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Couleur 93
Farbe 93

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Invited Papers, Round Table Discussions and Study Group Reports

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Beyond colour Hors de la couleur Mehr als Farbe

Green-Armitage, P

ABSTRACT

The word *tincture* is borrowed from its heraldic context where it is used for the metals, colours and furs in a coat of arms. It is here proposed as a general concept for all aspects of what we see beyond but including colour-such aspects as texture, gloss and transparency.

Given the value of colour order systems, the possibility of a more comprehensive tincture order system is discussed and some existing structures in the realm beyond colour are described. The importance of making the distinction between the phenomena we see, the physics of what is happening and the descriptive words we use is stressed. And the concept of tincture is offered as providing the framework for resolving some inconsistencies of language where *gold* is a separate word for metallic yellow with no equivalent for metallic green and where green can be transparent but white cannot.

HORS DE LA COULEUR

RESUME

Le mot "tincture" est d'origine un mot heraldique - email - qui veut dire les metaux, les couleurs, et les fourrures dans les armoiries. Le mot est ici proposé comme idée generale pour tous les aspects que l'on voit au delà, mais y compris, la couleur: tels aspects que la texture, le lustre et la transparence.

Etant donné la valeur des systèmes de l'ordre des couleurs, la possibilité d'un système de l'ordre des teintes plus compréhensif est discuté et quelques structures actuelles qui dépassent la couleur sont décrites. On fait ressortir l'importance d'une distinction entre les phénomènes que l'on voit, la physique de ce qui se passe, et le langage discrepant utilisé. Et l'idée de teinte ou "tincture" s'offre comme cadre pour résoudre quelques inconsistances linguistique où *or* est un mot distinct pour jaune métallique mais sans équivalence pour vert métallique, et où vert peut être transparent mais pas blanc.

UBER DIE FARBE

ZUSAMMENFASSUNG

Das Wort *Tinktur* wird in seinem heraldischen Zusammenhang angewendet, wo es zusammenfassend für Farben, Metall und Pelzwerk eines Wappenschildes gebraucht wird. Es wird hier vorgeschlagen als allgemeiner Begriff für alles, was wir über die Farbe

hinaus (aber Farbe mit eingeschlossen) erblicken - solche Bestandteile wie Gewebe/Struktur, Glanz und Durchsichtigkeit.

Die Bedeutung und Nützlichkeit von Farbenordnungssystemen ist anerkannt. Hier wird die Möglichkeit eines umfassenderes Tinkturensystems besprochen und einige vorhandene Anordnungen im Gebiet jenseits der Farben beschrieben. Es wird betont, dass es wichtig ist, einen Unterschied zu machen zwischen den Phänomenen die wir sehen, den physikalischen Ereignissen, und den beschreibenden Wörtern, die wir gebrauchen. Einige sprachliche Unvereinbarkeiten (wo, zum Beispiel, *gold* als separates Wort für metallgelb existiert, metallgrün aber kein entsprechendes Wort hat; wo grün durchsichtig sein kann, weiss aber immer undurchsichtig ist) lassen sich im Rahmen des vorgeschlagenen Begriffs Tinktur beseitigen.

1. INTRODUCTION

Ermine, on a chief indented gules three estoiles or

Anyone familiar with the medieval French and concise terminology of heraldry would recognise that as a description, or *blazon*, of a coat of arms; this one is illustrated in Woodward's *A Treatise on Heraldry* [1] and belongs to the Estcourt family. Anyone else who wanted to describe it would have to say something like: "the top third of the shield is red, the bottom two thirds white with black markings to represent ermine. The two areas meet at a zig zag border. On the red area there are three gold stars."

Heraldic descriptions are both more concise and more precise than everyday language. Heraldry also has a particularly useful word - *tincture*. Tincture, as it is used in heraldry, is "an inclusive term for the metals, colours and furs in a coat of arms" [2], so the gold, red and ermine of the Estcourts are each a different tincture. Heraldry recognises three categories of tincture: the *metals* gold and silver, the *colours* red, blue, green, purple and black, and a number of conventionalised patterns for the various *furs*. (Two other colours are occasionally listed, the dishonourable *stains* known as tenny and sanguine.) A tincture, therefore, implies more than colour. It is also surface quality and texture.

