CHAPTER 8

Seurat and "painting with light"

Introductory

This chapter introduces Georges Seurat's radical departure from a four century old and universally accepted approach to painting light. The previous four chapters have introduced the artistic practices and the science that prepared the way for this. They have also providing images to illustrate some of the manifestations of reflected-light that he may well have had in mind.

- *Chapter 4 is about the Renaissance approach to painting light, which centred on local and whole-field lightness relations with particular reference to finding the darkest and lightest regions in the scene (chiaroscuro) and gradations of lightness across surfaces. In this scheme of things the depiction of shadows was a matter of painting "what you see", which seemed reasonable enough but brought with it all sorts of unsuspected problems.*
- *Chapter 5 focuses on the scientific revolution in the understanding of light and colour coming from a combination of the work of Isaac Newton and the insights of the numerous scientists who realised that all sensory experiences including those that relate to colour and effects of light are made in the head. Newton clarified the physical nature of light. The scientists who focused on what the eye/brain did with the light entering the eye introduced concepts like "induced colour," the "three primaries", "complementary colours" and "colour/lightness contrast effects".*
- *Chapter 6 shows the Impressionists had an agenda which included the idea of emphasising the reality of the picture surface and playing off the ephemeral and the permanent aspects of appearance.*
- *Chapter 7 illustrates the difference between glossy and matt surfaces,*

with special reference to inter-reflectivity and the effect of viewing angle on appearances.

It is now time to turn to Seurat's innovations. As explained earlier, these were inspired by a diagram that he found in a physics book,[1] which showed him that there is a component of the light that strikes surfaces which, unlike the component which produces body-colour, does not enter into them. Rather it is reflected directly back without changing its wavelength composition. Influenced by other recent scientific ideas, Seurat believed that he could represent this component by means of mosaics of tiny dots containing juxtapositions of complementary or near-complementary pairs.

Seurat's "pointillist" ideas

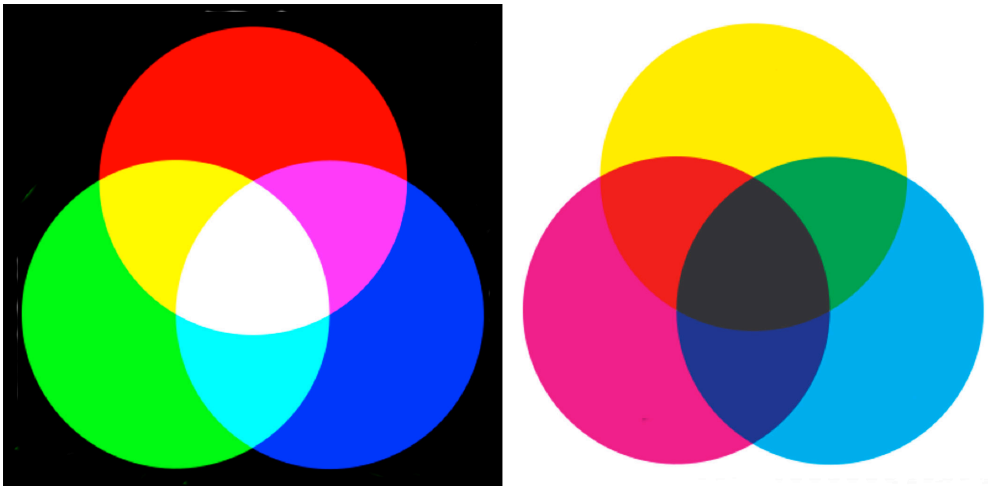

Figure 1 : Additive and subtractive primaries

We start with a reminder the difference between additive and subtractive colour mixing. *Figure 1* (left side) illustrates the additive primaries - red, blue and green and (right side) subtractive primaries - magenta, cyan and yellow. Also illustrated in the crossover regions are mixtures between pairs, which are always the complementary to the primary opposite. In the additive case all of these are lighter than their parents and the combination of all three is "white", which is the lightest of them all. In contrast, in the case of the subtractive primaries all the

1 Rood, Ogden (1881) [1879]. Students' Text-book of Color; Or, Modern Chromatics, with Applications to Art and Industry. New York: D. Appleton and Company.

mixtures are darker than their parent colours and the combination of all three is black, which is the darkest of them all. Again, the complementaries are always the mixture of the remaining two primaries. *Figures 3 and 4* display the additive and subtractive pairs respectively.

