A Grapheme Synaesthete's A–Z of Colour

A textile practitioner's response

Gweneifur Jane Fereday
Student number: 9441280

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Department of Art and Design

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Abstract

This research looks at the physical properties of colour and the colours that can only be experienced by the individual grapheme colour synaesthetes considered in the study. These colours are particularly exceptional, as unless their existence can be verified in another form they must remain as private individual experiences that could be described, but not physically witnessed, by others.

The research addresses the problems of colour reconstruction from a professional's expertise and knowledge of dyeing and weaving, with experience of colour matching within the textile industry.

This work explores the re-construction of the alphabet colours of five grapheme synaesthetes, and observes the interrelationship between these colours once they have been categorised and re-located into a series of woven 'colour charts', using the 'paint chart' format as 'a platter to serve colour' as Joseph Albers once remarked. I have used the matched colours as 'ready mades', applying order systems to create stand-alone art works that are my responses as an artist and maker to the synaesthetes' colours, using colour categorisations to create boundaries within the broad jurisdiction of a colour label. I was interested to see if once the colours had been re-organized and woven into the 'colour chart' format, whether their colours would remain as identifiable to the individual synaesthetes and whether these colours could hold different qualities for them particularly as some of the participants remarked that they did not like many of their personal colour photisms. This work has crossed the boundaries from internal 'brain generated' colour perceptions to 'material colour', opening up the opportunity to share, in part, the colour experiences of five grapheme synaesthetes'. The work undertaken for this study has generated multiple possibilities for future new art work, this is discussed in chapter 7.

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Contents

Chapter four covers my personal practice as an artist and explains how my training and previous working life has led to and informed this current research. It discusses the ideas behind the work undertaken to date and the intentions within the work.

Chapter 5 discusses colour and how it works. The introduction sets out the intentions within the chapter and the subheadings again are used to structure the contents of the chapter. It covers a broad spectrum of information and includes a literature review that is embedded within each section. The intention is to discuss the elements that crucially hold this research together and explains the rationale for the content and order within the chapter. Stage 1 and Stage 2 are referred to but the details of the findings are included in Chapter 6.

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Chapter 1: Introduction

Grapheme colour synaesthesia is an involuntary experience of sensations of colour that present themselves while reading text. The text automatically triggers a sensation or perception of colour. A grapheme synaesthete is a person who 'sees' letters or numbers as particular colours.

While giving a lecture on colour at the University of the Creative Arts, Farnham, I encountered a student who told me that she 'saw' colours when she read text. She explained that each letter of the alphabet had its own bespoke colour and that she had lived with this experience for as long as she could remember. This discussion came about as a result of her becoming notably distressed by the display of over three hundred colours I had laid out as part of my lecture. The concentration of so many colours in one place had triggered in her sensations of panic and nausea that caused her to vacate the vicinity almost immediately. During our ensuing conversation, she explained that she was a grapheme synaesthete. This meant that she experienced colours continuously that were triggered by reading text or numbers, or by thinking of words, names, letters and numbers. As a consequence of this phenomenon she sometimes suffered from overload, as had happened during my lecture.

I had never come across this phenomenon before at first hand, and was intrigued to learn more. I suggested that she might paint her coloured alphabet, which she did, but she found the results disappointing and reported being frustrated that the colours she had painted did not adequately demonstrate her actual letter colour perceptions. A year later I began to investigate the possibilities of reconstructing her colours using acid dyes on woollen yarn. I was interested to pursue the possibility of reconstructing or translating her letter colours into analogue form. (I use the word 'translate' in the context of converting something from one form or medium into another.) My research for this study links personal, specific colours to letters of the English alphabet. All the work has been predicated upon colour, colour sensation and perception.

The study therefore has been structured around two main research questions:

1. Can the colour sensations perceived by grapheme colour synaesthetes be reconstructed?
2. What can a fine art textiles practice contribute to the understanding of the colour perceptions of grapheme colour synaesthetes?

The purpose of this research is to increase understanding of what a grapheme colour synaesthete experiences by presenting their personal internal colour sensations in a tangible, clearly intelligible, physical external form through the medium of fine art textiles. By attempting to reproduce the personal letter colours of a small number of grapheme colour synaesthetes, my personal experience as a dyer and weaver will be utilised to establish a series of art works that relate to the information gathered.

In order to introduce information that pertains to the condition called synaesthesia, Chapter 2 provides a brief overview of synaesthesia and explains what it is and how it works. It also highlights specific issues relating to grapheme synaesthesia. The intention behind this chapter is to explain, in 'layman's' terms, some of the complexities of synaesthesia and to provide insight into the experiences of a grapheme colour synaesthete.

An explanation of the rationale behind the way I approached this subject has been covered in Chapter 3: Methodology. My background as a dyer is particularly pertinent to this study, as it underpins the rationale behind the choice of methods selected for this work. My accumulated knowledge and skills in colour matching have been acquired through time, experience and experimentation. This study forms a continuum with past work that has culminated in a consolidation of my dyeing skills learnt and refined over time. Chapter 4: Personal Practice illustrates the trajectory that my earlier work has taken and helps to explain how past investigations have contributed to this current research study on colour and text. I have selected examples of earlier work that illustrates this trajectory.

The subject of colour is vast and complex. Chapter 5 investigates colour in relation to the naming of colours; a key role in the process of the letter colour reproduction. This study explores whether the medium of textiles can provide an adequate vehicle to fulfil the role of transformation from a brain-constructed colour into physical material or object colour and

whether the physical form I adopted for this study was the appropriate medium for the task. I discuss this in my Chapters 6 and 7.

Alphabet colours matched from the synaesthetes have been used in the study to create work that challenges personal colour choices and patterns of working while testing the constancy of the synaesthetes' colour perceptions when their colours were taken out of context and alphabetical order.

The exhibition that was hosted at Middlesex University showcasing the practical element of this study is discussed in Chapter 6: Research Findings and Discussion as well as in Chapter 7: Discussion and Conclusions.

The Appendices are listed and run chronologically, showing the processes and results of the work undertaken. Illustrations show previous work and the work from the exhibition. It is my intention to show this work in a public gallery space in the future, as I would like to present it to a wider audience to obtain additional feedback. There are a number of anatomical images or diagrams embedded within the text that will help the reader to locate the areas of the eye and brain that are being discussed. The brain images indicate where colour and language are processed.

Chapter 2: Synaesthesia

> Synesthesia has been described as a 'merging of the senses,' with more than 150 different manifestations reported depending on what is 'merged' (sound with color, taste with shape, touch with smell and so on).
>
> (Simner and Hubbard, 2013, p.xvix)

2.0 Introduction

This chapter draws together expert knowledge on the subject of synaesthesia and will explain to some extent how synaesthesia works and the mechanisms that trigger a synaesthetic response. In the 'Overview of terminology and findings' section of their jointly edited book *The Oxford Handbook of Synesthesia*, Simner and Hubbard (2013) explain that, 'Synaesthesia … is a multivariant condition, incorporating a number of extremely diverse phenomenological experiences' (p.xxii). The complexity and subjective nature of this condition makes assessing it difficult, and to date, research suggests that it has not been possible to pinpoint any one reason for its occurrence. Synaesthesia is thought to be an inherited condition and it is known to occur in both female and male members of the population; however, why some people are carriers only and others are both carriers and synaesthetes, is not fully understood. Ward (2008) noted, no one has as yet found the 'synaesthesia gene'. This issue of inheritance and genetics is further discussed by Asher and Carmichael (2013) (pp.23-45) in their chapter entitled: The genetics and inheritance of synaesthesia. Chapter 2 in *The Oxford Handbook of Synesthesia*, Simner and Hubbard (2013).

Colour synaesthesia is thought to occur in approximately 1–2% of the adult population (Simner et al., 2006). As indicated in the epigraph to this chapter Simner and Hubbard (2013) remark that there are thought to be at least 150 different forms of synaesthesia, and there is an extraordinary variety of reported synaesthetic experiences, which provide neuroscientists and psychologists with useful data for investigating how the human brain processes information, and how information is utilised to navigate the external world. But as this project focuses specifically on one form, namely the colour experiences of grapheme-colour synaesthesia, it was not relevant to include here all the other synaesthetic variations that experts in the field

have discovered to date. The purpose of this chapter is specifically to record some of the findings on grapheme colour synaesthesia from a number of expert sources in the field and apply these findings, where pertinent, to set a context for this particular study. Even within the distinct category of grapheme colour synaesthesia there are multiple variations of experience, as will become evident throughout this thesis. A small selection of personal examples from the synaesthete participants are included in this section, although more detailed material is included at the end of this thesis in Chapter 6: Research Findings and Discussion and within the Appendices.

2.1 Definition of Synaesthesia

The term synaesthesia is taken from the Greek *syn* meaning 'together' and *aesthesia* meaning 'sensation'. The term is used when describing a variety of phenomena.

> Most commonly, it is used to denote a condition in which stimulation in one sensory modality also gives rise to an experience in a different modality. However, conditions involving different qualities within one modality (e.g., when sight of letter shapes evokes color) are labelled synaesthesia as well.
>
> (Robertson and Sagiv, 2005, p.3)

Simner and Hubbard (2013, pp.64–5), provide a survey of research in this area and conclude by suggesting that all newborn children's brains are more highly connected than those of adults and that this can give rise to synaesthetic-type experiences in childhood. As the young brain matures natural pruning occurs reducing this hyperconnectivity in most adult brains, but for a few adults the pruning process does not take place, which gives rise to fully developed adult synaesthesia.

> … by age 6.5 years, approximately one-third of graphemes have stabilized enough that the color associated to the letter or digit does not change. One year later this stable characteristic has spread to approximately 'half' of graphemes.
>
> (Simner and Hubbard, 2013, p.71)

Grapheme colour synaesthesia, as cited earlier by Robertson and Sagiv (2005), involves two senses or different 'qualities' within the same single modality in the brain, as opposed to two senses or 'qualities' in two different modalities or regions of the brain, which is the case in other forms of synaesthesia. In the case of grapheme-colour synaesthesia, it is the sense of sight that triggers the perception of colour while viewing letters, words and digits. When a person with normal colour vision (Kueppers, 1982, p.30) looks at an array of coloured objects on a table, they will note that the blue plate has a number of 'orange' oranges on it. Some of the oranges might still have their green leaves attached and there might be a brown wooden breadboard with a loaf placed on it that is also brown, but of different brown hues to the wooden board. The table may be covered with a white cloth and a newspaper placed next to the breadboard. All this information has to be absorbed, registered and processed so that when that person with normal colour vision (see Chapter 5: Colour, for definition) reaches for an orange s(he) knows where the orange is in relation to the bread and the breadboard, etc. The term normal colour vision here refers to people who have 'a normally functioning visual system' and are therefore 'colour-efficient' (Kueppers, 1982, p.30). This perception of where and what things are, is visual information that is bound in our brains. Grossenbacher (1997, pp.148–72), describes perception as the process of converting energy from the physical world through receptor cells that 'contribute to a complex system of neural signalling', bringing about a 'mental representation of the surrounding world'. This 'model of reality' is constantly revalidated through an interaction with the external world. For perception to occur, we need to possess the faculty to perceive. This is an instinctive ability to recognise truth, aesthetic qualities and sensations and happens when, for example, the mind experiences sensations that relate to the external world.

According to Alvarez and Robertson, (2013) in the case of a grapheme colour synaesthete with normal colour vision, they will experience what a person with normal vision experiences, but in addition will experience synaesthetically induced colours when they read the printed text on the newspaper; as in the scenario described above. For the grapheme colour synaesthete, the black printed letters on the white paper will yield a variety of different colours that appear automatically. So, the black colour of the printed text is the 'normal' form of colour that is triggered by different wavelengths reflected from the printed text and received by the retina. The grapheme colour

synaesthete will see the black text and, in addition, the letter shape or shapes will cause two perceptions to occur simultaneously: the 'synaesthetic colour/colours', and the 'print colour/colours'. As Alvarez and Robertson (2013) point out:

> One fascinating paradox that remains unanswered in the study of grapheme-color synesthesia is how it is possible for the synesthete who perceives synesthetically colored letters to experience print and synesthetic color simultaneously, appearing in the same place without the two colors blending together. (p.317)

Alvarez and Robertson go on to explain (2013 p.326) that perception of 'print colour' for a non-synaesthete with normal colour vision starts by wavelength opponent processing responses to the different wavelengths of light in the retina. Whereas synaesthetic colour perception seems to be revealed via a different process, using mechanisms other than wavelength opponent processing. Alvarez and Robertson further remark that in almost all cases, 'synesthetic color arises after the point at which separate wavelengths blend normal color vision, meaning that if synesthetic and print color do converge, they cannot blend, even in the extreme case where they share a single spatial location' (2013 p.329). Ward (2008, pp.4–5) verifies this, suggesting through his work that in fact synaesthetic 'text doesn't override the true color [that is the print colour]', as the colours appear to 'coexist and compete for attention'. He goes on to refer to the different ways synaesthetes perceive their letter colours, a subject that is dealt with later in section 2.4. Projector and Associator.

Perceptual binding is where visual information that has left the retina is separated into various types or features such as colour, light, shape, scale and movement. The brain then binds these multiple separate features correctly into the different objects registered, like the blue plate and the 'orange' orange, referred to previously. This definition of perceptual binding illustrates the complexity of vision and our understanding of what we 'see' in the external world (see Chapter 4: Personal Practice). However, a synaesthete has more complex visual tasks to implement before their perception can be bound.

The complexities and variations within synaesthesia make it difficult to pin down, pigeonhole, or settle for any one definition or concept of it. The importance of understanding

the complex concepts of synaesthesia became evident while working with the participants in this study to establish their personal colour experiences and highlights the rationale for carrying out qualitative research to understand the unique colour perceptions of each synaesthete.

As with most things the more you know the more you know you don't know. Synaesthesia is one of those subjects like colour; wonderful to be aware of and impossible to nail down. It is this elusiveness that is so compelling. To approach the task of reconstructing a synaesthete's colour perceptions requires a precision of language that can conjure up a verbal picture that others can relate to. Language therefore forms a bridge between the experience and the audience. To perceive is to recognise and connect, and to sense is to experience and be conscious of perceiving.

2.2 Sense and Perception in Synaesthesia

> Perceived reality is the continuous product of ongoing interplay between expectation and incoming sensory signals …
>
> (Grossenbacher, 1997, p.148)

Senses are the stimuli that we use to interpret complex data or information that must be absorbed before we are able to perceive. Aristotle (384–322 BCE) was the first person to identify what have become known as the original five senses of sight, smell, touch, hearing, and taste. Our ability to detect other stimuli through our 'sensory modalities', include temperature, movement, pain, balance, and vibration. Today the consensus is that we have more than five senses if the extra senses of thirst, hunger, and other bodily senses are included. Senses are the physiological capacities of organisms that provide data for perception.

When we individually perceive colour for example it is impossible to know whether someone else perceives it in the same way. Sagiv and Frith (2013, p.926) ask, 'Is it possible that while we agree on the names of colors, we experience them differently?' According to Albers (1963), everyone experiences colour differently. Although we might agree on a common name for a colour, we cannot know for sure that one

person's idea of a particular hue will perfectly match another person's idea of that same hue. Even if we point to the same hue and agree its label, as we cannot be that other person we cannot know that the experience we share is identical. Sagiv and Frith (2013) point out: 'In general comparing experiences remains very challenging because we simply cannot get into other people's heads' (p.928).

Synaesthetes, Sagiv and Frith continue, 'are living examples of a mixed-up spectrum of sorts'. Although they experience surface colour in the same way that a non-synaesthete might, grapheme colour synaesthetes experience black and white text as black and white while in addition they experience them as coloured.

> Thus, different grapheme-colour synesthetes have a different correspondence between colors and common objects (which are shared with the rest of the population) and between colors and graphemes (which are not).
>
> (Palmeri et al., 2002; Ramachandran and Hubbard, 2001a, cited by Sagiv and Frith, 2013, p.929)

It was these particular issues around colour perception, experience and communication that drove this PhD research study (see Chapter 5: Colour). This study has been devoted to the investigation of colour through the colour perceptions of a small cohort of five grapheme-colour synaesthetes. Synaesthetic experiences utilise the same sensory cortices in the brain believed to be essential for 'processing and awareness of the stimuli normally associated with such experiences' (Sagiv and Frith, 2013, p.931).

2.3 The Brain

The two diagrams of the brain Figures 2 and 3 below have been included to assist the reader in locating the areas of the brain that are activated for processing text and colour. Figure 27 in Chapter 5: Colour, shows a diagram of the eye that illustrates how the eye processes information absorbed through the retina.

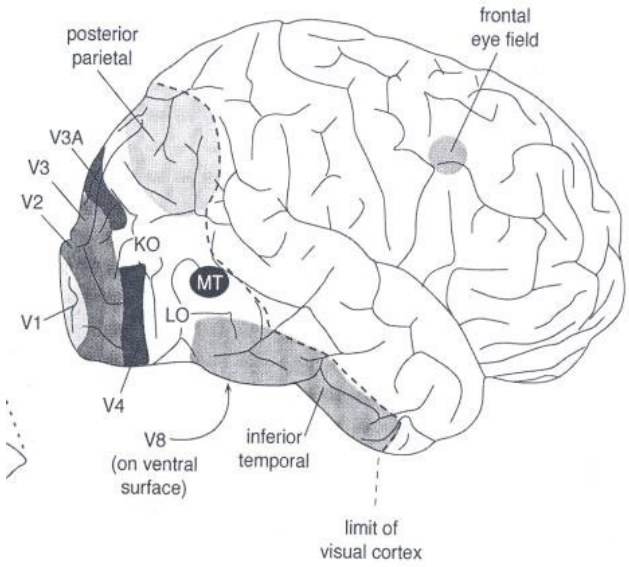

Figure 2: Ramachandran (ed.), (2002) Image of the left side of the human brain showing visual cortex *Encyclopedia of the Human Brain,* (Vol. 4)

Visual information is processed via the retina to (see Figure 27) to V1, the primary part of the visual cortex, and from there sent to the other regions in the visual cortex. The area in the brain designated for colour processing is called visual area 4, or V4, which forms part of the visual cortex. The V4 area includes other specific areas within its compass such as the fusiform gyrus and the lingual gyrus (see Figure 3). Colour signals are received through the retina of the eye and processed by the part of the brain responsible for visual perception; this cortical processing results in colour vision. The cortical regions in the brain, the outer layer or grey matter of the brain, such as the parietal, temporal and occipital lobes, are all located at the back of the head. They integrate sensory information and memory information. I will discuss this in relation to the experiences reported by the participants in this study in Chapter 6: Research Findings, and Chapter 7: Discussion and Conclusions. Participant 3 for example reported that her colours 'occur in my head, towards the back of my head, rather than to the sides'. The precise location, function and mechanisms of the V4 complex are still not fully understood, nor how exactly they work, but it is thought that visual areas V1, V2, V4 and V8 process visual information relating to colour that enables the human brain to identify and differentiate colour (Zeki 1993). A number of magnetic resonance imaging studies (fMRI) have shown that colour stimuli activates multiple areas in the brain, such as the fusiform gyrus and the lingual gyrus. These areas together with others form visual area 4 (V4). This area is still being investigated for its precise location, mechanism and function.

Sagiv and Frith (2013) explain that colour perception for people with normal colour vision and grapheme-colour synaesthetes activate the visual regions in the brain, V4 and V8. This is important for understanding the function of the 'essential nodes' that support conscious experience, as these are the 'areas that are necessary for such experiences (and may or may not have other functions)' (2013 p.931). Since Zeki (1990), V4 has been identified as being necessary for colour vision, 'but in order to demonstrate it is necessary for color consciousness', it must be demonstrated 'that there could be no color experience without V4' (p.931).

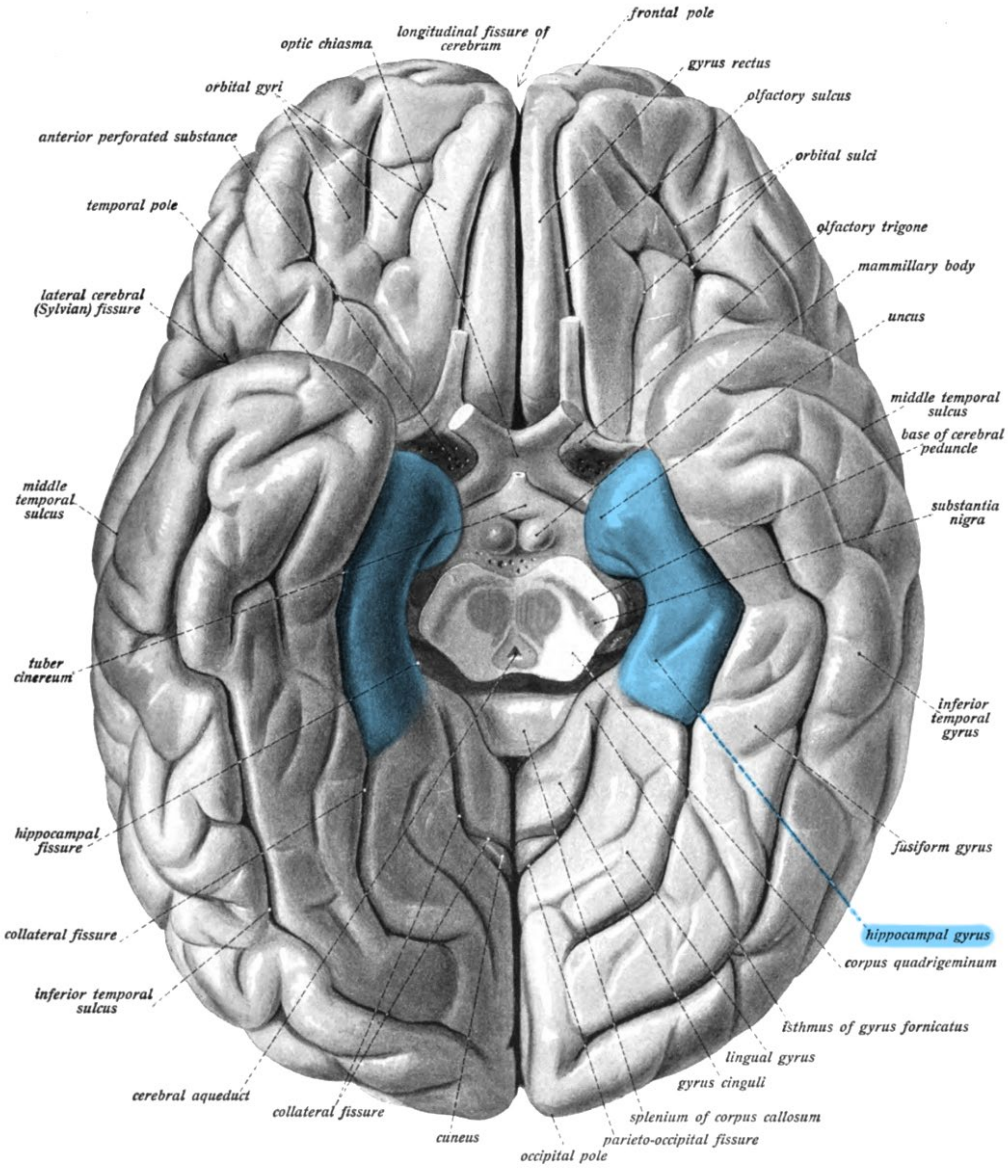

Figure 3: Sobotta, J. (1908) *Atlas of Human Anatomy* showing areas of the brain such as the fusiform gyrus that have been referred to in this text in relation to synaesthesia.

> Studies of synesthetic color experience show a similar pattern of V4 activation (Hubbard et al., 2005; Nunn et al., 2002), providing further converging evidence to support the idea that V4 is indeed necessary for supporting the subjective experience of seeing color.
>
> (Sagiv and Frith, 2013, p.932)

How can colour be perceived when it is not there on the page? That is to say, when black text is being read on a white page, for example. Zeki and others identified the visual region V4 as being the area in the visual cortex of the brain that responds specifically to colour, becoming activated when colour images were viewed, but not activated while blacks, whites and greys were being viewed. According to Ward (2008, p.24), 'area V4 is also related to our conscious perception of color, and our conscious experiences of color do not correspond faithfully to the wavelengths of light'. Ward is referring here to the way our perception of an 'identical colour' automatically adjusts to change according to the quality of light source: for example, a white can appear to be grey when seen in shadow, or have a blue tinge when lit by cold LED lighting. He goes on to explain that, 'area V4 is responsible for this illusion. V4 infers the color of objects taking account of the surrounding lighting conditions.' Colour vision has evolved so that the information from a light source and the resultant surface reflection from that light can be disentangled by our sense systems to extract representations of the 'real-world'. In the Prelude to his *The New Philosophy of Vision* (2005, p.5), Matthen points out that authors such as Richard Gregory, J.J. Gibson, Jerry Fodor and David Marr 'assume that our sensory systems are problem solvers … They deliver an interpreted message; this interpreted message constitutes sensory consciousness.' He goes on to explain that:

> … sensory signals are the result of several mind-independent physical variables: physical reality, the state of the medium through which a sensory organ receives sensory input, the state of the perceiver herself. In order to guide organisms in their interactions with the external world, sensory systems are faced with disentangling the sources of the signals they receive … to solve this problem, sensory systems too use invariants [constants] in physical stimuli. (Matthen, 2005, p.5)

‘Print colour’ and ‘synaesthetic colour’ for grapheme-colour synaesthetes is triggered by the shape of a letter or digit, and ‘triggers hue selective networks to produce the phenomenological experience of color’ (Alvarez and Robertson, 2013, p.317). The ‘concurrent’ is the colour experience, and the stimulus, the grapheme, is the ‘inducer’ that induces the colour experience. It is still unknown whether the ‘synesthetic colors [are] bound in perception, and if so are they bound through the same mechanisms as print colors?’ (2013 p.317). The colours experienced by grapheme-colour synaesthetes appear to remain consistent over time for each synaesthete, although the particularity of the letter colours differs between each synaesthete. Not all grapheme-colour synaesthetes experience these occurrences in the same way.

2.4 Projector and Associator Synaesthetes

Grapheme letter colour synaesthetes can be classified as either ‘Projectors’ or ‘Associators’. ‘Projector’ synaesthetes experience their colour photisms as projected outside their bodies either directly onto the text being read, or as a film of colour between them physically and the text. ‘Associator’ synaesthetes experience their colour photisms inside their heads in their ‘mind’s eye’, somewhere between the back of the eye and the back of the head (Blake et al., 2005; Dixon et al., 2004; Smilek et al., 2002; Ward et al., 2007). The two categories within grapheme-colour synaesthesia refer to the manner in which the synaesthesia is experienced. These different experiences seem to be linked to the way the brain ‘mind maps’ the experience perceived. Projectors are ‘bottom up’ and Associators are ‘top down’ (Ward et al., 2007). According to Leeuwen (2013, p.243), ‘even when the synesthetic color is experienced as an overlay on the grapheme, the physical ink color on the paper is still perceived’.

2.5 Lower and Higher Synaesthesia

Another distinction between the different types of grapheme colour synaesthetes is the distinction between ‘Lower’ and ‘Higher’ synaesthesia. According to Ramachandran and Hubbard (2001), these differences depend on whether the shape of the inducer is the trigger (lower synaesthesia), or whether it is the conceptual features of the inducer that are the trigger, for example the fact that 4 is the numerical equivalent to IV (higher synaesthesia).

2.6 Developmental Synaesthesia

All the participants I worked with displayed signs of 'developmental synaesthesia'. In *Synaesthesia: Classic and Contemporary Readings* (1997, p.7), Baron-Cohen and Harrison define 'developmental synaesthesia' as possessing the following traits:

(a) It appears to have a childhood onset, in all cases before four years of age;
(b) It is different to hallucination, delusion or other psychotic phenomena;
(c) It is reported to be different to imagery arising from imagination;
(d) It is not induced by drug use;
(e) It is vivid;
(f) It is automatic/involuntary; and
(g) It is unlearnt.

Part of this study, was to test whether the five participants would be able to distinguish their letter colours if they were separated from the grapheme and relocated among the other similar colours, taken from the remaining participants' letter colours. Having established their individual colour photisms and reproduced them using dyes (see Chapter 5: Colour), the aim was to test whether the participants' personal colours would remain readily identifiable under altered conditions. To test this phenomenon, a set of woven colour charts, Series 1–8 were completed. The results are entered in Chapter 6: Research Findings towards the end of this thesis. If the participants were able to identify their letter-colours without the grapheme being present, this would indicate that they may be 'bidirectional' grapheme colour synaesthetes, in other words they would be able to identify their letter colours without the aid of the grapheme. Although, 'bidirectionality' would be a rare phenomenon to find in such a small cohort of participants, as part of this study, this was an interesting question to pursue with regard to the extent of the participants synaesthetic experiences. An increased understanding of 'bidirectionality' and other specific qualities associated with synaesthesia, such as the 'projector' and 'associator' experiences (see section 2.4), could eventually increase an understanding of the neurocognition of synaesthesia (Kadosh and Henik, 2013, Chapter 6, pp.111–118). It has been discovered that some grapheme colour synaesthetes have shown that instead of their experience being a solely 'unidirectional' experience, they experience 'bidirectionalality', i.e. 'inducer' to

'concurrent' and back to 'inducer'. I discuss my participants' responses to this in Chapter 6: Research Findings.

2.7 Studying Synaesthesia

One of the difficulties with studying synaesthesia at a clinical level appears to be the subjective nature of the phenomenon. However, the development of more sophisticated neuroimaging techniques that are able to examine brain activity patterns and compare those of synaesthetes with non-synaesthetes, has contributed considerably to our understanding of the way synaesthesia might work. Positron emission tomography (PET) and, more recently, functional magnetic resonance imaging (fMRI) techniques have for example, enabled the neural mechanisms that cause synaesthesia to be empirically investigated (Hubbard, 2013, 'Synaesthesia and Functional Imaging', pp. 475-499, and Lovelace, 2013, 'Synaesthesia in the Twenty-First Century', pp.409-439). Prior to these advances in technology, the sole method for information gathering was through direct reportage. It is, however, well understood that despite the considerable technical advances now available, direct reportage continues to be an invaluable source of information gathering. This is in most part due to the complexities and idiosyncratic nature of synaesthesia. Despite the small-scale nature of the information gathered for this particular study as an artistic rather than a scientific one, I have found that each participant has reported a unique set of richly articulated colour descriptions and anecdotes.

An interesting characteristic of grapheme colour synaesthetes is that they seem to be exceptionally sensitive to nuances of colour, and to the language used in naming colours. From tests undertaken by Rich et al. (2006), fMRI tests found that synaesthetic colour experiences were uniquely associated with activations in the lingual gyrus, thought to be involved in colour naming. It has been found that part of the brain concerned with colour, letter and word processing, the fusiform gyrus, shows an increased cortical thickness, volume and surface in grapheme synaesthetes. 'It is possible that the detected anatomical differences are a consequence of and not a primary reason for life-long experience of grapheme color synaesthesia' (Janke et al., 2009). For grapheme colour synaesthetes the nomenclature of colours appears to be axiomatic with the condition, and the depth and detail of their colour descriptions are

significant. According to a study undertaken by Simner et al. (2005, p.97), 'synaesthetes use a lot more words to describe colours than do nonsynaesthetes – four hundred and ninety five compared to fifty-eight'. Comparing variants in their descriptions of 'green' for example, Simner counted 'fifty-four different shades by synaesthetes compared to five shades from nonsynaesthetes' (J.A. Simner et al., 2005).

2.8 Grapheme-Colour Synaesthete Participants in this study

All the participants I have been working with in this study also demonstrated a highly developed awareness and relationship to their specific letter colours. They all took the subject of colour and the task of describing their colours very seriously, being careful to take time to find the most appropriate words to describe their colour photisms (Simner et al., 2005). Each of the participants in this study experienced unique colour sensations for each letter of their alphabets. Even if some of the participants agreed that a letter colour was of the same colour family, I found that this was mostly where the similarity ended (see Chapter 6: Research Findings).

As Ward (2008, p.4) remarks, 'the colors and the experiences are very hard to put into words'. All the participants for this research study mentioned living with their colours since childhood. A number of them remarked that they actively disliked some of their alphabet colours, which would appear to support the involuntary nature of their synaesthetic experience. Participant 3, for example, mentioned that none of her alphabet colours were her favourite colours, and some of them she strongly disliked. The depth of interest in colour shown by the participants was striking compared to non-synaesthetes that I have worked with, which may possibly be explained by synaesthetes being more familiar with colour on an intimate and almost continuous basis. For a non-synaesthete this experience of involuntary colour sensation is hard to imagine.

The intention in this study has been to replicate the colour perceptions, or sensations of the individual letter colours of the participants to enable non-synaesthetes, like myself, to share in some way what a grapheme colour synaesthete might experience. This intention formed the foundation of this research. Obviously, the complexity of the entire experience would be impossible to replicate accurately; however, my interest was in the reproduction of the personal letter colours experienced by the five, grapheme colour synaesthetes who had agreed

to work with me on this project. All the participants reported that they had lived with synaesthesia for as long as they could remember (see Baron-Cohen and Harrison (1997) quote below). Indeed, one participant reported that she had assumed everyone experienced the same sensation until this was tested by a chance conversation at work (see Chapter 6: Research Findings).

There are studies that have looked into whether there are commonalities among synaesthetes regarding letter colour photisms. Evidence from a number of studies shows that a high proportion of grapheme synaesthetes experience 'A' as red, for example (Simner, 2013). However, from the sample of five participants in this study, it was found that two claimed that 'A' was red, two claimed that 'A' was yellow and one claimed that 'A' was blue (see Chapter 6: Research Findings).

During the reproduction of the letter colours of the participants in this study of grapheme colour synaesthetes, I focused on the task of establishing which particular red each contributor experienced if they were to agree that 'A' was red, for example, and to see if it was possible to reconstruct their particular colour sensations into the analogue form of dyed yarn. Baron-Cohen and Harrison (1997, p.38) pose the question: whether the basic elements of synaesthesia can represent the equivalence of '"building blocks" or "modules of cognitive science"', where perception is constructed like a sculptor would use clay to model/build a statue; or is it 'perception constrained by sensation as it unfolds from within'? (p.38). This idea of perception as being either something that is built up over time or pared down, is most interesting; however, my main focus has been on the replication of the individual colour perceptions of my participants rather than the investigation of how they perceive them.

2.9 Conclusion

For the purposes of this project, I did not attempt to measure or map which parts of the brain are activated when a letter and colour is perceived by the participants. The intention is rather that my artwork should have the potential to act as a conduit between art and science, to open out our awareness of colour and how a particular section of the population's experiences of colour can be so varied and different from the larger proportion of society. Through many years of teaching I have come to understand that each individual perceives things differently and uniquely. I have taught in a variety of Adult Education Institutes, in a centre for specially

gifted children in London, and at a number of Universities. This experience has enabled me to observe first-hand how people absorb and process information. My preoccupation throughout this study has been to apply this accumulated observation and acquired awareness to my participants and never to assume that I know what they mean, always taking the precaution to check and double check that I am as close as one can be to an understanding of what the participants are trying to convey. As Sagiv and Frith (2013, p.930) point out, 'One thing that synaesthesia teaches us about our conscious experience is that we cannot take it for granted that others see the world in the same way. Indeed, if there is anything that we have learned about consciousness it is that appearance and intuitions can be misleading'. Each of the participants I worked with experienced qualitatively different experiences from each other, but it was apparent that in comparison to my personal everyday perceptions they appeared to be able to perceive more, making their everyday experiences more complex and multi-layered than I, as a non-synaesthete and external witness, could have possibly imagined. However, their rich descriptions have assisted my imagination to work hard to catch up with their complex and involved subjective reportage. The relatively close involvement with my participants was both exciting and troubling, as initially I was unsure whether what I was proposing to attempt would be feasible.

This chapter is a compilation of information gathered mainly from the psychology and neuropsychology fields of study on synaesthesia. Where pertinent, I have included personal examples from the participants I have worked with, although this will be dealt with in more detail at the end of this thesis in Chapter 6: Research Findings. I have also used this chapter as an opportunity to comment on how the scientific research I have studied has informed the way I have approached the practice element of this research. The definition of perceptual binding, for example, has been helpful in affirming or justifying the colour chart format I chose for the production of the woven work undertaken for this study.

Chapter 3: Research Methodology and Process

3.0 Introduction

In this chapter I will define the various methodologies I employed to expand my research into grapheme letter colour synaesthetes. I will explain how I have used the main features of action research as headings as a guide to my exploration of this subject. The intention of this research was to establish whether it was possible to reproduce the letter colours of a small cohort of grapheme colour synaesthetes. In order to explore the processes of colour reconstruction for the study, the methodologies adopted were adapted for this task. Though the research was subjective in nature, each participant in this study became their own 'constant' as only they could verify whether their personal letter colour perceptions – known as *photisms* – had been reproduced accurately to their specification.

In order to meet the outcomes of this study, qualitative research was conducted within the ethos of action research. This chapter will provide an overview of the research methodology, the rationale for action research, the processes undertaken, and the collaboration which was essential to the outcome.

3.1 Rationale for Action Research

In line with the ethos of action research, the enquiry needed to be flexible, requiring constant reflection, projection and consultation. By its nature this study relied on a close collaboration with the participants involved and their readiness to enter into the spirit of what was a complex and time-consuming commitment. action research, therefore, became the selected methodology embracing the nature of 'developing the act of knowing through observation, listening, analysing, questioning and being involved in constructing one's own knowledge' (Koshy, 2005, p.xiv). The design of this research study evolved naturally from working with a small number of grapheme synaesthetes, initially two (increasing to five at a subsequent stage) to test whether it was possible to replicate their personal colour alphabets using a questionnaire, conversation and analogue colour samples taken from the Munsell Color Book (Volumes 1 and 2).

As the research was to be conducted by a single researcher, it was vital from the start to keep the investigation small enough to manage while in-depth enough to remain valid. As Denscombe wrote (2014, p.55): 'The prospect of getting some valuable insight depends on being able to investigate things in depth.' It is this aspect of depth that has underpinned the research undertaken from the outset.

The purpose of the research was specific and did not require collecting large quantities of data to prove a statistical point. For this reason, the qualitative research approach was selected as this allowed for an in-depth examination with fewer participants and sat well with the collaborative nature of the study (Denscombe, 2014). The Action Research paradigm provided an appropriate methodology to adopt for this research as the research was both small-scale and 'hands-on' (Denscombe, 2014), practice based, and collaborative. The study will create 'new knowledge based on enquiries conducted within specific and often practical contexts' (Koshy, 2005, p.3). Each of the synaesthetes I have worked with during this study has experienced a unique colour sensation for each letter of the alphabet. Even if some of them agree that a letter colour is of the same family – for example, 'green' – I have found that this is where the similarity ends (see Chapter 6: Research Findings). Other studies – Simner and Hubbard (2013), for example – have discovered trends in letter colour perceptions with grapheme synaesthetes, but these have been scientific studies linked to neuroscience and psychology that have been searching for patterns and ratios. This PhD research has followed an artistic, aesthetic angle that focuses on the qualities and nuances of the unique letter colours, taking them into a physical analogue form. No study that I have come across has taken this information further to establish the small differences or variations within the relatively broad categorisation of a colour name.

3.2 Reliability and Validity

Reliability was an important factor in this study. Reliability is described as consistency or stability of a measure and a consideration of whether, if the measure is repeated, one would obtain the same result (Denscombe, 2010).

Part of acknowledging the importance of reliability was to repeat the question of the letter colour perceptions of the five participants and only after a stability of response occurred

could the analogue colour chips be introduced into the equation. Had this been introduced from the outset it may have affected the outcome of the participants' colour decisions. Koshy (2005, p.109) cites Hopkins (2002) who:

> makes a useful distinction between validity, which reflects the internal consistency of one's research, and reliability, which reflects the generalisability of one's findings.