Surface quality and texture are attracting more and more attention as it is increasingly clear that there is a world of difference between gold and yellow, between matt black and glossy black and between rough bricks and smooth terra cotta. New standards and new instruments

are being developed to measure glossy, metallic and pearlescent surfaces. People refer to the problem of measuring *appearance* (as distinct from, but including colour) but I prefer the heraldic term *tincture* and will now use it beyond the confines of heraldry for the totality of what we see.

If our everyday vocabulary is seriously inadequate for describing colour, our vocabulary for the inclusive domain of *tincture* is even more impoverished. The eleven basic colour terms identified in Berlin and Kay's famous study [3] look impressive beside the two words which could claim the status of basic *tincture* terms - gold and silver. For the rest we have to use a more or less elaborate system of adjectives which would include such words as glossy, metallic, transparent, smooth and furry.

There may be advantages in an extended vocabulary for colour [4] but the present inadequacies of colour words and the potential for misunderstanding that would remain were long ago recognised by Albert Munsell [5] whose solution was a system of notation and a three dimensional colour solid. Colour order systems have tamed the world of colour. A *tincture* order system could help to clarify the more unruly world of total appearance, but if three dimensions are inadequate for colour [6] and if colour itself is an integral part of *tincture*, it is clear that *tincture* will require something rather complex. Nevertheless, I do not share the pessimism of Richard Hunter, the pioneer of appearance measurement, who believed that "... the geometric attributes such as gloss, haze and translucency ... which are associated with the spatial distribution of light by the object, cannot be uniquely defined in any organised co-ordinate arrangement as can the colour attributes." [7] What I foresee is a structure of structures with separate scales for each aspect of appearance and points of contact which would allow us to appreciate the relationships which may or may not exist between such things as a candle flame, a yellow flower and a gold ring.

A great deal of work to this end has already been done in Argentina and I have proposed a model of my own which connects transparent colours to those that are opaque [8]. A *tincture* order system would accommodate such scales as matt to glossy, glossy to metallic, transparent to opaque, smooth to rough, as well as the scales of colour and also scales connecting the so-called *modes of appearance*: illuminant, illumination, surface, volume and film.

While investigating the possibilities of such a system it is important to make a clear distinction between the phenomena as we see them, the physical events which give rise to the phenomena and the words we use to describe what we see.

2. WHAT WE SEE

The raw data of vision could be reduced simply to coloured shapes. A large and complex set of circumstances determines what sense we make of those coloured shapes. It is not often that we experience the *isolated colour* of a single light stimulus. As Evans points out: "In most cases we deal with more than one

stimulus ... and it is not surprising to find perceptual interactions among them." [9]

Identification of some object like an apple requires perception of several coloured shapes. The juxtaposition of lighter and darker coloured shapes enables us to read the three dimensional form of the apple. The degree of contrast and the sharpness with which the edge of the highlight is defined, reveals the extent to which the surface of the apple is more or less glossy. Already we are beyond colour and in the realm of *tincture*.

Another aspect of appearance or *tincture* which requires the presence of more than one coloured shape is transparency. Something may be physically transparent but we have no means of reading that without the presence of other coloured shapes. In fact it is possible, with particular combinations of coloured shapes, to read as transparent a surface which is opaque. The conditions required for this have been thoroughly investigated by Osvaldo da Pos [10].

Some properties not only require the presence of more than one coloured shape but also the opportunity to look at something from different positions. I have pointed out elsewhere [11] how we need the experience of moving highlights to understand the characteristics of a glossy surface. I recalled the question posed by W.D. Wright: "What is colour for?" and his answer: "... to tell us about objects" [12], and I referred to the importance of more than one viewpoint to tell us about such aspects of objects which are better described under the broader definition of *tincture*. Now I would prefer to rephrase Wright's question and ask: "What is *tincture* for?"

When professional snooker players line up their shots they must decide where to aim and how to strike the ball. The rules of the game lay down the order in which the different coloured balls can be hit and how many points each colour is worth, so it is the colour dimensions of *tincture* which will guide the aim. But before they strike the ball some other dimensions of *tincture* will have been noted by the players: the glossiness of the balls and the texture of the playing surface. According to Terry Green, Manager of Billiard Supplies of Australia [13], shiny new balls roll faster than old ones and their speed is also affected if the surface is old and worn.