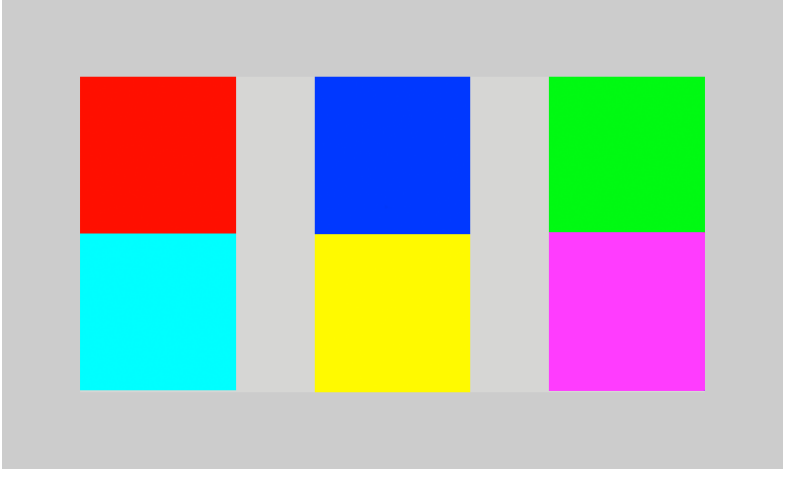

Figure 2 : Additive complementary pairs - primaries at the top

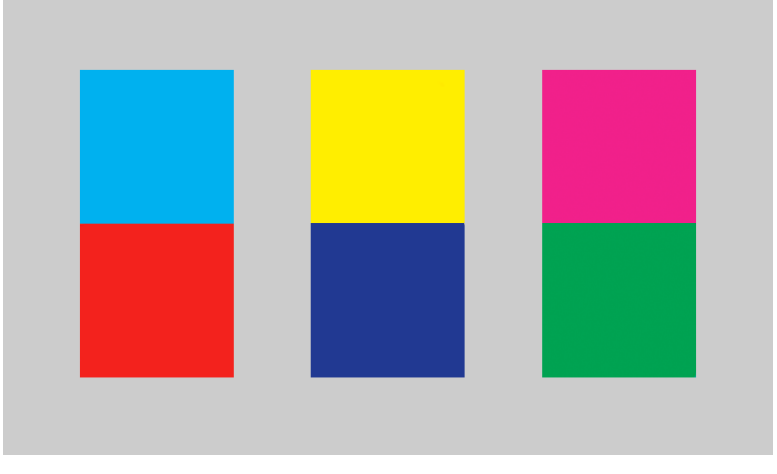

Figure 3 : Subtractive complementary pairs - primaries at top.

As Seurat never provided a clear exposition of his ideas,[2] it has been necessary to find out about them from the evidence provided by the combination of

2 William Innes Homer:: Seu*rat the the Science of Painting*, MIT, 1964

his paintings and the somewhat scant and not necessarily authoritative writings of others.[3]

Historians trying to work out his methodology on the basis of what they can see in his paintings are faced with intrinsic difficulties. In particular, the pigment-colours used by Seurat have been subject to changes due to the passage of time (a common problem with paintings when looked at after long time intervals). For example, the zinc yellow he favoured proved to be very unstable. When he made his paintings it was a fully saturated yellow, now it is a dirty brown. Likewise, in Seurat's time, the pigment-colours nearest to magenta (the crimsons) depended on the notoriously fugitive dyes extracted from plants of various kinds. Obviously mixtures using these have changed significantly.[4]

A thought experiment

But all this is not of great importance in the present context, as the purpose of this book is not primarily to establish precise historical truths but to use history as a way of focusing on and clarifying practical painting issues. Accordingly, rather than relying on my understanding of Seurat's theoretical framework, I will start a thought-experiment of my own by imagining myself in the position of a scientifically inclined artist in the early 1880s who is determined to find a way of depicting the influences of reflected-light on appearances in natural scenes. Suppose that my search leads me, as it did Seurat, to investigate books on the subject of painting light and that, as a result, I come across the most up to date of them all, "*Modern Chromatics"* by Ogden Rood a physicist and amateur painter.[5] In this I find an account of the author's elaborations on James Clark Maxwell's pioneering experiments involving mixing colours optically, using rotating discs.[6] As explained in *Chapter 4*, these show that separate areas of pigment-colour blended by this method do so ***additively***, as when light beams are combined (*Figure 1,* left side). For example "*red*" and "green" make "*yellow*", even if it is rather desaturated in appearance.