Koshy goes on to explain that:

> in general, most action researchers and those who use qualitative methods are concerned with validity rather than reliability, in so far as their focus is a particular case rather than a sample. (Koshy, 2005, p.98)

For the purposes of this study, I have used the participants themselves as a measure of reliability and consistency as they are unique in having the only firsthand experience of their personal letter colour sensations. If their colour perceptions shifted this could be an indicator of their condition rather than an indicator of inaccuracy. Through detailed one-to-one meetings and conversations using the participants personal colour descriptions, the Munsell Color Book, notating the dye recipe for each colour and obtaining detailed feedback on each result prior to verification I hope to satisfy possible issues of internal consistency. The circular nature of Action Research required observation, reflection, action, modification, and movement into new directions (McNiff and Whitehead, 2010), which embraced the dynamics of this study.

3.3 Observation

The participants in this study were happy to fully commit to the project and expressed interest in the ensuing outcomes. At each stage of the research the participants were included as crucial contributors and collaborators in the progress and developments of the research. They provided the information that enabled me to proceed with the study. To achieve reliable results, I needed to devise a process that could transform these private internal colour experiences into an external analogue format that could adequately replicate the individual's

internal colour perceptions. They answered the questionnaire presented (see Appendix 1), and undertook the various informal semi-structured interviews and discussions that followed prior to the practical dye-lab colour matching stage. We met on a face to face basis for the initial data gathering (see 3.11, 3.11.2, 3.11.2.2 and 3.11.2.3). This established the foundation for the enquiry. Once this information had been gathered, communication via email became an additional method to verify that what I had notated in their presence, as their responses to the questions during our meetings, were correct. As Denscombe (2014, p.124) states: 'The vision of action research as a cyclical process fits in nicely with the quest for perpetual development built into the idea of professionalism.'

Once the initial questionnaires had been completed, the next stage was to establish the descriptions of the colours experienced by each participant. This process required time as the experiences of each participant were unique and as we had only recently met each other, it was essential that they were given as much time as they needed to describe their letter colour experiences in full without feeling rushed. The choice of words used to describe their colours needed to be well considered and carefully crafted. Denscombe (2014, p.123) explains that Action Research is both 'practical and applied' and 'undertaken as part of [the] practice rather than a bolt-on addition to it'. Part of the research involved the exploration of the characteristics of colour in general and the personal nature of the participants' colours in particular. Until this study no one except close family members had interrogated the participants on their letter colour experiences, and certainly not to any significant depth.

3.4 Reflection

To some extent this research embraces a phenomenological approach, as being primarily subjective in nature it relies on description rather than analysis and rests on my interpretation of the participants' colours, as a dyer and colour matcher, rather than taking a more scientific and measured approach. As Denscombe points out: 'Phenomenology is concerned first and foremost, with human experience … A phenomenon is something that stands in need of explanation; something of which we are aware but something that, as yet, remains known to us only in terms of how it appears to us directly through our senses' (Denscombe, 2014, p.139). This aspect of colour perception, which rests solely on our senses, required the participants to be able to reflect on their colour perceptions in sufficient depth to be able to

convey their experiences clearly and precisely, in order to enable me to transcribe them into physical form. This, then, was a visual demonstration of the essence of the synaesthetes' colour experience. The Munsell Color Book (see section 3.10 Materials in this chapter) was pivotal in starting this external analogue process as it bridged the gap between the exclusively internal colour experience of the grapheme synaesthete and the external physical colour experience of material colour. It provided the necessary colour reference which, together with their personal colour descriptions, gave me a starting point for the colour reconstruction. Once the colours had been dyed, the analogue material – the dyed yarn swatches – were sent to each participant by post for their critical responses. The rationale for using dyes to reconstruct the colours is reflected in my earlier career as a freelance colour matcher for the textile industry which, along with my early dye-lab training at art school, enabled me to be able to assess a colour with visual accuracy and thereby replicate or match a colour to a sufficient level of precision.

3.5 Action

The process of matching and sending off batches of colours to each participant was spread over the spring and summer months to ensure sufficient daylight time within which to work. The process of reflection led to action from my part once the colours were returned with their critique attached. This process of 'to-ing and fro-ing' took a period of four years as there were 130 colours to match to a high specification, and I had to fit in with each participant's work schedule and availability to respond and study the dyed colours I sent to them.

3.6 Modification

The modification process was part of the matching process as I gradually became more involved with each participant's particular letter colours. I found it essential to work with one participant at a time in order to maintain the close rapport that was necessary for the precision of the task of colour matching.

3.7 Movement

Once the colours had been verified, I was able to turn my focus to my woven textile work, where I used the participants' colours that had been matched to their satisfaction. These textiles formed the colour charts Series 1–8 (see Chapter 6 Research Findings exhibition installation images).

3.8 Case Studies

Case studies have the potential to form an integral part of research as explained here: 'Case studies are a "step to action". They begin in a world of action and contribute to it' (Adelman et al., 1976, p.140).

Case studies for individual participants have been developed from the initial questionnaire that was designed to provide the framework from which to build a personal profile for each participant. 'The case study approach enables the research to delve into intricacies of the situation in order to describe things in detail, compare alternatives or perhaps, provide an account that explores particular aspects of the situation' (Denscombe, 2014, p.56). As already mentioned, I have utilised the questionnaire in tandem with semi-structured interviews to gather information that would enable me to replicate the colours of each participant as the foundation for further enquiry into the fragility of colour perception. Case studies are useful in being able to draw on varying techniques for collecting information such as interviews, questionnaires, documents and observations for analysis (Yin, 1989).

3.9 Participants

Due to the relative rarity of synaesthesia awareness and its specialist nature (see Table 1.1) Prevalence estimates for 'lexical-color' (Simner and Hubbard, 2013, p.15), the initial participant for this study was selected via introduction, from which a snowball sample of synaesthetes emerged. As described by Denscombe (2010, p.34), 'with snowball sampling, the sample emerges through a process of reference from one person to the next. At the start, the research is likely to involve just one or a few people.'

The first (sampling) participant was a student who attended a lecture on colour that I gave at the University of the Creative Arts (UCA). The next two participants came via introduction from this student. Of these three potential participants, two volunteered to continue after the initial questionnaire meeting and subsequent email. Once this initial work had commenced and was completed the remaining participants were found through reference from colleagues and responses to a mail-out from the secretary of the UK Synaesthesia Association. 'In action research, researchers collaborate with practitioners and other stakeholders. Contrary to many other research paradigms, action research works with rather than on or for the researched' (Koshy, 2005, p.27). The participants who took part in my research were essential to this project and without their personal and professional input the results achieved could not have materialised. Their intimate relationships with their colour photisms and their willingness to share and explain their experiences, made this project exciting and vibrant.

> Action research … insists that practitioners must be participants, not just in the sense of taking part in the research but in the sense of being *an equal partner in the research*. (Denscombe, 2014, p.125)

Of eight initial questionnaire interviews, five participants were taken forward to completion. All participants were female and four were from art and design backgrounds. (See Appendices 2–6 for questionnaire profiles.)

3.10 Materials Used

Letterpress (AEIOU):
To test the participant's reactions to their letter colour photisms I produced a hand-printed series of different font designs and sizes to test whether different scale and font designs might trigger different letter colour sensations (see Chapter 6: Research Findings).

Munsell Color Book (volumes 1 and 2, Serial Number 55627021109):
Numerous colour systems have been devised over time as an aid to colour consistency in industry such as Pantone, the Natural Colour System (NCS), the RAL colour system and Oswald, for example. All of them have their particular strengths and weaknesses; these have been discussed in more detail in Chapter 5. For this study, it was found that the Munsell

colour system to be the most appropriate for my requirements as a colour matcher. Apart from having the facility to remove the individual colour chips, all the participants found Munsell easy to use and understand. The Munsell Color Book contains approximately 1,600 colour chips that are arranged according to the Munsell colour order system of Hue (the colour), Value (the lightness or darkness of the colour) and Chroma (the relative intensity of the colour). Each page represents one hue with colour chips that can be removed from the page to facilitate colour comparison. These colour chips have reference details printed on the back (see Figures 9-13).

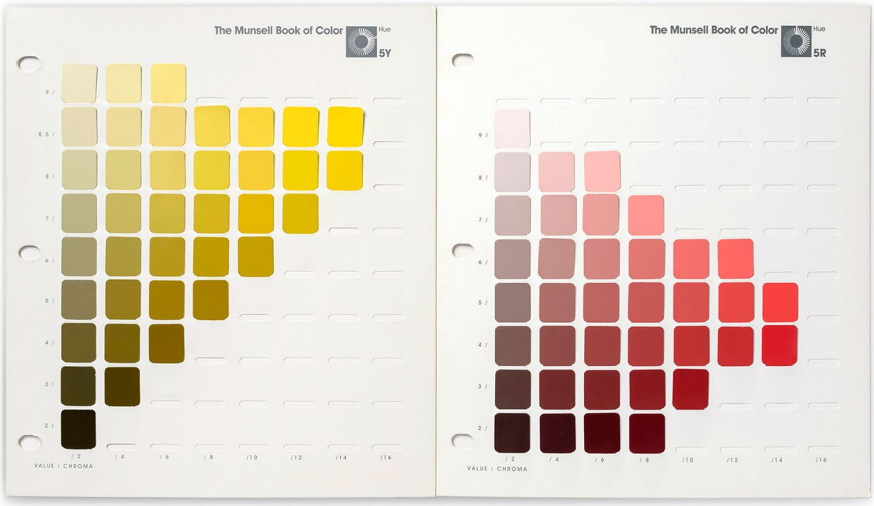

Figure 4: Pages from the Munsell Color Book volumes 1 and 2

Figure 5: Pages from the Munsell Color Book volumes 1 and 2

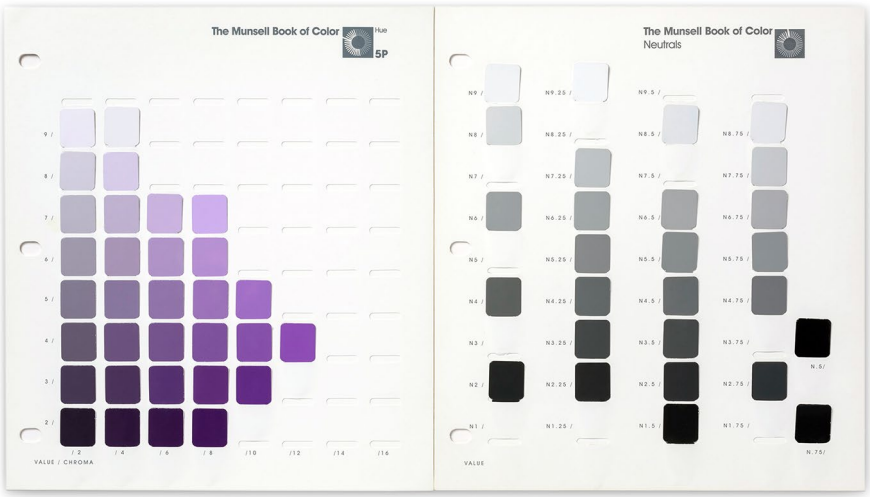

Figure 6: Pages from the Munsell Color Book Volumes 1 and 2

3.11 Research Methods

3.11.1 Questionnaire

A questionnaire was devised to provide the information required to conduct the initial investigation (see Appendix 1). It was used within the informal semi-structured interview process with each grapheme synaesthete participant. This provided the opportunity to establish the level and quality of synaesthetic experience of each of the participants, enabling a clear assessment of stability of data to take place. The questions were designed to establish a closer understanding of the issues relating to the individual's experiences, and to collect sufficient descriptive colour data to work from. Semi-structured interviews enable the interviewer to be more flexible regarding the order of the information gathered, because 'the answers are open ended, and there is more emphasis on the interviewee elaborating points of interest' (Denscombe, 2014, p.204). Using the information gathered from the synaesthetes via the questionnaire, it was possible to reproduce the letter colours for each participant and this informed the content of the subsequent stages of the research.

3.11.2 Interviews

3.11.2.1 First Semi-Structured Interview

The introduction of the questionnaire and the hand-printed letter press fonts formed the initial two elements that created the structure for the first semi-structured interview and laid the foundation for future meetings. Each participant's responses to the questions and the

letterpress fonts were returned to them via email to check for any possible errors or misunderstandings that may have occurred during the collection of the data in the first meeting. The printed fonts varied in size, shape and design, and were introduced to see if their variance had any impact on the quality of the participant's letter colour perceptions. (The results of this are discussed in Chapter 6: Research Findings.) The font designs were limited to the vowel letters AEIOU.

Figure 7: AEIOU Type Face Fonts – The Oriental One and The Wild West One

3.11.2.2 Second Semi-Structured Interview

This follow-up meeting was undertaken to verify the descriptive consistency of the initial response to each participant's letter colour perceptions. At this stage the Munsell Color Book volumes 1and 2 were employed, providing the facility for the participants to be able to remove the individual colour chips and separate the colours they had initially identified, and compare them for accuracy. They could then take the colours that they thought might be appropriate for each letter colour and place them next to similar shades of the same colour name for direct comparison and verification. Thus, providing the initial analogue colour references enabled the participants to identify the nearest physical shade available to match their internal colour photisms and personal verbal colour references that had been obtained during the first and subsequent meetings. These colour chips were then notated, each colour having a number reference and any additional comments regarding the qualities of the colours were also recorded at this stage (see Chapter 6: Research Findings).

3.11.2.3 Third Semi-Structured Interview

This follow-up meeting was held to confirm the stability of the previous analogue information obtained. This reflection was crucial for the process of refinement and confirmation of the colour data being gathered. The meetings were held in natural daylight conditions during the spring and summer months. The reproduction of the personal letter colours for each participant was also conducted during the spring and summer under natural light conditions in my dye-lab. Dye stuffs and chemicals were measured and recorded (see Appendices 7–11: Dye recipes and process notes).

The precise colour notation and reconstruction could only commence once this process of verbal and analogue evidence had been satisfactorily established. The Munsell Color Book, provided a visual starting point to work from in conjunction with the verbal descriptions of the colours experienced. The working method and process for reproducing the participants' letter colours in my dye-lab is listed below.

3.12 Method for reproducing the colours

1) Order colours into recognisable colour categories, i.e., whites, yellows, oranges, reds, etc., starting from light to dark.
2) Work on palest colours first within each identified colour category (by dyeing the pale colours first: if the colour was not achieved first time the colour dyed could be set aside and utilised for a potential future colour match).
3) If colour not achieved during first attempt, label yarn and put aside, repeat matching process with fresh skein.
4) For each new shade check previously discarded colour matchings for potential adaptations for new shade.
5) Continue process until all shades matched in identified colour category (see 2).
6) Notate all actions as process proceeds (some shades needed to be matched five or six times; see Chapter 6: Research Findings).
7) Post off shades to participant for written feedback and verification.
8) Re-dye rejected shades, using feedback as guide, re-send altered shade to participant.
9) Continue process until all colours have been verified by participant.
10) Type up recipes and process as recorded during dyeing process.
11) Label letter colours from each participant and store.

The methodology for reconstructing the individual colours of each of the synaesthete's personal letter colours was a systematic process of deconstruction to reconstruction, a breaking down of the constituent parts that represented each letter colour. By visually calculating the percentages of each colour that made up the colour or shade I was aiming to reproduce, it was possible to reconstruct an approximation of each colour and through a process of refinement and adjustment, arrive at a visual conclusion. In order to unravel some of the complexities that this presented, it was necessary to establish whether the colour sensations perceived by the grapheme synaesthetes could be reconstructed, so that non-synaesthetes might have an opportunity to obtain more awareness of the personal colour perceptions that a grapheme synaesthete experiences.

Figure 8: Examples of colour matching correspondences. Participant's 1 and 5.

My earlier experience as a freelance colour matcher for the textile industry, alongside my early dye-lab training at art school enabled me to assess a colour with visual accuracy and thereby replicate or match a colour to a sufficient level of precision. The visual calculation of a colour is for me a subjective process whereby I decide what each colour is made up of. For example, a green would probably consist of yellow and blue, but the exact yellow and blue cannot be known for sure just from first examination, so I would begin by anticipating how

dominant the yellow in the green was and add a blue gradually to the yellow until the depth of shade was achieved. Then I could assess whether the colour needed to be adjusted to include a little red for example (to warm up the green), and this would be added drop by drop, until the correct shade had been achieved.

Once the matching process was completed, the colour would be sent to the synaesthete for critical analysis. Each participant was asked to view their letter colours in daylight conditions and encouraged to reflect on their colour perceptions to judge whether the shade sent to them for that particular letter colour matched with their unique letter colour perception. The length of time for the matching process varied considerably and in a few instances, took up to five or six attempts before the shade matched the colour experience of the participant. Each colour matching has been recorded and notated so that the process of matching could be tracked (see Appendices 7–11). The relative small scale of the working group of participants underlines and reinforces the qualitative nature of this study, and the validity of the case-study approach.

I have utilised my long-term experience as a dyer and weaver to establish a series of art works that relate to the data gathered from the participants in this study. I designed a series of five limited edition Alphabet colour books. All the pages are loose leaf, allowing them to be arranged in specific and variable orders for letter colour nomenclature and colour classification comparisons with each participant. This arrangement also facilitates the possibility of cross-referencing the description variance on colours that fall into the same colour classification across all five synaesthetes participating in the study. Multiple arrangements of information are thus able to be visually accessible at a glance (see Figures 9-13 below).

Figure 9: Printed page prototype from Participant's 1 and 2 - page 'A'

Figure 10: Printed page prototype from Participant's 1 and 2 - page 'E'

Figure 11: Printed page prototype from Participant's 1 and 2 - page 'I'

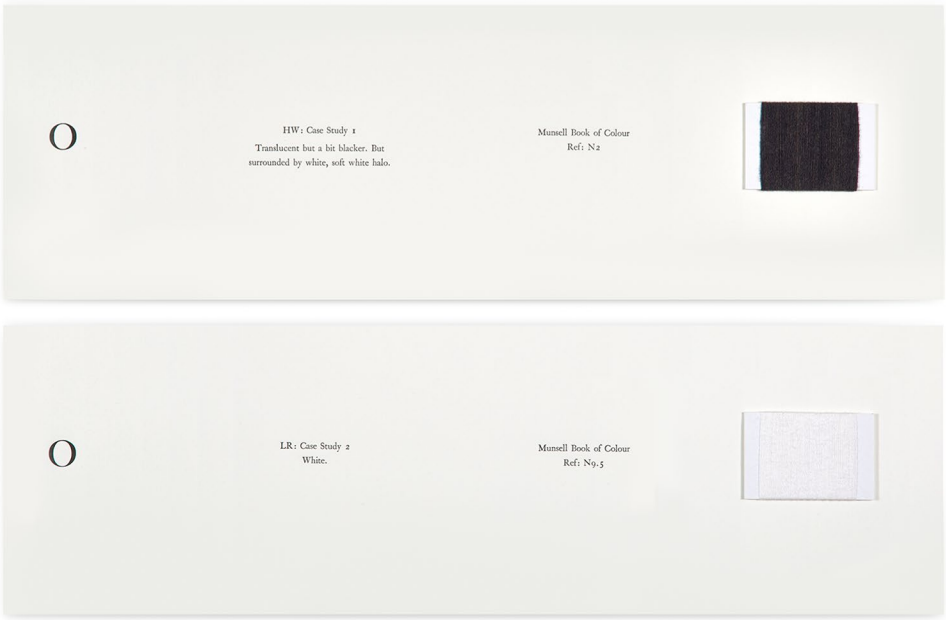

Figure 12: Printed page prototype from Participant's 1 and 2 - page 'O'

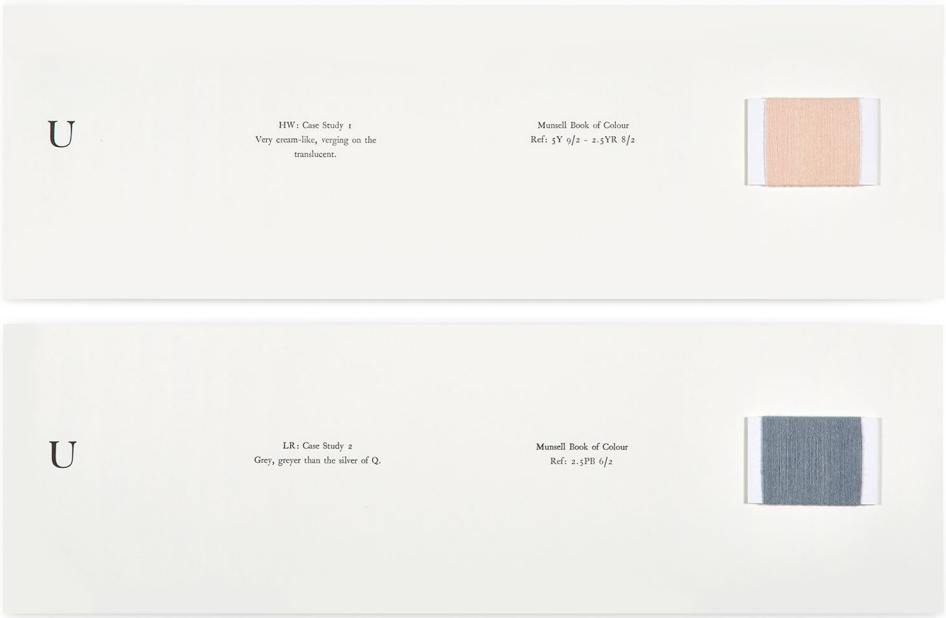

Figure 13: Printed page prototype from Participant's 1 and 2 - page 'U'

With the five sets of coloured alphabets that were matched to the synaesthete's specifications, I have produced a series of woven textiles using the letter colours that were reconstructed. These take the form of a series of woven colour charts, based on the traditional paint chart format that set out to explore classifications of colours extracted from the combined alphabet sets. For example, I have calculated that there were twelve colour classes, with some borderline classifications such as blue/green, yellow/orange, red/violet, etc. From the 130, matched letter colours I identified the following colour classes:

1) Yellows;
2) Ochres;
3) Oranges;
4) Browns;
5) Reds;
6) Pinks;
7) Violets/Purples;
8) Blues;
9) Greens;
10) Blacks;
11) Greys;
12) Whites.

The final colour categorisations were condensed into seven sets, starting with the initial colour categories of yellow, red, blue and green. I decided to combine the borderline colours within broader colour categories, for example pinks and purples were combined to create Colour Chart 5. The 'neutrals' category of whites, greys and blacks were combined to create Colour Chart 6 and the 'earth' colours, the oranges, ochres and browns, were combined to create Colour Chart 7 (see Woven Colour Chart Series 2–8: Chapter 6 Research Findings, Figures 42-48).

During the research process, I alternated between writing and practice. I began by writing about my own working methods (see Chapter 4: Personal Practice), and finding connections that linked my past work to the proposed research. Once I was satisfied that the initial idea was sound, I invested a considerable block of time ensuring that the participants' colours could be replicated correctly, as this was the basis for the study itself and all other work hinged on the success or failure of this initial task. Once a verified colour collection had been established, I began to investigate the subject of colour and how this might inform and feed into the research (see Chapter 5: Colour). In addition, I needed to investigate the subject of synaesthesia, and how this influenced the participants' approach to and experience of their letter colours (see Chapter 2: Synaesthesia). Once Chapters 2 and 5 had been written, I began the process of transforming the dyed threads into the woven colour charts (see Woven Colour Chart Series 1–8: Chapter 6, Research Findings, Figures 41-48).

The 130 matched shades formed the visual material from which I could produce my woven work. By laying out all the colours from all of the participants and arranging them into the broad colour categories of yellow, red, blue, etc., I was able to begin to create orders of colours that reflected my approach to the initial colour matching stage. This posed the question, when does a yellow visually become an orange or a green? This subjective judgement is the colour matcher's mantra. The selection process took time to reflect upon, as the more one contemplates a colour the more that colour seems to shift places with another colour. This shifting of place became the starting point for the next stage of developments within my work. The colour categories were arranged and rearranged until I found a layout that I considered fitted the colour label and I found to be aesthetically pleasing. The process and decision making was a subjective one, I did however consult professional opinions as I was interested to use them as a sounding board prior to making my final selections of shades for each of the identified colour categories. The final decision of which shades constituted the

broad colour labels of yellow, red, blue, etc., was purely my own. As already mentioned, the intention to weave these classified colour sets into the form of colour charts was to ensure that each block of colour could be separated by a neutral non-coloured field, enabling each letter colour to be seen without being compromised or altered by the colours surrounding it. The final colour compositions, however, read as a complete statement.

The first woven colour chart took each participant's set of colours in order A–Z. I presented each panel vertically, 'A' being at the top and 'Z' at the bottom. Neutral panels separated each vertical panel or strip of letter colours. There were eleven panels in total for this work: five 'A–Z' panels and six neutral panels, (see work in progress, Figure 15, below). These separate strips were joined together to form one coherent composition (see Figure 41). This first chart sets the reference points for all the remaining colour charts, enabling easy visual cross-referencing of all the reconstructed colours. In this way, the intention was that the participants would be able to identify their personal letter colours within the first chart, as the order of the colours reflected the order of their alphabet letter colours. Series 2–8, Figures 42-48, comprising the segregated colours from the combined alphabets, were woven applying a sequential system that took all the yellows from participant one first, and placed them in their letter colour order, followed by all the yellows from participant two placed in their letter order, and so on. This process continued until all the participants with yellow letter colours had their yellows placed in their participant order and their letter order. This process was repeated for all the other colour categories. The aim was interested to ascertain whether the participants would still be able to identify their letter colours once they had been taken out of their original context. For example, Colour Chart 2 consisted of fifteen shades of yellows identified for colour category one. The woven colour charts were labelled as follows: yellows; reds; blues; greens; pinks and purples; earths: oranges, browns and ochres; and neutrals: whites, greys and blacks.

Figure 14: A-Z Alphabet card windings combined 1-5

Figure 15: Woven Alphabet Colour Chart: work in progress

One of the intentions for separating each participant's colours into the classifications listed above, was to test how strong the colour photisms of each participant were once their colours had been taken out of context. Could they for example identify their letter colours from the colour charts without having the actual letter as a colour trigger reference? In addition, I wanted to test whether the grapheme synaesthetes I had been working with were able to automatically override the usual colour perceptions that shift according to the colours that surround them or they were placed next to. In his *Interaction of Colour* (1963, p.1), Joseph Albers devised a series of colour exercises that demonstrated how, as he put it, 'color deceives continually' (see Chapter 5: Colour). The second intention was to test whether the participants had developed different opinions regarding their colours, as some of them had remarked that they did not like many of their colour photisms, and seemed to have no control over the colours that they perceived when triggered by text.

The participants were all invited to an exhibition of the work that was produced as my response to the colours reconstructed for this research. Their responses were recorded (see Chapter 6: Research Findings). This was a new departure for my practice as an artist, as previously I had tried to avoid using other people's colours as 'readymade' colours to produce art work, always preferring to manufacture my own self-initiated colours for my work. I have discussed my responses to this colour research alongside those of the participants in an attempt to 'square the circle' (See Chapter 6: Research Findings and Chapter 7: Discussion and Conclusions). The exhibition of the work enabled me to test some of the questions that remained outstanding (as identified in the previous paragraph) with regard to the participants' responses to the work, and draw together the complex threads and connections that have manifested over the course of this research. The methods of recording the participants' responses to my work will be through dialogue and written notes, so that a commentary on their thoughts and perceptions can be recorded alongside the work that I have produced.

In addressing the problem of colour reconstruction from the perspective of my practice as a colour specialist within the field of fine art textiles, I have been forced to reconsider my approach to colour. By employing the colours of others to create woven compositions I have inevitably set aside my own personal colour preferences in order to create new work. This has been an exciting process and immensely informative for the development of my art practice, providing an increased understanding and appreciation of colour and how it works.

Chapter 4: Personal Practice

In this section, I discuss the ideas and processes behind a selection of the textile work produced prior to this current research. To help put this PhD study into context, I will draw on artists who have influenced my thinking throughout my career as a weaver and dyer. I will discuss my choice of medium for each of the earlier works cited, as this relates to the current work in this research study. I have listed the works below and included illustrations and work details for each piece at the beginning of this chapter.

The methods I have employed previously in my work explore considerations of colour, proportion, placement, scale and material, through the use of predetermined units of colour that have been intuitively placed in various orders, until the order I am subconsciously seeking has been arrived at. It is important to point out here that 'subconscious' in this context should not imply lack of organised thought or planning. Albers (1967, p.237) mentions intuition and its equal role to thought:

> All rendering of form, in fact all creative work, moves between polarities: intuition and intellect, or possibly between subjectivity and objectivity. Their relative importance continually varies and they always more or less overlap. (Joseph Albers, Alvini (ed.) (1988) p.237)

The free-form organisation and reorganisation of the units/panels within my work allows for unexpected choices to come into play that were not necessarily determined prior to production. The fluidity gained by working in this way provides multiple-choice options that extend the scope of the work, pushing the boundaries of possibility of choice right up to completion. I have listed below the examples of previous work that I will be referring to in this section. All other examples of my work illustrated in this thesis will be the work produced as a result of this research.

Figure 16: *Testpiece* (1973) 196cm x 173cm

Materials: Worsted wool; Dyes: natural/historical and synthetic.

This work was an experiment to test whether natural/historic dyes and synthetic dyes could sit comfortably side by side within a multicoloured composition without jarring. It was also an exercise in demonstrating the range of colours available with historic dyes.

Figure 17: *Abstract 1* (1983) 259cm x 178cm

Materials: Wool rug yarn; Dyes: Madder red, Indigo blue.

An investigation into the impact of a reduced palette, and warm versus coolness of colour. The device of different width strips to punctuate or interrupt the main colour field was also an experiment.

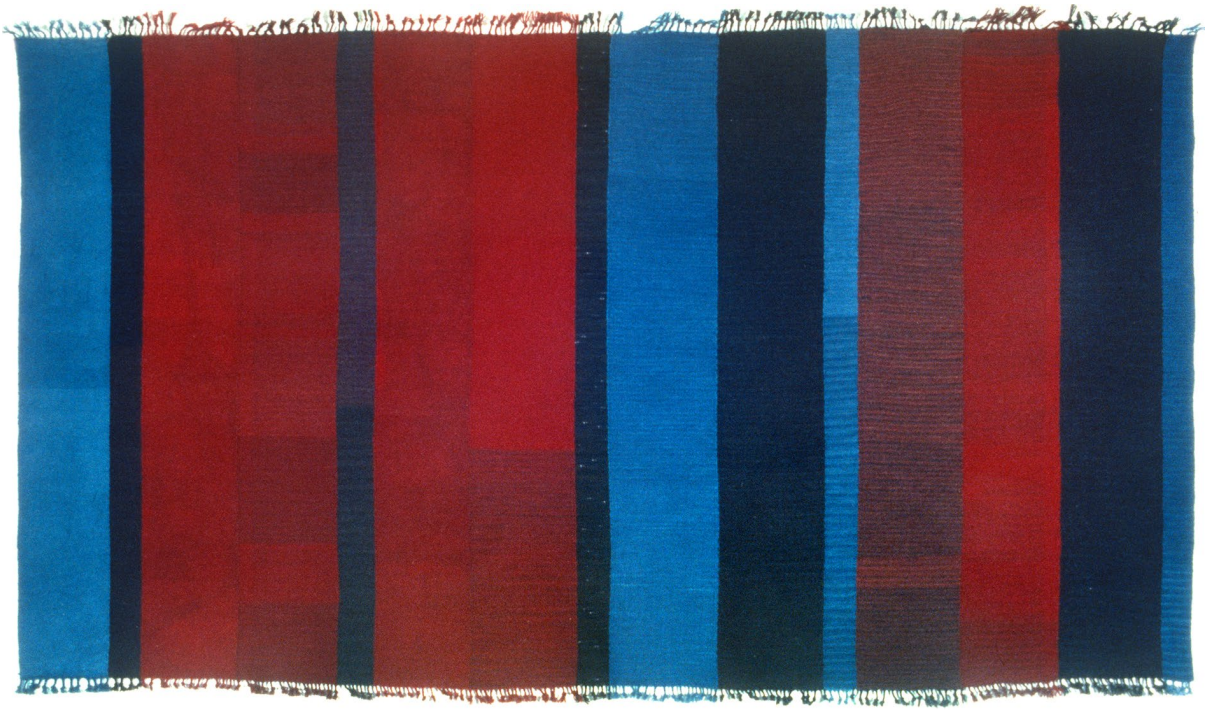

Figure 18: *Abstract 2* (1983) 178cm x 135cm

Materials: Wool rug yarn; Dyes: Madder red, Indigo blue.

A second version of Figure 17 continuing the investigation of the impact of a reduced palette and warm versus coolness of colour. As above, the device of strips of different widths to punctuate or interrupt the main colour field was a continuing experiment.

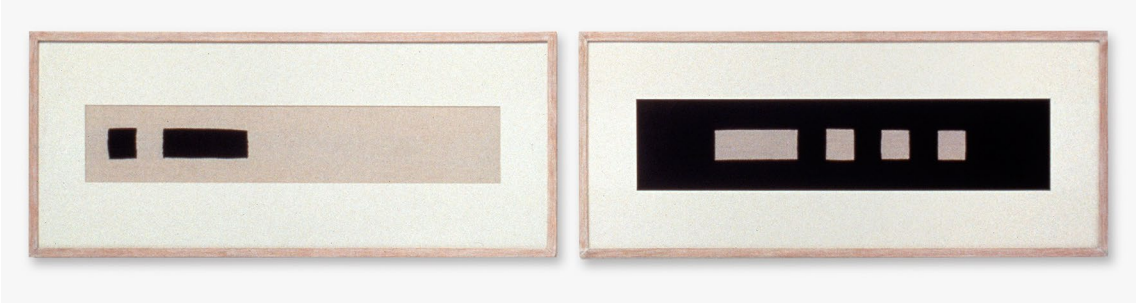

Figure 19: *Morse Code 'A', 'B'* (1998) 76cm x 31cm

Materials: Mercerised cotton; Dyes: synthetic.

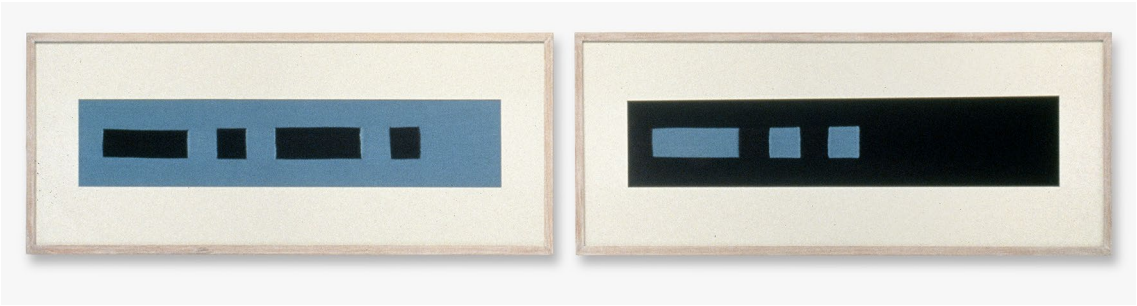

Figure 20: *Morse Code Alphabet 'C', 'D'* (1998) 76 cm x 31cm

Materials: Mercerised cotton; Dyes: synthetic.

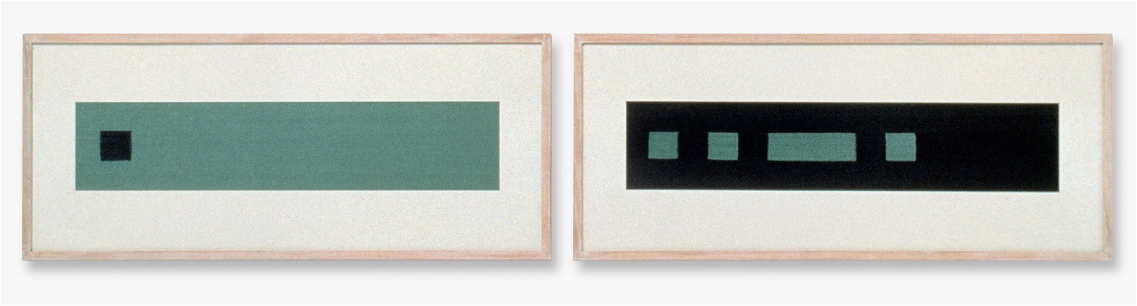

Figure 21: *Morse Code Alphabet 'E', 'F'* (1998) 76 cm x 31 cm

Materials: Mercerised cotton; Dyes: synthetic.

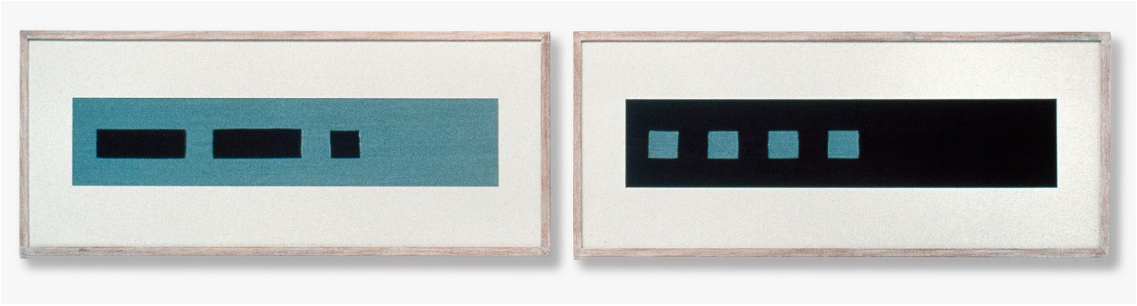

Figure 22: *Morse Code Alphabet 'G', 'H'* (1998) 76 cm x 31 cm

Materials: Mercerised cotton; Dyes: synthetic.

An investigation into the abstract language of Morse code and colour memory, and how colour has the ability/capacity to evoke a time and place.

