a welcome one to a motorist running low on petrol. London Transport has filled the streets with great mobile slabs of red. Not only do the red buses identify London Transport, they have come to represent the city of London itself. Londoners would not have it any other way – London would not be the same if the buses were blue. The easyGroup has even larger ambitions [34] (p13): ‘easyGroup will develop Europe’s leading value brand into a global force. We will paint the world orange!’ Colour invasions in public places are not always welcome.

Munehira Akita and Iwao Nara describe the invasion of Kyoto by a tide of vivid yellow signs [8], a colour which they describe as alien to Japanese sensibilities and damaging to the visual harmony of the city. The ‘Historic Monuments of Ancient Kyoto’ have been placed on the UNESCO World Heritage List [36], with Kyoto City Government also introducing regulations to conserve historic sites and the natural environment. However, neither the city’s regulations nor the UNESCO listing applies to the city as a whole. Akita and Nara believe that stronger guidelines, especially for the use of colour, should be introduced and applied to the whole city. They recognise the clash of interests [8]:

‘The love of beauty ‘without being obvious’ is very old with the Japanese while advertisers are quite understandably interested in what they call ‘attention getting’.

Nevertheless Akita and Nara imply that the cityscape belongs to the citizens of Kyoto and that the citizens’ interests should take precedence over those of the international corporations.

While a person or organization might own a building, and might reasonably claim the right to colour it in any way they please, the colours of buildings have an impact on other people and can affect the whole community. Colour in the built environment is a topic of major interest among those who participate at meetings of the International Colour Association (AIC) [37]. Papers like that by Akita and Nara [8] deal with the problems of conflicting interests, the influence of globalisation and how best, if at all, to regulate the use of colour in the exterior environment. As with the registration of colours as trademarks, the concern here is not with how the use of colour should be regulated – that is another issue which needs attention. The concern is with what it is that should be regulated and again, the basis of any regulation should be inherent colours.

Where there is a long history of colour use, such as in ancient Kyoto, the appearance was often limited by the substance colours that were available. A good example of this is provided by Sonia Prieto in the case of Parati, a small town on the coast of Brazil [38]. Parati is not on the UNESCO World Heritage List but it is protected by the Patrimônio Histórico e Artístico Nacional and can be seen as a good example of colonial architecture where the original colour treatment has been preserved. Walls were white and the woodwork painted in a small range of quite vivid colours. Prieto lists some of the locally available substance colours and explains how pigments were obtained from clays, woods, plants and the cochineal insects. While they have substance colours and formula colours the walls and woodwork of Parati also have inherent colours which could be matched with other substance colours and formula colours just as Perkin's mauve could be matched by using different recipes. Rather than insist on using the original paint recipes, guidelines for Parati could restrict home owners to paints with inherent colours that matched those of the original paints.

A detailed discussion of the politics of colour are beyond the scope of this paper but some of the issues and some of the questions that need to be addressed became evident in papers presented at the 9th AIC Congress in 2001. In a summary of those papers, it was noted that colour in the built environment had been a common theme during the congress [39]:

'There was acknowledgement of the cultural role of colour and the way that it can contribute to a sense of place and a sense of community. This seems to be threatened by globalisation. One notion that emerged during the congress was that of colour as an agent of cultural colonisation, greatly facilitated by technological advances. We saw some wonderful examples of colour traditions from different parts of the world. We also saw the results of colour colonisation – blind adoption of international colour trends out of context and the excessive intrusion of advertising in the urban scene. So the question arises: whose colours should they be? Are the colours to promote the interests of the multinational corporations or are they to reinforce the sense of belonging for members of a community? If we believe in protecting and preserving local identity, should colour guidelines be introduced and reinforced? Or should we acknowledge that the world has moved on and allow market forces to dictate the colours of our cities? Would enforcement of traditional colours turn our older cities into theme parks? If we don't like what is happening and want to restore the colours of past traditions, how do we do that? Should we try to turn back the clock? And, if so, how far back?'

Conclusion

Philosophical discussions about the nature of colour have been hampered by the assumption that colour is a single kind of thing. The various positions taken by participants in the debate can be reconciled if it is accepted that there are different kinds of colour, that these are related but different nevertheless. The way to test what kind of colour is under consideration is to note how an individual colour would be identified. 'Colours' can be identified by chemical analysis (substance colour), by reference to a formula guide (formula colour), by use of a spectrophotometer (spectral profile colour, psychophysical colour), by direct juxtaposition with a standard sample (inherent colour), by referring to a colour atlas when direct juxtaposition is not possible (perceived colour). When colours are identified by name in general conversation

it is likely that the speaker will mean both a physical property and a visual experience (conventional colour).

Where cases of intellectual property or regulation arise it is important to be clear what kind of thing it is that is being claimed as property and what kind of thing it is that is to be regulated.

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