When we choose an apple to eat we do not base our selection on colour alone. We also note the glossiness of the apple's skin. We may even pick it up and polish it to see if we can improve the shine. We choose it for its colour *and* for its gloss. We choose it for its *tincture*. The wicked Queen knew what she was doing when, disguised as an old lady, she used an apple of exceptional gloss/red *tincture* to tempt Snow White.

3. WHAT IS HAPPENING

The radiation entering our eyes brings the information we need to see coloured shapes. It may have its origin in the sun or some other source and it may shine directly into our eyes. Or it may reach us after interacting with some object or substance. Colour is determined by the spectral composition of the radiation. Other aspects of

tincture are determined by the way the radiation is absorbed, reflected, transmitted or scattered and its spectral composition can be changed as these processes are more or less selective.

When studying the phenomena of gloss, transparency etc. it can be useful to know what is physically happening, but it is important not to confuse the two. Gloss may be the *result* of specular reflection but it is not the same thing. Physical transparency is not the same thing as phenomenal transparency and it is possible to have either without the other.

4. HOW WE DESCRIBE WHAT WE SEE

It would be useful to have separate words for the phenomena and their causes. Barry Maund has argued that colour is "a case for conceptual fission" [14]. The word *colour* does double duty for what we see and the physical properties of surfaces whereby they interact with light in a characteristic way. It is possible that languages will evolve to make up this deficiency. In the case of colour words, the work of Berlin and Kay [3] provided an unexpected insight into language evolution. It would appear that there is a definite pattern according to which a language's vocabulary of basic colour terms increases as the culture becomes more sophisticated.

A possible process for vocabulary growth is suggested by one of Berlin and Kay's criteria for determining whether or not a word should be regarded as a *basic colour term*: "colour terms that are also the name of an object characteristically having that colour are suspect ... This ... criterion would exclude *orange* in English if it were a doubtful case ..." Initially people might have described something as "the colour of an orange" or "coloured like an orange". In due course it ceased to be necessary to use the simile. The word *orange*, used alone, might have served a kind of apprenticeship when it was used by a minority but it has proved its worth and now has its place in everyday language. Words like *olive* and *turquoise* might be going through a similar process. And the same kind of process could be envisaged for tincture words which include other aspects of appearance. *Bronze* might soon join gold and silver.

I don't believe the story of Eskimos having 20 different words for "white" but I could believe that they have 20 different words for snow. These words would surely include aspects of the appearance of snow beyond mere whiteness. I doubt whether they would use these words to describe something else like a sheet of paper or a dress, but if they were to do so they would be doing more than describing the colour - it would be the tincture of the sheet of paper or dress.

When Othello, in Shakespeare's play, describes Desdemona's skin as "whiter ... than snow And smooth as monumental alabaster" [15] he uses a colour word for the colour of her skin and a simile for the other aspect of her skin's appearance which completes the description of her skin's tincture. It is easy to imagine the word alabaster evolving into a basic tincture term so that it might eventually be possible to say "she has alabaster skin" without being suspected of being a poet.

5. COLLECTIONS OF NAMED SAMPLES

One way to overcome the inadequacies of vocabulary and the slow process of language evolution is to have a collection of named samples. When several people have the same collection they can refer to the collection and use the names and know that they will be understood, at least by those who also have access to the collection. Examples of such collections are the colour cards produced by paint manufacturers.

A collection of textures was published in 1966 by the photographer Phil Brodatz [16]. He identified each texture but also assigned a number as a means of differentiating photographs of the same class of surface. He created different textures by varying the lighting and the degree of magnification or reduction, so D94 is a brick wall reduced to 1/6 actual size and D95 is 1/12 actual size. According to Robyn Owens and Peter Kovesi [17], who are both active in the field, researchers in computer vision use the Brodatz textures as reference images for comparing their results.