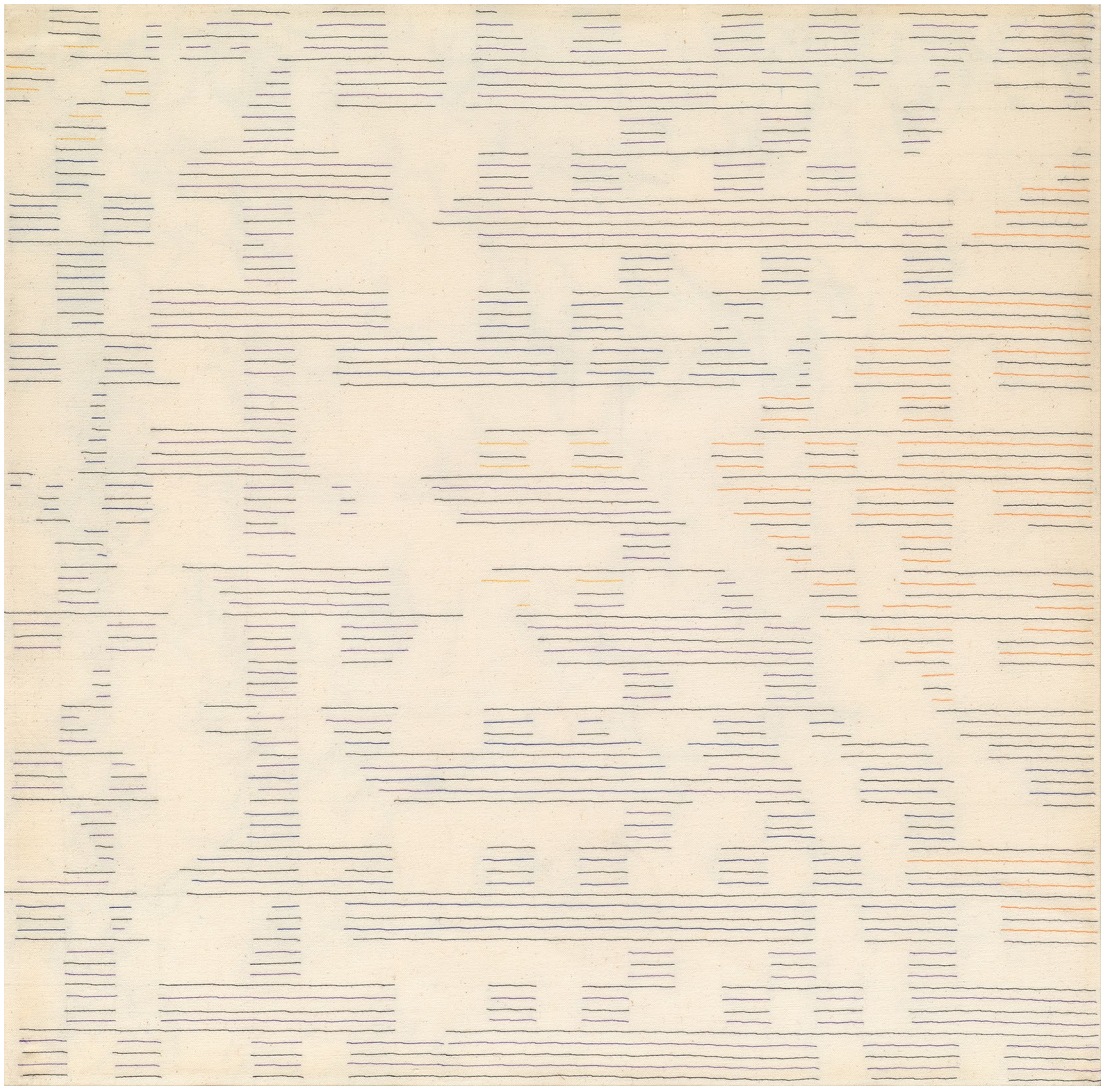

Figure 23: Morse Code series: *Tribute to Friendship* 1 (1998) 63cm x 66

Materials: unbleached cotton duck, graphite and coloured sewing thread.

An investigation into the abstract language of Morse code and colour, to explore ideas of friendship and fragmentation.

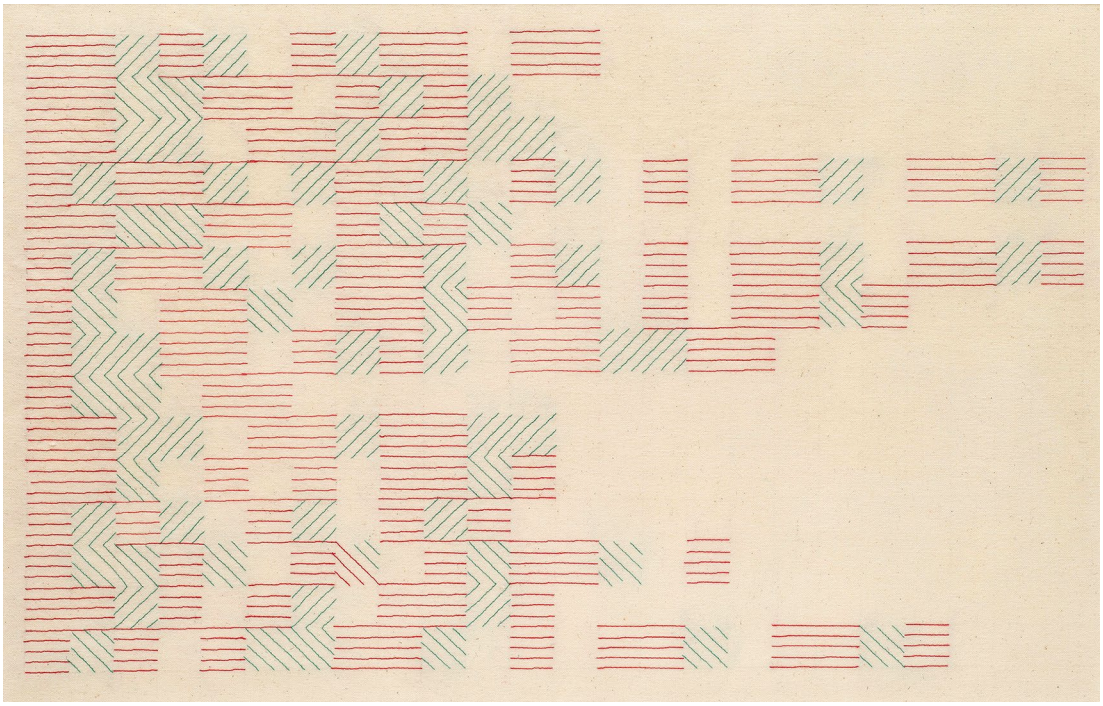

Figure 24: *Morse Code series: Tribute to Friendship 2* (1998) 90cm x 53cm

Materials: unbleached cotton duck, coloured sewing thread.

An investigation into the abstract language of Morse code and colour, to explore ideas of friendship and fragmentation.

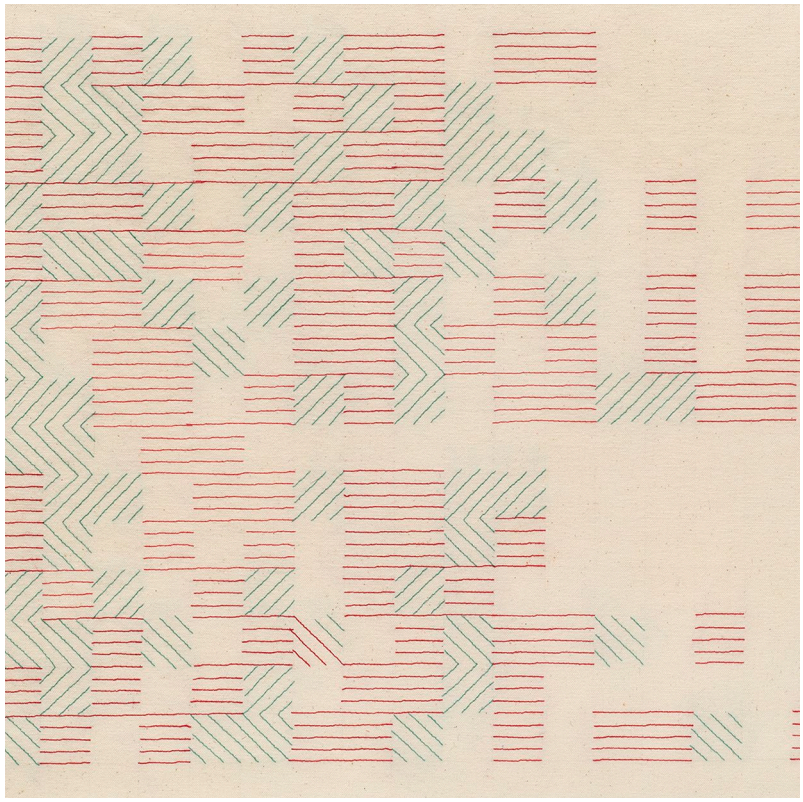

Figure 25: *Morse Code series: Tribute to Friendship 2* detail (1998)

Figure 16: *Testpiece* (1973) was, on reflection, an important work as it enabled me to draw together my colour experiments with natural dyes and to combine them with a selection of synthetic dyes that I had been working on at that time. All the colours I used in this work and all subsequent works have been hand-dyed to exacting colour specifications with the yarns carefully chosen for each piece. Until this time I had kept the two colour sets separate, careful not to compromise, or confuse the different colour characteristics found in the historic dye colours, with those found in the synthetic dye colours. The difference between the, two colour categories as I perceived them was that the historic dyes had a rich and dense depth of character, possibly due to the impurities inherent in the dyestuffs. Their reaction to daylight appeared to be quite different from that of the synthetic colours, giving off an almost 'audible' resonance – especially noticeable in the 'golden' sunlight of the afternoon – that the synthetic colours did not share. These are personal observations that have come from working directly with the two dye sets for a number of years. The synthetic colours on the other hand gave the appearance of relative flatness and purity and were more 'monotone' in appearance in comparison to the historic dyes. This may be due to the contrasting apparent purity of the synthetic dyestuffs, which gave them a sharpness and high definition, providing

a more ‘clear-cut’ and ‘hard-edge’ effect. Again, these are my personal observations. (It would be possible to measure the reflective qualities of both dye sets, however, as this study is not specifically concerned with this aspect of colour measurement and therefore the comparisons of historic with synthetic dyes lies beyond the remit of this study).

The decision therefore to combine the two sets of colours was an experiment to test this observation and note if the apparent visual differences were in fact as ‘clear-cut’ as previously thought. For me, Testpiece, proved my subjective observations to be sound. The dyes I selected to use for my PhD study were synthetic dyes as these are more flexible for the complex and exacting colour matching required for this project, and none of the synaesthetes identified colours that necessitated the use of historic dyes (see Dye recipes, Appendices 7-11).

The weave structure I chose for Figure 16, and subsequent works was intentionally restricted to plain weave, as it was important for the work that the colours could be seen without the additional distraction more complex cloth structures would have imposed on the final composition. The bands or lines of colour within each woven strip in *Testpiece* were of varying widths, as the aim was to explore the juxtapositions of the colours to see how they reacted in conjunction with each other. During the weaving process, only a small section of the woven fabric can be seen physically in front of the weaver before the cloth disappears around the front roller. I used this visual and practical limitation as a device to dictate the size of each colour composition within the panels. This resulted in a series of multiple compositions within each strip, where each ‘small area’ acted as a visual statement or mini composition in its own right, like a sentence in a text, or a line in a poem. (This approach has been carried through into the present research, and discussed later on in the text.)

The width of the strips that made up this composition were of identical, as the intention was to build up the overall width of the work, panel by panel. By adding the strips together, arranging and rearranging the panels after they had been woven a composition was constructed that could be read as one entity.

The colours in all my work are decided upon prior to the execution of the work. These may be shifted slightly at the dyeing stage but fundamentally I will have worked out the exact colours I wish to work with, prior to commencing the work. These colours are often ‘in my

head' and the dyeing process is where the exact shades are realised. For my PhD study, however, the colours have already been predetermined by the findings of my research under the auspices of the synaesthetes; the exactness of the reconstruction of their colours has been controlled by them through a process of close collaborative exchange. The details of this painstaking process are shown in Appendices 2–6 and 7-11.

The scale of my past works has been contingent upon the ideas behind the work and the materials employed to execute the final piece. Sometimes the unit widths are identical and sometimes they vary depending on the initial intentions within each work. The formatting of the methods of working is evident in the works illustrated in Figures 16, 17 and 18. In Figures 17 and 18 *Abstract 1 and 2* (1983), the colours were reduced to three and by building up the areas of colour through repetition, unit by unit, the focus became the colour itself rather than the build-up of a collection of multiple colours as seen in Figure 16. The simplification of the reduced colour palette in Figures 17 and 18 enabled concentration on the qualities of the colours themselves and the surface qualities within the panels. The raised joins of the panel segments formed ribs that stood out from the surface fabric, helping to draw attention to the units that formed the main colour field.

The colour was embedded into the surface through dyeing rather than laid onto the surface as experienced with a painted or printed surface, and the colour variations within the dyed yarn appeared as subtle repeated lines or ripples throughout the panels. The evidence of the handmade within the work makes a significant visual and aesthetic separation between the human input, the hand-made element, in contrast to an industrial machine made approach. Each panel contained incidental 'blemishes' or 'process traces' which, when pieced together, drew attention to the colour qualities within the colour field of the work itself. Everything in the work was held within the materials and processes that made up the work. This approach to making allowed the possibility of chance and the unexpected to be embraced, facilitating an elastic, expansive approach to the creative process.

In his essay 'Simple Gifts', Storr (1993, p.27), discusses Robert Ryman's workmanlike approach to his practice in his 'Lugano' and 'Classico 5' series of 1968, and mentions the 'process traces rather than expressive drips' of the paint on the surface, which 'give these works an internal expansiveness and painterliness'. It is this evidence of 'process traces' that I identify with in my own work. I like the honesty within the work to be evident, not being

afraid to show human errors when they occur within the work, if they can provide an unexpected improvement that provides an additional dimension to the final outcome. The choice of when to go with an interesting mistake if the mistake proves to add an unexpected but welcome improvement to the work.

My work, though woven, refers more to painting than textiles in that the considerations for the work are for the textile to be viewed flat and hung on a wall, without the obvious additional considerations required for an applied function of a textile with a practical application. My choice of yarn and method of colouring the work are made with painterly considerations in mind, in that the work is never viewed folded or manipulated in any way and the tactile considerations of the textile remain predominantly visual and flat like a canvas.

In Figures 17 and 18: *Abstract 1 and 2*, (1983), I employed the addition of narrow panels within the works to act as punctuation for the dominant colour fields within the compositions. I have used this device of narrow panels in my current study as a means of separating the alphabet colours I worked with, and have adopted the format of a standard colour chart for each composition in the series. This layout provides a clear platform for the colours to be viewed, individually and collectively (see Figure 1 *Woven Alphabet Letter Colours: A-Z: 1-5*).

In *Abstract 1 and 2*, Figures 17 and 18 there are three colours within each composition, a warm deep madder red and two indigo blues, one bright and the other darker in tone. In Figure 17 the darker blue panels are about one-third of the width of the lighter blue panels and the lighter blue panels are the same width as the madder red panels. Again, the final arrangement of the composition occurred after the panels had been woven, though before the work commenced there was a clear intention to 'de-clutter' and simplify the composition by reducing the number of colours within the piece and to concentrate instead on the colour qualities within the individual panels themselves. The choice of colours was intended as an exploration of warmth and coolness of colour: the madder is the rich warm colour and the two indigo blues the contrasting cooler shades, one bright and luminous, the other a darker blue/black shade. The colours in Figures 17 and 18 have no decorative or additional meaning or underlying significance. These works are simply an exercise in colour placement and proportion that provide, as Storr (1993, p.25) says about Ryman: 'the structure of

concentration and the fascination of random incident'. For me this eloquently articulates the exploratory nature of working directly with one's materials to learn, through making, their potential and scope. As mentioned earlier the reason for implementing panels of different widths alongside multiple panels of the same colour was to use the narrower panels as accents to the main colour field, in the manner of Barnet Newman's zip paintings (see Figure 26, below).

Figure: 26 Barnett Newman's Zip Painting, *Adam* 1951, 1952 © ARS, NY and DACS, London 2019

The present research study on colour and text is a development from previous work where Morse code and Braille notation were implemented with colours that held particular significance for me personally, with alphabet letters and text. The colours used for the Morse code series (Figures 19, 20, 21 and 22) were taken from recollections of times or places, and this abstract Morse code system was used to produce an alphabet. These panels were woven in a weft-faced plain weave construction or tapestry weave so that the colours could be seen as solid blocks of colour (as also illustrated in Figure 16: *Testpiece*). The woven panels were arranged in pairs AB, CD, EF etc., where the colour of the letter A would become the background colour for B, and the colour of the letter B would become the background for A and so on.

The Morse code and Braille series (Figures 19, 20, 21 and 22) came from an interest in visual communication through the abstract mechanical languages of Morse code and Braille; I had been aware of these alternative methods of communication through family members who had used them. I knew that during the Second World War Morse code radio operators, like my father, had been able to tell when their lines of communication had been intercepted from the subtle nuances of emphasis or pressure on the keys. The idea that a series of dots (dits) and dashes (dahs) had the capability of conveying discreet but discernible personal characteristics through touch or pressure, like the infinite variety of interpretations of a music score, or minute differences of interpretation through inflection of speech, prompted me to consider other tactile and sensory possibilities. As Agnes Martin (1975, p.124) wrote in reference to her print series, *On a Clear Day 1973*:

> Art work that is completely abstract – free from any expression of the environment is like music and can be responded to in the same way. Our response to line and tone and color is the same as our response to sounds. And like music abstract art is thematic. It holds meaning for us that is beyond expression in words.

The addition of colour, for example, with the abstract elements of the dits and dahs, created a set of works that had the capacity to hold within them more than the sum of their parts. As Tiffany Bell (2015, p.29) wrote of Agnes Martin's work, '[I]n her art, a contrast between material presence and the suggestion of something other – a memory or feeling – is always present.'

My research with grapheme colour synaesthetes took their unique letter colour coding as the foundation for a series of investigative works that challenged my patterns of working and the individual's ability to identify and associate with their personal letter colour attachments when their personal colour alphabets were subjected to shifts of proportion and sequencing. I was interested to see how colour fragmentation may affect the participants' original letter colour perceptions and associations. Recording these responses as part of this study enabled me to address, research and question whether dyed yarn and woven textiles could contribute to our understanding of the relationship between imagined colour, material and perceived colour. I have discussed this in Chapter 6: Research Findings.

With Figure 19, the intention of the addition of colour to the dots and dashes alphabet was to instantiate the work with some chemistry of sensations/emotions, though the works themselves were not intended to be illustrative. As Figures 19, 20, 21 and 22 were part of a series in memory of my father, I chose colours of a quotidian nature that I had remembered throughout my life at home and that had remained in my subconscious. The significance of these colours was that they reminded me of times, events, places and everyday objects, like markers in history, and had the ability to conjure up for me an array of thoughts, smells and memories. These reminiscences, though non-descriptive, were random abstract colour memories that were not taken in any chronological order but identified as suggestions of a story or timeline pared down like a Haiku poem.

The Figure 19 Morse code series prompted the consideration of the effect of colour on an individual and whether the colours in the work, though personal to me, could stand up independently of their original conception and hold their own as a series. The exercise was initially a personal notation of colours that soon became a robust collective of unexpected parings that were taken beyond the immediate family context and projected into the public domain through exhibitions. These highly personal works went on to have a separate life that invited others to engage with the works on their own terms. This question of translation from one individual's experience to another individual's interpretation that was initiated by this series, has subsequently been developed and underpins the foundation of this current PhD study on grapheme synaesthesia.

For the *Morse Code Series* (Figures 19, 20, 21 and 22), in representing my colour perceptions and associations, I took the letters of the alphabet in pairs, AB, CD, EF, GH, and chose a colour for each letter. 'A' was the warm brown/black of an old black and white television in Provence, but it also reminded me of the brown/black ink of the *Independent* newspaper when it was first published. 'B' was the creamy white of rag watercolour paper. As already mentioned, the letter colour for 'A' became the background colour for 'B' and the letter colour for 'B' became the background colour for 'A'. This system of 'leap frogging' continued throughout the alphabet.

What was interesting about Morse code was, as previously mentioned, its similarities to music: the inherent awareness necessary of the precise rhythm and 'beat' needed to convey a message. The accuracy required to press a key at predetermined intervals to convey a

message had the capacity to transfer a personality through the ether, reminiscent of a Jazz improvisation. Through inflection and interpretation, distinct differences of character can be discerned and complex knowledge transferred. This subtle and complex means of communication forms the essence of this current research and links ideas behind this earlier work to the present work.

The second series of work using Morse code and Braille (Figures 23 and 24) were entitled *Tributes to Friendship*, and the colours in these works were borrowed from Indian Hindu and Buddhist colours that I had been drawn to during my field trips to India in the mid-1990s. I had recently returned from a research trip to India and decided to adopt certain colours that had a symbolic significance from Hindu and Buddhist traditions to reaffirm the meanings of the words used within the texts, thus once again combining colour and text within my compositions. Each composition had two constituent colours, using complementary opposites, such as red/green etc. Some of the text had been intentionally rubbed out to fragment or confuse the composition's message, as a half-heard comment or snatched moment might be construed. The texts were machine-stitched onto canvas over drawn graphite lines of Morse code and Braille. In Figure 24 red and green were used in the text. Red and green, as complementary opposites, gave the visual dynamic that enhanced the composition: Red represented activity, creativity and the energy of life, while green represented life itself. In Figure 23 blue and yellow/gold were used within the text. Again, these colours were complementary opposites: blue represented wisdom and gold to signify life, light and truth, while the yellow within the gold stood for humility. (Cooper,1979, pp. 39–42).

The Morse code and Braille works seen in Figures 23, 24 and 25 were articulated through stitch as a reference to the hand-embroidered samplers that hung in my grandparents' parlour with messages reminding us to be good and true. The unintentional flaws of these machine-stitched compositions contributed a welcome addition to the final outcome, a reminder of the imperfections of the human condition. These works were about friendship and the constancy of friendship. However, once again the origin of the elements within these compositions was not a fundamental prerequisite to the appreciation of these works. As with all my work, they were intended to be viewed without being incumbent upon any personal associations that the works may have contained within them.

My awareness and interest in colour is from a practical, hands-on involvement with the making of colours and how colours react to each other in different contexts. I have taken an interest in colours from different cultures and times in history so that I have a wide awareness and knowledge of cultural differences in the applications of colour throughout history and the world. Although the colours in this current study belong to the synaesthetes who participated in the research, and therefore hold no obvious personal connection to my experiences, I have become intimately involved in the recreation of them and they have over time become an embedded part of my colour repertoire. My previous work with colour has provided a significant foundation and has fundamentally contributed to, and informed, my approach to this PhD study. My work gravitates towards making 'in order to see things happen' (Storr, 1993, p.25), focusing more on the materials of production and the consequences of certain choices and actions.

Once the work leaves the studio it has to stand alone, and no matter what one's intentions were, the test is always the public's response, lending a welcome tension to witness the reception of the work in the public domain. While my work has been shown in public, to date I have not felt it necessary to interrogate an audience to obtain a deeper understanding of the work's impact outside the studio environment. However, my current study has been a collaborative venture from the outset and without the close participation of my team of grapheme synaesthetes, the work could never have been made. Their input forms an integral part of the work, and their responses to the work produced, forms a unique part of this investigation.

In his essay 'Simple Gifts', Storr (1993, p.25) mentions the contrasting intentions behind the work of Frank Stella and Robert Ryman: 'Stella tries to make things happen to painting; Ryman paints in order to see things happen.' For me, working closely with materials to 'see things happen' sits well within my modus operandi, as this approach presents opportunities for development right up to the end, allowing for the element of the unexpected to maintain a 'work in progress' approach until final completion.

For Mark Rothko, Barnett Newman and Ad Reinhardt, colour formed an intrinsic element in their work, and the work they produced from the 1960s and '70s made a significant impression on me as an art student, and helped to inform my own opinions on how to use colour and articulate the function I expected colour to have in the work I was producing.

These three major figures in American art all made a point of mixing their own colours and controlling the exact nuances of the colours within their work, and seemed to be enthusiastically close to the craft and exactitude of their medium. I found this attitude and approach inspiring and encouraging, as I was aspiring to apply this way of working within my own practice as a weaver and dyer.

Albers and Ryman, who sourced their colours directly from industrial paint manufacturers, also influenced my thinking about my work. They tended not to mix their colours, preferring to take them direct from the tube or can. Albers took time to carefully source as many different hues as he could find from paint manufacturers in the USA and Europe, working directly from the tube without mixing his colours at all, except for certain pinks, purples and occasional blues that were unobtainable via his industrial paint sources. All the colours he used were meticulously catalogued and listed on the back of each work. He made extensive collections of 'ready-made' commercial colours, taking great care and diligence in sourcing new colours for his collection. Albers recorded every aspect and stage of his working process, from his numerous preparatory colour swatches, to the measurements of the units of colours used. This reminded me of my note taking and record keeping, though mine were taken from a 'making colour' point of view. Robert Ryman also used his colours straight from the tube or tin, eventually limiting his palette to whites, and pushing the boundaries of what had been previously accepted within the conventions of the time (Robert Ryman exhibition catalogue, Tate Gallery, London, 1993).

These earlier works have been discussed here in order to place my current work in context and to illustrate the continuum of thought and practice that is inherent in the work. This study has provided an opportunity for reflection and clarification not previously articulated.

Chapter 5: Colour

‘There is No Color in the Physical World’

(Kueppers, 1982 p.106)

5.0 Introduction

This chapter refers to aspects of colour that have specific relevance to this study. I have embedded a literature review on colour within the chapter and used subheadings to assist navigation and articulation of this complex subject. My views on colour until this current research study had been purely personal, aesthetic and subjective in nature. Until now I have not attempted to link so many aspects that surround our understanding of colour and what it does and how we use it. This study has led me to investigate the subject of colour more widely and consider colour in more depth, beyond the personal. Kueppers describes the world as being comprised of matter and energy, both being colourless. He says that colours ‘only *seem* to be a material property … [colour] exists exclusively as a sensory perception on the part of the viewer’ (Kueppers, 1982, p.15). As a dyer and maker, it is to this concept that I have kept returning during my research, the physiological facts together with the human experience. It feels counter-intuitive to accept that there is no colour in the physical world, as I have spent my life recording and making physical colours, that I use in my work. I have studied how to make colours, travelling to India to learn about natural dyes on cellulose fibres and spending months trying to replicate Turkish red, and yet I can accept the fact that without light there is no colour, and that material objects can remain identifiable objects through the sensation of touch even when the light has been removed and their colour has disappeared.

What we know as seeing colour is a result of light rays that transmit information. The molecular structure of a material determines which light rays are absorbed and which are remitted or transmitted; the colour stimulus is the remaining light or the ‘residual light’ which is the colour that the observer experiences. Palmer (1999), who describes colour as a ‘psychological property of our visual experiences’, goes on to explain:

> The colors we see are based on physical properties of objects and lights that cause us to see them as colored, to be sure, but these physical properties are different in important ways from the colors we perceive. (Palmer, 1999, p.95)

While colour can be considered from many different perspectives including physics, chemistry, psychology, neurology and philosophy, this research project focuses on the particular personal colours of these participants who are grapheme synaesthetes, alongside my practical work as an artist and dyer. Palmer's comment on the link between the physical and the perceptual, however, makes a point that is fundamental to this study. One obvious problem it raises is how do I know that what I 'see' is what my participants 'see'? The answer to this is I don't. But I have learnt that through careful observation, discrete comparisons of the colour descriptions and data gathered through conversations undertaken with my participants, together with the aid of the Munsell Color Book, the colours I reconstructed according to the participants were replicated to their satisfaction. At all times, they were encouraged to be highly critical and forensically precise.

Colours can be described or explained as sensations, psychological properties of visual experiences, mental properties, representations, constructions of the brain, and properties of the brain. From this, it rapidly becomes apparent that, far from being straightforward, the subject of colour is in fact highly complex in nature and contingent on multiple factors conjoining at the correct time to enable a human with normal colour vision to experience any colour at all. The term normal colour vision here refers to people who have 'a normally functioning visual system' and are therefore 'colour-efficient' (Kueppers, 1982, p.30). If there is an absence or reduction in sensitivity to one or more of the three colour receptors in the retina a reduction in colour discrimination will result, while those with normal vision have fully functioning colour receptors (Verity, 1980, p.93).

Gibson (1950) lists all the elements that have to come into play before a human can see, and one soon becomes aware that what we tend to take for granted is in itself quite miraculous, and as he states himself: 'People who have not thought about the problem find it difficult to realise that sight depends on such a complicated chain of circumstances, for seeing does not "feel like" that. It "feels as if" things were simply there' (p.1). He continues:

> There are … a number of conditions which have to be fulfilled before anyone can see: there must be light to see by; the eyes must be open; the eyes must focus and point properly; the sensitive film at the rear of each eyeball must react to light; the optic nerves must transmit impulses to the brain. (Gibson, 1950, p.1)

Gibson (1950, p.1) refers to 'a seeing man … [who] can match colors and draw representations of things' and asks: '[H]ow do we see light and how do we perceive color?' He argues that, 'light and color are, in a way, the raw material of vision. The perception of an object in space would be impossible if one were not sensitive to the light reflected from the object and to the brightness and hue of this light' (p.3). He further notes that there is a quantity of information regarding brightness and hue of light but that this does not provide answers to other questions such as the difference between how we see an object and how we see abstract colour. As he notes, '[T]he seeing of an object is an ability quite different from [the] seeing of abstract color. Seldom or never does one see a color as such' (Gibson, 1950, p.3).

Mausfeld (2010) discusses the concept of abstract colour in his essay 'Color within an Internalist Framework: The Role of Color in the Structure of the Perceptual System':

> The concept of 'color per se' as an abstract attribute that can be dealt with in a decontextualized way has been developed, in the technological context of coloration techniques and dyeing processes, as the basis for standardizations and norms for capturing color appearances. The idea of 'color per se' is, thus, the product of technology-shaped cultural abstractions, including its corollary ideas that color can be characterized by basic colour attributes, such as hue, saturation, and brightness, and that color appearances can be represented by three-dimensional color space. Mausfeld (2010, p.123)

As Mausfeld argues, in capturing the complexities of colour expression through language, technologically driven abstractions have shaped our individual colour conceptions.

It could be argued that our visual experiences cannot be separated from the holistic aspect of all the elements that have to synchronise and work in tandem with each other, before we can

'see' anything, let alone understand what we are 'seeing'. In *The Perception of the Visual World*, Gibson (1950) is mainly concerned with objects and the problem of perception as opposed to sensation. He would argue that, the traditional explanation of the difference between perception and sensation is that 'perceiving things depends on first having sensations. Sensations are supposed to be the raw material of human experience and perceptions the manufactured product. Only when sensations are combined in perception do they make us experience' (Gibson, 1950, p.11). In summary, he goes on to say:

> If everything that we are aware of comes through stimulation of our sense organs, and if some things nevertheless have no counterparts in stimulation, it is necessary to assume that the latter are in some way synthesized. How this synthesis occurs is the problem of perception. (Gibson, 1950, p.24)

In their book *Colour Ordered*, Kuehni and Schwartz (2008) explain that an important function of the human visual system is to be able to sift through the mountain of information we receive continuously and find the information that we need to survive. They set out the context for their book in Chapter 1, by giving a short introduction to vision and colour vision that clearly and precisely lays the foundation for the remaining chapters. As they explain:

> Knowing what information to extract has been learned adaptively over millions of years … All but the final interpretation of this processing is done subconsciously. (Kuehni and Schwartz, 2008, p.4)

According to psychologists Goodale and Milner (2004), visual information is passed separately to two different areas in the human brain, creating two ways of seeing: 'vision for action' and 'vision for perception'. As they point out: 'one way to get a handle on how vision works is to study what happens when it goes wrong – not just when it goes wrong in the eye but when it goes wrong in the brain' (p.xi). In their book *Sight Unseen: An exploration of conscious and unconscious vision*, they have observed how 'vision for action' is dealt with by our subconscious, and involves reaction rather than contemplation, while 'vision for perception' enables us to contemplate and compare, facilitating both recognition and planning involving an awareness of form and colour.

> The visual system that gives us our conscious experience of the world is not the visual system that guides our movements in the world. (Goodale and Milner, 2004, p.xii)

As discussed above, this study of grapheme colour synaesthetes' colours and their reconstruction, has led me to consider in more depth what colour is, and how it works. Joseph Albers remarks in his *Interaction of Color* (1963, p.1):

> In visual perception a color is almost never seen as it really is – as it physically is. This fact makes color the most relative medium in art.

Because of the complexity of the visual system and colour vision in particular, Albers' statement, which derives from years of experimentation and observation through his dual experience and practice as a teacher and artist, has become pivotal to the way I have approached this study of colour and grapheme synaesthesia. An awareness of the variants of light and atmosphere on material surfaces has to be of major importance when considering colour equivalence and colour matching, especially when it is known that when attempting to establish a commonly agreed definition of, for example, a unique hue. Tests for identifying the precise unique red, green, blue and yellow have illustrated the variance within individuals' perceptions and illustrate that we all perceive individual colours differently (Kuehni, 2001, 2003, 2004). As Albers points out:

> If one says 'Red' (the name of a color)
> And there are 50 people listening,
> It can be expected that there will be 50 reds in their minds.
> And one can be sure that all these reds will be very different.
> (Albers, 1963, p.3)

5. 1 Colour Vision

> The visual system works like a computer system in which the eye is the input unit and the brain is the arithmetic unit. Color sensation is the output product.
> (Kueppers, 1982, p.26)

The human eye is a sense organ that allows light to enter it through the pupil or lens where light is transmitted to the retina situated inside the back of the eye. The retina is a layer of light-sensitive tissue that covers over half of the interior surface of the eye; there is ‘a small dip in the retina which defines the visual axis of the eye and which is used for seeing fine detail’ (Verity, 1980, Ch. 6, pp.81–95). Protein compounds form opsins with varying spectral sensitivity that for humans result in sets of rods and cones (Kuehni and Schwarz, 2008). The rods and cones within the retina are light-sensitive cells that connect to the optic nerve and transmit sense messages to the brain.

There are three types of cone cells in the retina that are responsible for detail and colour vision. These are identified as short wavelengths (S: 400–500nm), medium wavelengths (M: 450–630nm), and long wavelengths (L: 500–700nm). The following colours are perceived between electromagnetic wavelength intervals of ‘visible light’: Red, 635–700nm; Yellow, 560–590nm, and Blue, 450–490nm, although human cone cell responses are known to vary between individuals with normal colour vision resulting in what is referred to as polymorphic variation. Under low light conditions the rods in the eye dominate, attending to our peripheral vision, where colours become muted and detail is less clear; rods deal with wavelengths in the region of 500nm (Kuehni and Schwartz, 2008, pp.2–3; Burnham, Hanes and Bartleson, 1967, pp.56–8).

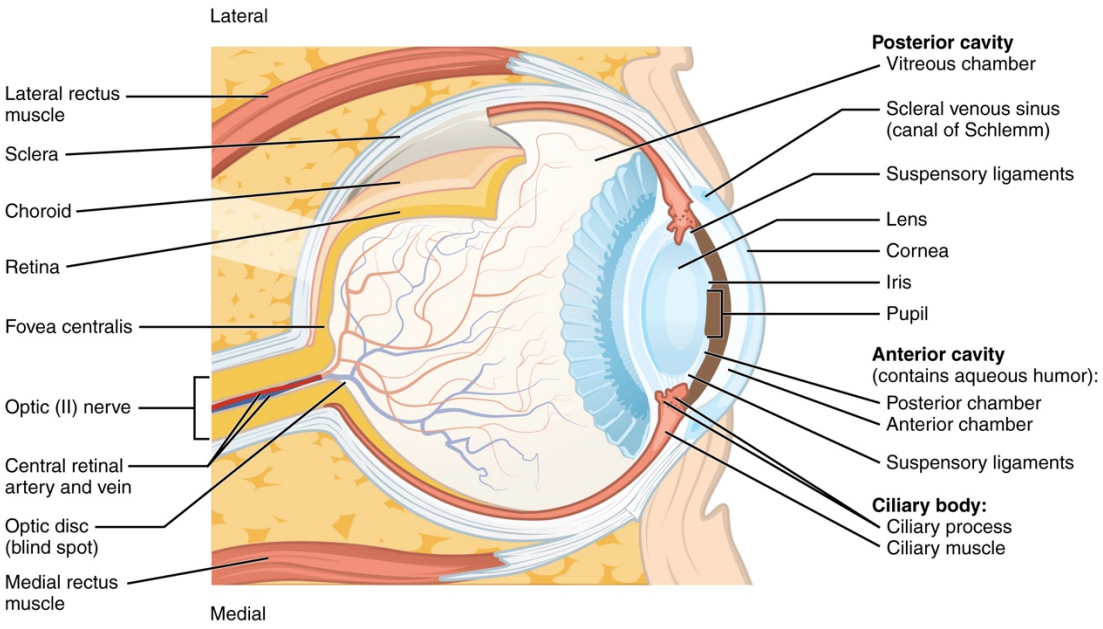

Figure 27: Structure of the eye Anatomy and Physiology OpenStax (2013)

The visual spectrum is part of the electromagnetic radiation of visible light that forms part of electromagnetic energy. This energy can be expressed in terms of wavelengths.

> Light is a form of energy radiated as a transverse harmonic vibration in the form of an extremely large number of elementary units of energy known as quanta. The vibrations are electromagnetic disturbances of these units. (Verity, 1980, p. 37)

Cumming and Porter (1990) describe what happens to the eye when it focuses on coloured surfaces or objects and explain what happens when the eye is subject to varying wavelengths:

> Yellow light naturally focuses directly on the retina, and is the colour which we perceive most acutely. Red naturally focuses at a point behind the retina, so the lens of the eye has to grow convex to focus the red on the retina and in so doing gives the sensation of pulling the colour nearer. Blue naturally focuses at a point in front of the retina, so that the lens grows concave to focus it, and gives the sensation of pushing the colour back, so blue seems to recede in comparison with other colours. (Cumming and Porter, 1990, p.37)

The effect of changing light qualities affects the way we perceive colour. 'Depending upon the spectral composition of the light, there is also a change in the spectral composition of the color stimulus that reaches the eye as information' (Kueppers, 1982, p.16). In 1825 Purkinje published his findings on the changing appearances of colours as the light changed and this came to be known as the Purkinje shift, or Purkinje phenomenon (Burnham, Hanes and Bartleson, 1967, p.60 [3.1.2c.4]). As the 'spectral composition' of all colour stimulus depends on the spectral composition of the illumination, it follows that as the quality of the light source shifts and alters, so will the quality or nature of the colour sensation being experienced. Light rays 'are merely transmitters of information' (Kueppers, 1982, p.25). With this observation in mind, and my experience as a colour matcher, I was careful with this study to reconstruct the participants' colours only under daylight conditions in the spring and summer months.

Colour vision has an added significance for grapheme colour synaesthetes, as they appear to have the potential to experience colour in two different ways: first, as a person with 'normal

vision' does, that is to say, with all three colour receptors unimpaired, and second, as a grapheme synaesthete, which means experiencing colour without the need of any sense data from object colour or surface colour. The colour trigger for a grapheme synaesthete is text. As mentioned earlier, in the case of grapheme letter colour synaesthetes, 'achromatic forms such as letters, words and numbers elicit vivid experiences of colour' (Rich et al., 2006, p. 2919), and only they experience the colours triggered. In other words, the colours they experience are unique to them and invisible to others; to all intents and purposes, therefore, they do not exist except as a colour response interpreted within their unique brains as a subjective mind-dependent psychological phenomenon. Though these personal colour experiences are activated in the ventral occipital cortex (V4) area of the brain where object colour and surface colour are experienced, they might be less susceptible to the influences of environmental changes or shifts that those with normal colour vision alone are, and this possibility forms part of this study.

Rich et al. (2006) wrote a paper that examined the neural correlates of colour imagery by asking participants to imagine colours of familiar objects and the involuntary colour experiences associated with grapheme colour synaesthesia. By means of various tests employing the use of functional magnetic resonance imaging scans (fMRI), to establish more accurately which parts of the brain were engaged when their participants were tested. As they point out, they were testing two distinct types of internally generated colour experience:

> In both synaesthetes and non-synaesthetes, voluntary colour imagery activated the colour-selective area, V4, in the right hemisphere. In contrast, the synaesthetic colour task resulted in unique activity for synaesthetes in the left medial lingual gyrus, an area previously implicated in tasks involving colour knowledge. Our data suggest that internally generated colour experiences recruit brain regions specialised for colour perception, with striking differences between voluntary colour imagery and synaesthetically induced colours (Rich, A. N. et al., 2006, p. 2918).

The voluntary imagery tests activated the right of V4 in both synaesthetes and controls; however, when 'coloured letters were presented, V4 activity was evident for both groups, though on the left in the synaesthtetes and on the right in the controls'. It is still not known what the exact role of the lingual gyrus is for synaesthetes. 'It seems probable that

synaesthesia involves retrieval of colour knowledge and semantic information related to colour' (Rich et al., 2006, p.2924).