I also know from a diagram that I have seen in a physics book (*Figure 5,*

3 Particularly Felix Fénéon, the Art Critic and Seurat enthusiast.

4 As have the purples that Van Gogh made using mixtures of blue and crimson which now appear as blues.

5 Rood, Ogden N, 1879, *Modern Chromatics*, New York.

6 James Clerk Maxwell, 1856, 'Theory of Perception of Colours', Transactions of the Royal Scottish Society of Arts, Vol. 4.

Chapter 4)[7] that the light that reflects back from the surfaces of the objects I am wanting to depict combines wavelengths coming from the main light sources with a multitude of much less powerful ones provides by the interreflections between the different coloured surfaces in the proximity. Consequently, I can assume that it contains a mixture of all wavelengths.

In another place in "*Modern Chromatics"*, I come across the following passage:

> "*A method of mixing coloured light seems to have been first definitely contrived by Mile in 1839, although it had been in practical use by artists a long time previously. We refer to the custom of placing a quantity of small dots of two colours very near each other, and allowing them to be blended at the proper distance. The results obtained in this way are true mixtures of coloured light.*"

Still engaged in my thought-experiment, this information excites me with the idea that I might be able to paint the "*white-tending*" reflected-light using arrays of closely packed, varicoloured dots representing combinations of the three light primaries. Also, since the complementary of a primary is made from a combination of the other two primaries, it must be possible to depict the white-tending reflected-light by means of a mosaics comprising any primary and its complementary. Indeed, mosaics comprising any complementary or near-complementary pair would do.

All this leads me to the question of which pigment-colours to use. Since, as will be explained in *PART 4*, there would be no possibility of arriving at anything like a true complementary pair directly out of tubes, I would have to compromise doing the best I am able to using mixtures. Even with modern pigments, this would invariably lead to a certain degree of desaturation. However, after a bit of experimentation, I would find that any two colours from opposite sides of the colour circle would blend according to the additive principle.

Much more significantly, I am faced with minefield of difficulties relating to what Mile referred to as "*blending at a proper distance*". In other words, at a ***viewing distance*** from which the resolving power of the eye is no longer sufficient to distinguish the separate dots. What this distance is will depend on a number of factors, in addition to the resolving power of the ***lens-system*** of the viewer. Apart from ***dot size*** and ***packing-density,*** the most important of these is the ***difference in lightness*** between the pigment-colours that are to be optically

7 *Also "The Glossary", Figure 1.*

mixed. Not surprisingly the rule is that the greater the difference in lightness, the greater the viewing distance necessary for blending to occur.

But what about the problem of arranging for all the pigment colours on a picture surface blending at the same viewing-distance? Possibly the only plausible way of doing this would be to make sure that all the pigment-colours that are to be optically blended are all of equal lightness. As none of the tube colours available are equal in lightness, achieving this would require at least some of them to be mixed with darker or lighter colours. The inevitable result would be desaturation and, consequently, outcomes that are even further from the colours of unadulterated additive primaries. As someone who has made abstract paintings based on these principles,[8] I can assure readers that the work involved is daunting. Indeed, it is my view that is impossible for anyone painting from nature, mixing the colours on their palette in the normal way to cover a picture-surface with a number of regions of colour composed of different arrays of optically mixing colours that blend at the same viewing distance.

As mentioned above, other factors that determine the blending distance are ***dot size*** and ***packing-density***. With respect to dot size, the rule is that the smaller the dot used the nearer the blending distance. With respect to packing density, the important variables are the size and lightness of the gap between the dots.

The practice

When we move from speculation to practice, we find that there are significant additional complications to take into account. One way of thinking about these is by extending our thought-experiment. For this purpose, let us consider *Figure 4*, which crudely illustrates several elements that might be found in a typical landscape. It contains the sun, a blue sky, a tree, a grass lawn, a house and a woman dressed in purple, carrying a red parasol.

For our starting point let us take the regions of the lawn which are illuminated directly by the sunlight. Since in our example the *body-colour* is a relatively homogeneous green, it presents no problems. The real challenge is to depict the *reflected-light.* How should we set about representing the complexity due to the multiplicity of wavelengths of light embodied within the *surface-reflection?* We can start with the knowledge that it will be dominated by the white-tending, all wavelength encompassing sunlight. But it will also be influenced by a mind-

8 "*Painting with Colour," Chapter 5, Figures 1-4.*

boggling variety of secondary light sources,[9] even if sometimes their effect is extremely marginal.