Another collection of textures, this time in colour, is the *Phototone* range produced by Letraset [18]. The collection is intended for use as background images by designers. Such collections, however, are only valuable to those who have access to them and their usefulness in revealing the ways in which the appearance of surfaces can be different from or related to each other is limited. These limitations were recognised by Munsell and overcome by his colour order system [5]. A more comprehensive set of relationships would be revealed in a tincture order system.

6. A TINCTURE ORDER SYSTEM

Ordinary people might regard colour as one dimensional. A snooker ball is red - end of story. It is also glossy - end of another story. Colour specialists, on the other hand, know about three dimensional colour solids and can imagine the snooker ball changing colour and moving through pink to white, via brown to black, towards yellow or towards blue and green - getting lighter, darker, duller, more vivid or changing hue. But its glossiness is no less intrinsic to its being a snooker ball than is its redness. In fact glossiness is the one dimension of tincture that unifies all the differently coloured balls on the table. Now we could imagine the ball losing its shine or becoming metallic, becoming translucent and then transparent. We could imagine its surface less smooth and becoming rough or even hairy. The snooker ball is now at an intersection in a complex network of appearance scales which would constitute a tincture order system.

7. EXISTING STRUCTURES

A *General Theory of Design* has been developed in Argentina. The work, initiated by César Janello, is being carried on by Claudio Guerri and José Caivano. The theory has four sub-theories each of which has its own three dimensional structure modelled on the structure of a colour order system. *Colour* itself constitutes one of these sub theories, the favoured

models being the colour solids of Munsell and Pope. The other sub theories are: *texture*, *cesia* and *spatial delimitation*.

7.1 Texture

The model for texture has been described by Janello [19]. Its dimensions are *size*, *density* and *directionality*.

The *size* of the textural elements reaches a maximum just before that point where the surface would begin to be seen as subdivided rather than textured. This would be the threshold between texture and pattern. A chess board would appear as a pattern to those playing the game but from beyond a certain distance the black and white squares would appear, not as separate elements, but as an all over texture which would appear progressively finer as one moved further away.

The *density* is determined by the relative size of the textural elements and the intervals between them. A scale where density increases and then decreases can be seen at the beginning of a shower of rain. Dark spots appear on the road which we might see as low density texture. As it continues to rain the density increases until half the road surface is wet. Up to this point the textural elements have been the dark wet spots. Now the situation reverses and the paler dry spots are seen as the elements and the density decreases. Zero density is reached again when the road is completely wet.

At the zero end of the *directionality* scale the dimensions of textural elements and intervals is uniform in all directions, like the chess board. If the black and white squares were replaced by rectangles there would be an increase in directionality. There are many ways in which directionality can increase: the elements can get longer and thinner and the intervals can increase in one direction but not the other. A texture of maximum directionality is linear like corrugated cardboard.

This model may seem very restrictive and may seem to have no place for textures that cannot be accommodated in a rectilinear grid. Textures like tree rings and finger prints might seem to be excluded. But it is not difficult to relate tree rings to the linear textures of maximum directionality. The varying width of the darker and lighter rings and the varying intervals between them which together constitute a record of the tree's growth can be accommodated on the scales of size and density.

7.2 Cesia

There is no word that embraces such phenomena as gloss and transparency, so Janello coined a new word, *cesia*, derived from his own name César. A very elegant model for *cesia* has been constructed by Caivano [20] with the dimensions *absorption*, *permeability* and *diffusivity*. If clear glass could be regarded as perfectly transparent there is more than one way in which it could change until it became opaque.

As with sunglasses, glass can absorb light while still allowing one to look through and see objects quite clearly, but as more and more light is absorbed it becomes less and less easy to see through the glass, until it becomes impossible and the glass would be described as black. This would be a scale of *absorption*.

Alternatively not all the light might be able to penetrate; instead of being absorbed some light might be reflected back again so that one might be able to see, at the same time, what is on one side of the glass and what is on the other (such a piece of glass is, of course, a beam splitter). If the ratio of what is reflected to what is transmitted can be varied there would be a scale connecting clear glass to mirror - a scale of *permeability*.

A third possibility would be that the glass might not be optically perfect so that some light might be scattered and the view through the glass become blurred. If one were looking out of a bathroom window while someone was having a hot shower, condensation would form on the window. Visibility would get progressively worse until finally it would not be possible to see through the window at all - it would be white. This would be a scale of *diffusivity*.