Newell (2013) discusses the nature of grapheme synaesthetes' colours and says that:

> Although the colors induced by graphemes were thought to be idiosyncratic and peculiar to each individual synaesthete, recent studies have suggested that this may not be the case as certain patterns linking the form of the grapheme to a particular color have emerged across synaesthetes. For example, some recent studies have observed remarkable inter-synaesthete agreements on the nature of the colour induced by particular letters, such that A tends to be red, B tends to be blue, C tends to be yellow, and I and 1 and O and 0 are often black or white (see e.g., Barnett et al., 2008; Rich, Bradshaw and Mattingly, 2005; Simner et al., 2005). Brang et al. (2011) reports that graphemes which are more visually similar to each other are more likely to trigger similar colors. (Newell, 2013, p.186)

These findings were only partially mirrored by my participants' experiences. Two out of the five claimed that A was red, two said A was yellow and one said A was grey. Three out of five agreed that B was blue, one said it was brown and the fifth said it was green. Two said that C was orange, two found that C was yellow and another said it was green. In addition, I found that although they might agree that a particular letter had the same colour label, the actual shade of that colour would vary and therefore remain unique to them. I discuss my participants' colours in more depth in Chapter 6: Research Findings, and in the Appendices.

5.2 Colour Perception

In the previous section on colour vision I referred to imagined colour in relation to tests setting out to establish which parts of the brain are engaged for different tasks involving colour perception that does not require the external stimulus of object colour or surface colour.

Most of us are able to imagine colours in our heads from memory without needing the prompt of actually 'seeing'. As explained above, colour can occur when colours are

perceived without the aid of a direct stimulus such as ‘object colour’ or ‘surface colour’. The idea of imagined colour might appear straightforward to begin with, in that all or most of us are able to imagine colours in our heads from memory without needing the prompt of actually ‘seeing’ the material colour. For example, lemon yellow, pillarbox red, or lime green. But again, our imagined colours will be different from our neighbour’s imagined colours, as Albers (1963) noted.

The experience of after-image is another way of experiencing colour that has been constructed by our brains. It requires concentration and the effect does not last long, but it may be the closest a non-synaesthete like myself might come to being able to imagine what the sensation of synaesthesia feels like.

The after-image is an interesting phenomenon that appears as an automatic response from the brain after the viewer has been focusing on a colour for a significant period of time; these are temporary colour experiences that occur as a result of focusing on an area of colour for long enough to tire the eyes causing an adaptation of the retina within the visual system. Verity (1980) explains:

> A prolonged, steady gaze at an appropriately illumined coloured area produces a state of local adaptation on the retina. When the gaze is transferred to a uniform white area, the previous pattern is seen, but in its complementary colour. This occurs because the receptors previously most stimulated have lost their sensitivity. As the receptors regain their sensitivity, so the colours in the after-image change. (Verity, 1980, p.91)

After-images are not colours that exist physically as material colour exists for the viewer, but if one stared at an area of orange for example one could expect to see an afterimage of blue. As I mentioned earlier this colour sensation is probably the closest those of us who are not grapheme colour synaesthetes might come to understanding the intense colour experience that a grapheme colour synaesthete witnesses.

The artist James Tyrrell exhibited a series of light works that explored colour and light at the Gagosian Gallery, London (2010), one of the exhibits being a white cube that could only be entered via steps from the front of the cube structure. On entering the cube one became aware

that the floor gently sloped downwards towards the opposite wall where coloured light was projected on a loop system that was projected through a discreet slit in the floor. The colour rotation was timed to ensure that the observer had sufficient time to absorb the colour experience before it shifted to another shade. The instructions were to stare at the facing wall of coloured light for a while and then turn 180 degrees to face the entrance and look outside the cube, at the white wall that was framed by the square entrance you had just walked in through. The effect was dramatic and powerful on a large scale, as one would experience a bright yellow-green after staring at a magenta wall, or a Klein blue after staring at an orange wall. This sensation is a psycho-physiological process called simultaneous contrast and was known to Goethe, who devised experiments with simultaneous contrast relating to complementary colours such as red/green etc. As Holtzschue (2011, p.137) remarked, 'Goethe's observations were so wide ranging and fundamental that almost every concept in modern color study can be found in his writing.'

The reason for this induced sensation is thought to be a reaction to the eye becoming tired of the colour it has been focusing on; so, to relieve the brain, its opposite colour is produced, its complementary hue, as a reaction to this colour fatigue. This is called simultaneous contrast where sensations are constructed by the individual's brain. These colour sensations do not last as once the eye has recovered the sensation reverts back to white, whereas our experience with material colour lasts as long as the eye rests upon the material being viewed.

Colour perception is the processing and ordering of a sequence of stimuli that are transformed into information that enables us to understand what we have experienced. The actual mechanisms that are called into play for this to occur are described below, and each individual will bring their own unique and personal experience to this process of interpretation. Spinelli (2005) explains: 'the "hard data" we receive through our senses, and the "meaning" we construct from them, make plain … the inferential elements in perception' (p.40). Our brains receive sensory information via electrical impulses that travel through our nerve fibres at high speed, moving from sensory input to physical stimulus to perceptual analysis and interpretation. As most perceptions are experienced unconsciously and at high speed the impression is that they are experienced at the same time as sensation (Rodemann, 1999, p.155). Spinelli (2005, p.40) articulates the differences between sensations and perceptions, saying that the 'function of sensation is to react to stimuli' whereas the function of perception is 'to impose logic and order' amongst 'the chaos of thousands of sensations

that bombard our senses'. In other words, perception enables us to make sense of stimuli via sensation.

Keuppers (1982) describes colour as a sensory perception, rather than a material property. According to Holtzchue (2010, p.50), colour is not solely a sense experience but a fusion of sensation and perception and although sensation can be measured, perception cannot, making colour even more complex to consider as a phenomenon.

As I mentioned earlier, Albers (1963) remarked that if there were fifty people in a room and all of them were asked to identify a specific red, each person would offer a different version of that red. My aim to reconstruct the personal letter colours of my participants was therefore a delicate and complex process of unpicking what the participant meant when they described their colours, being careful not to impose my perceptions onto theirs. What for example is meant by a 'tall dark colour'? Sometimes the struggle to communicate the right words that fitted their particular colour sensation seemed immense, and time was essential to enable this process to be completed. Were words alone sufficient? The important thing was not to lead with suggestion, but listen and absorb the ensuing struggle to convey something that could not be pointed to or visually shared first hand.

With this in mind the collaboration with my participants was even more miraculous than I had already suspected or expected it to be. As, Rich et al. (2006, p.2919) point out: 'Crucially, synaesthetic colours arise as an internally generated colour experience without voluntary effort, and are difficult to fully suppress even when there is the desire to do so.' During this study, I came across this phenomenon at close hand, as this almost continuous colour experience on occasions caused a sensation of overload for Participant 1, and fatigue in all five participants (see Chapter 2: Synaesthesia).

Normally speaking, perception facilitates us in sifting through the myriad of information that is constantly around us in the outside world and selects what we need to process these sensations, enabling us to detect colours, and sounds etc., so that 'The amount of light reflected by an object will determine its colour (as perceived by us)' (Spinelli, 2005, p.40). Therefore, as Kueppers (1982, p.24) points out, colour only exists as a sensory perception of the observer.

> The occurrence of a sensation is immediately followed by *perception*. Perception is the critical connection between human beings and their environment. … Perception *decides* what has been sensed. It *recognizes* and *identifies* the sensation. (Holtzchue, 2010, p.49)

5.3 Nomenclature of Colour

Although this section is not solely about defining colour terms, it is evidently crucial for this study that a demonstration of an awareness of them is made. A careful and considered use of language has been essential and has added a richness to the work that, although I had anticipated it as an important ingredient of this study, I had not fully appreciated until now how essential it would become until I began working so closely with my participants. The language we use to describe our various colour experiences now takes on an increased importance and significance. Establishing whether it was possible to understand their colour experiences or sensations sufficiently via the personal descriptions of their colour photisms, in order to attempt their reconstruction, formed the first stage of this work. Through a combination of detailed conversations and the analogue colour chips as physical examples, from volumes 1 and 2 of the Munsell Color Book, language, one of the two main forms of communication for this study, has taken on new levels of significance. This is where the nomenclature of colour becomes pivotal to the study in terms of sharing experiences, alongside a capacity for understanding what is meant by a particular colour term, or a set of words associated with a colour.

As human beings, we manage to communicate what we mean by a particular colour through language and example, and this is how we are taught to recognise and name colours from childhood in association with an object or a surface. This enables us to communicate with the world outside ourselves and interact with others. Rumelhart and McClelland (1986, p.134) found that there was a close link between ‘the possession of color words and the output of general learning mechanisms’. Rice (1980) and Smith (1984) found that children who were less familiar with colour terms displayed difficulty in sorting by colour (cited in Hardin and Maffi, Color Categories and Thought, 1997, p.129). Research indicates therefore that colour identification goes hand in glove with our ability to discern colour.

We might say for example that, broadly speaking, a buttercup is yellow, a strawberry is red. Most of us learn enough about colour recognition, to be able to identify whether a fruit is ripe, unripe or overripe, according to its colour. There are of course other sense considerations apart from colour to consider, such as smell, feel and texture, but colour would be a primary sense for this initial recognition.

In, *The Semantics of Colour*, Biggam offers a clear and concise definition of the differences between colour terms, categories and concepts. This precision has been beneficial for this study acting as a helpful guide in ways of communicating and recording information:

> Categories are concepts in the mind, belonging to the cognitive domain, whereas terms are words and expressions, as represented in speech and texts, which belong to the linguistic domain. (Biggam, 2012, p.20)

Biggam goes on to explain that colour terms are labels that enable ideas to be shared among people who speak or understand the same language. The concept and the name can occur as one, where a single word can refer to the name and the concept, but this is not always the case:

> It is a convention (although not an invariable one) in linguistics to separate them visually in print, when required, by means of SMALL CAPITALS (concepts) and *italics* (words). For example, I may say 'In English, RED is denoted by *red*, but in Spanish, RED is denoted by *rojo*'. (Biggam, 2012, p.20)

Biggam gives an excellent example of how easy it can be to confuse a concept with a word:

> For example, a person may read a Middle English (ME) text which includes the word *red*. The reader may assume this word is identical with [Modern English] ModE *red* but this could lead to a misunderstanding of the text because the same *form* of a word (in this case, the spelling) does not necessarily indicate the same *meaning*. (Biggam, 2012, p.58)

As Biggam points out, meanings can be confusing even amongst users of the same language if sufficient care is not taken, as language is constantly evolving and can take on unexpected nuances:

> All this can happen while the word labelling the concept retains the same form. Thus our reader of Middle English may be surprised to find that the object described as *red* was actually purple or pink because Middle English did not have basic categories for these hues, so they were included in the Middle English red category. (Biggam, 2012, p.58)

This is not a study of historical linguistics. It has, however, been helpful to be reminded of the importance of not assuming that one understands what a participant is saying before checking and double-checking that the participant really does mean a particular colour from the descriptive language they have employed (see Chapter 3: Methodology). An example of the importance of this became apparent while I was conducting a study of eighteenth-century dyestuffs and dyeing processes. This took me to the Trowbridge archive, where there was an excellent collection of dye receipt books from that period. Amongst the names I came across were various names for what we would classify broadly speaking as GREY in the English language: *Light Ash*, *Light Bloomy Ash*, *Gras'd Ash* and *Pearly Ash*. These four evocative examples of colour names immediately caused me to think of the different wood ashes that might have been found in the fire grate of any eighteenth-century household. I imagined different timbers producing different greys and how a collection of subtle greys could have been observed and recorded. I subsequently discovered, however, that what I had assumed to be descriptions of eighteenth-century wood ash residues were more likely to have been referring to 'specialized terms restricted to hair and facial colouring' (Casson, 1997, p.228 and Biggam, 1993, pp.41–53).

In the fourteenth century, for example, the ash colour would have been classified as one of the secondary colour terms, the first of which was incorporated into the English language between 1350 and 1500. Apparently:

> twelve terms developed hue senses at this time, of which nine were names of dyestuffs, pigments and textiles (and earlier entities from which they derived): *gold*, *silver*, *violet*, *azure*, *crimson*, *russet*, *ochre*, *scarlet*, and *vermillion*. The

> three terms with non-colorant entity senses – *auburn*, *blond*, and *ash* – were specialized terms restricted to hair and facial coloring'. (Casson, 1997, p.233)

Biggam's advice to consider the concept and the colour term separately until they are understood, is sound advice, especially with regard to this project. While exploring different colour order systems and how language terms evolve and shift to describe colour, I found *Werner's Nomenclature of Colours* (1821). This publication was intended to be a useful guide for 'The Arts and Sciences – particularly Zoology, Botany, Chemistry, Minerology, and Morbid Anatomy. Annexed to which are examples selected from well-known objects in the Animal, Vegetable and Mineral Kingdoms.' The book shows hand-painted squares of colour followed by examples of animals, vegetables and minerals, that Werner considered contained the colour within them. This enabled colour comparisons to be made first hand. There are, for example, sixteen entries for GREEN Nos: 46–61. No. 46: *Celandine Green* has *Phaloena Margaritaria* for animal, *Back of Tussilage Leaves* for vegetable and *Beryl* for mineral. Whereas example No. 51, described as a: *Bluish Green*, has *Egg of Thrush*, *Under Disk of Wild Rose Leaves* and *Beryl*. The full list of colours for the category of GREEN are: *Mountain Green*, *Leek Green*, *Blackish Green*, *Verdigris Green*, *Bluish Green*, *Apple Green*, *Emerald Green*, *Grass Green*, *Duck Green*, *Olive Green*, *Oil Green* and *Siskin Green*. Keeping the green theme, the Victoria and Albert Museum have produced a Museum Colour Guide that has colour names attributed to various historical periods associated with their permanent collection. For example, *Goose Turd Green*, from the eighteenth century, was particularly evocative, as not far from my home in London there is one of the last stretches of a drover's road which led from Norfolk to Smithfield market where geese would be walked from their place of production to be sold and this colour would have been very familiar along the drover's way.

In his book on eighteenth-century dyeing methods William Partridge mentions four BLACKS, two BLUES and one RED and gives the recipes for how to achieve them. The colour names are given as *Black*, *Blue Black*, *Yellow Black*, *rich Reddish Brown Black*, *Jet Black*; for BLUE: *Sapphire Blue*, *Mazarine Blue*, and for RED: *Flannel Red*. It is clear in this text that the colour names are practical descriptive ones that a dyer would find helpful to identify from a hands-on working perspective, and it is this approach that I have taken towards the colour descriptions I have been given by my participants. I was mindful to avoid leading questions or word suggestions when it came to colour naming, preferring to record the conversations

verbatim and digest the information given before further questioning could take place. Participant 5, for example, described 'F' as 'Really hard to describe, it's a pale metallic fake, Platinum/Gold. A tall colour, long slender, tall colour.' It was only the assistance of the Munsell Color Book references that made it possible to attempt to unpick what all this data might mean.

As a continuation of my investigation of the naming and categorisation of colours, I found a two-volume box set of colour patches that the British Colour Council issued in conjunction with the Royal Horticultural Society in 1938 on horticultural colour charts of plant colours. There are of course paint charts and fashion forecast colour charts and architectural colour charts that are interesting to compare for colour naming and categorisation purposes, and in light of this I have prepared an Alphabet book for each participant with their personal nomenclature alongside the Munsell colour references and the reconstructed dyed swatches. This way the individual colour names can be viewed for comparison, reflection and analysis (see Chapter 3 Methodology and Process Figures: 9-13). This leads on to colour classifications and categories, which underpins to a great extent how I have chosen to implement the colours that have been reconstructed for this project in my own work.

Figure 28 'S', 'T', 'U' from Exhibition of work, 2019

5.4 Colour Classifications/Categorisations

> **Classification** – the act or system of arranging in classes.
> **Category** – What may be affirmed of a class; a class or order of things, people etc possessing similar characteristics.
> **Categorise** – to place in a category or list; to class.
>
> *The Chambers Dictionary*: New Ninth Edition, 2003

The work I produced from the participants' alphabet colours was initially put in an order of classification following the chronology of the English alphabet A–Z and the order of participants, Participant 1, 2, 3, 4 and 5 (see Figure 1: Alphabet Colours: A-Z: 1-5). The intention behind this work was to set the context for the remaining works that were subsequently arranged in order of colour categories, i.e., yellow, orange, red, etc. These colour categories were taken from the colours found in the five alphabets. As I explain further on in this chapter, the aim of clustering the colours together was to see if it was possible for the individual participants to identify their personal alphabet colours once they had been regrouped with the other participants' alphabet colours.

The categorisation of a colour places a colour into a class or division of colour types such as yellow, orange, red, for example. Colour notation and the problems of colour categorisation have occupied artists and scientists for centuries. John Gage, amongst other scholars of colour, has identified contributors to this field, citing individuals as far back as Aristotle, Leonardo da Vinci and Galileo. Closer to contemporary times, Ewald Hering, Wilhem Ostwald, Albert Munsell and the Optical Society of America (OSA) worked on numerous colour systems, devising systems for ordering colours into three-dimensional models that placed colours in evenly spaced geometrical order for universal identification and reference purposes. Every system devised seems to be appropriate for some applications and not for others. (The literature on this topic lies beyond the scope of this study.)

> Although it is an intricate task to determine just how many colors there are, even for a 'normal observer,' we can at the very least state that there are many …The color terms and their corresponding color categories which have emerged through history may, of course, also be seen as color reference systems, and it is a color

> system of this kind that average people use in all cultures in their everyday speech. (Sivik, 1997, p.163)

Linguistically speaking, colour tends to be classified or defined under the terms of hue, the actual colour we are referring to (such as red, for example), saturation, the purity of a colour and tone, the value of the colour, its darkness or lightness. The Munsell Color Book follows the traditional colour order system of visually perceptible progressions of hue, value and saturation.

As already mentioned, hue refers to the actual colour; these may be the spectral hues of refracted light – additive colour – or the basic hues of pigments or dyes – subtractive colour. This study deals with subtractive colour, the mixing of dyes to reconstruct sets of colours described and articulated by the participants. To explore the colours as sets of identified classes, e.g. yellow, orange, red, I have adopted for this study the colour chart format, producing a series of woven panels in order to ensure a simple, direct approach to the ensuing work. In a way, the straightforwardness of the paint chart layout or format enables the viewer to see the colours set out without any sentimental attachments or insinuations, making a much clearer, less cluttered statement of events. The colours can therefore be seen for what they are: a collection of personal precepts, but direct reconstructed matter-of-fact precepts. Before settling on this format, I had been thinking about how to approach working with the participant's colours and had undertaken a series of small-scale card windings that explored partitive mixing. This is where the individual colours are mixed through their juxtaposition, as opposed to physically, as seen in the catalogue of Sol Lewitt drawings, Singer (1993, pp. 120-131). In place of a drawn line of colour I used a single end of yellow yarn next to a single end of blue yarn for a few centimetres, so that at a distance the two colours would visually merge into green.

Although I had been aware of many artists who had used the paint chart as a structure for their work, it was the exhibition and book, *Color Chart: Reinventing Color, 1950 to Today* curated and written by Ann Temkin, that convinced me that this was the way to go. Although my paint charts are in no way a standardisation of my participants' colours – as Temkin refers to them, 'The color chart as the foundation of standardization' (Temkin, 2008, p.18) – they are an interpretation of them and it is my intention to use this format to keep the colours clearly separated, identifiable and clean. As the colours of each participant are personal and

imbued with their individual experiences, memories and sensibilities it is not respectful or appropriate for me, the artist, to confuse matters by interposing my personality and preferences onto their colours. As such the business-like matter-of-factness that a paint chart conveys is the perfect visual vehicle for this work, enabling the individual enquiries of this research to occur without confusion.

> It is important to distinguish between systems for the arrangement of colors that are based on the physical attributes of stimuli and those systems we can call *phenomenological* or purely psychometric, i.e., systems which are based solely on color sensations and their interrelations. It is the latter that conceptually ought to be of greater relevance than the others in research on human cognitive categorization of color sensations, which is a psychological aspect of the truly multidisciplinary role of color research. (Sivik, 1997, p.164)

The intention of this study was to use the colour chart system to explore 'colour sensations and their interrelations' as Sivik describes above.

5.5 Colour Matching

This study is not concerned with the measurement of colour with regard to colorimetry – the measurement of light – as the work undertaken here deals with the measurement of pigment rather than light and has a more subjective starting point. Obviously, mathematics has been brought into play here with percentages and ratios, but these have been workshop-based calculations applied practically to the reconstruction of the colours. The difference of shade may have been shifted through the addition of a few carefully measured drops of dissolved dye solution, and although these stages have been recorded, the manual nature of the process removes it from the multidimensional scaling that defines the space of colours with measured distances between each shade, the Traditional Colour Space (TCS) of the more clinical geometrical ordering of colour. My measurements have been specific to the individual participants and subjective, and therefore do not fit within the clinical precision of any particular colour science model. However, as Kuehni and Schwarz (2008, p.5) point out, 'It is a fact that natural objects, when viewed in natural conditions, generally maintain their color appearance reasonably well regardless of the spectral power distribution of daylight

(excluding colourful sunrises and sunsets)'. I have endeavoured to maintain these viewing specifications throughout this study in order to maintain a level of constancy.

The terms often used for material colour, that is the colour of things, are 'object colour' or 'surface colour'. As Kueppers (1982) explains, different materials can be identified by their colour appearance according to their different absorption of particular wavelengths within the visual spectrum: 'Object color … materializes due to the individual absorption capacity of the particular material.' He goes on to say that:

> … information … is transmitted to the observer through the nonabsorbed portion of the light that reaches the eye as a 'color stimulus.' This nonabsorbed portion is reflected (remitted) in the case of opaque materials and is allowed to pass through (transmitted) in the case of transparent materials. Hence, the hue perceived is the remnant of the light that strikes the eye – in other words, the 'residual light'. (Kueppers, 1982, p.16)

In my practice as a dyer and within the remit of this study, it has not been appropriate to investigate to any great extent how colour is perceived; my concerns with colour have been taken from a practitioner's perspective. I measured dyes in variable quantities to produce the colours I wished to match, and the physical engagement of this process has been notated so that I am able to track the stages required to build the individual colour I was aiming to reconstruct. This is a very different set of measurements with very different outcomes from those of colour science. I have not collected large amounts of data to create statistics that can prove a particular point of view. The data I have collected is more qualitative, and relies on smaller, but manageable amounts of information. I have used this information to create work that explores the consequences of certain choices of colour classification and clustering with regard to the participants whose colours I have been reconstructing and utilising to produce my art work. I am concerned with the grapheme colour synaesthete's experience of colour and the potential of that experience through its reconstruction within a fine art textiles practice. In particular, whether their synaesthetic colours are subject to alterations of perception when rearranged out of context or placed with other shades of the same category, such as greens and reds, for example. I am also interested in the participants' use of verbal language to describe their colour photisms, which has led me to reflect on language and how it has the capacity to inspire and enhance a colour experience. This is a study in which each

participant's experience is critical and central. The collaborative nature of the work has been integral to the practice.

For this study and the purposes of matching a colour, it has been useful to be able to discern the subtle differences between one shade of a colour with another and by applying this information I have been able to manipulate dyes to recreate a facsimile of the colour I am hoping to replicate. My understanding of colour is from my practical hands-on experience of matching colours with dyes, knowledge that, as mentioned previously, has been built up gradually over a period of many years. Although I am not a dye-chemist, through practice and experimentation I can usually predict that if I combine certain dyes together I will be able to reconstruct the colour I am aiming for.

Holtzchue (2011, p.148) points out that 'Albers stressed the instability and relativity of perceived colors and the power of visual training.' What has struck me with the synaesthetes I have been working with is the stability of their colours with regard to their personal colour experiences and the work I have done to some extent sets out to test this perceived constancy. The participants have in effect trained themselves in an awareness of or sensitivity to colour through living with their involuntary colour photisms all their lives. This seems to have embedded in them an acuity with colour that appears to be exceptional, at least unusual in relation to humans with normal colour vision. I say this from my experience with working with students in art and design, who employ colour in all their design activities. I have found that few of them initially demonstrate what I would detect as a second nature confidence with colour and this is where I would agree with Albers that colour is a language that has to be learnt.

> Dyes are subtractive colours and as such absorb all the light wavelengths in the visible spectrum except for those of the colour sensation they are reflecting. Subtractive colours or pigment colours are less bright than the additive colours emitted by light because they absorb light. (Cumming and Porter, 1990, pp.34–5)

Although the statement above is undoubtedly true I have found that the translucency of dyes provides a more luminous result than some paint pigments allow as paint requires a binder to keep the pigment in solution, and this tends to some degree to create a barrier to luminosity.

During the colour matching process, I begin by studying the colour to be matched closely in daylight conditions. I assess its constituent elements and proceed to work out the percentages of each element that will build up the replication of the colour sensation in front of me. Although it is possible to articulate what happens with colour physiologically as the following text demonstrates, it is what makes the individual's colour experience unique that is for me as an artist what has driven this particular study. I have therefore focused on the physical material ramifications of specific colour reconstructions, which I will show in the work produced from them.

A description of the numerous parts of the brain that are automatically engaged before a colour can be registered as an entity, has been included below in order to demonstrate that human colour vision requires a complex series of interactions and cross referencing before a colour perception can occur fully. Until now I have separated the functions or elements that are required to interact and function fully for us to 'see' colour. The following text links these functions.

> There are three cerebral stages involved in normal colour perception … The first stage is concerned with gauging the wavelength composition of every point, a function of V1. The second stage consists of ratio-taking and thus constructing the colour, as well as making the brain independent of the continual changes in wavelength composition; this process is undertaken by the V4 complex and is independent of the actual nature of the object or surface. The final stage consists of investing objects with colour and monitoring that the colour is right; this is a function of several areas, including the inferior temporal cortex, the hippocampus and the frontal cortex. (Zeki, 1999, p.203)

In the above quote, Semir Zeki describes which parts of the brain are engaged during the process of colour vision, (see 2.3 The Brain). What happens in the eye before the signals are passed to the brain are equally miraculous. Verity (1980) explains as follows:

> The physiological process by which the eye can distinguish one wavelength in the spectrum from another by its colour, or distinguish one coloured surface from another, operates through retinal light receptors which give a characteristic response for each distinct colour. This does not mean that, for

> each of the many hundreds of thousands – even millions – of colours that can be distinguished, there is a particular type of receptor ... though there are more than a 100 million receptors in the retina. What it does mean is that a different pattern of nerve signals is generated by the colour receptors for each colour the eye can discriminate. (Verity, 1980, pp.84–85)

What happens next is as complex when we decide to enter into a discussion about the colour/colours experienced. Language, though vital as a starting point for communication, plays only a part in this process of identification. For this study, I have employed other tools such as physical examples of existing colours that may be similar and therefore an aid to narrow down and focus upon a particular sensation or photism. Finally, there are the reconstructions that enable a match to be achieved and these again require careful adjustments according to the instructions of the participant.

5.6 Conclusion

This chapter has covered some of the complexities with regard to the subject of colour, while focusing on the considerations that have been drawn upon within this research. An investigation has been provided of the significance of how we communicate our experiences of colour and has identified what happens in order to enable us to perceive colour, while reflecting on whether it is possible to share these experiences of colour to any reliable depth, rigour or understanding. The chapter has reflected upon aspects of what has been said about the physics and philosophy of colour, and discussed some of Joseph Albers' practical observations and experiments with colour, some of which have been utilised to test the participants' colour reactions for this PhD.

As I have pointed out, with regard to the participants' personal letter colours, however, in light of the fact that they have all remarked that their letter colours have been with them for as long as they could remember, and that these colours had remained constant over that time, I was interested to note whether their colour experiences or photisms had the capacity to over-ride the normal tendency that non-synaesthetic colours have to shift perceptibly under a variety of conditions. I was interested to see whether some of the established exercises that Albers devised that alter our perception of a colour could be applied to the grapheme

synaesthetes, namely colour juxtaposition and proximity. The work that was produced from the participants' colours was exhibited at Middlesex University and the responses of the participants to the work were recorded and are discussed in Chapter 6: Research Findings, and Chapter 7: Discussion and Conclusions at the end of this thesis.

Chapter 6: Research Findings and Discussion: Participants

6.0 Introduction

Chapter 6 explores the results of the aim of this project which was to test the possibilities of reproducing the colour photisms of a small group of five grapheme synaesthetes. This process required colour samples being sent back and forth to each participant, until the correct colour could be achieved and verified (see Dye Recipes Appendices 7-11). Because there is so much detailed information for each participant, I have decided to take each participant in the order in which I met them, and share their personal profiles as case studies. Initially I worked with two participants so that if the colour matching exercise proved a success, I could then move on to work with a larger cohort of participants. If, however, the colour matching process had proved to be unsuccessful, this would have been the time to end this particular line of enquiry. As the first cohort of two participants yielded interesting results, I was able to increase the number of participants to five in total. For practical reasons, taking into consideration the time the colour matching process had taken for the first two synaesthetes, this seemed the optimum number. The plan to start small and gradually expand the number of participants proved to be appropriate. The project was ambitious, as no one, to my knowledge, had attempted to colour match synaesthetes' letter colours using dyed yarn as their medium. It was impossible to know whether dyed yarn could adequately replicate their initial colour photisms because their colours were not initially experienced as 'material or object colour', but rather from coloured light – that is, a 'brain induced' experience, a concept that was impossible to imagine personally first hand.

Although the process was slow, the synaesthetes' comments were lucid, honest and extremely constructive. I had urged them not to settle for a colour that was not as it should be, according to their experiences. All the participants patiently received and returned my colour matching experiments enclosing each time a fresh critique on the newly adjusted colours sent to them. The slowness of the colour matching process enabled me to focus in depth on the individual nature of each colour, and by the time the colours had been matched correctly, I felt that I knew them as my own. Prior to analysing the findings from the research under the five Personal Profiles of the participants, there is an itemised review of the

rationale that underpins each of the stages of the methodological approach as fully detailed in Chapter 3: Methodology.

6.1 Methodological Rationale Review

6.1.1 Questionnaire

As already discussed in Chapter 3: Methodology, the majority of the participants I met were initially unknown to me; the questionnaire enabled me to obtain a broad understanding of the individuals I hoped to be working with (see Appendix 1: 'Questions to Synaesthetes'). There were 31 questions in total, some of which were similar to each other. However, I decided not to edit the questions asked, keeping to the original first draft as I found that the similarity elicited different responses which provided richer material to work with. Where I have included their responses in this chapter I refer to them as (Q1 etc.). Once I had gathered a broad overview of each participant, I was able to move on to more detailed questions regarding their specific letter-colour experiences. It is this information that was pivotal to the success of the colour matching process (see Appendices 2–6: Alphabet Colour Descriptions).

6.1.2 Colour matching

Matching the participants' colours was spread over a period of four years from 2011 to 2015. It was important to make sure that the colour matching process took place during the spring and summer months to eliminate too much variation in light quality which may have affected the colours being matched. This shortened the season for colour matching considerably and contributed to extending the duration of the colour matching process, while ensuring maximum consistency and stability. The project placed my matching skills to the forefront as the success of the project hinged entirely on my ability to capture the personal letter colours of the participants. A majority of the recipes were recorded at the time of colour matching and were transferred into a more legible format at a later date (see Dye Recipes Appendices 7-11). There are gaps in the records of the matching process which occurred during the colour matching stage. This happened when the work was in full flow and stopping every second to record what I was doing would have been counterproductive to the success of the colour matching process. When colours are being created, choices of what dyes to add and when to add them needs to happen quickly and seamlessly. The additions have to be measured carefully and added gradually at the right temperature, and sometimes stopping to

record each tiny adjustment can have a destructive impact on the success of the resulting shade being matched. As all the colours have been verified the evidence of each colour is intact and therefore can be re-matched from the original. I have decided to leave these recipe gaps blank, as their absence has no negative impact on the results of this study. It is evident in the notes submitted that the colour matching process could in some cases take up to six attempts before the colour was verified as an accurate rendition of the participant's letter colour experience. I have included a selection of examples of the colour matching process for the reader to be able to appreciate the detailed and complex nature of this endeavour, together with the decision-making processes involved in the lead-up to the final colour conclusion. These will be apparent in the individual profiles of the participants (see Dye Recipes Appendices 7–11). The individual descriptions of the participants' colours have been printed as box sets of printed pages which include the participant's initials, their colour descriptions, the Munsell colour references, and their customised letter colour. This work formed part of the exhibition held at Middlesex University (January/February 2019, see Figures 29-40, and Alphabet Colour Descriptions Appendices 2–6).

6.1.3 The Exhibition

The exhibition showcasing the practical results of this study was held at Middlesex University, Hendon, from February 4th-17th 2019. It marked the culmination of the practical work that had taken place. The work shown consisted of eight woven pieces and 130 printed pages with each of the five participants' 26 alphabet letter colours displayed alongside their letter colour descriptions and their Munsell colour references. These formed the five limited edition box sets referred to previously (see Figures 29-40).

The intention behind the exhibition was to provide all the participants with an opportunity to be able to contribute valuable feedback on the work produced from their letter colours, by giving their opinions on what they saw, commenting on the work exhibited, and most importantly, providing a commentary on their personal colours. All the participants were contacted prior to booking the exhibition space in order to find a time that would suit the majority of the participants. From this, I was able to establish that Participant 3 had relocated to the USA; however, the four remaining participants reported that they would be available and that they were looking forward to seeing the work and revisiting their colours.

In the event Participant 1 was unexpectedly summoned to attend a course as she was in the process of retraining to be a paramedic, and Participant 5 experienced a sudden family emergency and was unexpectedly called away. Therefore, though Participants 1 and 5 had initially expressed every intention of being able to attend the exhibition and proffered dates that would be convenient to them, their personal circumstances changed at the last minute, preventing them from being able to see the work. I have recorded the responses of the remaining two participants who were able to attend the exhibition and these responses have been recorded within their personal profiles below.

6.2 Personal Profiles of the Participants

6.2.1 Participant 1: HW

HW was a student of textiles at University College of the Arts, Farnham. She graduated in 2010 and set up her own weave studio. HW has dyslexia as well as synaesthesia. She reported that her mother was also a synaesthete, and that for as long as she could remember they had always discussed their colour experiences quite openly within the family. She has a brother who has not inherited synaesthesia. HW reported that all her colours were flat, but glowed and that none of them had textures, and stated that:

> All colours are seen in a black void. Kandinsky 'inner harmony is black'. Colours glow, are luminous, not harsh like neon. Numbers, days of the week and calendar of the year are seen in 3D black space.

I gave all the participants a small notebook at the end of our first meeting, so that they could jot down any additional thoughts about their synaesthesia that had not been covered in the questionnaire. HW was the only participant who recorded additional information. Most of this material is included below.

> Love for another is so real it's luminous, filled with Golden yellows and lemon creams.

> The word/name 'Sue' tastes like honey. It is a yellow in colour. The 'S' is a stronger yellow than the 'U' and the 'E' is an orangier yellow. 'E' as an

independent letter is a rustier orange so possibly the yellow of the ‘S’ is overshadowing this orange.

I find when I am more tired my synaesthesia is stronger. For example, number plates on the M25 after a long day at University.

When two unit numbers are seen, or thought about the colours are the same as if they were single units: e.g., 24 is a yellow 2, and red 4 the same as 2 and 4.

The ‘black void’ in which I see thoughts, letters, words and numbers is black due to the lack of light. It is not a flat surface it is space. Because of this special quality I can move, zoom in and around this 2nd sight. On its colour – it is black but it is very slightly grey. Just like … night rather than a crisp black surface. It is important to note the black is matt, there is no reflection from it as if space that goes into infinity away behind the letter or number line.

My number lines and calendar is also seen in this black space.

November is shades of nut browns. The ‘E’ at the end is particularly orange. October, is shades of greys like a pigeon, the ‘T’ is blue – a steely blue. I get a weak orange feel to the ‘E’ like in November.

Numberline (sic) pivots on 12 to the right for infinity but as I get closer to 100, my perspective changes from straight on to looking to the left.
12 13 14 15 16 17 18 19 20 21 …
11
10
9
8
7
6
5
4
3

2
1

The letter ‘H’ is a strong red. It holds its own in words. For example, the word ‘shop’ is yellow but the ‘H’ stays red. Or in the blue word ‘thank’, the ‘H’ is still red. I find the colour of the word is determined by prominent letters. For example, the green ‘F’ will make ‘F’ words like ‘February’, ‘friend’ and ‘fortune’ inherently green, although other colours are found within the words.

The quality of the colour is hard to put into real terms but I will try … There are spatial colours like the black space they are seen in. They are slightly glowing. If there is multiple colours in a word they can be in two different ways:

Strongly independent letters: e.g., PATH – P is pink
A is yellow
T is blue
H is red

Whereas [in] less definite words such as ‘October’ the colours boardlessy [sic] melt into each other within the area of the word. Like paint dropped on a wet piece of paper.

Small words:
‘It’, ‘if’, ‘is’, the ‘I’ stays grey/white and the second letter is the same as the independent letter. ‘T’ is blue, ‘F’ is green and ‘S’ is yellow.
The same can be said for ‘O’ words. ‘O’ is a darker shade of ‘I’. ‘Go’, ‘so’, ‘ho’, ‘to’, ‘of’, ‘on’, ‘oo’.

‘Who’ and ‘How’ – as a dyslexic, I often reverse these two words. The colours are helpful to let me know as ‘H’ is red, ‘W’ is green and ‘O’ is a grey clearer in opacity. ‘How’ therefore leads with red and ‘who’ leads in green.

I am not sure if it is coincidence but the word ‘invisible’ is pale in colour and a little translucent.

The word ‘word’ is broken down into a green ‘W’ a leaf greed [sic]. A dark grey ‘O’, the ‘R’ is a warm brown and the ‘D’ is a blackened brown.

Strangely the word black is not in colour. It lightens to grey slightly at the ‘L’ and has a flash of yellow around the ‘C’.

4th, 5th, 6th, 7th, 8th – the ‘th’ of a positional number is always blue, ‘t’ and red ‘h’.

‘Monday’ is shades of warm yellow an iconicaly [sic] cheery colour for the first day of the week!
‘Tuesday’ is blue – mid blues with the ‘T’ being the darkest.
‘Wednesday’ is greens with the ‘W’ and ‘d’s’ being the darkest.
‘Thursday’ is also blues but the ‘h’ is red, [which is] how I differentiate it from ‘Tuesday’. The blues are more purple and matter [sic] than Tuesday.
Friday is green but a dark, forest green. It lightens in the middle near ‘i’.

When I look at signs or numbers on a clock, timetables, number-plates, phone numbers and prices, my mind projects the colour into my vision, covering the true colour. For example:
01892 545040 my home business line, to me changes from this black pen to:
0’s – white outlined in black
1 – very pale grey
8 – orange
2 – yellow
5’s – blue
4’s – red
This means the phone number is easy to remember as 545040 is made of only 3 colours which is faster to remember.

M4 – red motorway
M5 – blue motorway
M3 – the green motorway

The colours of the numbers always are constant to the point that the clock is the same. For example:
2's are yellow so 2pm or 2am are yellow hours
3's are green so 3pm is green, as 30 is green 2.30 is yellow and green respectively.
4's are red so 4:30 is red to green
45 mins is red, blue therefore 4.45 is red, red, blue
3.45 is green, red, blue
am is yellow, fudge brown
pm is pink, fudge brown
These colours project on an analogue or digital clock.

I have begun to reflect on this additional data in Chapter 7: Discussion and Conclusions.