Figure 4 : A scene containing the sun, the sky and landscape

One logical possibility for representing the white light would be to ignore the complications and paint a mosaic of white dots all over the green of the lawn. But, it turns out that doing so can hardly help leaving the whites too visible because white being the lightest of colours will almost certainly turn out to be strongly contrasted with the other colours. Only the yellows would be anywhere

9 All visible surfaces of any colour can be described as "*secondary light sources*".

near in terms of lightness. Even if it by some miracle it did blend, the outcome will necessarily be an unnatural degree of desaturation of the greens. Clearly, as a way of painting light, this option leaves much to be desired.

Luckily there are two alternative approaches to investigate. The first of these, although a great deal more complex and time consuming to implement, has the advantage of being more revealing of the complex of factors that need to be taken into account. For this reason alone, it is well worth considering a process that will take the remainder of this chapter. Later, in *Chapter 11,* we will turn to the second of the approaches to painting reflected-light, which is both simpler and more practical. Meanwhile we will prepare for it in *Chapter 9* and *Chapter 10* by confronting the vexed and important question of what is meant by the phrases "*seeing light*" and "*illusory pictorial space*".

The first pointillist solution

As just suggested, the bulk of light reflected from our patch of green is bound to be coming from the sun. As an approach to depicting this, I could adopt what may well have been Seurat's logic, starting with the two premises (a) that sunlight contains all the colours of the rainbow and (b) that any individual body colour can be represented either by mixtures of the three primaries or any one primary and its complementary.

As I have already painted green to represent the body-colour of the grass, I could argue that there is no point in painting it in a second time. All I need is to produce the remaining components of the white light and spatter the lawn with dots of these, such that when viewed from a given picture-viewing distance, they blend with the existing green. For this purpose I will want to ensure that they are small enough and not too different in lightness.

In one way of thinking about the situation, my problem has been reduced to finding "*white-minus-green*". Since this is not the name of any of the colours in my paint-box, I have to work out what it means in practice. However, doing so is not difficult, since the theory of the "*three additive primaries*" (*Figure 1*) tells me that where mixtures of light are concerned *green* is a primary colour and that its complementary is created from a combination of the other two light primaries, namely *blue* and *red*. Accordingly, as shown in the left hand side diagram in *Figure 1,* white-minus-green is *magenta (a mixture of cyan and yellow)*.

However, before rushing headlong into painting appropriately sized and spaced *magenta* dots all over the place, I would do well to pause and reflect on a number

of factors. First I need to remember that by the time it reaches the earth's surface, the sunlight which I am trying to paint is no longer the pure white of unadulterated sunlight. As described in the section on aerial perspective in *Chapter 5*, much of its light has been scattered by the atmosphere and many of its wave-lengths, predominantly the shorter ones, have been filtered off. Accordingly, I can think of the sunlight penetrating through to the world's surface as *white minus a gamut-of-the-shorter-wavelengths*. As everybody knows, the result is that we see the sun as a "*slightly yellowish white*". Eureka! It looks as if I have my answer: I must give a yellowish tinge to the *magenta* dots with which I am speckling the green of the grass. In other words, I should paint them *a yellowish magenta (somewhere between red and orange, depending on the proportions of the contribution colours)*.[10]

But I am far from finished with my task. I need to represent more than just the reflections of direct sunlight coming from the grass area. The wavelengths in the sun's light have been scattered in all directions by the atmosphere, including back towards the earth's surface. As the shorter wavelengths are scattered a great deal more than the longer ones, the outcome is not only a blue looking sky, but also blue light from the sky illuminating the grass. This being the case, it is only logical that I should I add a sprinkling of blue dots to the green and orange ones already in my painting. Again they should be of an appropriate size and spacing.

Nor is that all for I know that all the other surfaces in the scene are acting as secondary light sources that invariably combine both body-colour and reflected-light. Thus, for example, purple light scattered-back-out from the purple dress of the woman with the parasol is also shining on the grass, even if only in very small quantities. I must, therefore, add a very small number of purple dots. Similarly, the fact that there is light reflecting from the wall of the house means I must add some wall-coloured dots. And so it goes on, a few dots of this colour and a few dots of that so as to represent various small quantities of light reflecting of the various surfaces in the environment. When I have finished I will have created a patchwork of coloured dots that might look something like the one of Seurat's "*Pointillist*" paintings as it would have looked before its colours were degraded.