7.3 Spatial Delimitation

The model for *spatial delimitation* has been described briefly by Caivano [21]. It can be used to analyse three-dimensional forms as well as two dimensional shapes, each of which can be characterised according to positions on three scales or dimensions.

A triangle or tetrahedron is at one end of the *formatrix* scale. The next step is a square or cube and the number of sides and planes increases until it reaches infinity at the other end of the scale with a circle or sphere.

The scale for *size* is self evident except that only a portion of the scale could be used as suitable for a given situation, the terminal points being infinitely large and infinitely small.

For the third scale the word *saturation* has been adopted and is used to refer to the proportions - a shape that is short and fat is more saturated than one that is tall and thin.

The red snooker ball can now be used to test this General Theory of Design. The ball can be given a Munsell notation to locate it in the colour model. Being smooth it would be at a zero point in the texture model. In the *cesia* model its redness provides a clue to selective absorption and its permeability is zero. Its diffusivity is a bit more difficult in that the overall redness suggests high diffusivity while the surface gloss suggests the opposite. Perhaps it should be treated as two things, as a sphere inside a very thin close fitting membrane. The sphere is selectively absorbent, impermeable and highly diffusive. The membrane, on the other hand, is minimally absorbent, maximally permeable and minimally diffusive. In the model of spatial delimitation the ball is at one end of the *formatrix* scale, at some point on the size scale as determined by its diameter, and it is 100% saturated. (An egg is an example of something less saturated than a sphere.)

The structures in this General Theory of Design are quite seductive and also quite helpful, especially when dealing with the physical situation. But once again it is important to distinguish between what is physically happening and what we see. One could imagine a kind

of metamerism of cesia where two surfaces appear identical in a particular context even though, if measured, they would be shown to have different degrees of diffusivity, permeability and absorption. The scales of tincture are intended to relate strictly to what we see, so a scale of transparency would refer to *apparent* transparency rather than *physical* transparency.

8. SCALES OF TINCTURE

The concept of tincture offers a greatly enriched framework for apprehending the things we see. The scales in a tincture order system would include several scales of colour and the scales of texture and cesia. Gloss and metallic appearance scales have aspects of both texture and cesia. Brass, copper, steel, chrome, silver, silver paint, gold, gold paint all appear metallic. Some are achromatic, others have hue. The texture and cesia scales are closely connected here. Rough texture and a metallic appearance do not seem to be incompatible. It is possible to imagine a scale connecting something painted gold and something of polished brass. There would be a simultaneous change towards a smoother and more perfectly reflecting surface. When a red snooker ball is placed between a ripe tomato and a metallic red Christmas tree ornament it is possible to imagine a continuous scale connecting them.

9. AN ART OF TINCTURE

The concept of tincture makes it easier to appreciate the work of Howard Taylor, an artist who lives and works in the karri forest in the south west corner of Western Australia. My interest in surface quality and texture - as distinct from colour, but at the same time inseparable from colour - dates from my first visit to his studio in 1985. The paintings he showed me were extraordinarily simple, a typical format being a rectangular figure on a rectangular field. Attention was focussed on the borders between figure and field which varied in how sharply they were defined and where sometimes there was a subtly graded change of colour just before the border. In other paintings there are three concentric rectangles. In these paintings there is a transitional band between the field and the central rectangle. Curtin University owns three paintings of this latter format and they exemplify Taylor's pre-occupations with contrasts and transitions. However, unlike the contrasts and transitions in Josef Albers' paintings from the series *Homage to the Square* which are contrasts of colour alone, the contrasts in Taylor's paintings would be better described as contrasts of tincture.

In *Black figure* the central rectangle is glossy and the outer area is matt but in the band which separates them the surface has a buttery texture so there is contrast not only between glossy and matt but also between smooth matt and textured matt. *White Figure* could be read as three steps in a texture scale. The texture of the canvas is clearly visible in the outer area which is covered with a thin film of paint. In the centre the layer of paint is thick and smooth and the texture of the canvas has disappeared. In between is an area of transition. *Veiled Figure* is about transparency and in this case the small rectangle does not appear to lie on top but underneath a larger rectangle which appears to be translucent.