6.2.1.1 Questionnaire: Participant 1: HW (see Appendix 2)

HW discovered aged eight that she was a synaesthete when her mother said in the car that her name was 'pink' and she said, 'No, Hannah is red' (Q1 and Q2). HW's mother has synaesthesia (Q3). When HW looks at an alphabet she sees letters filled with the colour against a black space (Q4). When asked whether different fonts altered her colour experience, she replied, 'Yes, the bolder or thicker or rounder the letters, the quicker the [colour] response' (Q5). HW reported that she conjured up her letter colour sensations in her 'mind's eye', and this was strongest (Q6). Text did not alter her experience in any way (Q7). The colour of the paper did not alter her letter colour experience, 'as they are strongest in my mind's eye' (Q8); nor did texture alter her colour experience (Q9). HW's letter colour experiences did not have textures attributed to them; they were 'very flat in the 3D black space' (Q10). When asked whether the colours of each letter were determined by the physical experience of the letter or the sound the letters make, HW reported, 'I can get sensations associated with certain words, such as tastes but not to specific letters' (Q11). Her letter colours were stronger when written down (Q12). Her colours occurred in the centre of her field of vision (Q13). As for the location of her colours, she described 'the letters [as] filled in

over the top of the font colour/layered' (Q14). When asked whether colours came into view independently, or were they triggered by something (Q15), HW reported they were 'independent but stronger if I focus on it'. When asked, 'Are the colours always the same?' (Q16), she replied, 'Yes, when independent; however, [they] will change if within a word to take on that word's colour.' Regarding punctuation (Q17), she reported that 'punctuation will take on the colour of the word. Or [depending on] how tired I am.' She added that 'The name of the language has a colour that is it' (Q18). 'Sound is associated with taste and how the word is spelt influences the colours' (Q19). To the question 'Does the colour appear the same whether the grapheme is read, heard or thought of?' (Q20), HW responded that her colour perceptions presented 'strongest/quicker response when read or thought in "mind's eye" but apart from that, no'. With reference to whether vowel letters lightened or darkened a word (Q21), HW remarked that 'they have their own independent colours with no correlation'. Vowels did not dominate over consonants; 'H', 'A', 'T', 'Q', 'D' [and] 'B' have strong [colour] associations' (Q22). Consonants were not coloured differently to vowels (Q23), and the first letter of a word did tend to affect or dominate the word, but not always (Q24). Letters did inherit the shade of nearby letters (Q25). In response to the question 'Does the meaning of the word have an influence on its colour, e.g., banana, orange, lime?' HW's answer was 'Yes, now I have just read that sentence!' (Q26). But, she added, 'the meaning of a word did not change the colour of the word' (Q27). HW didn't think that her letter colours had changed with time, but was not completely sure (Q28), and grouped letters didn't change due to their context (Q29). The repetition of a letter within a word didn't result in that letter colour dominating the colour of the word (Q30). Finally, when HW was asked if, when 'a word has a different meaning or sound when used in a different context, can this affect the colour of the word?' she responded, 'It is about the contained letters as a whole, so I would say no' (Q31).

6.2.1.2 Findings Chart: Participant 1: HW

Date of Meeting	Verbal Colour Description	Munsell Color Reference	
30/4/10	A – *'Yellow, bright acidy Canary Yellow, really strong'*	**2/11/10:** Y2.5 8/12	**16/6/11:** 2.5Y 8/16
30/4/10	B – *'Brown, Greeny Brown, cold muddy'*	**2/11/10:** 10YR 4/6	

30/4/10	C – *'Orangey, Rusty, sometimes it's paler sometimes it's strong Burnt Orangey'*	**2/11/10:** 7.5YR 6/12	
30/4/10	D – *'Very similar to B, but Greyer and paler, not Beige'*	**2/11/10:** 2.5Y 4/4	
30/4/10	E – *'Similar to C, but really intense Orange, something in between as 5YR5/12 is too Brown'*	**2/11/10:** 5YR 6/14 – 5YR 5/12	**16/6/11:** 2.5Y 4/4
30/4/10	F – *'Green, Bluey Green, changes subtly Bluey to Emerald'*	**2/11/10:** 10GY 3/6 – 10GY 4/8 'halfway between the two'	
30/4/10	G – *'Grey Brown, biased Grey, Mushroomy Grey?'*		**16/6/11:** *'Between'* N5.25 and N 4.25
30/4/10	H – *'Bright Red, Primary Red, very strong colour'*		**16/6/11:** 7.5R 4/16
30/4/10	I – *'Is it White, is it Grey? Very pale if it is and is towards Pale Grey, almost White'*		**16/6/11:** N9
30/4/10	J – *'Similar to I, but a little Browner, barely there, has a tint to it'*		**16/6/11:** 2.5YR 8/2 – 2.5YR 7/2
30/4/10	K – *'Orange based, White based tint'*		**16/6/11:** 5YR 8/6 *'but a bit paler, slightly paler'*
30/4/10	L – *'Doesn't have anything defined by its shape, like looking through a window, you see past it. See the outline edge is defined, but the centre, middle of the L is the same as outside the L see through like a window. Defined by its background, translucent takes whatever it is against'*		**16/6/11:** P-RP 9/5P
30/4/10	M – *'Orange, but not Orange, Ochre, intense'*		**16/6/11:** 7.5YR 7/10
30/4/10	N – *'More of a true Reddier Brown'*		**16/6/11:** 7.5YR ¾

30/4/10	O – *'Is definitely a Deep Yellow'*		**16/6/11:** N2 *'but surrounded by White soft White halo. Inner ring of O is like an iris misty in centre, rather ambiguous not easy to see, not strong'*
30/4/10	P – *'Pink same as* William Morris as Designer *by Ray Watkins, the spine of the cover, Whitey Pink or Pink with White in it'*		**16/6/11:** 2.5R 8/6
30/4/10	Q – *'Puce, fleshy dulled Pink, meaty Pink, cooked ham Pink, dull'*		**16/6/11:** 5R 7/4 – 5R 7/6 *'in between'*
30/4/10	R – *'Ambiguous colour, is it Red or Rusty Brown?'*	**2/11/10:** 10R 3/10 *'2nd line from bottom of page'* 10R *'5th row on right'*	
30/4/10	S – *'Yellow, same as A, but a little bit paler, in words the same though. Sue tastes like Honey'*		**16/6/11:** 2.5Y 8/12 *'slight, its background Orange coming through'*
30/4/10	T – *'Blue, Thomas the tank engine Blue. All 'th' words are 5PB 3/10'*		**16/6/11:** 5PB 4/12 and 5PB 3/10
30/4/10	U – *'Very Cream like, verging on the translucent 5Y 9/2'*	**2/11/10:** 2.5YR 8/2 and 2.5YR 9/12?	**16/6/11:** 2.5Y 5/8?
30/4/10	V – *'Similar to U on the feel, but the Purple side of Mushroom'*		**16/6/11:** P-RP 9/5 RP and P-RP 8/5RP *'Twin'*
30/4/10	W – *'Minty Green, White based'*	**2/11/10:** 2.5G 8/6	
30/4/10	X – *'Doesn't really have much to it, but leans to the Greys/Neutral'*		
30/4/10	Y – *'Similar to U but a bit Pinker'*		
30/4/10	Z – *'Is it Purple is it Grey, is it Yellow? Really muddy Ochre, but…?'*		

6.2.1.3 The Exhibition: Participant 1: HW

Exhibition Colour Charts

HW was not able to attend the exhibition so the list below indicates the actual blocks of colour as they occur in the woven charts. As HW was the first participant her colour block numbers start from the beginning. The layout of the colour charts is the same for all, they begin from the top and run from row 1, (1,2,3) moving down to row 2, (4,5,6) and 3, (7,8,9) until all the colours from all the participants have been included in that particular colour chart.

Yellow Chart: 'A', square 1, 'S', square 2; Red Chart: 'H', square 1, 'R', square 2;
Blue Chart: 'T', square 1; Green Chart: 'F', square 1, 'W', square 2;
Pink Purple Chart: 'P', square 1, 'Q', square 2; Earth Chart: 'B', square 1, 'C'; square 2;
'D', square 3; 'E', square 4; 'M', square 5; 'N' square 6; 'Z', square 7;
Neutrals Chart: 'G', square 1; 'I', square 2; 'J', square 3; 'L', square 4; 'O', square 5;
'V', square 6; 'Y', square 7; 'Z', square 8, (same shade as square 7 earth chart).

6.2.2 Participant 2: LR

I met LR via an introduction from HW. They were friends and discovered that they were both grapheme synaesthetes. HW worked in an office. LR reported that she did not know how she acquired her alphabet colours. She mentioned that she had no other forms of synaesthesia that she was aware of.

6.2.2.1 Questionnaire: Participant 2: LR (see Appendix 3)

LR first became aware of her synaesthesia in 2005 during a meeting at work to discuss the layout of a map for a website, and what colours 'to [mark] the cities in'. LR suggested, 'Why don't we do the areas in the colours we see them in?' She quickly realised that no-one understood what she was talking about when everyone else in the room looked blank at her in response to this suggestion (Q1). LR recalled that she was in the region of four, five or six years old when she remembered having a conversation with a friend, that Wednesdays were orange days (Q2). The colours of the days of the week according to LR, are:

> Monday: Yellow; Tuesday: Red; Wednesday: Orange; Thursday: Grey;
> Friday: Blue; Saturday: Black; Sunday: Brown.
> Most words like and; of; the; are black and white, but other words are coloured.

LR has a brother who sometimes sees colours, she was not aware of any other members of her family having synaesthesia (Q3). According to LR:

> Manchester is orange, Sheffield is orange, Farnham is blue, Cranley is yellow, Guildford is brown'. Apple is green, very vibrant, not a foresty green, Granny Smith green, not Golden Delicious green. [I am not sure why LR included the word 'Apple' here].

Question (Q5) asked each participant whether different fonts altered their letter-colour experience and if so how? In order to assist them in answering this question, I showed each participant a book of hand-printed letter press fonts of differing sizes and designs. The letters were displayed in a row with each font design shown on a separate page. The letters of the vowels were all in the capital letters of A, E, I, O, U. The decision to pick the vowels as a set of 'example letters', as opposed to printing the whole alphabet was based on the frequency of these letters within the English vocabulary. Out of the five participants, LR, was the only participant to register a difference. She commented that, 'All the fonts except the 'Oriental one' [page 6 from the hand printed fonts book], and the 'Wild West one' [page 16 from the hand printed fonts book], are seen as separate [to the] colours of the letters. The 'Oriental one' is Red. The Wild West one is Brown'. The two fonts that influenced Participant 2's colour perceptions can be seen in Figure 7: AEIOU, Chapter 3 Methodology.
LR was the only participant to record a difference of colour perception with this test, and as later revealed, she sees whole words as one colour so it is possible that she saw the cluster of letters in the same way. Participant 2's individual alphabet letter colours for the vowels, A, E, I, O, U, were described by her as follows:

> 'A': 'Yellow, solid yellow, it must dominate because the word "Alphabet" is yellow, sunshine yellow.'
> 'E': 'Blue much more vibrant blue than "B".'
> 'I': 'Transparent like your folder, it has a white sheen to it".
> 'O': 'White.'
> 'U': 'Grey, greyer than the silver of "Q".'

Another possible explanation for red, representing all five letters of one of the fonts, and brown, representing all five letters of the other, is that the distinctive designs of these fonts may have conjured up a stronger mental image or trigger, 'Oriental' red and 'Wild West' brown, dominating the individual letter-colours themselves, thus altering the automatically

triggered colour perception described. The effect of the pictorial nature of the fonts is interesting and might be worth investigating further at a later stage.

LR can conjure up her letter colour sensation in her mind (Q6). She didn't think that text altered her colour experience (Q7) and she didn't think that the colour of the paper altered her experience (Q8). The texture of the paper or surface of the text had no influence on the colours (Q9), and her letter colours were smooth and flat having no texture to them (Q10). In response to the question 'Are the colours of each letter determined by the physical experience of the letter or the sound the letter makes LR responded 'possibly with words rather than letters' (Q11). LR, reported that different pronunciations of letters and words changed their colours (Q12). When asked 'where do the colours occur in your field of vision?' (Q13), LR reported that they occurred 'at the front', and that the location of her colours was situated 'at the back of the mind'(Q14). LR's letter colours are triggered 'independently'(Q15). Her colours are always the same (Q16). When asked if punctuation marks, braille or musical notation had colours (Q17), she reported that the word 'braille' was grey, that a comma was brown, a full stop was red and Germany was black'. Other languages had different colours (Q18). But the way a word is spelt or sounds did not influence its colour (Q19). Whether the grapheme was read, or thought of didn't change its colour (Q20). Vowel colours lighten a word (Q21), and consonants made a word heavier (Q22). She also remarked that 'sometimes the first letter of the word dominates the colour of the word, but not always, [and cited two examples], Aunt is yellow, Uncle is brown'(Q24). Her letters do not inherit the shade of the nearby letters in a word (Q25). LR thought that it was possible that the meaning of a word might change the colour of the word, but she didn't proffer any examples (Q26). The meaning of the word did possibly change the colour of the word (Q27). LR's colours have not changed with time (Q28). The frequency of a letter in a word didn't mean that the colour of that letter dominated the colour of the word, [but] 'the sound of the word informs the colour of the word' (Q30, Q31).

6.2.2.2 Findings Chart: Participant 2: LR

Date of Meeting	Verbal Colour Description	Munsell Color Reference	
30/4/10	A – *'Yellow solid Yellow, it must dominate because the word alphabet is Yellow, Sunshine Yellow'*	**2/11/10:** 2.5Y 8/12	**30/6/11:** 5Y 8.5/12 *5Y 8.5/14 5Y8/14

30/4/10	B – *'Blue, fairly standard Deep Blue'*	**2/11/10:** *****5PB 2/8	
30/4/10	C – *'Orange, not a very bright one a dirty Orange'*	**2/11/10:** 2.5YR/12	**30/6/11:** *5YR 6/!4 2.5YR 5/14 *(between the two)*
30/4/10	D – *'Brown, your suitcase in shadow'*	**2/11/10:** 5YR 2/2	**30/6/11:** 7.5YR 3/4 7.5YR 2/4
30/4/10	E – *'Blue much more vibrant Blue than B'*	**2/11/10:** 5PB 4/12	**30/6/11:** 5PB 4/12 *(not as bright as it should be)* 5PB 3/10 *(too dark, more intense)* 5PB 5/12 *(too light)*
30/4/10	F – *'Black, Munsell book Black'*	**2/11/10:** No 75	**30/6/11:** N/1 or N/75 *(Farnham is Blue 5PB 3/8)*
30/4/10	G – *'Black, Munsell book Black'*	**2/11/10:** No 75	**30/6/11:** N/1 or N/75
30/4/10	H – *'Brown, similar to D, but a little brighter'*	**2/11/10:** 7.5YR ¾	**30/6/11:** 5YR 2/4
30/4/10	I – *'Is transparent like your folder, it has a White sheen to it'*	**2/11/10:** N8.75	**30/6/11:** N9 or N9.25 or N8.75
30/4/10	J – *'Beige/tan, like the reference book covers, the stacked four in the study room, Susan Bosence reference books'*	**2/11/10:** *'Between'* 10YR 7/6 and 10YR 6/6 *'Brown parcel paper'*	**30/6/11:** 7.5YR 5/6 or 5/8 *(closer to 5/6)*
30/4/10	K – *'Black, as before'*	**2/11/10:** N75	**30/6/11:** N5 or N1
30/4/10	L – *'Is a strong Black, intense, saturated'*	**2/11/10:** N1	**30/6/11:** N5
30/4/10	M – *'Orange, dirtier than C'*	**2/11/10:** 5YR 5/12	**30/6/11:** 2.5YR 5/12 or 5YR 5/12 *(but almost want more yellow)*
30/4/10	N – *'Brown, deeper Brown than others'*	**2/11/10:** 7.5YR 2/2	**30/6/11:** 7.5 YR 3/4 or 2/4 and 7.5YR 2/4 – 2/2 *(too dark, needs to be*

			brighter)
30/4/10	O – *'White'*	**2/11/10:** N9.25	**30/6/11:**
30/4/10	P – *'Blue, more like B'*	**2/11/10:** 10B 3/8	**30/6/11:** 2.5PB 4/10 – 3/10
30/4/10	Q – *'Silver Grey'*	**2/11/10:** 2.5PB 6/2 *'T- shirt colour, soft Pinkish Grey'*	**30/6/11:** N8.25 – 2.5PB 8.2
30/4/10	R – *'Brown, brightest Brown of them all'*	**2/11/10:** 10YR 3/6	**30/6/11:** 7.5YR 3/2 *(almost too dull, should be warmer than that so maybe)* 2.5YR 3/2 or 2/2
30/4/10	S – *'Red, strong Red'*	**2/11/10:** *'Between'* 7.5R 4/10 and 7.5R 4/14 *'like a matt version of this'*	**30/6/11:** 7.5R 4/16 or 7.5R 3/12 *'not unhappy with 1st previous choice of colours'*
30/4/10	T – *'Black, like L'*	**2/11/10:** N1	**30/6/11:**
30/4/10	U – *'Grey, Greyer than the Silver of Q'*	**2/11/10:** 2.5PB 6/2 *'like my cardigan, soft bleached Grey'*	**30/6/11:** N7.5 *'more of a Greyie Grey'*
30/4/10	V – *'Grey, similar to U'*	**2/11/10:** N8	**30/6/11:** N7 *'probably V is not as clear, more difficult to define'*
30/4/10	W – *'Black, like L'*	**2/11/10:** N1	**30/6/11:** N1.5 *'a bit duller than last time'*
30/4/10	X – *'Brown, paler'*	**2/11/10:** 7.5YR 3/6	**30/6/11:** 10YR 2/2 *'previous choice is too bright, too Yellow'*
30/4/10	Y – *'Yellow, vibrant'*	**2/11/10:** 10YR 8/14	**30/6/11:** 2.5Y 8/14 or /16 *'between the two'*
30/4/10	Z – *'Red, same as S, but a more Purpley Red'*	**2/11/10:** 7.5R 3/12	**30/6/11:** 7.5R 4/14

6.2.2.3 The Exhibition: Participant 2: LR

LR visited the exhibition on February 12th 2019, and remarked that of the 26 letter colours that I had matched from her alphabet colour descriptions, the letters '"U" and "V" should [on reflection] be more blended'. She thought when revisiting the colours, after several years' gap (somewhere in the region of eight years), that these two letter colours should be much closer in tone than she had previously thought: '"U" was too dark and should have been closer to "V".' She found that the woven chart, including all the participants' alphabet colours in the same composition, was muddling because, as she said, 'there are too many colours in the vicinity'. She remarked that 'translating a block of colour back into a letter colour requires another brain process which does not feel natural'. The fact that the other alphabets were so different bewildered LR but this did not disturb her – she thought that they were 'wonderful'. When asked if the unbleached ecru background colour interfered with her letter colours, she reported that she 'didn't find the background colour intrusive'. She did, however, remark that on the colour charts showing the combined categorised colours of yellows, reds, blues etc., the 'colour charts with separated colours do not have enough space around them though the background doesn't hinder [colour] identification'. The idea of finding the letters within the colour charts was not something that LR had considered trying, and she anticipated that this would be difficult. LR did not recognise any of her letter colours in the pinks and purples chart. This was correct as none of her letter colours was included in this particular colour category. I have itemised below the colours that LR identified when she visited the exhibition. The colour charts are listed in order as yellow, red, blue, green, pink/purple, earth, and neutral.

Exhibition Colour Charts: Participant 2: LR

Yellow Chart (Figure 42)

LR had two letter colours that she identified as yellow, namely 'A' and 'Y'. She reported difficulty in recognising 'A' from the yellow colour chart and was not confident that she had found the correct colour square. She remarked that 'the bottom row of colours meant nothing [to her] but all the others with the exception of square 6 had a familiarity to them'. In the Yellow woven colour chart, square 3 was in fact LR's colour-matched yellow of choice for her letter 'A', while square 4 was her colour-matched yellow of choice for her letter 'Y'. LR did not manage to identify her letter colour 'Y' from the yellow colour chart; she remarked that, 'Square 1 or square 2 could equal "A",' and that 'Square 8 equals "A".' Square 8 was a

warmer yellow than LR initially described and verified for ‘A’, as her actual letter colour during the colour-matching process.

Red Chart (Figure 43)
LR had two letter colours from her alphabet that she described as red, the first being ‘S’ and the second ‘Z’.

At the exhibition LR pointed out that in the red chart, squares 2, 8 and 11 meant nothing to her. However, ‘Squares 1 and 3 could be [her] Z or S.’ When this was checked from the woven colour chart, in reality square 3 was LR’s ‘S’ and square 4 represented her ‘Z’.
LR demonstrated difficulty in identifying ‘Z’, as her colour-identification list below indicates:

> Squares 1 and 3 equal same letter colour Z.
> Squares 5 and 7 equal same letter colour Z.
> Squares 6 and 9 equal same letter colour Z.
> No way could 8 equal Z.

‘It is harder to tell letter colours when all the colours are clustered together,’ LR reported. ‘The brighter colours are easier to find as letter colours whereas the neutral chart is less obvious and less important. At a glance, the last three alphabet panels are obviously not mine, but [squares] 1 and 2 could be, but as you go down the letters [in the colour chart], definitely not.’

Blue Chart (Figure 44)
LR had three letter colours from her alphabet that she described as blue, the first being ‘B’, the second ‘E’, and the third ‘P’.

At the exhibition LR identified the following: ‘Square 2 equals “B” and “E”.’ When this was checked from the woven colour charts, it was found that in fact square 2 equalled ‘B’; square 3 equalled ‘E’ and square 4 equalled ‘P’. LR picked out the following: ‘Square 11 could be “B” or “E” and even “P”.’

This observation from LR that square 11 could be ‘B’ is not that different from her actual colour specification, though square 11 was duller than her original colour description and verification. As a replacement for ‘E’ her own letter colour is much brighter and paler than square 11 as is her original choice for letter ‘P’. Square 11 in the woven colour chart did not belong to LR, but was closer to ‘B’ colour-wise than ‘E’ or ‘P’, which are much paler blues.

Green Chart (Figure 45)
LR was the only participant out of the five that had no greens in her letter colour alphabet.

Pink Purple Chart (Figure 46)
LR was the only participant out of the five that had no pinks or purples in her letter colour alphabet.

Earth Colour Chart (Figure 47)
LR had eight letter colours from her alphabet that fitted the earth colour chart category: they were ‘C’, ‘D’, ‘H’, ‘J’, ‘M’, ‘N’, ‘R’ and ‘X’.

Despite the fact that LR had 8 letter colours that were categorised as earth colours in the earth colour chart, she reported that she found these colours the most difficult to identify when they were displayed in the format they were presented in. Again, I was reminded that LR had pointed out during her visit to the exhibition that ‘it is harder to tell letter colours when all the colours are clustered together’. As the earth colours in the chart ranged from browns to oranges to light tan shades this factor may have had an increased negative impact on her ability to find her letter colours. As she put it, ‘the brighter colours are easier to find as letter colours’. Her actual letter colours from the earth chart were as follows:

Square 8 was LR’s ‘C’; square 9 was ‘D’; square 10 was ‘H’; square 11 was ‘J’;
square 12 was ‘M’; square 13 was ‘N’; square 14 was ‘R’, and square 15 was ‘X’.
LR identified her letter colours from the earth colour chart as follows:

> Square 8 equals ‘M’.
> Square 12 equals ‘C’. [LR was able to successfully pick out two of her letter squares, but got them in the incorrect order according to her initial colour verifications. Square 8 was in fact letter ‘C’, and square 12 was ‘M’.]

> Square 21 equals ‘R’? ‘R’ could be square 6 or square 10, square 16 equals ‘A’?

LR reported difficulty in distinguishing her browns from the combined browns of the five participants’ alphabet colours. Despite the fact that LR had eight letter colours she was only able to identify four of them, and all of these differed from her actual letter colour verifications.

Neutrals Colour Chart (Figure 48)
LR had eleven neutral letter colours; within the neutrals chart these are listed below as follows:

> Square 8 was ‘F’ (‘black’); square 9 was ‘G’ (‘black’); square 10 was ‘I’ (“transparent white, like your plastic folder. It has a white sheen to it”); square 11 was ‘K’, (‘black’); square 12 was ‘L’ (‘black a stronger black than ‘F’ intense, saturated’); square 13 was ‘O’ (‘white’); square 14 was ‘Q’ (‘silver grey’); square 15 was ‘T’ (‘black strong black, intense like “L”’); square 16 was ‘U’ (‘grey, greyer than the silver of “Q”, my cardigan, soft bleached grey’); square 17 was ‘V’ (‘grey, similar to “U”’); square 18 was ‘W’ (‘black, strong intense, saturated like “L”’).

However, according to LR, ‘Square 3 equals “V”, square 2 equals “U”.’ Though LR would now say that square 2 was closer to ‘U’, she acknowledged that ‘this is different to the existing colour in the printed alphabet page’, and ‘Squares 10, 13, 16, 19, 22, could all be “T” or “W”.’ Of the eleven letter colours that were ascribed to the neutral colour chart, LR was unable to identify one correctly. This verifies her observation that the brighter colours were easier to pick out, and that all the colours were difficult to find because they were too crowded or ‘clustered together’, needing more space between them as they had on the printed page sets. This could be worth revisiting by producing a second and third edition of the woven colour charts where more space would be provided around each block of colour and finally a different shade of white, a bleached white background, used to replace the existing ecru shade.

Participant 2: LR

Yellow Chart: 'A', square 3; 'Y', square 4;

Red Chart: 'S'. square 3; 'Z' square 4;

Blue Chart: 'B', square 2; 'E', square 3; 'P', square 4;

Green Chart: None;

Pink Purple Chart: None;

Earth Chart: 'C', square 8, 'D', square 9; 'H', square 10; 'J', square 11; 'M', square 12; 'N', square 13; 'R', square 14; 'X', square 15;

Neutrals Chart: 'F', square 8; 'G', square 9; 'I', square 10; 'K', square 11; 'L', square 12; 'O', square 13; 'Q', square 14; 'T', square 15; 'U', square 16; 'V', square 17; 'W', square 18.

6.2.3 Participant 3: AA

I first met AA in 2013, she was an MA student, studying Design Products at the Royal College of Art, London. She was in her first year of a two-year course. AA has now returned to the USA. AA is bilingual.

6.2.3.1 Questionnaire: Participant 3: AA (see Appendix 4)

When asked when she discovered that she had synaesthesia, AA reported that she had always had synaesthesia. But when asked for a specific age she stated ten-ish to nineteen years (Q1, Q2). 'There were small clues along the way. When I was ten years old I remember having a conversation with a friend and saying that each letter of the alphabet had a particular colour.' She felt 'nausea that "C" could not be a dark green'. For AA, 'C' was 'light citrus, lemony yellow. On my degree course at Stanford College, California when I was nineteen and in my second year of Product Design through mechanical engineering, my synaesthesia was established. We were given five paints – red, blue, yellow, black and white, and asked to mix 300 shades, and paint 300 objects each in a distinct colour. I painted ping-pong balls. We were then asked to arrange our objects in sets of warm to cool, dark to light, saturated to desaturated. I found this exercise very stressful' (Q1).

When questioned whether any other members of her family had synaesthesia she wasn't aware of any, although she mentioned that her mother and grandmother were both painters and understood her synaesthesia. 'They don't think I'm crazy' (Q3). When she looks at an

alphabet, ‘It happens in my head and is not triggered by fonts or text. In text colours are more the mood of the content, e.g., days of the week have a colour. Sunday is Amber yellow’ (Q4). Different font designs didn’t affect or alter her colour experience (Q5). ‘The colour sensation is conjured up in my mind except for the days of the week and personalities. I am immersed in the colour, surrounded by the colour. The word Alphabet has no emotional impact or not much’ (Q6). ‘Text overrides individual letter colours,’ she reported. ‘Emotions in the text have an input of the colours. Every colour has an extremely strong personality’ (Q7). When asked whether the colour of the paper altered her letter colour experiences, AA remarked that, ‘it wouldn’t interfere with the colour sensation, but the quality of the paper could annoy if it was inferior quality’ (Q8). Texture did not alter her letter-colour experience (Q9). AA’s letter colours did not have textures attributed to them, ‘but some colours are thin or thicker than others, like watercolours or acrylics etc.’ (Q10). The colours of each letter were ‘determined by the physical experience’ of the letters not the sound the letters make (Q11). Her colours did not vary in colour whether they were written or spoken (Q12). AA’s colours occur ‘in my head, towards the back of my head, rather than to the sides’ (Q13). She reported that her colours were ‘in my head, not external. If my head was a box, the walls get painted in that colour. I feel the colour blue is cobalt blue, it can be seen as a flat colour, very stable (Q14).

She continued: ‘[My colours] are triggered by text or thinking about something, but it doesn’t have to be conscious, i.e., I love maths where numbers change through addition or multiplication [and] they automatically jump to another colour’ (Q15). To the question ‘Are the colours always the same?’ AA replied, ‘Yes, some letters have a stronger colour than others. Colours do not change with time of day or season. The front end of the alphabet is more distinct and clearer or specific than “H”, “I”, “J”, which are less defined’ (Q16). AA did not report punctuation marks, Braille or music as having colours, though she does read music (Q17). Other languages did have different colours, for example her second language is Hindi, ‘where every [group of] four letters is a family, and these have a particular colour, but not as distinct as English, which is my first language. In Hindi, it is more about the shape giving the colour whereas in English it is less so’ (Q18). When asked if the way a word was spelt or the way a word sounded had an influence on the colours, (Q19) AA remarked, ‘Not sound, definitely. Complete words have less colour association, e.g., “chair” has no particular colour possibly red, but “C–H–A–I–R” have definite attributes, but the individual letter colours are not combined as a single colour word’ (Q19). Her grapheme colours remained the same

whether they were read, heard or thought of (Q20). Her vowel colours lightened a word (Q21). Her vowels did not dominate over her consonants except for 'A'. 'All other vowels are in the background. I feel partial to "A" as my initials are "A"' (Q22). Her consonant letter colours were different to her vowel letter colours except for 'A' (Q23). The first letter of a word dominates the colour of the word (Q24). In answer to the question, 'Do letters inherit the shade of the nearby letters?' AA replied, 'Some do, some letters are seen as a cluster and some more distinct. For numbers, this is completely true' (Q25). When asked whether the meaning of the word had an influence on its colour, e.g., banana, orange, lime? AA reported that 'banana is yellow, but each letter is different' (Q26). She didn't think that the meaning of the word changed the colour of the word (Q27). When asked if her colours had changed with time, AA replied, 'I feel that what has changed is my ability to articulate the colours better. My perception has become more complex with time, but the [colour] families have stayed the same. There has been a refinement of colours with time in line with awareness of colour through study' (Q28). In response to the question 'Do grouped letters change colour due to their context?' AA replied, 'Letters individually don't change colour' (Q29). The repetition of a letter in a word didn't dominate the colour in that word (Q30). To the final question (Q31), 'If a word has a different meaning or sound when used in a different context, can this affect the colour of the word?' AA answered 'Yes, I don't have very strong [colour] associations with nouns for example.'

6.2.3.2 Findings Chart: Participant 3: AA

Participant 3 needed more time to settle into the task of identifying her letter colours and it was apparent that accuracy was paramount. We needed two meetings to complete the first Munsell exercise and I have used both to formulate the dye shade.

Date of Meeting	Verbal Colour Description	Munsell Color Reference	
25/4/13	A – *'Red: has a slight tinge of pink, definitely towards crimson, not vermillion'*	**21/6/13:** 7.5R 5/16 *'for saturation'*	3.75R 5/14 and 3.75R 4/14 *'for colour, these two are Pinkier than'* 7.5R 5/16 *'but not intense enough'*
		23/6/13: 7.5R 5/16 *'for saturation'*	5R 5/14 and 5R 4/14 *'for colour'*
24/1/14	*A –'Pinkish Red'*	**24/1/14:** 3.75R *'more reddish version'*	

25/4/13 **24/1/14**	B – *'Cobalt'* B – *'Blue, Cobalt'*	**21/6/13:** 5PB 4/12 **23/6/13:** 5PB 4/12, plus 2.5PB 4/10 and 2.5PB 5/12 but wants to stick with original colour ref. choice **24/1/14:** *'in between 5PB and 5PB 4/12'*	
25/4/13	C – *'Lemon Yellow'*	**21/6/13:** 5Y 8.5/14 **23/6/13:** 5Y 8.5/14 **24/1/14:** 6.25Y 8.5/12 *'perhaps between first choice and second'*	
25/4/13	D – *'Orange, but a lighter Orange, between a Yellow and an Orange'*	**21/6/13:** 5YR 7/14 **23/6/13:** 5YR7/14 and 6.25YR 7/16 *'a combination of both'* **24/1/14:** 1.25Y 8/16	
25/4/13	E – *'Lime Green'*	**21/6/13:** 2.5GY 8/12 **23/6/13:** 2.5GY 8/12 **24/1/14:** 5GY 7/12	
25/4/13	F – *'Dark Green, not dark but leafy Green, more towards Blue than Yellow'*	**21/6/13:** 8.75 GY 6/12 **23/6/13:** 8.75 GY 6/12 **24/1/14:** 8.75GY 6/12	
25/4/13	G – *'Sort of like Yellowy Orange, kind of towards Brown, deeper Yellow Orange'*	**21/6/13:** 8.75YR 7/12 *'but too milky'* **23/6/13:** 10 YR 7/14 *'a bit too bright, so needs to be between the two'* **24/1/14:** 7.5YR 6/14 with a bit of 1.25Y 7/12	
25/4/13	H – *'H, I, J are all in the purple family'*	**21/6/13:** 5RP 5/4 *'better than ref below'* **23/6/13:** 2.5RP 5/4 *'but not Brown enough'* ***24/1/14:*** 2.5RP 5/4 – 5RP 5/4 *'maybe a little browner'*	
25/4/13	I – *'Is almost Violet, but de-saturated Violet, pastel'*	**21/6/13:** 7.5PB 6/6 **23/6/13:** 7.5PB 6/6 **24/1/14:** 7.5PB 7/6	

25/4/13	J – *'Is more typical classical Purple, similar to my cardigan'*	**21/6/13:** 2.5RP 4/12 *'too Pink'* **23/6/13:** 5P 4/12 *'too Blue, therefore in between the two'* **24/1/14:** 7.5P 5/*10 'with a little'* 10P 4/12	
25/4/13	K – *'Is Purple, more Fuchsia, a bit more Pink'*	**21/6/13:** 6.25RP 5/14 **23/6/13:** 2.5RP 5/12 *'the vibrancy of the first ref is good and the colour is closer to the first ref but needs the blueness of the second ref'* **24/1/14***: 'more Pink than J'* 5RP 5/12 *'but maybe a bit more saturated'*	
25/4/13	L – *'Is like D, but more Yellow than Orange'*	**21/6/13:** 10YR 8/14 *'was a struggle to pinpoint as was H'* **23/6/13:** 7.5YR 7/16 *'is better than first but is too dark and too Orange, needs a little less Red and closer in tone to first but is too dark and too Orange, needs a little less Red and closer in tone to first choice more Yellow than Orange but U is same colour but more Yellow'* **24/1/14:** *'in between'* 7.5YR 7/16 and 10YR 8/14 *'but slightly towards a tint, i.e., with White, milky'*	
25/4/13	M – *'A Brick Red Pink'*	**21/6/13:** 5R 6/12 *'1st and 2nd but needs to have a dash more Yellow but not in the middle of 1st and 2 choice, i.e., closer to 1st but with a bit more Yellow'*	

		23/6/13: 8.75R 6/14 **24/1/14:** 3.75R 6/12 *'but a bit lighter'*	
25/4/13	N – *'An Orangey Brown'*	**21/6/13:** 5YR 6/*14* *'1st and 2nd but too muddy and too dark. Very hard'* **23/6/13:** 10 YR 8/12 – 7.5YR 7/14 *'like the tone of this shade and the paler Yellow of the tonally closer to 7.5YR 7/14'* **24/1/14:** 5YR 6/12 – 6.25YR 7/14 *'between the two'*	
25/4/13	O – *'Is definitely a Deep Yellow'*	**21/6/13:** 2.5Y 8/16 **23/6/13:** 1.25Y 8/16 *'in between the two shades'* **24/1/14:** 2.5Y 8/16 *'with a little'* 1.25Y 8/16	
25/4/13	P – *'Pinkish Purple'*	**21/6/13:** 10RP 6/12 *'but too dark and too muddy, difficult'* **23/6/13:** 10P 5/12 *'but too Blue, needs to be somewhere in between the two'* **24/1/14:** *'in between'* 3.75RP 6/12 *'and'* 5RP 6/12	
25/4/13	Q – *'Royal Purple, Queen's royalty, magic, mystical'*	**21/6/13:** 1.25RP 4/12 **23/6/13:** 7.5P 3/10 '*is better than 1st but could have a bit more Pink to make it Royal Purple'* **24/1/14:** *'because Yellow is O sometimes Q appears as yellow initially, but only for a split second'*	

25/4/13	R – *'Blue, a bit darker than B but in the same family'*	**21/6/13:** 2.5PB 3/10 *'correct tone but with less Yellow'* **23/6/13:** 5PB 3/8 *'blueness is correct but too dark'* **24/1/14:** 6.25PB 3/12 'and' 5PB 4/12	
25/4/13	S – *'Lemon Yellow'*	**21/6/13:** 5Y 8.5/10 – 3.75Y 8.5/12 *'in between the two'* **23/6/13:** 3.75Y 8.5/12 **24/1/14:** *'Yellow, like C but lighter'* 5Y 8.5/12 *'and'* 3.75Y 8.5/12	
25/4/13	T – *'Teal'*	**21/6/13:** 5BG 6/8 **23/6/13:** 7.5BG 6/8 *'colour is exactly in between these two references, 1st and 2'* **24/1/14:** 2.5BG 7/8	
25/4/13	U – *'A light Yellow Orange'*	**21/6/13:** 3.75Y 8.5/12 **23/6/13:** 10YR 8/14 *'colour is between these two references, 1st and 2'* **24/1/14:** *'a deeper Yellow'* 2.5Y 8.5/10 *'and'* 1.25Y 8/16	
25/4/13	V – *'A Blue, it's sort of like B but with a lot of White mixed into it, a pastel colour shade'*	**21/6/13:** 7.5 PB 7/4 + 5PB 7/6 *'colour closer to first reference, but with more Blue'* **23/6/13:** 5PB 7/6 **24/1/14:** *'I is similar but more Violet'* 5PB 7/6	
25/4/13	W – *'Also Blue, the same darkness as B, but with a bit of Green in it'*	**21/6/13:** 10B 4/10 – 10B 4/8 **23/6/13:** 10B 4/8 *'feels better than 1'* **24/1/14:** 2.5PB 3/10 *'with a bit of'* 10B3/10	

25/4/13	X – *'Cool Grey'*	**21/6/13:** N6.75 **23/6/13:** N6.75 **24/1/14:** N6.5	
25/4/13	Y – *'Yellow maybe a Cadmium Yellow, warmish?'*	**21/6/13:** 6.25Y 8.5/12 **23/6/13:** 5Y 8.5/12 *'colour in between the two'* **24/1/14:** *'in between'* 2.5Y 8.5/10 *'and'* 5Y 8.5/8	
25/4/13	Z – *'Warm Grey, a darker warm Grey'*	**21/6/13:** 10RP 4/1 **23/6/13:** 10PB 3/1 *'tone needs to be in between these two but the colour is closer to 1st choice'* **24/1/14:** 'in between' 5Y 5/1 'and' 5Y 6/1	

6.2.3.3 Exhibition Colour Charts: Participant 3: AA

AA was unable to attend the exhibition as she has relocated to the USA. Her colours within the woven colour charts are therefore listed below without her commentary.

