1 LIGHT AND VISION

FIGURE 4: LIGHT AND COLOUR

A sunset with crepuscular rays. The sunbeams radiating from our local star, the Sun, give us the feeling that our world is flooded with light.

Ours is a Universe of light...

The light we see defines the way we understand the world around us. What is solid and what is insubstantial, what is bright and what is dark, what is beautiful and what is ugly. All of these concepts derive from visual cues. But since our vision is inextricably linked to the nature of the Sun, in a real sense even our aesthetics are deeply rooted in astronomy. Perhaps it is no wonder that images of the Universe can trigger such a sense of awe. But the light from the Universe contains so much more than the light we can see for ourselves...

“Every newborn baby is the result of 3 billion years of evolution and a demonstration of the physical connection between the human organism and the Universe”

When a baby opens its eyes for the first time it finds itself bathed in light. Every newborn baby is the result of 3 billion years of evolution and a demonstration of the physical connection between the human organism and the Universe. Our eyes are biological detectors shaped by evolutionary advantage to utilise best the flood of light from our nearest star, the Sun. It is no coincidence at all that our eyes see exactly the spread of colours over which our Sun radiates most brightly. It exemplifies the beauty of biological efficiency, and reminds us that if we lived near a star that shone differently, we would have formed a different concept of what constitutes “visible” light.

Human colour theory

How does our eye see colour and what makes the **spectrum** of colour? Our eyes are biological light detectors, allowing our brains to construct images from the signals passing down the optic nerve. Human eyes have three different types of colour-sensitive cells that allow us to differentiate three fundamental, or **primary**, **colours** of light: red, green, and blue. Combinations of these three primary hues produce the entire spectrum of colours that we can see, from pale pastels to bold, vivid tones.

How do the other colours relate to the primary hues of red, green and blue? It is all in the combinations and proportions. Equal pairs of primary colours produce the **secondary colours** of light. Red and green combine to form yellow. Green and blue yield cyan, while blue and red make magenta. Other shades, like teal, orange or purple, emerge by varying the proportions of the three primaries slightly. If red, green and blue are all present in equal amounts, then the result is white, while black is just the complete absence of all of them. Such colour combinations are known as **additive** as they reflect the operation of the human eye as light of different colours is added.

"Any image we see can be broken down into three greyscale components representing red, green and blue light"

The simplicity in this arrangement of colours makes it easy for us to record and present full colour images using digital technology. Any image we see can be broken down into three greyscale components representing red, green and blue light. A television or computer monitor uses separate red, green and blue elements (LEDs, backlit LCDs, or glowing phosphors) to present these images together so that we see the full colour result. Likewise in print, choosing the right combination of inks can recreate an image that will reflect the right combinations of red, green and blue into our eyes to represent the full colour image (See Box: Subtractive colours).

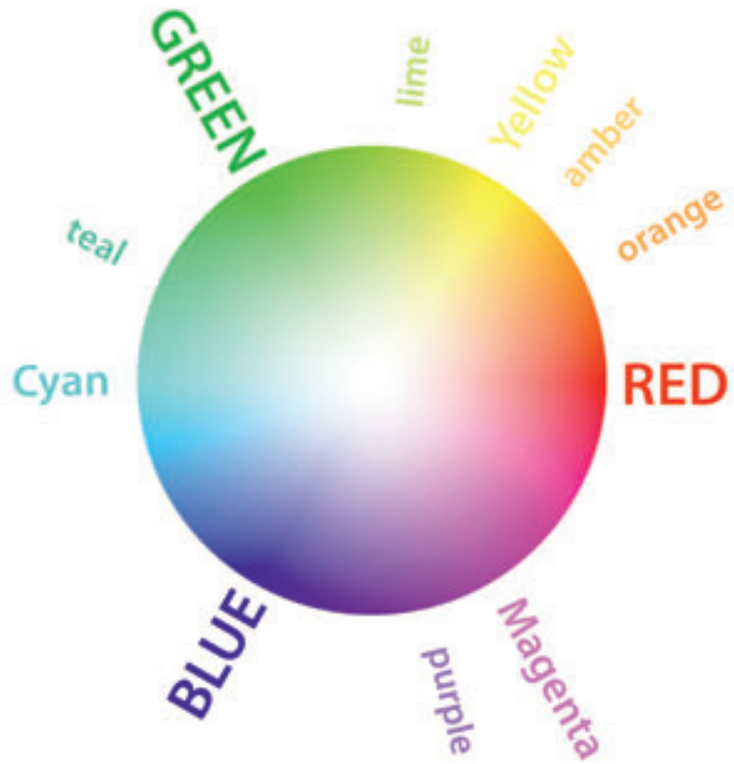

FIGURE 5: COLOUR WHEEL

The three fundamental colours of light, as seen by our eyes, are red, green and blue. Combinations of these three primary hues produce the entire spectrum of colours that we perceive, seen here organised in a so-called colour wheel. The secondary colours, cyan, magenta and yellow, fall exactly between the primaries, and other hues fall at other locations. Note that our eyes are most sensitive to slight shifts between red and green, with more recognisable colours falling between them than any other two primaries.