10. THRESHOLDS

In some of the scales in a tincture order system there would be thresholds. While the hue scale of most colour order systems is regarded as a single continuous scale, in the Natural Colour System there are four separate scales where the four unique hues are the thresholds. Unique Yellow, for example, is at the same time the end of the Green-Yellow scale and the beginning of the scale from Yellow to Red.

There may also be thresholds between matt and glossy and between glossy and metallic even though the changes along the scale can be continuous. If such a scale were illustrated with a row of spheres or cylinders the first threshold would occur at that point where a highlight becomes visible. Increasing gloss is characterised by increasing contrast between highlight and shadow and by the highlight becoming more sharply defined. In a glossy surface the highlight, being a reflection of the light source, is the same colour as the light source. In a metallic surface it may have the same hue as the surface itself. A glossy red cylinder could be expected to have a white highlight while the highlight of a metallic red cylinder could be pink. At the same time the contrasts in the metallic surface are much greater than those in the glossy surface. But since these contrasts can be increased or decreased in a continuous way, and since there can be a continuous scale connecting white and pink, the threshold might have to be determined as that point at which one would say the highlights cease to appear white and begin to appear pink. (This may seem reasonably straightforward, but I suspect it will turn out to be more complicated. Given a scale connecting matt and metallic via glossy it will be necessary to take note of the different kinds of gloss identified by Hunter [7]).

A useful medium for investigating these phenomena is the range of film materials used for special effects in display and the coloured filters used for lighting in the theatre. Sample sets are produced for reference by such companies as Lee [22] and Rosco [23]. A film of silver mirror material can be taped round a cylinder and covered with any of the coloured filters to produce metallic reds, blues and greens. Yellow filters, of course, produce gold. There are also mirror films which have a texture and there are diffusion films - half white, quarter white and eighth white diffusion - which make it possible to produce a series of steps between gloss and metallic.

Evans [9] has identified a threshold at the point where colours cease to appear greyish and begin to appear what he calls *fluorent*. It is possible to imagine a continuation of such a scale up to and beyond the point (another threshold) where a fluorescent surface appearance gives way to something that looks like a light source. The computer screen provides an interesting place to investigate this threshold between surface and illuminant. In spite of the fact that we know that what we see is self luminous it does not always appear to be so. It is only necessary to point to an area of brown on the screen; no light source would be described as "brown". Glossy and metallic surfaces provide another interesting link between surface and illuminant since one can look along a highlight and see it growing in brightness until it is too bright to look at and begins to look like the source of light itself.

11. CONNECTIONS

The separate aspects of an object's tincture - its colour, texture, degree of gloss, transparency etc. - can be considered in isolation and located on independent scales. It might also be possible to establish points of contact. Before I encountered Caivano's model of *cesia* I had proposed something similar [8]. My model had his scales of absorption and diffusivity (which I called, rather perversely, *black transparency* and *white transparency*) but it lacked the dimension of permeability. I felt something was missing but couldn't identify it. However I used the opportunity of a third dimension to connect what I could now call *cesia* to the world of colour. I had scales from clear transparent to transparent yellows, reds, blues and greens - a transparent colour solid - and a corresponding opaque colour solid where the yellows, reds, blues and greens connected with white. With the two colour worlds connected by the scale from clear transparent to white there would also be scales connecting any point in the transparent world to any point in the opaque world.

A useful example to describe the possibilities in this scheme is a cup of tea. To clear water can be added more and more tea leaves and more and more milk. Tea leaves take us along the scale of absorption (*black transparency*) and the milk takes us along the scale of diffusivity (*white transparency*). At a particular point is the perfect cup of tea and I believe that our judgement of that involves more than colour. For want of anything better I have been calling this quality *visual penetrability* and perhaps that equates with Caivano's other dimension - permeability. There may be scope here for "metamerism" where two cups of tea might look the same though one might have more tea leaves but also more milk than the other, but I don't think so.