Having worked out how to paint the sunlit parts of the grass, it is time to turn to the shadow of the tree on the grass. As there is no direct sunlight reaching the shaded area, the major light-source is now the "*blue*" light coming from the whole expanse of the sky. So I paint in a spattering of blue dots.

After this, I go through the same procedure as before with a view to repre-

10 Thus providing an explanation for the multiplicity orange dots in Seurat's paintings

senting the contribution of all the secondary light sources by painting a few dots here and a few dots there. I realise that although a proportion of these represent body-colours that has been scattered back from within surfaces, another proportion corresponds to the light that has been reflected from those surfaces without changing its wavelength composition. For thinking about this reflected-light, I need to remember that it will be the same wavelength combination as that of the light striking the surfaces in question. Most likely the main components of this will of be a dominant *yellow/white* of the sunlight and a nevertheless important *blue* of the sky. With this idea in mind and using the same logic as before, I add a sprinkling of orange dots and a few more blue ones to the other colours in the shadows.

When I look at what I have done, I see that the entire surface of my painting is covered with a patchwork of dots which together cover the whole spectrum. In particular I notice that everywhere complementary or near-complementary colours are juxtaposed. Stepping back from the picture-surface, I find these blend according to the rules of additive colour and that at the ***blending point*** a shimmering sensation occurs. I realise that I have made a *Pointillist* painting of the kind that so excited the critic Felix Fénéon.

Finally, when choosing the pigment-colours to use in my efforts to follow Seurat's approach to ***painting with light***, I should use the most fully saturated available. My aim should be to get as close as possible to *pure prismatic colours.*

The sequel

In theory, the benefits of the method just described can be considerable. However, despite the enthusiastic reception Seurat's version of it got from progressive contemporaries and the number of artists that gave it a try, few of the better known of them were to persevere with the experiment for long.[11] The reason for this was not only that the rigorous requirements of the method were tedious to implement and the outcomes far too "*dotty*" for most tastes, but also that it got in the way of free mark-making.

Luckily for the future of ***Modernism in Painting***, it was soon discovered that what most artists considered to be the main advantages of the optical colour-mixing principles pioneered by Seurat could be obtained without getting bogged down in the *Pointillist* methodology. It was only after this realisation that the revolution instigated by Seurat's ideas could be said to be truly under way. Any-

11 A notable exception was Camille Pissarro

one who wants to assess the importance of this to the future of painting is invited to compare any work made before 1886 with any work by almost any progressive colourist made after that date. Take for example, Titian, Vermeer, Rembrandt, Constable and Turner and compare them with post 1886 Monet, Van Gogh, Gauguin, Cézanne, Matisse, Bonnard, etc.. Clearly a new colour-based dimension had arrived in painting. Although many other factors contributed, none were more important than the influence of Seurat's attempt to paint with light.

Implications

The main body of this chapter has been taken up with an approach to painting light derived from Seurat's use of mosaics of dots containing complementary pairs that blend in the eye when viewed from an appropriate distance. Although this pointillist approach had the immediate effect of galvanising forward-looking members of the painting community,[12] it was soon after abandoned by them. The method was not so much important in itself as in how it pushed artists in new directions.

The impact of Seurat's ideas on the future of painting was the greater because they emerged in the context of a flowering of new theories about the perception of colour. In the following chapters we will be looking at how these can be pushed forward with particular reference to:

- *The ideas of Marian Bohusz-Szyszko as refined by our research at the University of Stirling.*
- *Colour-mixing (PART 4).*

As we shall see, the outcome is an approach to painting effects of light on surfaces and in environments that is both much easier and more rewarding than Pointillism. A considerable bonus of the method is that it also has benefits in relation to the depiction of illusory pictorial space and to the creation of harmony and, if desired, discord.

As explained in the "Introduction to the science", at the beginning of this book, the main treatment of the painting of shadows is reserved for the second book in this volume "Painting with Colour". Also reserved for BOOK 2 are the implications of Seurat's work in the story of how artists came to make use of the discoveries of the perceptual scientists concerning **induced colours***, including those relating to* ***colour and lightness contrast phenomena***.

12 Pissarro, Van Gogh, Toulouse-Lautrec, Cézanne, Gauguin and many more