Yellow Chart: 'C, square 5; 'L', square 6; 'O', square 7; 'S', square 7; 'U', square 9; 'Y', square 10;

Red Chart: 'A', square 3; same as LR's 'S';

Blue Chart: 'B', square 5; 'R', square 6; 'T', square 7; 'V', square 8; 'W', square 9;

Green Chart: 'E', square, 3; 'F', square 4;

Pink Purple Chart: 'H', square 3; 'I', square 4; 'J', square 5; 'K', square 6;

Earth Chart: 'D', square 16; 'G', square 17; 'N', square 18;

Neutrals Chart: 'X', square 19; 'Z', square 20.

6.2.4 Participant 4: VJB

When I first met her in 2013, VJB was a freelance knitwear designer for 'Acorn Conceptual Textiles'. She had studied textiles at Nottingham Trent University and she responded to a 'call out' I submitted via the Synaesthesia Society (see Chapter 3: Methodology).

6.2.4.1 Questionnaire: Participant 4: VJB (see Appendix 5)

VJB mentioned that the first time she heard about synaesthesia was at University. 'I was nineteen years old and the teacher spoke about nineteenth-century artists and writers with synaesthesia, specifically talking about people who saw days of the week in colour, and I thought, I've got that! The first time I remember experiencing synaesthesia was at school in my reception class. We were learning to write our A, B, C, the page was white and the letters were black but I saw them in colour. "A" was red, "B" was blue and "C" was green' VJB's synaesthetic colours began at nursery in the cloakroom where the pegs had colours ascribed to them; she described them as 'A' – red apple, 'B' – blue ball, 'C' – green (Q1). 'I must have been four years old' (Q2). 'None of my other family members have synaesthesia' (Q3). 'When I look at an alphabet I can see that the letters are black, but once they are in my head I see colours' (Q4). Different font designs did not alter her colour experiences (Q5). VJB reported that she didn't need to see text to see her colours. 'I can see anything I want in my head such as music, letters, words, people, places, memories, stories and all physical objects' (Q6). 'When I look at a chunk of text, I see a "mood-board of colour" rather than each letter as an individual colour. It's sort of like getting a bowl of water and dropping different coloured inks into it, then swirling them around. The colours move around in my head as I read text. However, if I home in on a certain word or letter, then I can see the colours in detail' (Q7). Does the colour of the paper alter her experience? (Q8). 'Yes, if I write a list, for example, on a green post-it, I will visualise the post-it in my head as green with black text on it.' Texture did not alter her letter colour experience (Q9). VJB's letter colours did not have textures associated with them, they were 'just flat colour' (Q10). Are the colours of each letter determined by the physical experience of the letter or the sound the letter makes? (Q11). 'They are determined by the physical experience [of], for example, reading a word. The sound of the letter does not affect the colour. The colour of the letter affects the colour of the sound' (Q12). 'If a word is [spoken] to me, it is still the same colour as if I read it.' In answer to the question 'Where do the colours occur in your field of vision?' VJB reported, 'If it's a single letter it's between my eyes, inside my head, but at the front of my head. If it's a word or cluster of words I see them in the same place but if I'm thinking of a physical object or a person or even memories or sounds the colours are in the whole of my head' (Q13). 'The location is always inside my head' (Q14). When asked, 'Do colours come into view independently, or are they triggered by something?' (Q15), VJB replied, 'I think it's probably always triggered by something. My head is never empty because there are so many stimuli around every day that I often don't even notice, it is automatic.' She added, 'The letters stay

the same but music and sounds can vary according to the change in instruments and what time in my life I associate the music with, because the moods affect the colour as well. People have colours according to the colours of the letters in their name and these can change based on if I like or dislike them. For example, if I really like a person their colour can become brighter and stronger or shiny or sparkly' (Q16). VJB went on to say, 'Musical notes have the same colours as my alphabet. Punctuation marks are black. Braille has no colours but it might if I used it. As I have become older the synaesthesia has become more intense and enhanced' (Q17). As regards whether other languages have different colours, VJB reported, 'No, because the words are still made up of the same letters in the alphabet' (Q18). Her answer to the question 'Does the way a word is spelt or sounds have an influence on the colours?' was: 'No to sound. Yes, to how it's spelt. Usually the first letter of a word dominates the colour of the word, but individual letters still retain their colours or come through. However, the overall word tends to become a mood-board. My sister Maisie is dark red. Her name is made up of "M" – dark red, "A" – post box red, "I" – black, "S" – yellow, "I" – black, "E" – cream. When I see her name, I see shades of dark red with flecks of black. The "S" is barely visible and I can't see the cream of the "E" at all' (Q19). 'Does the colour appear the same whether the grapheme is read, heard or thought of?' (Q20). 'Yes, if it is an individual letter, but if it's a word it can provoke a lot of different colours, especially when reading a book. This is because there is such a large amount of text going into my brain, containing people and speech and places and objects, that I get an overall blur of colour. The colours that I read in books can also be influenced by the colours of the cover' (Q20). Vowel colours do not lighten or darken a word, and vowels do not dominate over consonants, but consonants are coloured differently to vowels, because each letter is different and has its own colour' (Q21, Q22, Q23). For VJB, the first letter of a word dominates the colour of the word (Q24). Letters do not inherit the shade of nearby letters (Q25). Though, according to VJB, the meaning of the word does have an influence on its colour (Q26), the meaning of the word does not change the colour of the word (Q27). VJB's colours have not changed with time, 'but they have become easier to distinguish as time goes on because their intensity has progressed' (Q28). Grouped letters do not change due to their context (Q29); however, if a letter is repeated in a word this does dominate the colour of the word (Q30). If a word has a different meaning or sound when used in a different context, this has no effect on the colour of the word (Q31).

6.2.4.2 Findings Chart: Participant 4: VJB

Date of Meeting	Verbal Colour Description	Munsell Color Reference	
16/8/13	A – *'Red, slightly paler than Post Box Red'*	**13/9/13:** 7.5R 4/16	
16/8/13	B – *'Mid to Light Blue'*	**13/9/13:** 7.5B 6/10 *'but needs to be a bit paler, tiny'*	
16/8/13	C – *'Kind of a Bright Grassy Green, but then when I think of my boyfriend's name Colin, Col, I see an Emerald Green, but it's almost matt versus shine'*	**13/9/13:** 7.5GY 8/10 *'but needs to be brighter, right shade too flat'*	
16/8/13	D – *'Dark Blue, like a darker shade of Royal Blue'*	**13/9/13:** 5PB 2/8	
16/8/13	E – *'Cream, Magnolia but a bit lighter'*	**13/9/13:** RY 9/5Y	
16/8/13	F – *'Brown, Milk Chocolate Brown'*	**13/9/13:** 5YR ¾	
16/8/13	G – *'Quite similar to F but a bit darker. There is no Orange in it but it's orangier'*	**13/9/13:** 7.5 YR 2/4	
16/8/13	H – *'Peach, Pinky Peach'*	**13/9/13:** 2.5YR 8/6 – 10R 8/6	
16/8/13	I – *'Black, solid Black as Black as you can get'*	**13/9/13:** N5 *'neutrals page'*	
16/8/13	J – *'Is another Brown, but very, very, very dark'*	**13/9/13:** 2.5YR 2/2 *'Sort of similar to your suitcase colour, it would be if it was a word, might need to change'*	
16/8/13	K – *'Very Dark Green, Leafy Tree Green but dark like Pine Tree colour'*	**13/9/13:** 7.5G 3/8 – 2.5G 3/10	
16/8/13	L – *'Again another Green, but probably a few shades lighter than K'*	**13/9/13:** 10GY 5/12 *'but needs a tiny bit more Yellow, almost a little bit too dark'*	
16/8/13	M – *'Blood Red'*	**13/9/13:** 7.5R 3/12 *'Maisies's colour'* (Maisie is Verity's sister)	

16/8/13	N – *'Brown, close to Black'*	**13/9/13:** 5YR 2/4 *'possibly slightly darker, might need to change'*	
16/8/13	O – *'Orange, like an orange'*	**13/9/13:** 2.5R 3/10 *'Probably spot on '*	
16/8/13	P – *'Red Post Box Red, but slightly faded or paler'*	**13/9/13:** 7.5R 4/16 – 7.5R 4/14	
16/8/13	Q – *'Like a Burgundy Red'*	**13/9/13:** 2.5R 3/10 '*probably spot on'*	
16/8/13	R – *'Is like a very mid to light Pinky Orange, a slightly faded shade'*	**13/6/13:** 10R 8/6 *'and'* 7.5R 8/6 *'and'* 5R 7/10	
16/8/13	S – *'Yellow, a light Bright Yellow'*	**13/9/13:** 5Y 8.5/14 *'like this but lighter and brighter, basically 5Y 8.5/8 but loads brighter'*	
16/8/13	T – *'Light Blue, Sky Blue'*	**13/9/13:** 7.5B 7/8 *'Timothy* [Verity's brother] *colour'*	
16/8/13	U – *'Like a Reddy Brown'*	**13/9/13:** 7.5R 3/6	
16/8/13	V – *'Lilac, V in my alphabet is slightly darker than V in a word e.g., my colour is Lilac'*	**13/9/13:** *''V' has two colours, light'* 5P 7/6 *'and dark'* 2.5P 2/10 ''V' *in the alphabet is dark,' V' in my name is a lighter colour'*	
16/8/13	W – *'Like a sea Blue, quite a strong colour'*	**13/9/13:** 10B 3/10 *'WC as in toilet is'* 7.5B 4/10	
16/8/13	X – *'Grey/Silver'*	**13/9/13:** N8.25 – N7.5	
16/8/13	Y – *'Black Brown with a bit of Red – Blacky Grey second'*	**13/9/13:** N1 Black neutrals, N1.25 Black neutrals, 7.5R 3/12 Red, 7.5R 2/2 *'hard to see this as one single solid colour, therefore there are four colours present'*	

16/8/13	Z – *'Is like the colour of White Gold or very Pale Silver'*	**13/9/13:** *'Need to find Z using metallic shade cards for nail varnish'*	

6.2.4.3 The Exhibition: Participant 4: VJB

VJB was the second participant to visit the exhibition of the woven and printed works for this study. Her initial response to the combined woven alphabet piece, was one of annoyance, as the other participant's alphabets looked wrong to her.

> When I look at colours with my synaesthesthetic sight, I find it annoying/uncomfortable seeing incorrect colours of letters listed. When I step back and look at the exhibition as a whole, I like the fact that the alphabets are all different.

However, she also commented that:

> Seeing the exhibition was fantastic. My alphabet was laid out beautifully, and I was amazed at how the colours were identical to how I see them in my head.

VJB was referring to the alphabet pages here rather than the woven colour charts (Figures 42-48). She mentioned that when looking at the combined woven alphabets of all the participants, she was unsure whether her colours were correct. As she put it, 'They didn't look quite right'; she thought this might have been partly because the background was a cream or ecru colour, and not bleached white (or 'blank' as she put it), as the background colour of the printed pages were. She said that her colours needed to be 'floating in space with nothing around them'. VJB mentioned that in the past two or so years she had investigated the subject of synaesthesia in more depth and discovered that she had more forms of synaesthesia than the original grapheme synaesthesia that she had grown up with. Grapheme synaesthesia for her 'is just colours, numbers and words'. She explained that for her, people have colours and that she 'sees music rather than hears it, through shapes and colours almost like watching a score happen'. She prefers to close her eyes when listening to music so that she can 'see' the music rather than hear it. She also has a condition called spatio-temporal synaesthesia, where she experiences times, days of the week, months of the year, years and memories as colours. When she moves, all of the muscles that she uses for

that movement have colours, which shift through her body according to her muscle movement; when she touches people she 'feels all the colours', and a particular movement as it changes will change colour.

VJB was asked to re-verify her colours as they were presented at the exhibition on the alphabet pages. She commented that 'the orange should be a tiny bit "orangier", and that 'the "U" needs to be a bit more red as it is a bit too brown as it is'. The colour charts listed below are presented in order as yellow, red, blue, green, pink purple, earth and neutral.
VJB wrote a report on the exhibition, (see Appendix 5, p.198).

Exhibition Colour Charts: Participant 4: VJB

Yellow Chart (Figure 42)

VJB had one yellow amongst her letter colours and this was 'S', which was in reality square number 11 on the yellow chart. According to VJB 'square 5 or 11 equals "S"'.

Red Chart (Figure 43)

VJB had eight reds in her alphabet colours. 'A' was square 5 in the red chart; 'M' was square 6; 'O' was square 7; 'P' was square 8 and 'Q' was square 9. There was a total of eleven red squares in the red colour chart. VJB identified only three of her eight colours, and though she claimed one of her red squares she assigned it to a different letter. In her account square 8 was letter 'O', but during her letter colour verification stage, square 8 was 'P' and letter 'O' was square 7.

According to VJB, the last square in the red chart (square 11) equalled 'Q'; square 2 equalled 'U', and square 8 equalled 'O'.

Blue Chart (Figure 44)

VJB had four blues in her alphabet, 'B', 'D', 'T' and 'W'. 'B' was square 10 in the blue colour chart, 'D' was square 11, 'T' was square 12, and 'W' was square 13. There was a total of 15 squares in the blue chart. According to VJB, 'squares 10 or 12 equal "B", square 12 equals "B", square 10 equals "T" [and] square 2 equals "D"'. VJB initially picked out 'B' as square 10, but then her judgement began to waver and she mentioned that 'B' could have belonged to square 12, whereas square 12 in reality represented her letter 'T'.

Green Chart (Figure 45)

VJB had three greens in her alphabet, 'C', 'K' and 'L'. 'C' was square 5 in the green colour chart, 'K' was square 6, and 'L' was square 7. According to VJB, 'square 8 equalled "C" [and] square 4 could also be "C" but might be "L"'.

Pink Purple Chart (Figure 46)

VJB had three pinks or purples in her alphabet, 'H', 'R' and 'V', 'H' was square 10 in the pinks and purples colour chart, 'R' was square 11 and 'V' was square 12. According to VJB, 'square 15 equals "V", squares 4 and 5 could be "E", but [the] background interferes, [VJB thought that they were] too "pinky", square 11 equals "R"'. VJB did not manage to pick out any of her letter squares from this colour category.

Earth Chart (Figure 47)

VJB had five alphabet letters in the earth colour chart, 'F', 'G', 'J', 'N' and 'U'. Letter 'F' was square 19, 'G' was square 20, 'J' was square 21, 'N' was square 22 and 'U' was square 23. She remarked that 'all the browns are very confusing' and though she had several browns in her alphabet she was unable to pick her letter colours out. On reflection, she liked the fact that there was no correlation between the letter colours, and remarked that 'square 24 might be "U"'. In reality square 23 was her 'U'.

Neutrals Chart (Figure 48)

VJB had five neutrals in her alphabet, 'E', 'I', 'X', 'Y' and 'Z'. Letter 'E' was square 21 in the neutrals chart, letter 'I' was square 22, letter 'X' was square 23, letter 'Y' was square 24 and letter 'Z' was square 25. According to VJB, 'square 10 equals "I" and is Black, square 21 or 26 equals "E", but background interferes with verification, [while] trying to find "X" and "Z" is also problematic'.

Participant 4: VJB

Yellow Chart: 'S', square 11;
Red Chart: 'A', square 5; 'M', square 6; 'O', square 7; 'P', square 8; 'Q', square 9;
Blue Chart: 'B', square 10; 'D', square 11; 'T', square 12; 'W', square 13;
Green Chart: 'C', square 5; 'K', square 6; 'L', square 7;
Pink Purple Chart: 'H', square 10; 'R', square 11; 'V', square 12;
Earth Chart: 'F', square 19; 'G', square 20; 'J', square 21; 'N', square 22;

'U', square 23;

Neutrals Chart: 'E', square 21; 'I', square 22; 'X', square 23; 'Y', square 24; 'Z', square 25.

6.2.5 Participant 5: STH

STH is a jewellery artist and metalwork designer. She is a senior lecturer at London Metropolitan University. She is dyslexic and finds that wearing tinted spectacles helps her to see the world better, as it calms the movement she constantly experiences. STH speaks English and German. The best font for STH is Verdana. She uses the synaesthesia for remembering and translation, 'like when I go into German. Different fonts just confuse and side-track, as the translation is from seeing to converting to a noise that then makes sense. The simpler fonts are the best – but not in colour terms, just aesthetic.'

6.2.5.1 Questionnaire: Participant 5: STH (see Appendix 6)

'I didn't know the word [synaesthete], but knew letters had colours before I was twelve [years old], maybe ten' (Q1) and (Q2). STH didn't recall anyone else in the family being synaesthetic (Q3). 'I doubt it. I haven't come across anyone. I have a sister but she doesn't have it.' When STH looks at an alphabet, 'I experience overload because the whole alphabet is too much. When I look at a word it's the first two or three letters that are coloured. Any word that has more than five letters needs to be read and re-read, it doesn't stay with me because I am dyslexic' (Q4). In response to the question 'Do different fonts alter your colour experience?' STH remarked that she was 'not sure. I haven't noticed that' (Q5). 'The text is too much; it's the individual letters of a word that have colour. I can switch this on and off' (Q6). To the question 'Does text alter your experience in any way? If so, how?' she answered, 'I see the white bits more than the black bits' (Q7). When asked if the colour of the paper altered her experience (Q8), STH replied, 'Yes, letters move around the page because I am dyslexic. Red background is frantic, white is busy, grey is as close to standstill as possible'. On the question of the effects of texture, '[I] haven't noticed that, she said. 'It may distract because I am a materials person' (Q9). '[My colours] are matt not glossy and have no texture' (Q10). STH didn't know where her colours came from (Q11). 'Do the letters vary in colour if they are written or spoken?' (Q12) 'Spoken letters I don't see as coloured because I stay in the audible. I doubt that they do; my hunch is that it is more emotional or seasonal where any changes take place.' When asked, 'Where do the colours occur in your field of

vision?' she answered, 'Top centre inside my head, in my "mind's eye" … at the top of my forehead' (Q13, Q14). STH was asked, 'Do colours come into view independently, or are they triggered by something?' (Q15) 'I don't think I would see a colour and then make a word,' she replied. 'It's like the decoding of reading.' When asked if her colours were always the same, STH reported, 'I would say so, but I have a hunch they shift a little' (Q16). 'Braille goes between the shades of grey, the shadow. I don't think musical notes have colours. No to [the synaesthetic effect of] punctuation' (Q17). Other languages didn't have different colours (Q18). 'Does the way a colour is spelt or sounds have an influence on the colours?' she was asked. 'As I can't spell anyway, I think the answer is no. My sister used to say I drew rather than wrote, so on a bad day I'd draw my name badly' (Q19). 'Does the colour appear the same whether the grapheme is read, heard or thought of?' STH replied, 'Yes if it is an individual letter, but if it's a word it can provoke a lot of different colours, especially when reading a book. This is because there is such a large amount of text going into my brain, containing people and speech and places and objects that I get an overall blur or colour. The colours that I read in books can also be influenced by the colours of the cover' (Q20). The answers were no to questions (Q21) and (Q22) (see Appendix 1). To the question 'Are consonants coloured differently to vowels?' she replied, 'Yes because each letter is different and has its own colour' (Q23). The first letter of a word dominates the colour of the word (Q24), while letters do not inherit the shade of the nearby letters (Q25). Though the meaning of the word influences the colour of the word (Q26), the meaning of the word doesn't change the colour of the word (Q27). 'I don't think [the colours] have changed [with time], but they have become easier to distinguish as time goes on because their intensity has progressed' (Q28). Grouped letters didn't change colour due to their context (Q29). Repetition of a letter within a word dominates the colour of the word (Q30). The answer to (Q31) was no (see Appendix 1).

6.2.5.2 Findings Chart: Participant 5: STH

Date of Meeting	**Verbal Colour Description**	**Munsell Color Reference**	
23/9/13	A – *'Dark Blackish Blue'*	**2/11/13:** 5PB 2/4 *'Darkish Blue'* **8/12/13:** 5PB 2/2	**3/8/14:** 5PB 2/2

23/9/13	B – *'Brown, Dark'*	**2/11/13:** 5YR 2/2 and 7.5YR 2/2 *'Brown'* **8/12/13:** 5YR 2/2	**3/8/14:** 5YR 2/2
23/9/13	C – *'Sort of Khaki'*	**2/11/13:** 5Y 6/6 *'Khaki'* **8/12/13:** 2.5Y 6/10	**3/8/14:** 2.5Y 6/6
23/9/13	D – *'Lighter Brown'*	**2/11/13:** 10YR 4/4 *'Light Brown but is missing'* 10YR 3/4 *'but paler'* **8/12/13:** 10YR 5/4	**3/8/14:** 10YR 3/4
23/9/13	E – *'Something between Khaki and Brown'*	**2/11/13:** 5Y 5/2 *'Lemony Grey'* **8/12/13:** *'A dark colour neither Black'* 10YR 2/2 *'nor Brown, just dark like a void'*	**3/8/14:** 10YR 4/6
23/9/13	F – *'Really hard to describe, it's a Pale Metallic Fake Platinum/Gold'*	**2/11/13:** 10Y 6/8 *'Pale Green'* **8/12/13:** 2.5Y 5/2 *'A tall colour, long slender, tall colour'*	**3/8/14:** 2.5Y 5/6
23/9/13	G – *'A different shade of Brown'*	**2/11/13:** 5YR 3/4 *'Warm Brown'* **8/12/13:** 7.5YR 3/2	**3/8/14:** 7.5YR 2/4
23/9/13	H – *'An Off White, Neutrals page'*	**2/11/13:** N8.75 **8/12/13:** N8.75 *'White, just off'*	**3/8/14:** BG-PB 9/5PB
23/9/13	I – *'A Creamy White'*	**2/11/13:** N5 'White – Neutrals' **8/12/13:** N9	**3/8/14:** RY9/5Y
23/9/13	J – *'A Yellowish Darker Yellowish Khaki'*	**2/11/13:** 5Y 7/8 *'Yellowish Ochre'* **8/12/13:** 5Y 7/6	**3/8/14:** 2.5Y 6/10
23/9/13	K – *'A kind of a Grey'*	**2/11/13:** BG-PB 7/5BG to 6/5BG *'Greyish'* **8/12/13:** N4.5	**3/8/14:** N5

23/9/13	L – *'Like pine wood, Orangey Beige'*	**2/11/13:** 10YR 7/8 – 10YR 7/10 *'A wood colour between'* **8/12/13:** 2.5Y 7/8	**3/8/14:** 10YR 7/8
23/9/13	M – *'Blue Middle Blue'*	**2/11/13:** 2.5PB 3/10 *'Blue'* **8/12/13:** 10B 3/6 *'Middle Blue'*	**3/8/14:** 2.5PB 2/4
23/9/13	N – *'Greenish Yellow Colour'*	**2/11/13:** Y-G 8.75 GY 6/12 *'Greenish'***8/12/13:** 7.5 GY 5/10	**3/8/14:** 7.5GY 5/10
23/9/13	O – *'Black'*	**2/11/13:** N5 *'Black, Neutrals'* **8/12/13:** N5	**3/8/14:** N1.75
23/9/13	P – *'A Darker Grey'*	**2/11/13:** *'Middle Darkish Grey, Neutrals.'* N4.25 **8/12/13:** N4.25	**3/8/14:** N3.75
23/9/13	Q – *'Something of Black, 2nd'*	**2/11/13:** GY – G 4/10G *'Greenish Grey'* **8/12/13:** N2.25	**3/8/14:** N3
23/9/13	R – *'Green, 2nd'*	**2/11/13:** 2.5PB 3/10 *'Motor Racing Green'* 10GY 3/6 **8/12/13:** 10GY 3/6 *'try to find actual Motor Racing Green'*	**3/8/14:** 10GY 3/6
23/9/13	S – *'Red, Pillar Box Red'*	**2/11/13:** *'Red, Pillar Box Red'* R-YR8.75R 4/4, *'second from bottom up'* **8/12/13:** R-YR8.75R 4/4, *'Second from bottom up'*	**3/8/14:** 7.5R 4/14
23/9/13	T – *'White but really sharp'*	**2/11/13:** N9 *'White – Neutrals'* **8/12/13:** N9.5	**3/8/14:** N9.5
23/9/13	U – *'Green but going like Grass Green'*	**2/11/13:** 10GY 5/12 *'Pure Green'* **8/12/13:** 7.5GY 4/8 *'Greenish'*	**3/8/14:** 2.5GY 5/8

23/9/13	V – *'Between Green and Yellow Khaki'*	**2/11/13:** 7.5GY 6/6 *'Greenish colour'* **8/12/13:** 10GY 4/2	**3/8/14:** 5GY 4/8
23/9/13	W – *'It's a different kind of Green between Lighter Green and going off into Yellowish'*	**2/11/13:** 10Y 7/8 *'Khaki Greenish Muddy colour'* **8/12/13:** 7.5GY 4/4	**3/8/14:** 5GY 6/6
23/9/13	X – *'It's the colour, a White Creamy colour'*	**2/11/13:** 7.5Y 7/8 *'Ochre Khaki'* **8/12/13:** 7.5Y 5/6	**3/8/14:** 7.5Y 7/6
23/9/13	Y – *'It is possible it has no colour. It's not Grey, a light dirty Green possibly'*	**2/11/13:** 7.5Y 6/2 or 6/4 *'Khaki Greenish Yellow'* **8/12/13:** 5Y 8.5/12 *'Always have difficulty with* Y*'* 2.5GY 4/6	**3/8/14:** 5GY 6/6 or 5GY 6/4
23/9/13	Z – *'A Silver Grey'*	**2/11/13:** N8.25 or N7.75 *'Off White into Pale Grey, Neutrals'* **8/12/13:** N6.25 'Grey'	**3/8/14:** N7

6.2.5.3 Exhibition Colour Charts: Participant 5: STH

Yellow Chart: 'J', square 15, 'L', square 16; 'X', square 17;

Red Chart: 'S', square 11;

Blue Chart: 'A', square 14; 'M', square 15;

Green Chart: 'N', square 8; 'R', square 9; 'U', square 10; 'V', square 11;

'W', square 12; 'X', square 13; 'Y', square 14;

Pink Purple Chart: None;

Earth Chart: 'B', square 24; 'C', square 25; 'D', square 26; 'E', square 27;

'F', square 28; 'G', square 29; 'J', square 30; 'L', square 31;

Neutrals Chart: 'H', square 25; 'I', square 26; 'K', square 27; 'O', square 28;

'P', square 29; 'Q', square 30; 'T', square 31; 'Z', square 32.

6.3 Conclusion

The information and material shown in this chapter provides an insight into the complexities and uniqueness of the individual participant's colour experiences. I have quoted them verbatim, in this chapter as I wanted their responses to be included all together so that the full picture of their individuality could be appreciated. This information can also be found in the appendices. For the purposes of this study, I extracted all the information I needed to replicate the letter colours of the participants. The initial purpose for gathering all the data from the questionnaire, was to establish the extent of the participant's synaesthesia and to tease out the unique qualities of the individual participants' colour experiences, to facilitate their reproduction in my dye-lab. Although I feel that I have been able to achieve this, it is evident from the richness of the data gathered that more time could be devoted to this subject in order to do it the justice it deserves. I am only now beginning to explore the potential for this new work that will be developed post-Viva.

Figure 29: Installation shot of Alphabet printed box sets of participant's colours 'A' and 'B' from Exhibition at Middlesex University 2019

Figure 30: Installation shot of Alphabet printed box sets of participant's colours 'C' and 'D' from Exhibition at Middlesex University 2019

Figure 31: Installation shot of Alphabet printed box sets of participant's colours 'E' and 'F' from Exhibition at Middlesex University 2019

Figure 32 Installation shot of Alphabet printed box sets of participant's colours 'G' and 'H' from Exhibition at Middlesex University 2019

Figure 33: Installation shot of Alphabet printed box sets of participant's colours 'I' and 'J' from Exhibition at Middlesex University 2019

Figure 34: Installation shot of Alphabet printed box sets of participant's colours 'K' and 'L' from Exhibition at Middlesex University 2019

Figure 35: Installation shot of Alphabet printed box sets of participant's colours 'M' and 'N' from Exhibition at Middlesex University 2019

Figure 36: Installation shot of Alphabet printed box sets of participant's colours 'O' and 'P' from Exhibition at Middlesex University 2019

Figure 37: Installation shot of Alphabet printed box sets of participant's colours 'Q' from Exhibition at Middlesex University 2019

Figure 38: Installation shot of Alphabet printed box sets of participant's colours 'R', 'S', 'T', 'U', from Exhibition at Middlesex University 2019

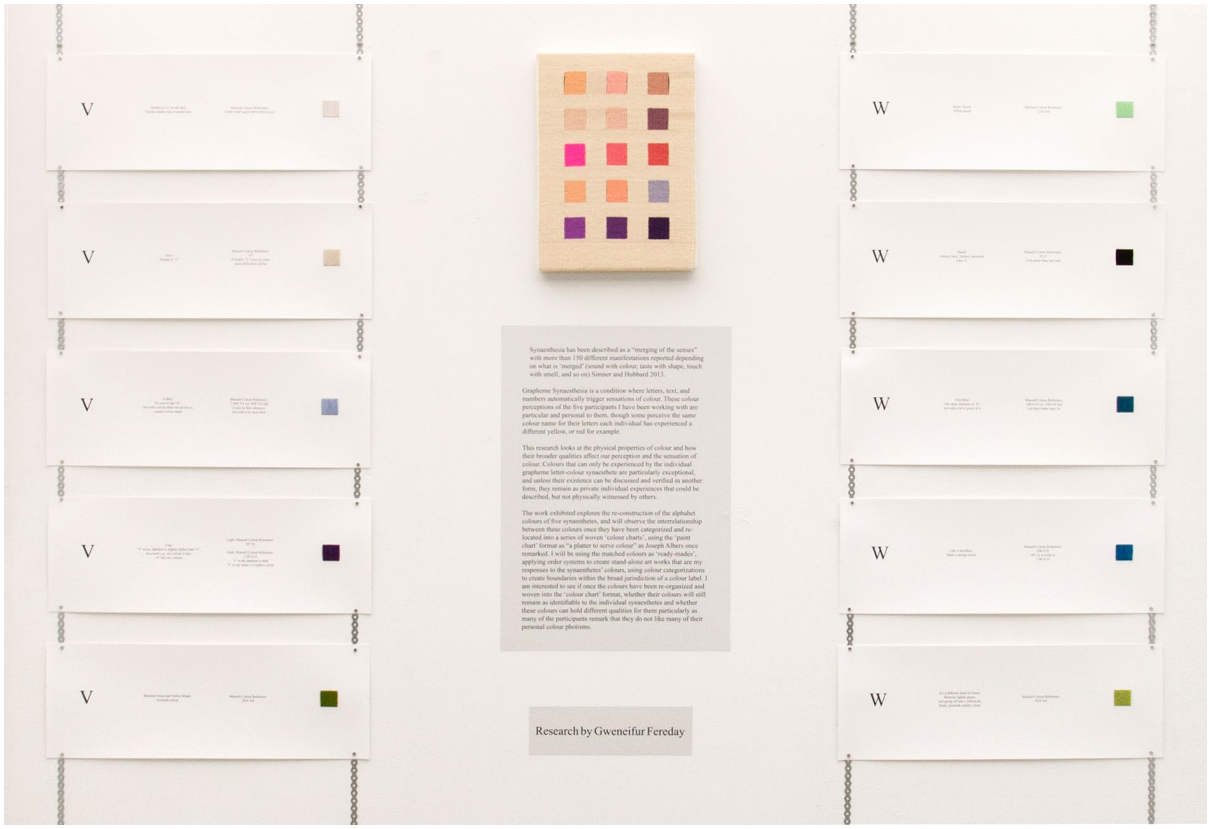

Figure 39: Installation shot of Alphabet printed box sets of participant's colours 'V' and 'W' from Exhibition at Middlesex University 2019

Figure 40: Installation shot of Alphabet printed box sets of participant's colours 'X', 'Y' and 'Z' from Exhibition at Middlesex University 2019

Figure 41: Installation shot of Woven Alphabet Colour Chart ‘A’ – ‘Z’ from Exhibition at Middlesex University 2019

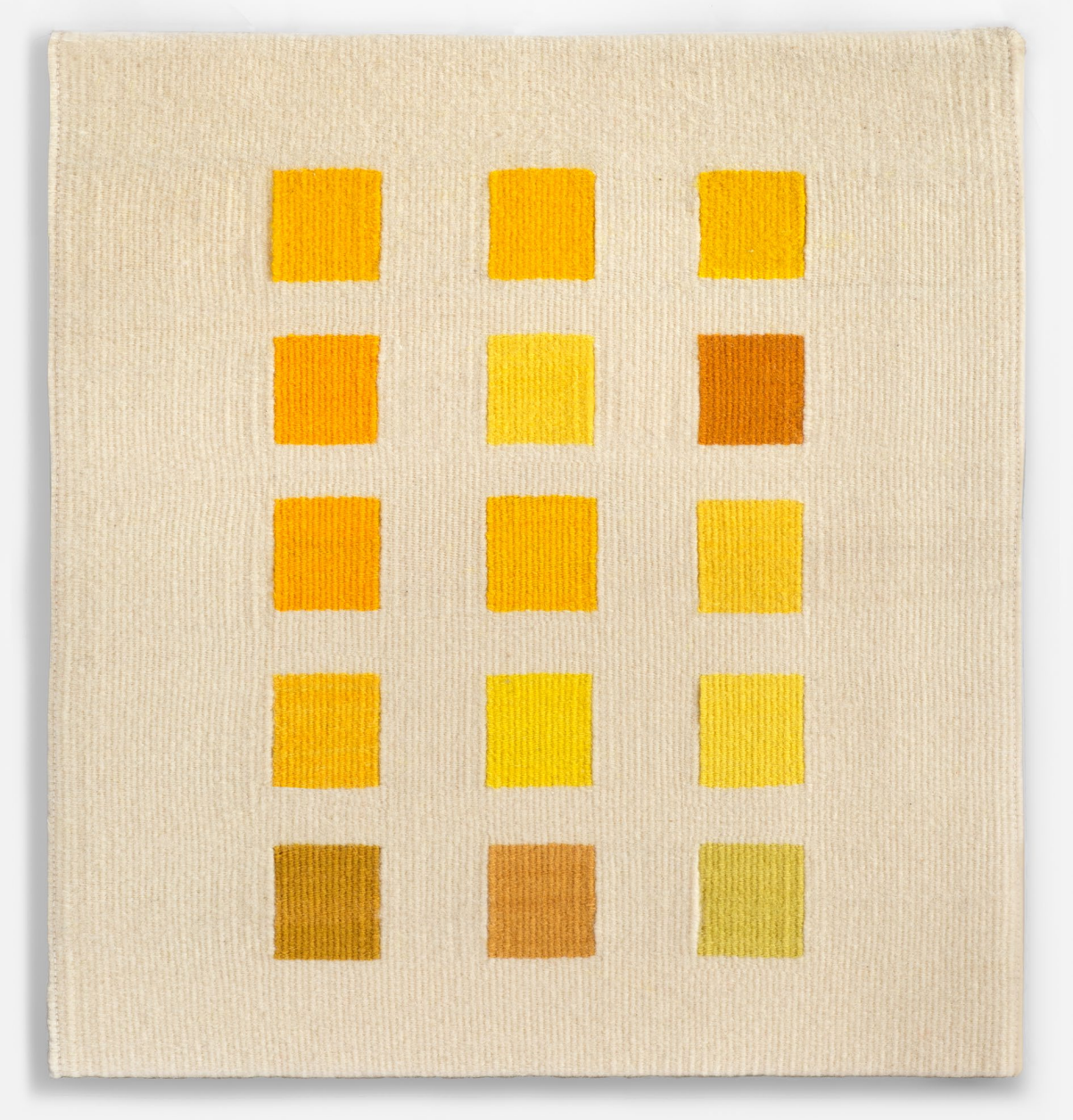

Figure 42: Installation shot of Woven Alphabet Colour Chart Yellow
from Exhibition at Middlesex University 2019

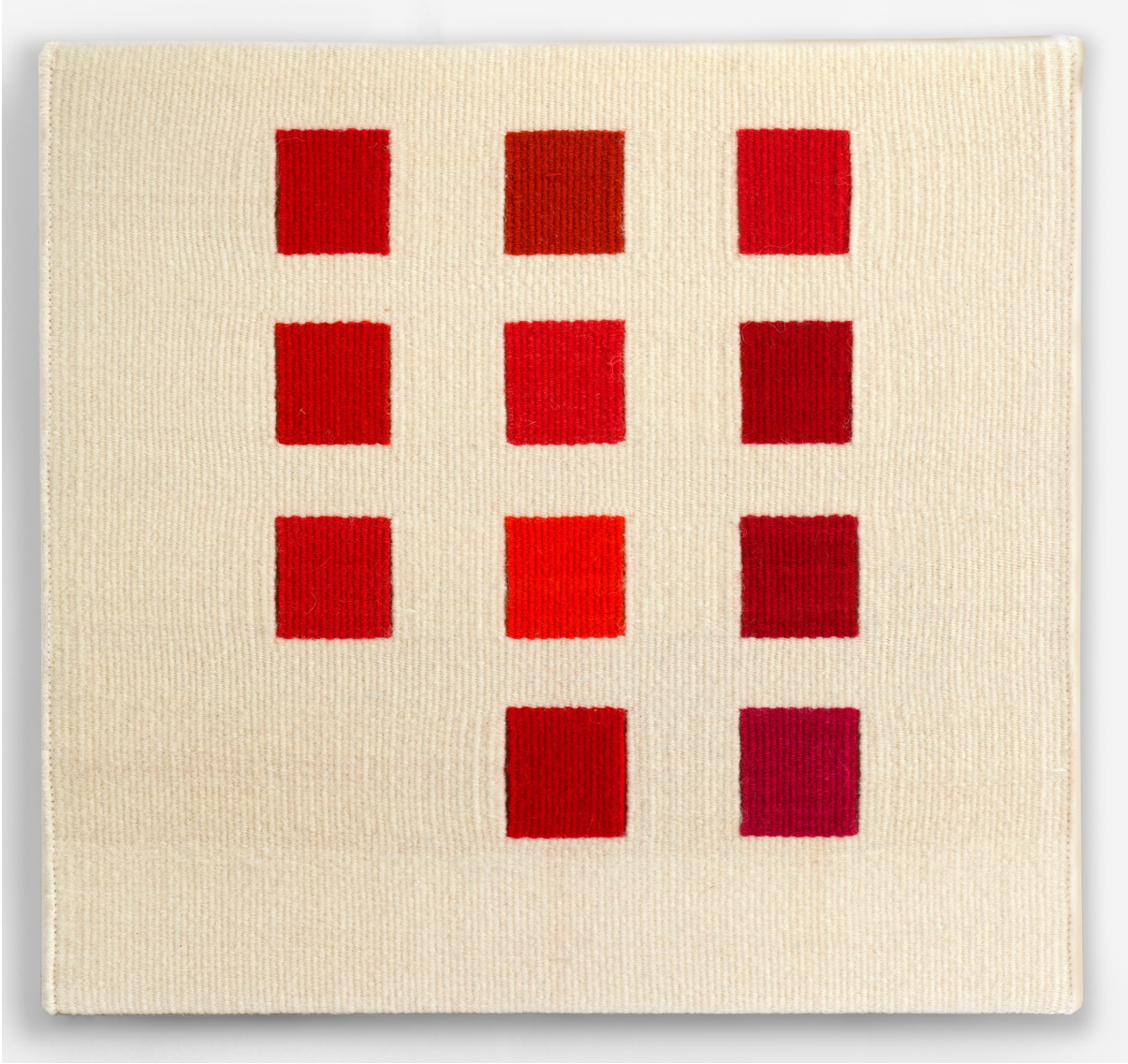

Figure 43: Installation shot of Woven Alphabet Colour Chart Red
from Exhibition at Middlesex University 2019

Figure 44: Installation shot of Woven Alphabet Colour Chart Blue
from Exhibition at Middlesex University 2019

Figure 45: Installation shot of Woven Alphabet Colour Chart Green
from Exhibition at Middlesex University 2019

Figure 46: Installation shot of Woven Alphabet Colour Chart Pink/Purples from Exhibition at Middlesex University 2019

Figure 47: Installation shot of Woven Alphabet Colour Chart Earths from Exhibition at Middlesex University 2019

Figure 48: Installation shot of Woven Alphabet Colour Chart Neutrals from Exhibition at Middlesex University 2019

Figure 49: Installation shot of work made for PhD study
from Exhibition at Middlesex University 2019

Figure 50: Installation shot of work made for PhD study
from Exhibition at Middlesex University 2019

Figure 51: Installation shot of work made for PhD study
from Exhibition at Middlesex University 2019

Figure 52: Installation shot of work made for PhD study
from Exhibition at Middlesex University 201

Figure 53: Installation shot of work made for PhD study
from Exhibition at Middlesex University 2019

Chapter 7: Discussion and Conclusions

7.0 Introduction

I have discussed aspects of the findings for this study in Chapter 6 and the ensuing work that resulted from them. This chapter will build on this dialogue and draw conclusions from the research undertaken for this study while discussing possible ways forward for developing future work. I was able to generate considerably more data than was needed for the specific research task undertaken for this study, and revisiting this data has been extremely beneficial, enabling me to reflect upon what I have achieved and to reacquaint myself with the extensive richness of the material that is available to be analysed for future projects.