Other examples of materials which can have a degree of visual penetrability are rocks and human skin. In these cases there would be more information to give us a clue to what we are seeing but alabaster and marble are clearly not only smoother but also more visually penetrable than sandstone. That may or may not have anything to do with the relative smoothness of the surface. Smoothness may also be one of the qualities which contributes to a "translucent" complexion. But there can also be cues to visual penetrability like out of focus veins which appear to be below the surface. According to Mary Quant [24] one of the tricks employed by women in the time of Q. Elizabeth I was to paint "veins" on their skins and then smudge the edges. Smudged veins are certainly part of the recipe for "marble" described in Jocasta Innes' book *Paint Magic* [25].

12. MODES OF APPEARANCE AND STATES OF MATTER

It might be taking the meaning of the word tincture too far from its heraldic origins, where it is clearly used in connection with objects and surfaces, but it will be useful to liberate tincture and allow it to be used in connection with all modes of appearance including what David Katz called the *illumination of empty space* [26]. At the same time it need not be stretching this meaning too far if an alternative view of modes of appearance is adopted.

A concept which seems potentially useful involves linking modes of appearance to the three states of matter: gas, liquid and solid. Each of these can be considered as changeable in the various directions of the scales of tincture - colour, texture and *cesia*.

12.1 Gas

If we start with gas, clear air is a volume of clear transparency. It has a position in each scale of tincture: it is achromatic, it has a smooth texture, it is minimally absorbent and diffusive and maximally permeable. It is now possible to imagine it changing along each of these scales, even the texture scale provided there is an increase in diffusivity for the texture to bite on. Diffusivity would be experienced as mist or fog and it is possible to think of mist as fine or coarse. At sunset the diffusivity might still be near zero but the colour would have changed, from achromatic to reddish.

The volume of air can appear bright or dim. Although we know it is the sun which is responsible it is possible to think of the volume of air as independent of an outside source of energy and able to move by itself up and down a scale of brightness. If we think of it like this it becomes possible to contemplate parts of the volume being brighter than others. When we look past each side of a tree when the sun is to one side the volume of gas on the shade side of the tree appears darker. This is what Katz called an *air shadow*: "An air-shadow causes the empty space in which it is seen to appear darker, and it appears as a medium filling this space, whereas the spaces before and behind it are seen as distinctly brighter." [26]

This volume of gas, which has tincture and the capacity to move from bright to dark, might be what Monet was trying to capture in his series paintings. The catalogue to the exhibition *Claude Monet painter of Light* contains an essay by John House [27]. House explained how Monet's concern became "... the all-enveloping atmosphere, rather than the varied textures and colours of the individual elements in the view." House quoted Monet's own words: "The motif is insignificant for me: what I want to reproduce is what lies between the motif and me." Monet described this as "the *enveloppe*, the same light spread over everything." Although the *Haystacks* and *Rouen Cathedral* paintings are the most famous and the most dramatic, the most convincing example of Monet's achievement I have seen is two paintings from the same viewpoint in a field of poppies. In one the sun is shining, in the other the sun is behind a cloud. On a day when clouds pass in front of the sun we experience changes in the quality of light but the changes are instantaneous, unlike the gradual changes that occur in clear weather between sunrise and midday, and they can be experienced again by simply looking from one painting to the other. (This was possible in the exhibition *Monet in the '90s* and the two paintings are reproduced side by side in the catalogue [28]).

Faber Birren [29] has described a way to capture the appearance of what he called *chromatic lights*, which involves looking at things through a coloured filter. Looking through the filter is not like being inside Monet's *enveloppe* but the effect on the appearance of things seems to be essentially the same. Birren goes on

to suggest making a filter by filling a water tank with coloured dye and a small quantity of milk. Looking through this it is possible to see how things might appear if we were surrounded by a coloured mist. Clouds, mist and fog would be gaseous volume tincture with more or less diffusivity and absorption. The mist or fog might also have a texture and it may come as no surprise that Monet particularly enjoyed painting the fog on his visits to London.

12.2 Liquid

Liquid volume colour as identified by Katz [26] is well accepted, but liquids can also be seen in a variety of tinctures. The scales of absorption and diffusivity have already been discussed in connection with the example of a cup of tea. And it is possible to get inside a volume of liquid and experience, in the sea, the same kind of influence on the appearance of things as Monet was studying and as Birren was able to capture by looking through filters. Turbulence and bubbles offer a wealth of textures, and diffusivity can be increased by sediment and clouds of micro organisms.