7.1 Discussion and Conclusions

The fact that I met the aims of the research by successfully matching the letter colours of my participants, therefore crossing the boundaries from internal 'brain generated' colour perceptions to analogue 'material colour', means that I have been instrumental in opening up the potential opportunity to share, to some extent, a small cohort of grapheme synaesthetes' letter-colour experiences to a wider audience.

Until now these unique perceptions have remained inaccessible to non-synaesthetes. One of the participants who was able to attend the exhibition of the results of this work, remarked that it was 'fantastic' to see the exhibition and noted that her colours were 'identical' to how she saw them in her head. This was a wonderful endorsement of several years' work from one of the participants, although I cannot take this as any more than one participant's confirmation that what I had been working towards had in fact worked for her in particular. Both the participants who attended the exhibition reported that they were happy with their letter colours apart from in both cases remarking that two of their 26 letter colours would benefit from slight adjustments. This means that 24 colour matchings out of 26 remained correct after a gap of six to eight years for two of the five participants; a testimony to the stability of the colours perceived by the synaesthetes. Although the remaining three participants have not been able to be tested to date, the evidence of the two who were tested, demonstrates that the colours perceived by the synaesthetes is more likely to be a stable

phenomenon and that it is highly likely that a synaesthete can recognise 'their' colours when presented in this format. This evidence provides an endorsement that material colour has the capacity to render itself as coloured light or 'imaginary' colour, that is, colour that is constructed by the brain's imagination.

A focused dialogue took place in my dye-lab between myself and the data gathered from the participants, where the letter colours were dyed and re-dyed, colours were added to and tweaked until the gap between the correct and incorrect became smaller and smaller and final verification of the colours was achieved. I still cannot explain what causes the participants to 'see' the unique colours they 'see' or where their particular letter colours originate from, or why they should experience letter colours that they dislike and why their letter colours do not include their favourite colour shades. The fact that they have to endure these colours in some instances like unwanted visitors, and the ongoing social impact that those colours have on the way they negotiate their lives within society, remains a complex issue that would merit further investigation.

As a non-synaesthete, I continue to be impressed by the level of energy required to process the amount of additional brain activity that synaesthetes appear to need in order to navigate their way through a typical day. Although some of them seem to be able to switch their colours on and off at will, others reported that the more tired they became the stronger their colour photisms presented themselves. Yet, interestingly, all the participants reported that they would not choose to be without their synaesthesia as their experiences enrich their lives beyond measure. It is hard to imagine how I would be able to navigate through life with all this extra information to process and react to, but all the participants felt blessed that they have the experiences they have, and are proud of being part of what can be characterised as a rather elite and special community.

It is my intention to develop future work from the data I have collected, as there is so much rich material that has not been fully explored or digested within this particular study. That is not to imply that the work undertaken for this research study is incomplete, but rather to point out that I gathered more data than was required for the purposes of this specific study. There are multiple possibilities that present themselves from this data, one being the way the colours of the letters and words are experienced. So far, my energies have been solely focused on matching the individual letter colours of each participant's alphabet, and I have

not been able to allow myself to deviate from this extensive task to investigate the information that did not directly pertain to the aim of this study. However, now that the work for this PhD study is reaching its culmination, I am able to revisit the data with fresh eyes. For example, some of the participants reported that their individual letter colours remained the same even when they were clustered together to form words. A word was therefore seen as several intact individual colour blocks arranged in order side by side to create the word. Others, however, reported that within a word, certain letter colours tended to dominate over other letter colours. I would like to investigate why this happens with some colours and not with others. The sound of a letter or a word has an effect on the colour of that letter or word for some, but not for others. Again, it has not been pertinent to enquire into this aspect for this specific research study. It was also reported by some that the colour of the first letter of a word tended to dominate the colour of the entire word, while others reported that certain words were made up of one solid colour, despite the fact that the individual alphabet colours that made up that word had specific colours ascribed to them. This information alone provides rich material for several new series of woven works.

Another issue that was raised by the synaesthetes who attended the exhibition was that the background shade used in the woven colour charts was crucial for one of the participants as it interfered with her ability to find her letter colours, although the other participant did not find this a problem. Both participants, however, found that there was not sufficient space provided around each letter colour in the colour charts, which contributed to their difficulty in locating their personal letter colours. Neither of the two participants who attended the exhibition demonstrated a tendency to 'bi-directionality', 'inducer' to 'concurrent' and back to 'inducer' (see Chapter 2: Synaesthesia). This is where the letter triggers the colour, and the colour in turn triggers the letter. For future work I will revisit these issues of space and background to inform future compositions.

On reflection, I have successfully reproduced the participants' individual alphabets and this has provided more than simply a palette of 'harvested' letter colours. The spatial relationships of the colours and the language embraced to describe them has provided a rich repertoire of material for future investigation. As I have done the participants justice with respect to their letter colours I feel ready to produce work that still relates to their synaesthesia but to some extent is less clinical and will enable me to take a more intuitive approach, without diminishing the authority or ownership of the participants' letter colours in

any way. While all future work produced would always include and welcome the participants' critical input, I would, however, foresee a future relationship that is to some extent more relaxed. I intend to pursue my commitment to abstraction as a vehicle for the examination of the integration of colour and text, drawing multiple strands of visual information together to form new compositions.

7.2 Future Developments

There are a number of elements within the data collected that have not been focused upon within this study, but would be worthy of future development. One being the colours of whole words, and why some words presented themselves as solid colours, yet others did not. Take, for example, the days of the week. The first three participants volunteered that for them the days of the week were dominated by one single colour. My immediate thought was, why? This was not one of the questions in the questionnaire, so the information obtained relates only to the three participants who mentioned this phenomenon during the course of our collaboration. It would be interesting to establish whether any of the colours they reported for the days of the week could be found within their individual alphabet colours. There may be interesting connections here that I could investigate further for later work.

One of the three participants who mentioned the days of the week, reported that when she looks at the alphabet, the colours happen in her head and were not triggered by letters or text. She referred to the mood of the content having an influence on her colour perceptions. This report on mood-influencing colours is an additional aspect of synaesthesia that potentially opens up further avenues for consideration. The implication here is that colours may be triggered by text that has already been processed in the brain, so that the meaning of the text triggers the letter colours not the shape of the letters. If this were the case, it would need to be interrogated further as it would deserve more consideration.

Due to the complexities of this research study, another aspect that was not investigated in the depth it deserves is the manner in which the participants experienced their colours. This appears to fall into two categories: those who experience their colours inside their heads, termed 'associators', and those who experience their colours as an external perception in space outside the body, known as 'projectors'. Their experiences are reported to be somewhere between the head and the text, where the colour is projected directly onto the text

or floats somewhere between the eyes and the text. All the participants in this study reported that their colour photisms occurred in their 'mind's eye', meaning that they were 'associators' rather than 'projectors' (see Chapter 2: Synaesthesia).

These three-dimensional colour spaces would be very interesting to explore as an installation where the colours could be placed in 3D space to reflect the unique physical aspect of the colour experiences of the participants recorded in this study. At present, I am considering a number of lines of enquiry that I would like to pursue in more detail from which to produce new work. All of these will involve teasing out in more depth particular aspects of colour perception that I have uncovered as a result of this research. The loyalty, patience and commitment that these five participants have shown has been quite overwhelming and I feel honoured that they have all embraced this research project in its entirety and entrusted me with their unique and very private experiences. They have been so professional and consistent with their time and concern to tease out what they really do experience and find the most appropriate words that best suit these experiences. It goes without saying that none of this would have been possible without them.

Although challenging, this project has been extremely interesting and thought provoking, contributing to new knowledge about colour and how we perceive it. The synaesthetes are as thrilled as I am to see their coloured alphabets in physical form. I feel excited and ready to produce more work in response to the information I have gathered and look forward to the freedom to pursue my own visual enquiries with the ready-made alphabet colour palette.

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Appendices

Appendix 1: Questions to Synaesthetes

1) When did you discover that you were synaesthetic?

2) How old were you?

3) Do any other members of your family have similar experiences?

4) Can you describe what you experience when you look at an alphabet?

5) Do different fonts alter your colour experience?

6) Can you conjure up the sensation in your 'mind's eye', or do you need to see the text?

7) Does text alter your experience in any way? If so, how?

8) Does the colour of the paper alter your experience?

9) Does texture alter your experience in any way, i.e., texture of paper or surface?

10) Do your colours have textures attributed to them? If so, can you describe them?

11) Are the colours of each letter determined by the physical experience of the letter or the sound the letter makes?

12) Do the letters vary in colour if they are written or spoken?

13) Where do the colours occur in your field of vision?

14) Do your colours have a particular location?

15) Do colours come into view independently, or are they triggered by something?

16) Are the colours always the same?

17) Do punctuation marks, Braille and musical notation have colours?

18) Do other languages have different colours?

19) Does the way a word is spelt or sounds have an influence on the colours?

20) Does the colour appear the same whether the grapheme is read, heard or thought of?

21) Do vowel colours lighten or darken a word?

22) Do vowels dominate over consonants?

23) Are consonants coloured differently to vowels?

24) Does the first letter of a word affect the colour of the word? Does it dominate?

25) Do letters inherit the shade of the nearby letters?

26) Does the meaning of the word have an influence on its colour, e.g., banana, orange, lime?

27) Does the meaning of the word change the colour of the word?

28) Have your colours changed with time?

29) Do grouped letters change colour due to their context?

30) If a letter is repeated in a word does this dominate the colour of the word?

31) If a word has a different meaning or sound when used in a different context, can this affect the colour of the word?

Appendix 2

First Interviewee: Participant 1: HW

First meeting 30/4/10 – Craft Study Centre, study room, Farnham, Surrey.

HW was a student of Textiles at UCA, Farnham; she graduated in 2010. Her mother is synaesthetic; they have always discussed their colour experiences quite openly. HW has a brother who has not inherited this phenomenon.
All HW's colours are flat but glow; none of them have texture.

Alphabet Colours

A: Yellow, bright acidy, canary yellow, really strong. Thinks her synaesthesia is yellow based and red, same as 2. (Munsell Color Book 2.5 Y 8/1).

B: Brown, greeny brown, cold muddy (Munsell Color Book: 10YR4/6).

C: Orangey, rusty, sometimes its paler sometimes it's strong burnt orangey (Munsell Color Book 7.5YR/12).

D: Very similar to B but greyer and paler, not beige (Munsell Color Book: 2.5Y4/4).

E: Similar to 'C' but really, really intense orange. (Munsell Color Book: 5YR6/14 to 5YR5/12, something in between as Munsell Color Book: 5YR5/12 is too brown.)

F: Green, bluey green changes subtley bluey changes to emerald. F often defines the word a strong leader (Munsell Color Book: 10GY3/5) to (10GY4/8).

G: Grey, brown biased grey, mushroomy grey?

H: Bright red, primary red, very strong colour.

I: Is it white is it grey, very pale if it is and is towards pale grey almost white.

J: Similar to ‘I’, but a little browner, barely there, has a tint to it.

K: Orange based, white based orange, tint?

L: Doesn’t have anything defined by its shape, like looking through a window, you see past it. See the outline, edge is defined but the centre, middle of the ‘L’ is same as outside the ‘L’. See-through like a window. Defined by its background, translucent takes whatever it is against.

M: Orange, but not orange, ochre, intense.

All colours are seen in a black void.
Kandinsky: ‘inner harmony is black’
Colours glow, are luminous, not harsh like neon.
Numbers, days of the week and calendar of the year are seen in 3D black space.

N: More of a true reddier brown.

O: Translucent but a bit blacker.

P: Pink same as *William Morris as Designer* by Ray Watkins (the cover), spine, whitey pink or pink with white in it.

Q: Puce, fleshy dulled pink, meaty pink, cooked ham pink, dull.

R: Ambiguous colour is it red/rusty brown (Munsell Color Book: 10R3/10), second line from bottom (Munsell Color Book:10 R5th in row on right).

S: Yellow same as ‘A’ but a little bit paler in words it’s the same though.

T: Blue Thomas the Tank Engine Blue.

U: Very cream-like verging on the translucent (Munsell Color Book:5Y9/1).

V: Similar to U on the feel, but the purple side of mushroom.

W: Minty green white based (Munsell Color Book: 2.5G8/6).

X: Doesn't really have much to it, but leans to the greys/neutral.

Z: Is it purple is it grey is it yellow, really muddy ochre, but…?

Letters that have strange shapes to them take longer to define colourwise, milliseconds. The size of letter makes a difference, the larger the letter the longer it takes unless the shape had a traditional simple shape.

Appendix 2a

First Interviewee: Participant 1: HW

First meeting 30/4/10 – Craft Study Centre, study room, Farnham, Surrey.

Questions to Synaesthetes

1) **GF:** When did you discover that you were synaesthetic?

HW: When my mum said in the car that my name was 'pink' and I said no Hannah is Red.

2) **GF:** How old were you?

HW: 8.

3) **GF:** Do any other members of your family have similar experiences?

HW: My mum is synaesthetic.

4) **GF:** Can you describe what you experience when you look at an alphabet?

HW: I see the letters as filled in with the colour against a black space.

5) **GF:** Do different fonts alter your colour experience?

HW: Yes, the bolder/ thicker/ rounder the letters the quicker the response.

6) **GF:** Can you conjure up the sensation in your mind's eye, or do you need to see the text?

HW: 'Mind's eye' is strongest.

7) **GF:** Does text alter your experience in any way, if so how?

HW: No.

8) **GF:** Does the colour of the paper alter your experience?

HW: No as they are strongest in my 'mind's eye'.

9) **GF:** Does texture alter your experience in any way, i.e., texture of paper or surface?

HW: No.

10) **GF:** Do your colours have textures attributed to them, if so can you describe them?

HW: Very flat in the 3D black space.

11) **GF:** Are the colours of each letter determined by the physical experience of the letter or the sound the letter makes?

HW: I can get sensations associated with certain words, such as tastes but not to specific letters.

12) **GF:** Do the letters vary in colour if they are written or spoken?

HW: Stronger written down

13) **GF:** Where do the colours occur in your field of vision?

HW: In the centre.

14) **GF:** Do your colours have a particular location?

HW: The letters are filled in over the top of the font colour/layered

15) **GF:** Do colours come into view independently, or are they triggered by something?

HW: Independent but stronger if I focus on it.

16) **GF:** Are the colours always the same?

HW: Yes, when independent; however, will change if within a word to take on that words colour.

17) **GF:** Do punctuation marks, Braille and musical notation have colours?

HW: Punctuation will take on the colour of the word. Or how tired I am.

18) **GF:** Do other languages have different colours?

HW: The name of the language has a colour that is it.

19) **GF:** Does the way a word is spelt or sounds have an influence on the colours?

HW: Sound is associated with taste and how the word is spelt influences the colours.

20) **GF:** Does the colour appear the same whether the grapheme is read, heard or thought of?

HW: Strongest/quicker response when read or thought in mind's eye but apart from that no.

21) **GF:** Do vowel colours lighten or darken a word?

HW: They have their own independent colours with no correlation.

22) **GF:** Do vowels dominate over consonants?

HW: No, H, A, T, Q, D, B have strong associations.

23) **GF:** Are consonants coloured differently to vowels?

HW: No correlation.

24) **GF:** Does the first letter of a word affect the colour of the word; does it dominate?

HW: As a rule, yes but not every time.

25) **GF:** Do letters inherit the shade of the nearby letters?

HW: Yes.

26) **GF:** Does the meaning of the word have an influence on its colour, e.g., banana, orange, lime?

HW: Yes, now I have just read that sentence!

27) **GF:** Does the meaning of the word change the colour of the word?

HW: No.

28) **GF:** Have your colours changed with time?

HW: Not sure completely – but I would say no as a whole.

29) **GF:** Do grouped letters change colour due to their context?

HW: No.

30) **GF:** If a letter is repeated in a word does this dominate the colour of the word?

HW: No.

31) **GF:** If a word has a different meaning or sound when used in a different context, can this affect the colour of the word?

HW: It is about the contained letters as a whole so I would say no.

Appendix 3

Second Interviewee: Participant 2: LR

First meeting 30/4/10– Craft Study Centre, study room, Farnham, Surrey.

Questions to Synaesthetes

1) **GF:** When did you discover that you were synaesthetic?

LR: I became aware in 2005, at work during a meeting to discuss a layout map on a website and what colours to do the cities in. I remarked, 'Why don't we do the areas in the colours we see them in?' Everyone in the room looked blank.

2) **GF:** How old were you?

LR: When I was four or five or six, just up from infant school. I had a conversation with a friend that Wednesdays were Orange days. When I was twenty-five I realised, at the meeting.

Monday: Yellow
Tuesday: Red
Wednesday: Orange
Thursday: Grey
Friday: Blue
Saturday: Black
Sunday: Brown
Most words like and, of, the, are black and white, but other words are coloured.

3) **GF:** Do any other members of your family experience similar traits?

LR: My brother sometimes occasionally sees colours. (Will ask if aunts and uncles have synaesthesia.)

4) **GF:** Can you describe what you experience when you look at an alphabet?

LR:

Alphabet Colours

A: Yellow solid yellow, it must dominate because the word alphabet is yellow, sunshine yellow.

B: Blue fairly standard deep blue.

C: Orange, not a very bright one a dirty orange.

D: Brown, your suitcase in shadow.

E: Blue much more vibrant blue than 'B'.

F: Black, Munsell book black.

G: Black, Munsell book black.

H: Brown similar to 'D', but a little brighter.

I: Is transparent like your folder, it has a white sheen to it.

J: Beige/tan, like the reference book covers, the stacked four in the study room [Susan Bosence reference books]

K: Black as before.

L: Is a strong black, intense, saturated.

M: Orange dirtier than 'C'.

N: Brown, deeper brown than others.

O: White

P: Blue, more like ‘B’.

Q: Silver grey.

R: Brown, brightest brown of them all.

S: Red, strong red.

T: Black like ‘L’.

U: Grey, greyer than the silver of ‘Q’.

V: Grey similar to ‘U’.

W: Black, like ‘L’.

X: Brown, paler.

Y: Yellow, vibrant.

Z: Red, same as ‘S’, but a more purpley red.

Manchester is Orange.

Sheffield is Orange.

Farnham is Blue.

Cranley is Yellow.

Guildford is Brown.

Apple is green, very vibrant, not a foresty green, Granny Smith green, not Golden Delicious green.

5) **GF:** Do different fonts alter your colour experience?

LR: All the fonts except for the 'oriental one' and the 'wild west one', are seen as separate colours of the letters. The 'oriental one' is Red. The 'wild west one' is Brown.

6) **GF:** Can you conjure up the sensation in your mind's eye, or do you need to see the text?

LR:

7) **GF:** Does text alter your experience in any way? If so, how?

LR:

8) **GF:** Does the colour of the paper alter your experience?

LR:

9) **GF:** Does texture alter your experience in any way, i.e., texture of paper or surface?

LR:

10) **GF:** Do your colours have textures attributed to them? If so, can you describe them?

LR:

11) **GF:** Are the colours of each letter determined by the physical experience of the letter or the sound the letter makes?

LR:

12) **GF:** Do the letters vary in colour if they are written or spoken?

LR: Different pronunciations of a letter and words do change the colours.

13) **GF:** Where, do the colours occur in your field of vision

LR:

14) **GF:** Do your colours have a particular location?

LR: Yes, the back of the mind.

15) **GF:** Do colours come into view independently, or are they triggered by something?

LR:

16) **GF:** Are the colours always the same?

LR:

17) **GF:** Do punctuation marks, Braille and musical notation have colours?

LR: The word 'braille' is Grey, 'comma' is Brown, 'full stop' is Red. Germany is Black.

18) **GF:** Do other languages have different colours?

LR:

19) **GF:** Does the way a word is spelt or sounds have an influence on the colours?

LR:

20) **GF:** Does the colour appear the same whether the grapheme is read, heard or thought of?

LR: Yes.

21) **GF:** Do vowel colours lighten or darken a word?

LR: Vowel colours lighten a word.

22) **GF:** Do vowels dominate over consonants?

LR: Consonants dominate over vowels.

23) **GF:** Are consonants coloured differently to vowels?

LR: Consonants make a word heavier.

24) **GF:** Does the first letter of a word affect the colour of the word? Does it dominate?

LR: Sometimes the first letter of the word dominates the colour of the word, but not always.
Aunt is Yellow
Uncle is Brown

25) **GF:** Do letters inherit the shade of the nearby letters?
LR: No.

26) **GF:** Does the meaning of the word have an influence on its colour, e.g., banana, orange, lime?
LR:

27) **GF:** Does the meaning of the word change the colour of the word?
LR: Yes, possibly.

28) **GF:** Have your colours changed with time?
LR:

29) **GF:** Do grouped letters change colour due to their context?
LR:

30) **GF:** If a letter is repeated in a word does this dominate the colour of the word?

LR: No

31) **GF:** If a word has a different meaning or sound when used in a different context, can this affect the colour of the word?

LR: Yes. The sound of the word informs the colour of the word.

Appendix 4

Third Interviewee: Participant 3: AA

First meeting 25/4/13 was held at the Royal College of Art, London

AA is 23 years old, and is an MA student, studying Design Products at the Royal College of Art, London. She is in the first year of a two-year course.

Questions to Synaesthetes

1) **GF:** When did you discover that you were synaesthetic?

AA: Always, there were small clues along the way. When I was ten years old I remember having a conversation with a friend and saying that each letter of the alphabet had a particular colour. Nausea that 'C' could not be a dark green. [For AA 'C' is light citrous, lemony yellow.] On my degree course at Stanford College, California when I was nineteen and in my second year of Product Design through mechanical engineering, my synaesthesia was established. We were given five paints – red, blue, yellow, black, and white, and asked to mix 300 shades, and paint 300 objects each in a distinct colour. I painted ping-pong balls. We were then asked to arrange our objects in sets of warm–cool, dark–light, saturated–de-saturated. I found this exercise very stressful.

2) **GF:** How old were you?

AA: Ten-ish to nineteen years.

3) **GF:** Do any other members of your family have similar experiences?

AA: Not to my knowledge, but my mother and grandmother both paint, and understand my synaesthesia. They don't think I'm crazy.

4) **GF:** Can you describe what you experience when you look at an alphabet?

AA: It happens in my head and is not triggered by Fonts/Text. In text, colours are more about the mood of the content, e.g., days of the week have a colour, Sunday = Amber Yellow.

5) **GF:** Do different fonts alter your colour experience?

AA: No.

6) **GF:** Can you conjure up the sensation in your mind's eye, or do you need to see the text?

AA: The colour sensation is conjured up in my mind except for the days of the week and personalities. I am immersed in the colour, surrounded by the colour. The word Alphabet has no emotional impact or not much.

7) **GF:** Does text alter your experience in any way? If so how?

AA: Text overrides individual letter colours. Emotions in the text have an input of the colours. Every colour has an extremely strong personality.

8) **GF:** Does the colour of the paper alter your experience?

AA: It wouldn't interfere with the colour sensation, but the quality of the paper could annoy if it was inferior quality.

9) **GF:** Does texture alter your experience in any way, i.e., texture of paper or surface?

AA: Not in terms of the colour I see.

10) **GF:** Do your colours have textures attributed to them? If so, can you describe them?

AA: They do not have textures attributed to them, but some colours are thin or thicker than others, like watercolours or acrylic etc.

11) **GF:** Are the colours of each letter determined by the physical experience of the letter or the sound the letter makes?

AA: They are determined by the physical experience.

12) **GF:** Do the letters vary in colour if they are written or spoken?

AA: No.

13) **GF:** Where do the colours occur in your field of vision?

AA: The colours occur in my head, towards the back of my head, rather than to the sides.

14) **GF:** Do your colours have a particular location?

AA: They are in my head, not external. If my head was a box, the walls get painted in that colour. I feel the colour, blue is cobalt blue, it can be seen as a flat colour, very stable.

15) **GF:** Do colours come into view independently, or are they triggered by something?

AA: They are triggered by text or thinking about something, but it doesn't have to be conscious, i.e., I love maths where numbers change through addition or multiplication they automatically jump to another colour.

16) **GF:** Are the colours always the same?

AA: Yes, some letters have a stronger colour than others. Colours do not change with time of day or season. The front end of the alphabet is more distinct and clearer or specific than 'H', 'I', 'J', which is less defined.

17) **GF:** Do punctuation marks, Braille and musical notation have colours?

AA: No, though I do read music.

18) **GF:** Do other languages have different colours?

AA: My second language is Hindi, where every four letters is a family, and these have a particular colour, but not as distinct as English, which is my first language. In Hindi, it is more about the shape giving the colour, whereas in English it is less so.

19) **GF:** Does the way a word is spelt or sounds have an influence on the colours?

AA: Not sound definitely. Complete words have less colour association eg: chair has no particular colour possibly red, but 'C–H–A–I–R' have definite attributes, but the individual letter colours are not combined as a single colour in the word.

20) **GF:** Does the colour appear the same whether the grapheme is read, heard or thought of?

AA: Yes.

21) **GF:** Do vowel colours lighten or darken a word?

AA: Lighten.

22) **GF:** Do vowels dominate over consonants?

AA: No, except for 'A'. All other vowels are in the background. I feel partial to 'A' as my initials are 'A'.

23) **GF:** Are consonants coloured differently to vowels?

AA: Except for 'A', yes.

24) **GF:** Does the first letter of a word affect the colour of the word? Does it dominate?

AA: Yes

25) **GF:** Do letters inherit the shade of the nearby letters?

AA: Some do, some letters are seen as a cluster and some more distinct. For numbers, this is completely true.

26) **GF:** Does the meaning of the word have an influence on its colour, e.g., banana, orange, lime?

AA: Banana is Yellow, but each letter is different.

27) **GF:** Does the meaning of the word change the colour of the word?

AA: I don't think so.

28) **GF:** Have your colours changed with time?

AA: I feel that what has changed is my ability to articulate the colours better. My perception has become more complex with time, but the families have stayed the same. There has been a refinement of colours with time in line with awareness of colour through study.

29) **GF:** Do grouped letters change colour due to their context?

AA: Letters individually don't change colour.

30) **GF:** If a letter is repeated in a word does this dominate the colour of the word?

AA: No.

31) **GF:** If a word has a different meaning or sound when used in a different context, can this affect the colour of the word?

AA: Yes, I don't have very strong associations with nouns for example.

Alphabet Colours – 25/4/13

A: Red, has a slight tinge of pink, definitely towards crimson, not vermillion.

B: Cobalt.

C: Lemon Yellow.

D: Orange, but a lighter Orange, between a Yellow and an Orange.

E: Lime Green.

F: Dark Green not dark but Leafy Green, more towards Blue than Yellow.

G: Sort of like Yellowy Orange, kind of towards Brown, deeper Yellow Orange.

H, I, J: All in the purple family.

I: Is most Violet, but de-saturated Violet, pastel.

J: Is more typical classical Purple, similar to my cardigan.

K: Is Purple, more Fuchsia, a bit more Pink.

L: Is like ‘D’, but more Yellow than Orange.

M: A Brick Red Pink.

N: An Orangey Brown.

O: Definitely a Deep Yellow.

P: Pinkish Purple.

Q: Royal Purple, Queen’s royalty, magic, mystical.

R: Blue, a bit darker than ‘B’ but in the same family.

S: Lemon Yellow.

T: Teal.

U: A light Yellow Orange.

V: A Blue, it’s sort of like ‘B’ but with a lot of White mixed into it, a pastel colour shade.

W: Also, Blue the same darkness a ‘B’, but with a bit of Green in it.

X: Cool Grey.

Y: Yellow maybe a Cadmium Yellow, warmish?

Z: Warm Grey, a darker warm Grey.

Appendix 5

Fourth Interviewee: Participant 4: VJB

First meeting: 16/8/13, 'Costa Coffee' near Cambridge station, 1.30–2.45pm.

VJB is a freelance knitwear designer for 'Acorn Conceptual Textiles'. She studied textiles at Nottingham Trent University.

Questions to Synaesthetes

1) **GF:** When did you discover that you were synaesthetic?

VJB: The first time I heard about synaesthesia was when I was at university. I was nineteen years old and the teacher spoke about nineteenth-century artists and writers with synaesthesia – specifically talking about people who saw days of the week in colour - and thought I've got that! The first time I remember experiencing synaesthesia was at school in my reception class. We were learning to write our ABC, the page was white and the letters were black but I saw them in colour. 'A' was red, 'B' was blue, and 'C' as green.

2) **GF:** How old were you?

VJB: I must have been four years old.

3) **GF:** Do any other members of your family have similar experiences?

VJB: No.

4) **GF:** Can you describe what you experience when you look at an alphabet?

VJB: When I look at an alphabet I can see that the letters are black but once they are in my head I see colours.

5) **GF:** Do different fonts alter your colour experience?

VJB: No.

6) **GF:** Can you conjure up the sensation in your mind's eye, or do you need to see the text?

VJB: No. I can see anything I want in my head such as music, letters, words, people, places, memories, stories and all physical objects.

7) **GF:** Does text alter your experience in any way? If so, how?

VJB: When I look at a chunk of text I see a 'mood-board of colour' rather than each letter as an individual colour. It's sort of like getting a bowl of water and dropping different coloured inks into it, then swirling them around. The colours move around in my head as I read text. However, if I home in on a certain word or letter then I can see the colours in detail.

8) **GF:** Does the colour of the paper alter your experience?

VJB: Yes. If I write a list, for example, on a green post-it, I will visualise the post-it in my head as green with black text on it.

9) **GF:** Does texture alter your experience in any way, i.e., texture of paper or surface?

VJB: No.

10) **GF:** Do your colours have textures attributed to them? If so, can you describe them?

VJB: No, just flat colour.

11) **GF:** Are the colours of each letter determined by the physical experience of the letter or the sound the letter makes?

VJB: They are determined by the physical experience, for example reading a word.

12) **GF:** Do the letters vary in colour if they are written or spoken?

VJB: No. If a word is said to me, it is still the same colour as if I read it. The sound of the letter doesn't affect the colour. The colour of the letter affects the colour of the sound.

13) **GF:** Where do the colours occur in your field of vision?

VJB: If it's a single letter it's between my eyes, inside my head, but at the front of my head. If it's a word or cluster of words I see them in the same place but if I'm thinking of a physical object or a person or even memories or sounds the colours are in the whole of my head.

14) **GF:** Do your colours have a particular location?

VJB: The location is always inside my head.

15) **GF:** Do colours come into view independently, or are they triggered by something?

VJB: I think it's probably always triggered by something. My head is never empty because there are so many stimuli around every day that I often don't even notice. It is automatic.

16) **GF:** Are the colours always the same?

VJB: The letters stay the same but music and sounds can vary according to the change in instruments and what time in my life I associate the music with, because moods affect colour as well. People have colours according to the colours of the letters in their name and these can change based on if I like or dislike them. For example, if I really like a person their colour can become brighter or stronger or shiny/sparkly.

17) **GF:** Do punctuation marks, Braille and musical notation have colours?

VJB: Musical notes have the same colours as my alphabet. Punctuation marks are black. Braille has no colours but it might if I used it. As I have become older the synaesthesia has become more intense and enhanced.

18) **GF:** Do other languages have different colours?

VJB: No, because the words are still made up of the same letters in the alphabet.

19) **GF:** Does the way a word is spelt or sounds have an influence on the colours?

VJB: No to sound. Yes, to how it's spelt. Usually the first letter of a word dominates the colour of the word, but individual letters still retain their colours or come through. However, the overall word then tends to become a mood-board. My sister Maisie is

dark red. Her name is made up of ‘M’ – dark red, ‘A’ – post box red, ‘I’ – black, ‘S’ – yellow, ‘I’ – black, ‘E’ – cream. When I see her name, I see shades of dark red with flecks of black. The ‘S’ is barely visible and I can’t see the cream of the ‘E’ at all.

20) **GF:** Does the colour appear the same whether the grapheme is read, heard or thought of?

VJB: Yes, if it is an individual letter, but if it’s a word it can provoke a lot of different colours, especially when reading a book. This is because there is such a large amount of text going into my brain, containing people and speech and places and objects that I get an overall blur of colour. The colours that I read in books can also be influenced by the colours of the cover.

21) **GF:** Do vowel colours lighten or darken a word?

VJB: No.

22) **GF:** Do vowels dominate over consonants?

VJB: No.

23) **GF:** Are consonants coloured differently to vowels?

VJB: Yes, because each letter is different and has its own colour.

24) **GF:** Does the first letter of a word affect the colour of the word? Does it dominate?

VJB: Yes.

25) **GF:** Do letters inherit the shade of the nearby letters?

VJB: No.

26) **GF:** Does the meaning of the word have an influence on its colour, e.g., banana, orange, lime?

VJB: Yes.

27) **GF:** Does the meaning of the word change the colour of the word?

VJB: No.

28) **GF:** Have your colours changed with time?

VJB: I don't think they have changed, but they have become easier to distinguish as time goes on because their intensity has progressed.

29) **GF:** Do grouped letters change colour due to their context?

VJB: No.

30) **GF:** If a letter is repeated in a word does this dominate the colour of the word?

VJB: Yes.

31) **GF:** If a word has a different meaning or sound when used in a different context, can this affect the colour of the word?

VJB: No.

Exhibition Report VJB
How the exhibition made me feel:

Seeing the exhibition was fantastic. My alphabet was laid out beautifully, and I was amazed at how the colours were identical to how I see them in my head. When I looked at them in the woven fabric, I found it hard to identify my colours, because the cream background affected them. I could pick out some of my colours but I couldn't recognise all of them.

It was really interesting to see them laid out against four other alphabets, and see the difference between my colours and other synaesthetic alphabets. It seemed really odd that other people could experience colours so differently to me. It weirdly made me feel less alone with the way I interpret the world through overlapping senses.

My synaesthesia

Synaesthesia type: Grapheme-colour synaesthesia, Chromesthesia, Spatio-temporal synaesthesia, Personality/emotion-colour synaesthesia

The first experience I had of my synaesthesia was when I was 5 years old at school and I remember I was learning to write. On the page of my notebook, my A turned red, my B turned blue, and my C turned green.

Whenever I think of letters or numbers I see them in my head as a certain colour. So words have different colours based on the letters they're made up of. Which means places and objects and anything will have colour.

People have colours based on the letters in their name. Whenever I think of a person I see their colour. But this can change based on their personality, how close they are as a friend, how well we get on. Colours fade out if the person isn't very nice, and colours get brighter when the person is awesome or really important in my life. Sometimes I won't like a person so much based on their colour if it's not aesthetically pleasing. Sometimes I like a person a lot because the colours of their name look amazing.

Feelings and emotions have colours, so if I'm in a certain mood I can see/feel the colour of that mood all around me.

Because I also have spatio-temporal synaesthesia, I can see hours in the day, days of the week, weeks, months, years, in circular shapes, and again all in different colours. This means memories and periods of time are in colour. I'll remember an experience or somewhere I visited, or a particular time in my life and see it in all the colours it's made up of. I'll also see this in my circular timeline. I can also see time.

My favourite kind of synaesthesia that I have is being able to see music. I don't just see colours, I see shapes and patterns. I love watching music in my head. And find different kinds of music emotionally provocative because of the colours. When I've been to festivals or listened to live music, a lot of the time I shut my eyes so that I can watch everything. It can

be quite an overload on my senses to be experiencing everything externally as well as internally.

When I describe any of this to other people they say it sounds tiring. I think it makes things in my head quite noisy and busy, and I'm overly sensitive in a lot of ways. But I wouldn't want to be without it. It definitely enhances my life and the way I experience things."

Appendix 6

Fifth Interviewee: Participant 5: STH

First meeting 23/9/13, STH's Studio, Islington, 1.45–2.45pm.

STH is a jewellery designer and university lecturer in London

Questions to Synaesthetes

1) **GF:** When did you discover that you were synaesthetic?

STH: I didn't know the word but knew letters had colours before I was twelve years, maybe ten.

2) **GF:** How old were you?

STH: Between ten and twelve years old.

3) **GF:** Do any other members of your family have similar experiences?

STH: I doubt it. I haven't come across anyone. I have a sister but she doesn't have it.

4) **GF:** Can you describe what you experience when you look at an alphabet?

STH: I experience overload because the whole alphabet is too much. When I look at a word it's the first two or three letters that are coloured. Any word that has more than five letters needs to be read and re-read, it doesn't stay with me because I am dyslexic.

5) **GF:** Do different fonts alter your colour experience?

STH: Not sure. I haven't noticed that.

6) **GF:** Can you conjure up the sensation in your mind's eye, or do you need to see the text?

STH: The text is too much – it's the individual letters of a word that have colour. I can switch this on and off.

7) **GF:** Does text alter your experience in any way? If so, how?

STH: I see the white bits more than the black bits.

8) **GF:** Does the colour of the paper alter your experience?

STH: Yes, letters move around the page because I am dyslexic. Red background is frantic, white is busy, grey is as close to standstill as possible.

9) **GF:** Does texture alter your experience in any way, i.e., texture of paper or surface?

STH: Haven't noticed that. It may distract because I am a materials person.

10) **GF:** Do your colours have textures attributed to them? If so, can you describe them?

STH: They are matt not glossy and have no texture.

11) **GF:** Are the colours of each letter determined by the physical experience of the letter or the sound the letter makes?

STH: No, I don't know where the colours come from.

12) **GF:** Do the letters vary in colour if they are written or spoken?

STH: Spoken letters I don't see as coloured because I stay in the audible. I doubt that they do, my hunch is that it is more emotional or seasonal where any changes take place.

13) **GF:** Where, do the colours occur in your field of vision?

STH: Top centre inside my head, in my 'mind's eye'.

14) **GF:** Do your colours have a particular location?

STH: The location is in my 'mind's eye' at the top of my forehead.

15) **GF:** Do colours come into view independently, or are they triggered by something?

STH: I don't think I would see a colour and then make a word. It's like the decoding of reading.

16) **GF:** Are the colours always the same?

STH: I would say so, but I have a hunch they might shift a little.

17) **GF:** Do punctuation marks, Braille and musical notation have colours?

STH: Braille goes between the shades of grey, the shadow. I don't think musical notes have colours. No to punctuation.

18) **GF:** Do other languages have different colours?

STH: No.

19) **GF:** Does the way a word is spelt or sounds have an influence on the colours?

STH: As I can't spell anyway, I think the answer is no. My sister used to say I drew rather than wrote, so on a bad day I'd draw my name badly.

20) **GF:** Does the colour appear the same whether the grapheme is read, heard or thought of?

STH: Yes, if it is an individual letter, but if it's a word it can provoke a lot of different colours, especially when reading a book. This is because there is such a large amount of text going into my brain, containing people and speech and places and objects that I get an overall blur of colour. The colours that I read in books can also be influenced by the colours of the cover.

21) **GF:** Do vowel colours lighten or darken a word?

STH: No.

22) **GF:** Do vowels dominate over consonants?

STH: No.

23) **GF:** Are consonants coloured differently to vowels?

STH: Yes, because each letter is different and has its own colour.

24) **GF:** Does the first letter of a word affect the colour of the word? Does it dominate?

STH: Yes.

25) **GF:** Do letters inherit the shade of the nearby letters?

STH: No.

26) **GF:** Does the meaning of the word have an influence on its colour, e.g., banana, orange, lime?

STH: Yes.

27) **GF:** Does the meaning of the word change the colour of the word?

STH: No.

28) **GF:** Have your colours changed with time?

STH: I don't think they have changed, but they have become easier to distinguish as time goes on because their intensity has progressed.

29) **GF:** Do grouped letters change colour due to their context?

STH: No.

30) **GF:** If a letter is repeated in a word does this dominate the colour of the word?

STH: Yes.

31) **GF:** If a word has a different meaning or sound when used in a different context, can this affect the colour of the word?

STH: No.

Alphabet Colours: 1st Description 23/9/13; 2nd Description 2/11/13

A: 1st Dark Blackish Blue; 2nd Darkish Blue – 5PB 2/4.

B: 1st Brown, Dark; 2nd Brown – 5YR 2/2 (7.5YR 2/2 find chip if it exists).

C: 1st Sort of a Khaki; 2nd Khaki – 5Y 6/6.

D: 1st Lighter Brown; 2nd Light Brown – 10YR 4/4 (but is missing 10YR 4/4 but paler).

E: 1st Something between Khaki and Brown; 2nd Lemony Grey – 5Y 5/2.

F: 1st Really hard to describe, it's a Pale Metallic Fake Platinum/Gold; 2nd Pale Green – 10Y 6/8.

G: 1st A different shade of Brown; 2nd Warm Brown – 5YR 3/4.

H: 1st An Off White; 2nd White just off – Neutrals N8.75.

I: 1st A Creamy White; 2nd White – Neutrals N5.

J: 1st A Yellowish Darker Yellowish Khaki; 2nd Yellowish Ochre – 5Y 7/8.

K: 1st A kind of a Grey; 2nd Greyish – BG-PB 7/5BG to 6/5BG.

L: 1st Like pine wood, Orangey Beige; 2nd A wood colour – 10YR between 7/8 and 7/10.

M: 1st Blue, Middle Blue; 2nd Blue – 2.5PB 3/10.

N: 1st Greenish Yellow Colour; 2nd Greenish – Y-G 8.75 to GY 6/12.

O: 1st Black; 2nd Black – Neutrals N5.

P: 1st A Darker Grey; 2nd Middle Darkish Grey – Neutrals N4.25.

Q: 1st Something of Black; 2nd Greenish Grey – GY-G 4/10G.

R: 1st Green; 2nd Motor Racing Green -10GY 3/6.

S: 1st Red; 2nd Red, Pillar Box Red – R-YR8.75R 4/4, second from bottom up.

T: 1st White but really sharp; 2nd White – Neutrals N9.

U: 1st Green but going like Grass Green; 2nd Pure Green -10 GY 5/12.

V: 1st Between Green and Yellow Khaki; 2nd Greenish Colour – 7.5GY 6/6.

W: 1st It's a different kind of Green between Lighter Green and going off into Yellowish; 2nd Khaki Greenish Muddy Colour – 10Y 7/8.

X: 1st It's the colour, a White Creamy Colour; 2nd Ochre Khaki – 7.5Y 7/8.

Y: 1st It is possible it has no colour. It's not Grey, a light dirty Green possibly; 2nd Khaki Greenish Yellow – 7.5Y 6/2 or 6/4.

Z: 1st A Silvery Grey; 2nd Off White into Pale Grey – Neutrals N8.25 or N7.75.

I only use my synaesthetic colours when I want to remember things. I can see the colours, almost take the colour.

0: A dead Black

1: White.

2: Red.

3: Green/Yellow mix.

4: Yellow.

5: Blue.

6: Black Blue.

7: Khaki.

8: A Purplish Dark Colour.

9: Brown.

10: Would be a Grey because it's made out of two. I see them as individual numbers i.e., two elements.

STH: 'The best font for me is Verdana. The synaesthesia is used for remembering/translation like when I go into German. Different letter fonts just confuse and side-track, as the translation is from seeing to converting to a noise that then makes sense. The simpler fonts are the best – but not in colour terms, just aesthetic.'

Appendix 7: Dye Recipes

Participant 1: HW

50g skeins: wool

'A': 'Yellow: Yellow; bright acidy canary, really strong yellow': Munsell 2.5Y 8/1 (8/6)

1) 1.25g Yellow 3GL
   2.5mls Evron Scarlet GTYN 150% (stock: 0.5g:100mls water)

'B': 'Brown; greeny brown, cold muddy': Munsell 10YR 4/6:

1) 55mls Yellow
   60mls Brown
   11mls Turquoise

'C': 'Orangey; rusty sometimes it's paler sometimes it's strong burnt/orange': Munsell 5YR 6/12:

1) 6mls Brown
   7mls Scarlet
   80mls Yellow

2) 3mls Brown
   6mls Scarlet
   106mls Yellow
   1mls Duramine Rhodamine B 400%

'D': 'Brown; very similar to "B", but greyer and paler not beige': Munsell 2.5Y 4/4:

1) 55mls Yellow
   60mls Brown
   16mls Turquoise

'E': 'Orangey; similar to "C", but really, really, intense orange': Munsell 5YR 6/14 – 5YR 5/12
(5YR 5/12 is 'too brown, something in between'):

1) 2.5mls Brown (stock: 0.25g Lanaset Brown G-01:100mls water)
   19mls Red (stock: 0.5g Evron Scarlet GTYN 150%: 100mls water)
   3mls Black (stock: 0.50g Evron Black B 150%:100mls water)

2) 14mls Brown (stock: 0.25g Lanaset Brown G-01:100mls water)
   6mls Scarlet (stock: 0.5g Evron Scarlet GTYN 150%:100mls water)
   25mls Yellow (stock:0.25g Brilliant Yellow 3GL:100mls water)

(too dark but on the right track)
Above recipe originally for 2nd attempt 'M' – Used this to try to create a more accurate 'E', by adding a 25mls yellow from stock, using yesterday's vat.

3) 7mls Brown
   3mls Scarlet
   12.5mls Yellow
   + 10mls Yellow

4) Overdye onto Yellow skein consisting of: (12mls Rhodamine, 7mls Brown, 1ml Turquoise)
   12mls Duramine Rhodamine B 400% (stock 0.25g:100mls water)
   2mls Lanaset Brown G-01 (perfect for 5YR 6/4, need to add more brown for a color towards 5YR 5/12:
   5mls Brown
   1ml Turquoise

'F': 'Green, bluey green; changes subtly bluey to Emerald': Munsell 10GY 3/6 – 10GY 4/8:

1) 0.75g Yellow
   0.25g Lanaset Green B

'G': 'Grey; brown biased grey, mushroomy grey': Munsell N5.25 – N4.25:
(Grey, mid to mid dark)

1) 40mls Lanaset Black B
   20mls Yellow Evron Brilliant Y3GL
   0.5mls Duramine Rhodamine B 400%
   10mls Lanaset Black
   10mls Evron Black B1.50%

2) 20mls Evron Black B1.50%
   10mls Lanaset Black B

3) 16mls Lanaset Black B
   5mlsLanaset Yellow 4GN
   10mls Evron Black B 1.5%
   0.5mls Lanaset Brown G-01 (third attempt)

'H': 'Bright red, primary red, a very strong colour': Munsell 7.5R 4/16:

'I': 'Is it white, is it grey, very pale if it is – grey almost white': Munsell N/9:

1) 4mls Black Evron B 150%
   4mls Yellow
   8 drops Brown

5mls Black MR 90%

2) Exhaust of 1st attempt

'J': 'Similar to "I" but a little browner, barely there, it has a tint to it': Munsell 2.5YR 8/2 – 7/2:

1) 4mls Black Evron B 150%
   4mls Yellow
   8 drops Brown
   5mls Black MR 90%

2) 16mls Lanaset Black B
   5mlsLanaset Yellow 4GN
   10mls Evron Black B 1.5%
   0.5mls Lanaset Brown G-01 (third attempt 'G')

'K': 'Orange based; white based tint': Munsell: 5YR 8/6

1) 5mls Scarlet
   8mls Yellow

'L': 'Doesn't have anything defined by its shape; like looking through a glass window, you see past it, see the outside edge is defined, but centre, middle of the "L" is same as outside the "L", see through like a window. Defined by its background, translucent, takes whatever it's against': Munsell: P-RP 9/5 P
Dyed onto bleached white merino:

1) 1ml Evron Black B 150%
   2 drops of Duramine Rhodamine B 400%

'M': 'Orange; but not orange, orange, but Ochre, intense': Munsell 7.5YR 7/10

1) 2.5mls Brown (stock: 0.25g Lanaset Brown G-01:100mls water)
   19mls Red (stock: 0.5g Evron Scarlet GTYN 150%: 100mls water)
   3mls Black (stock: 0.50g Evron Black B 150%:100mls water)

2) 14mls Brown (stock: 0.25g Lanaset Brown G-01:100mls water)
   6mls Scarlet (stock: 0.5g Evron Scarlet GTYN 150%:100mls water)
   25mls Yellow (stock:0.25g Brilliant Yellow 3GL:100mls water)
   (too dark but on the right track)

3) Begin with half the amount used above, and then begin adjustments to yellowness
   Add 10mls Yellow stock

4) 4mls Brown

2mls Scarlet
12.5mls Yellow

5) 6mls Brown
2mls Scarlet
48mls Yellow

'N': 'Brown; more of a true reddier brown': Munsell 7.5YR 3/4:

Overdyed reject brown skein from earlier sessions with:

1) 60mls Brown stock
100mls Brown Lanaset G-01 (stock: 0.25g:100mls)
20mls Scarlet
25mls Blue 2R

'O': 'Translucent; but a bit blacker': Munsell N2

1) 40mls Lanaset Black B
20mls Yellow Evron Brilliant Y3GL
0.5mls Duramine Rhodamine B 400%
10mls Lanaset Black
10mls Evron Black B1.50%
+ 26mls Evron Black B1.50%
40mls Evron Black B 1.50%
10mls Lanaset Brown G-01

'P': 'Pink; same as the cover of *William Morris as Designer* by Ray Watkins in the Craft Study Centre; Pink with white in it': Munsell 2.5R 8/6 (milky pink):

1) 4mls Scarlet
0.6mls Duramine Rhodamine B 400% (stock: 0.25g Duramine Rhodamine B 400%:120mls water)

2) 4mls Scarlet
2.4mls Duramine Rhodamine B 400%

'Q': 'Puce; fleshy, dulled pink, meaty pink, cooked ham pink, dull': Munsell 5R 7/4:

1) 6mls Brown
3.5mls Duramine Rhodamine 400% stock
5mls Yellow
12 drops Black

'R': 'Ambiguous colour; is it red or rusty brown': Munsell 10R 3/10:

1) Browny red quite dark, overdyed onto Pink 'P' 1st attempt
   30mls Brown stock
   123mls Scarlet stock
   10mls Duramine Rhodamine 400% stock

'S': 'Yellow same as "A" but a little bit paler in words, it's the same though': Munsell 2.5Y 8/12:

1) 1.25g Yellow 3GL
   2.5mls Evron Scarlet GTYN 150% (stock: 0.5g:100mls water)

'T': 'Blue; Thomas the Tank Engine blue': Munsell 5PB 3/10:

1) 0.5g Lanaset Blue 2R
   10mls Lanaset Blue 2R stock
   5mls Yellow

'U': 'Very cream like; verging on translucent': Munsell 2.5YR 8/2 – 2.5YR 9/12:

1) 5mls Brown

2) 7.5mls Brown
   9 drops Duramine Rhodamine 400% stock

'V': 'Very creamlike; verging on translucent': Munsell P-RP 9/5RP and P-RB 8/5 RP:

1) 0.1ml Duramine Rhodamine B 400%
   1ml Evron Black B 150%

'W': 'Minty Green; white based': Munsell 2.5G 8/6:

1) 20mls Turquoise – Evron Brilliant Blue R8G
   40 mls Yellow

2) 42mls Turquoise – Evron Brilliant Blue R8G
   30mls Yellow

3) 54mls Evron Brilliant Blue R8G 100%
   30mls Yellow (Lanaset Yellow 4GN)
   (Draw off 30mls of the above recipe)
   + 23mls Yellow

'X': 'Doesn't really have much to it, but leans to the greys/neutral': Munsell N8.75

1) 15mls Black
   10mls Yellow
   2 drops Blue Evron Cyanine
   4 drops Duramine Rhodamine B
   25mls Yellow

'Y': 'Similar to "U", but a bit pinker': Munsell 7.5R 8/4:

1) 5mls Brown stock
   1ml Rhodamine Duramine B 400%

'Z': 'Is it Purple, is it grey, is it yellow? Really muddy ochre but…': Munsell 2.5Y 5/2:

1) Overdyed from 24mls Turquoise, 13mls Brown:
   10mls Turquoise

2) 60mls Brown
   20mls Turquoise

3) 30mlsBlack Evron
   1ml Red – Duramine Rhodamine B 400%
   2mls Yellow

Appendix 8: Dye Recipes

Participant 2: LR

50g skeins: wool

'A': 'Yellow':

1) 1.5g Yellow, Lanaset Yellow 4GN
   2mls Red stock

2) 1.5g Yellow, Lanaset Yellow 4GN
   6mls Red stock

'B' or **'E':** 'Blue':

1) 0.75g Evron Brilliant Blue R8G
   0.25g Lanaset Blue 2R
   24mls Yellow stock

2) Overdyed skein from previous session using fresh Evron Brilliant Blue R8G (a turquoise blue overdye.
   0.25% Evron Brilliant Blue R8G
   Yellow Stock: 0.20g Lanaset Yellow 4GN: 100mls water - 10mls used

3) 0.325g Lanacet Blue 2R
   3mls Yellow (from stock)

4) 100mls Lanaset Blue 2R
   30mls Yellow
   20mls Evron Cyanine 8B 350% (stock: 0.10g:100mls water)

5) 0.20g Brilliant Blue R8G
   60mls Evron Cyanine 6B 350%

'C': 'Orange, not a very bright one, a dirty orange':

1) 3g Yellow 4GN
   22mls Red 2B (Red stock – Red 2B 0.5g:100mls)

2) 5g Lanaset Yellow
   69mls Red 2B
   6mls Blue

'D': 'Brown, your suitcase in shadow':

1) 1g Red 2B

0.25g Blue
0.5g Yellow

2) 40mls of Brown (0.25g Brown:100mls water)
   0.2g Brown

3) Return to paler shade of 22nd attempt, and over dye as not yellow enough, too pinkish, but only slightly.
   10mls yellow stock added to original vat.

4) (1st colour a bit too light), over dye with 0.25g Blue

5) 17mls Blue
   30mls Yellow:
   Over dye 'D' with wash of Yellow – Brown is more Claret brown than dark chocolate:
   50mls Brilliant Yellow 3GL (stock: 0.25g Yellow:100mls water)

'E': 'Blue, much more vibrant blue than "B"':

1) 0.25g Lanaset Blue 2R
   0.100mls Blue 5G

2) 0.20g Brilliant Blue R8G
   0.10g Evron Cyanine 6B 350%
   (1st skein in for 1hr, 2nd skein in exhaust)

'F', 'G', 'K': 'Black, Munsell book black':

1) 0.50g Black B
   exhaust blue with just a hint of blue left
   16mls Yellow

2) 1.5g Black B (first stage, 1g Black B, followed by an additional 0.5g Black B added to cool dyebath the following day. Heat raised slowly)

3) 0.5g Black B dye added to previous vat making a total of 2g dye added.

'G': Black, Munsell book black:

1) 0.50g Black B
   exhaust blue with just a hint of blue left
   16mls Yellow

2) 1.5g Black B (first stage, 1g Black B, followed by an additional 0.5g Black B added to cool dyebath the following day. Heat raised slowly)

3) 0.5g Black B dye added to previous vat making a total of 2g dye added.

'H': 'Brown similar to "D", but a little brighter':
(Lighter than 'D', similar to suitcase, but more yellow)

1) 0.5g Red
   0.25g Blue
   1g Yellow
   (Left in dyebath overnight)

2) 0.35g Red
   0.125g Blue
   1g Yellow

3) Overdye with addition of:
   Blue 0.08g

4) Overdye with:
   0.50g Yellow
   0.25g Blue
   0.2og Red

5) 0.55g Red
   0.20g Blue
   1.5g Yellow

'I': 'is transparent like your folder, it has a white sheen to it':
Dyed onto Bleached white, Merino yarn:

1) 4mls Evron Black MR 90%
   4 drops Lanaset Brown
   1ml Yellow

'J': 'Beige/tan, like the reference book covers, the stacked four in the study room (Susan Bosence reference books)':

1) 0.25g Yellow
   50mls Brown (0.20g Brown: 100mls water)
   5mls Blue (0.10g Blue: 100mls water)

2) 20mls Brown
   25.7mls Yellow
   2mls Blue

'K': 'Black, Munsell book black':

1) 0.50g Black B
   exhaust blue with just a hint of blue left
   16mls Yellow

2) 1.5g Black B (first stage, 1g Black B, followed by an additional 0.5g Black B added to cool dyebath the following day. Heat raised slowly)

3) 0.5g Black B dye added to previous vat making a total of 2g dye added.

'L': 'is a strong black, intense, saturated':

'M': 'Orange, dirtier than "C"':

1) 3g Yellow 4GN
   22mls Red 2B (Red stock – 0.5g Red 2B: 100mls water)
   4mls Blue 2R (Blue stock – 0.25g Blue 2R: 100mls water)

'N': 'Brown, deeper brown than others':

1) 0.5g Lanaset Brown G-01
   5mls Black stock
   35mls Brilliant Blue stock
   25mls Yellow stock

2) Over dye above with:
   20mls Blue R8G (stock: 0.25g dye: 100mls water)
   5mls Yellow stock

'O': 'White': Bleached yarn no recipe.

'P': 'Blue, more than "B"' (Blue mid):

1) 0.25g Lanacet Blue 2R
   30mls (blue stock: 0.25g Lanacet Blue: 1oomls water)
   10mls (yellow stock: 0.25g Yellow 4GN:100mls water)
   0.25g Lanacet Blue

2) 0.575g Lanacet Blue
   10mls Yellow 4GN

'Q': 'Silver Grey': Munsell 2.5PB 6/2:

4) 20mls Evron Black B1.50%
   10mls Lanaset Black B

'R': 'Brown, brightest brown of them all':

1) Over dye onto yesterday's beginnings, colour too greeny yellowy brown, therefore need to add more Brown (Lanaset Brown G-01)

2) 30mls Brown

'S': 'Red, strong red':

1) 1g Red
   13mls Yellow (from stock:1g -500mls)

2) 2g Red

'T': 'Black like "L"'

'U': 'Grey, greyer than the silver of "Q" (cardigan, soft bleached grey)':

1) 20mls Evron Black B1.50%
   10mls Lanaset Black B

'V': 'Grey, similar to "U"':

1) 16mls Black B Black B (stock 0.25g:200mls water)
   400mls of Blue (exhaust from 'B' vat)

5) 16mls Lanaset Black B
   5mlsLanaset Yellow 4GN
   10mls Evron Black B 1.5%
   0.5mls Lanaset Brown G-01 (third attempt HW exhaust)
   + 3 drops of Duramine Rhodamine B

'W': 'Black, like "L"':

'X': 'Brown, paler':

1) over dye recipe 6) for 'D'
   0.25g Brown
   0.75g Yellow
   60mls Blue
   5mls Brilliant Blue R8G (stock: 0.26g: 100mls water)
   Over dye to cool off the brown skein for 'D' with:
   40mls Yellow
   1.5mls Blue

'Y': 'Yellow, vibrant':

'Z': 'Red, same as "S", but a more purple red':

1) 2g Red 2B
   0.25g Yellow

Appendix 9: Dye Recipes

Participant 3: AA

50g skeins: wool

'A': 'Red, has a slight tinge of pink, definitely towards crimson, not vermillion':

1) 20mls Red – Evron Brilliant red 2B 125%
   + 25mls Yellow – Evron Brilliant Yellow 3GL
   + 2 drops Blue – Evron Cyanine 6B 350%

'B': 'Cobalt':

1) 18mls – Evron Cyanine 6B 350%

'C': 'Lemon Yellow, same as "Y" (but needs a little red drop by drop)':

1) 65mls Yellow
   + 2 drops Red – Evron Scarlet GTYN 150%

'D': 'Orange, but a lighter orange, between a yellow and an orange':

1) 60mls Yellow Brilliant Yellow 3GL
   + 18 drops Red – Evron Brilliant Red 2B 125%
   + 1 drop Blue – Evron Cyanine 6B 350%

'E': 'Lime Green':

1) 40mls – Evron Brilliant Yellow 3GL
   + 4 drops Turquoise – Evron Brilliant Blue

'F': 'Dark Green, not Dark but leafy Green, more towards Blue than Yellow':

1) 40mls – Evron Brilliant Yellow 3GL
   + 11.5mls Turquoise – Evron Brilliant Blue R8G

'G': 'Sort of like Yellowy Orange, kind of towards Brown, deeper Yellow Orange':

1) 50mls Yellow – Evron Brilliant yellow 3GL
   + 36 drops Red – Evron Scarlet GTYN 150%
   + 3 drops Blue – Evron Cyanine 6B 350%

2) Over-dye onto original skein as a colour needs to be browner

+ 20mls – Evron Brilliant Yellow 3GL
+ 19 drops – Duramine Rhodamine 400%
+ 9 drops – Evron Black MR 90%

'H': '"H", "I", "J", are all in the Purple family':

1) 30mls – Duramine Rhodamine 400%
   + 3mls – Evron Brilliant Yellow 3GL

'I': 'is almost Violet, but desaturated Violet, pastel':

1) 2mls – Duramine Rhodamine 400%
   + 1ml – Evron Cyanine 6B 350%
   + 5 drops – Evron Cyanine 6B 350%
   Over-dyed with:
   2mls – Duramine Rhodamine 400%
   + 5 drops – Duramine Rhodamine 400%

'J': 'is more a typical classical Purple, similar to my cardigan': (2nd attempt)

1) 27.5 mls – Duramine Rhodamine 400%
   +5mls – Evron Cyanine 6B 350%

'K': 'is Purple, more Fuchsia, a bit more, Pink':

1) 40mls – Duramine Rhodamine 400%

'L': 'is like "D" but more Yellow than Orange':

1) 50mls Yellow – Evron Brilliant Yellow 3GL
   + 18 drops of Red – Evron Scarlet GTYN 150%

'M': 'A Brick Red Pink':

1) 10mls Red – Evron Brilliant 2B 125%
   + 15mls Yellow – Evron Brilliant Yellow 3GL

'N': 'An Orangey Brown':

1) 60mls Yellow – Evron Brilliant Yellow 3GL
   + 23 drops Red – Evron Brilliant Red 2B 125%
   + 2 drops Blue – Evron Cyanine 6B 350%

'O': 'Is definitely a deep Yellow':

1) 40mls Yellow – Evron Brilliant Yellow 3GL
   + 9 drops Red – Evron Scarlet GTYN 150%

'P': Pinkish Purple': (3rd attempt)

1) 25mls – Duramine Rhodamine 400%
   + 5mls – Evron Brilliant Yellow 3GL

'Q': 'Royal Purple, Queen's royalty, magic, mystical'

1) 60mls – Duramine Rhodamine 400%
   + 2.5mls – Evron Cyanine 6B 350%
   + 2.5mls – Evron Brilliant Yellow 3GL (added at the end)

2) over-dyed onto 1st attempt
   + 15 drops – Evron Cyanine 6B 350%
   + 32mls – Duramine Rhodamine 400%

3) over-dyed onto 2nd attempt
   + 9mls – Duramine Rhodamine 400%

'R': 'Blue, a bit darker than 'B' but in the same family':

1) 20mls – Evron Blue Cyanine 6B 350%
   + 20mls Turquoise – Evron Brilliant Blue
   + 5mls Yellow – Evron Brilliant Yellow 3GL

'S': 'Lemon Yellow':

1) 20mls Yellow – Evron Brilliant Yellow 3GL
   + 3 drops Red – Evron Scarlet GTYN 150%

'T': 'Teal':

1) 12mls Turquoise – Evron Brilliant Blue
   + 2mls Yellow – Evron Brilliant Yellow 3GL

'U': 'A light Yellow Orange':

1) 24.5mls Yellow - Evron Yellow 3GL
   + 9 drops Red – Evron Scarlet GTYN 150%

'V': 'A Blue; it's sort of like "B" but with a lot of White mixed into it, a pastel colour shade':

1) 1ml Blue – Evron Cyanine 6B 350% (stock solution 0.5g:100mls water)
   + 3.5 mls Red – Duramine Rhodamine 400% (stock solution 0.25g:100mls water)
   + 5mls Red – Duramine Rhodamine 400%

2) Over-dyed onto 1st attempt – (needs to be a bit more, blue and a bit more saturated)
   + 10 drops – Blue – Evron Cyanine 6B 350%
   + 3 drops Red – Duramine Rhodamine 400%

'W': 'Also Blue, the same darkness a "B", but with a bit of Green in it':

1) Skein put into used 'R' vat after cooling
   + 5mls Blue – Evron Cyanine 6B 350% (stock solution 0.5g: 100mls water)

'X': 'Cool Grey':

1) 10mls Black – Evron Black B 150% (stock solution 0.5g:100mls water)
   + 2mls Yellow – Evron Brilliant Yellow 3GL
   + 10mls Black – Evron Black MR 90% (stock solution 1g:100mls water)

'Y': 'Yellow, maybe a Cadmium Yellow, warmish?':

1) 35mls Yellow – Evron Brilliant Yellow 3GL

'Z': 'Warm Grey, a darker warm Grey':

1) 15mls Black – Evron Black MR 90% (too cold)

2) Use exhaust from first attempt
   + 3 drops Red – Duramine Rhodamine 400%

Appendix 10: Dye Recipes

Participant 4: VJB

50g skeins: wool

'A': Red, slightly paler than Post Box Red':

1) 100mls Scarlet – Evron Scarlet GTYN 150% (stock 1g:100mls water)
   + 5mls Red – Duramine Rhodamine 400%
   + 1g Scarlet – Evron Scarlet GTYN 150%

'B': 'Mid to Light Blue':

1) 3mls Turquoise - Evron Brilliant Blue R8G
   + 2mls Blue – Evron Cyanine 6B 350%
   + 3mls Turquoise - Evron Brilliant Blue R8G
   + 1ml Blue – Evron Cyanine 6B 350%

2) 14mls Turquoise - Evron Brilliant Blue R8G
   + 5mls Blue – Evron Cyanine 6B 350%

'C': 'Kind of a Bright Grassy Green, but then when I think of my boyfriend's name Colin, Col, I see an Emerald Green, but it's almost matt versus shine':

1) 1st attempt too pale
   + 5mls Turquoise - Evron Brilliant Blue R8G
   + 15mls Yellow - Brilliant Yellow 3GL

2) 2nd attempt overdyed with:
   + 5mls Yellow
   + 6 drops Turquoise - Evron Brilliant Blue R8G

'D': 'Dark Blue, like a darker shade of Royal Blue':

1) 1st attempt too yellow and too dark
   15mls Turquoise - Evron Brilliant Blue R8G
   + 20mls Blue – Evron Cyanine 6B 350%
   + 10mls Yellow - Brilliant Yellow 3GL

2) 20mls Blue – Evron Cyanine 6B 350%
   + 10mls Turquoise - Evron Brilliant Blue R8G
   + 5mls Yellow - Brilliant Yellow 3GL

'E': 'Cream, Magnolia but a bit lighter':

1) 3 drops Red – Duramine Rhodamine 400%
   + 12 drops Yellow - Brilliant Yellow 3GL

'F': 'Brown, Milk Chocolate Brown':

1) 20 mls Brown – Lanaset Brown
   + 3mls Red – Evron Brilliant Red 2B 125%
   + 10mls Black – Evron Black B 150% (stock solution 0.5g:100mls water)
   + 1 ml Blue – Evron Cyanine 6B 350%
   + 22 mls Yellow - Brilliant Yellow 3GL

'G': 'Quite similar to "F", but a bit darker. There is no orange in it but it's orangier':

1) 40mls Brown – Lanaset Brown
   + 27mls Yellow - Brilliant Yellow 3GL
   + 5mls Black – Evron Black B 150% (stock solution 0.5g:100mls water)
   + 2 drops of Black – Evron Black B 150% (stock solution 0.5g:100mls water)
   + 14 drops Blue – Evron Cyanine 6B 350%
   + 9 drops Turquoise - Evron Brilliant Blue R8G
   + 6mls Turquoise - Evron Brilliant Blue R8G

'H': 'Peach, Pinky Peach':

1) Skein put into "P" dye bath exhaust

'I': 'Black, solid Black as Black as you can get it':

1) 14mls Black – Evron Black B 150% (stock solution 0.5g:100mls water), on top of AA's Grey

'J': 'is another brown, but very, very, very dark':

1) 20mls Black – Evron Black B 150% (stock solution 0.5g:100mls water)
   + 10mls Brown – Lanaset Brown
   + 3mls Red – Evron Brilliant Red 2B 125%
   + 5mls Yellow - Brilliant Yellow 3GL
   + 3mls Red – Evron Brilliant Red 2B 125%
   + Separate vat 2mls Yellow - Brilliant Yellow 3GL
   + 9 drops of Black – Evron Black B 150% (stock solution 0.5g:100mls water)

'K': 'Very dark Green, Leafy Tree Green but dark like Pine tree colour':

1) Skein put into exhaust vat of 'C'
   + 15mls Yellow - Brilliant Yellow 3GL

+ 5mls Blue – Evron Cyanine 6B 350%
+ 15mls Turquoise - Evron Brilliant Blue R8G

'L': 'Again another Green, but probably a few shads lighter than "K"':

1) 10mls Turquoise - Evron Brilliant Blue R8G
   + 10mls Yellow - Brilliant Yellow 3GL

'M': 'Blood Red':

1) 100mls Scarlet – Evron Scarlet GTYN 150% (stock 1g:100mls water)
   + 10mls Brown – Lanaset Brown
   + 90mls Red – Evron Brilliant Red 2B 125%
   + 10mls Yellow - Brilliant Yellow 3GL in separate bath = too dark

'N': 'An Orangey Brown':

1) 10mls Brown – Lanaset Brown
   + 1ml Turquoise - Evron Brilliant Blue R8G
   + 2mls Turquoise - Evron Brilliant Blue R8G
   + 5mls Yellow - Brilliant Yellow 3GL
   + 3mls Turquoise - Evron Brilliant Blue R8G
   + 2mls Black – Evron Black B 150% (stock solution 0.5g:100mls water)

'O': Orange, like an orange':

1) 100mls Scarlet – Evron Scarlet GTYN 150% (stock 1g:100mls water)
   + 7mls Evron Brilliant Red 2B 125%
   + 10mls Yellow - Brilliant Yellow 3GL into 3ml Yellow vat for 'R'
   + 10mls Yellow - Brilliant Yellow 3GL

'P': 'Red Post Box Red, but slightly faded or paler':

'Q': 'Like a Burgundy Red':

1) Used the remains of dye vat from 'M'

'R': 'is like a very mid to light Pinky Orange, a slightly faded shade':

1) 10mls Scarlet – Evron Scarlet GTYN 150% (stock 1g:100mls water)
   + 3mls Yellow – Brilliant Yellow 3GL over dyed onto the above to make it slightly more orange

'S': 'Yellow, a light bright Yellow':

1) 20mls Yellow - Brilliant Yellow 3GL
   + 3mls Scarlet – Evron Scarlet GTYN 150% (stock 1g:100mls water)
   + 1ml Black – Evron Black B 150% (stock solution 0.5g:100mls water)
   + 3mls Yellow – Brilliant Yellow 3GL

'T': 'Light Blue, Sky Blue':

1) 10mls Turquoise – Evron Brilliant Blue R8G
   + 2mls Blue – Evron Cyanine 6B 350%

'U': 'Like a Reddy Brown':

'V': 'Lilac, "V" in my alphabet is slightly darker than "V" in a word e.g., my colour Lilac':

1) 10mls Blue – Evron Cyanine 6B 350%
   + 15mls Evron Brilliant Red 2B 125%

2) Over-dye above with:
   + 5mls Blue – Evron Cyanine 6B 350%
   + 5mls Evron Brilliant Red 2B 125%

'W': 'Like a sea Blue, quite a strong colour':

1) 10mls Turquoise - Evron Brilliant Blue R8G
   + 4mls Blue – Evron Cyanine 6B 350%
   + 3mls Turquoise – Evron Brilliant Blue R8G
   + 5mls Turquoise – Evron Brilliant Blue R8G
   + 3mls Yellow – Brilliant Yellow 3GL = too much therefore swopped vats to exhaust
   'B' vat = 1ml Blue – Evron Cyanine 6B 350%
   + 20 drops Blue – Evron Cyanine 6B 350%

'X': 'Silver/Grey':

1) 0.5 ml Yellow – Brilliant Yellow 3GL
   + 1.5 mls Black – Evron Black B 150% (stock solution 0.5g:100mls water)
   + 9 drops Black – Evron Black B 150% (stock solution 0.5g:100mls water)

2) Over-dyed original cashmere skein as a continuation of 1st attempt
   + 6 drops Black – Evron Black B 150% (stock solution 0.5g:100mls water)

'Y': 'Black Brown with a bit of red – Blacky Grey second':

1) Second attempt over-dyed skein with:
   + 20 mls Brown – Lanaset Brown
   + 8 mls Black – Evron Black B 150% (stock solution 0.5g:100mls water)
   + 10 mls Black – Evron Black B 150% (stock solution 0.5g:100mls water)

'Z': 'Is like the colour of White Gold or very Pale Silver':

Appendix 11: Dye Recipes

Participant 5: STH

50g skeins: wool

'A': 'Darkish Blackish Blue':

1)

'B': 'Brown, Dark':

1)

'C': 'Sort of Khaki':

1) 10mls Yellow – Brilliant Yellow 3GL
   + 5mls Brown – Lanaset Brown
   + 3 drops Black – Evron Black B 150% (stock solution 0.5g:100mls water)
   + 4 drops Turquoise – Evron Brilliant Blue R8G
   Separate vat:
   18 drops Turquoise – Evron Brilliant Blue R8G
   + 10mls Yellow – Brilliant Yellow 3GL
   + 3 drops Black – Evron Black B 150% (stock solution 0.5g:100mls water)

'D': 'Lighter Brown':

1) 15mls Brown – Lanaset Brown
   + 40mls Yellow – Brilliant Yellow 3GL
   + 17 drops Black – Evron Black B 150% (stock solution 0.5g:100mls water)
   + 7mls Turquoise – Evron Brilliant Blue R8G
   + 17 drops Red – Evron Brilliant Red 2B 125%
   + 6 drops Brown – Lanaset Brown

'E': 'Something between Khaki and Brown':

1) 30mls Yellow - Brilliant Yellow 3GL
   + 12 drops Red – Evron Brilliant Red 2B 125%
   + 44 drops Turquoise – Evron Brilliant Blue R8G
   + 12 drops Black – Evron Black B 150% (stock solution 0.5g:100mls water)
   + 15mls Brown – Lanaset Brown

'F': 'Really hard to describe, it's a Pale Metallic Fake Platinum/Gold':

1) 15mls Yellow – Brilliant Yellow 3GL

+ 6mls Brown – Lanaset Brown
+ 3mls Turquoise – Evron Brilliant Blue R8G
+ 2 drops Black – Evron Black B 150% (stock solution 0.5g:100mls water)
+ 29 drops Turquoise – Evron Brilliant Blue R8G

'G': 'A different shade of Brown':

'H': 'An off White, neutrals page':

1) 4 drops Black – Evron Black B 150% (stock solution 0.5g:100mls water)
   + 1 drop Turquoise – Evron Brilliant Blue R8G
   + 2 drops Yellow – Brilliant Yellow 3GL

'I': 'A creamy White':

'J': 'A Yellowish Darker Yellowish Khaki':
Second attempt:

1) 20mls Yellow – Brilliant Yellow 3GL
   + 3 drops Red – Evron Brilliant Red 2B 125%
   + 7mls Turquoise – Evron Brilliant Blue R8G
   + 15 drops Brown – Lanaset Brown
   + 2 drops Black – Evron Black B 150% (stock solution 0.5g:100mls water)

'K': 'A kind of Grey':

1) Same as Participant 4's 'I'

'L': 'Like pine wood Orangey Beige':

1) 20mls Yellow – Brilliant Yellow 3GL
   + 3mls Brown – Lanaset Brown
   + 3 drops Red – Evron Brilliant Red 2B 125%

'M': Blue Middle Blue':

'N': 'Greenish Yellow Colour':

1) 50mls Yellow - Brilliant Yellow 3GL
   + 5mls Turquoise - Evron Brilliant Blue R8G

'O': 'Black':

1) 15mls Black – Evron Black B 150% (stock solution 0.5g:100mls water)
   + 5mls Brown – Lanaset Brown
   + Yellow – Brilliant Yellow 3GL
   + Turquoise – Evron Brilliant Blue R8G
   + 5mls Black – Evron Black B 150% (stock solution 0.5g:100mls water)
   + 30mls Black – Evron Black B 150% (stock solution 0.5g:100mls water)

'P': 'A Darker Grey':

'Q': 'Something of Black':

'R': 'Motor Racing Green' 2nd Attempt:

1) 70mls Yellow – Brilliant Yellow 3GL
   + 2mls Blue – Evron Cyanine 6B 350%

'S': 'Red, Pillar Box Red': Same as Participant 4's 'A'

1) 100mls Scarlet – Evron Scarlet GTYN 150% (stock 1g:100mls water)
   + 5mls Red – Duramine Rhodamine 400%
   + 1g Scarlet – Evron Scarlet GTYN 150%

'T': White but really sharp':

'U': 'Green but going like Grass Green': second attempt

1) 30mls Yellow – Brilliant Yellow 3GL
   + 2mls Turquoise – Evron Brilliant Blue R8G
   + 28 drops Brown – Lanaset Brown

'V': 'Between Green and Yellow Khaki':

1) 6 drops Brown – Lanaset Brown
   + 1 drop Black – Evron Black B 150% (stock solution 0.5g:100mls water)
   + 20mls Yellow – Brilliant Yellow 3GL
   + 1 ml Blue – Evron Cyanine 6B 350%

'W': 'It's a different kind of Green between Lighter Green and going off into Yellowish':

1) 15mls Yellow – Brilliant Yellow 3GL
   + 2mls Turquoise – Evron Brilliant Blue R8G

+ 9 drops Brown – Lanaset Brown

'X': 'It is possible it has no colour. It's Grey, a light dirty Green possibly, Khaki Greenish Yellow, always have difficulty with "Y"':

1) 5mls Yellow – Brilliant Yellow 3GL
   + 17 drops Brown – Lanaset Brown
   + 5 drops Turquoise – Evron Brilliant Blue R8G

'Y': 'It is possible it has no colour. It's not Grey, a light dirty Green possibly':

1) 5mls Yellow - Brilliant Yellow 3GL
   + 1ml Brown – Lanaset Brown
   + 2mls Turquoise - Evron Brilliant Blue R8G

'Z': 'A Silver Grey':