12.3 Solid

The difference between transparent coloured liquid, transparent jelly and solid transparent plastic may not be easy to detect but the notion of solid volume tincture can be accepted readily enough for the plastic if not for the jelly. It is perhaps less easy to accept something opaque like a brick as an example of solid volume tincture. Nevertheless I believe that an unpainted brick can appear to be coloured-all-through. The key to the perception of the brick as being coloured-all-through is its surface texture. One of my colleagues, Colin Latchem [30], first drew my attention to a distinction between coloured-on-the-surface and coloured-all-through when he suggested that he responded differently to bricks if they were painted. This leads me to prefer the term skin tincture to surface tincture. If the object appears coloured all through that is solid volume tincture, probably at one extreme on the permeability scale. If it appears painted we see it to be so and that is skin tincture. Howard Taylor draws the distinction between colour that is *on* an object and colour that is *in* an object. [31]

Transparent paints, dyes and inks make it possible to create the illusion that something is coloured-all-through because they do not alter the surface texture; they do not appear as a skin. In the 1983/84 International Colour Design Prize sponsored by the Design Centre Stuttgart the first prize was shared. One winner was the team of Antal Nemcsics and Mihaly Zador for their work in the restoration of the Buda Castle district here in Budapest. The other winner was Fritz Fuchs. Fuchs created poetry out of rough shuttered concrete with graded washes of transparent colour. In the words of the assessors: "Nothing here looks 'painted over'." [32]

13. SUMMARY

By way of summary, and as a further example of how useful the concept of tincture might be, it is worth quoting some of the observations made and questions

raised by Ludwig Wittgenstein in his *Remarks on Colour* [33]. This was published posthumously and is in three parts.

From Part I:

18. Can a transparent green glass have the same colour as a piece of opaque paper or not? If such a glass were depicted in a painting, the colours would not be transparent on the palette. If we wanted to say the colour of the glass was also transparent in the painting, we would have to call the complex of colour patches which depict the glass its *colour*."

46. It could be that we had two words for "green" one for green surfaces, the other for green transparent objects. The question would remain why there existed no colour word corresponding to the word "white" for something transparent.

19. Why is it that something can be transparent green but not transparent white?

33. We speak of the "colour of gold" and do not mean yellow. "Gold coloured" is the property of a surface that shines or glitters.

54. It is easy to see that not all colour concepts are logically of the same sort, eg. the difference between the concepts "colour of gold" or "colour of silver" and "yellow" or "grey".

From Part II:

4. What then is the essential nature of *Cloudiness*? For red or yellow transparent things are not cloudy; white is cloudy.

From Part III:

79. There is gold paint, but Rembrandt didn't use it to paint a golden helmet.

152. Mightn't shiny black and matt black have different colour-names?

If we replace the word *colour* with the word *tincture* it is clear that colour/tincture words vary in the degree of precision with which they are used [4] and that some of these words can be used in more dimensions of tincture than others.

Green objects can be light or dark, dull or vivid. They can also be transparent or opaque, matt, glossy or metallic. White objects must be light and can only be opaque, matt or glossy. Yellow objects can be anything a green object can be except dark or metallic. We have a separate word for dark yellow-*brown*, and a separate word for metallic yellow-*gold*. One could argue that it would be useful to have separate names for shiny black and matt black. It would be even more useful to have separate words for colour-as-a-visual-experience and colour-as-a-physical-property-of-an-object. But we are stuck with the language we have inherited and, while I find the *concept* of tincture very useful, I do not expect the *word*, with the meaning I have given it here, to appear suddenly in everyday conversation.

14. CONCLUSION

All this might seem a bit esoteric to a practical person like an architect or designer. However I believe it is useful to have a structure for one's thoughts. If a colour order system reveals a range of possibilities beyond the limits of the colour cards produced by the paint, ink and textile manufacturers, a system of tinctures, with its structure of related structures, would reveal an even richer world of possibilities for contrasts and relationships far beyond colour.

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