

The analysis of colour, light and volume in interior architectural spaces

Renee Helena Pescini



Fig 0.1 Resene Colour Swatches Board

This colour board was created to increase my understanding of hue, saturation and tonal value.

Colour Sense Considered

The analysis of colour, light and volume in interior architectural spaces.

By

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Abstract

This thesis examines the spatial comprehension and perception of architectural interior spaces through the diverse variables of colour, light and volume. The research methodology is through experimentation, adapted from the Stanford design thinking innovative design analysis process. The purpose of this research is to understand the effects of manipulating colour, light and volume in architectural interior spaces. This will be explored through various design strategies and techniques to achieve the desired experience and human emotional response in a positive atmospheric manner. This will allow architects and designers interested in applying colour, light and volume more efficiently within the interior built environment with the purpose to achieve certain atmospheric qualities and experiences. This thesis will be of particular interest to those designing to create atmospheric qualities and human emotional driven responses in interior architectural spaces. Pleasant and stimulating are the key human emotional responses that the research experiments and observations focus on.





Methodology





Stanfords Design Process 42 Thesis Methodology 44 Reflection 46





Pleasantness Stimulating Stressful Depressing

Reflection

52

54

56

58

Light and Volume

Light and Volume	67
Sunlight diagrams	70
Reflection	72





78

Pilot Experiments

Colour Collages Experiments





Volumetric Experiments 80 Cube and Circular Experiments 82 Emotional Categories Experiments 84 Stressful Category Experiments 86 Tonal Experiments 88 Tonal Coloured Experiments 90 Colour Blind Experiments 92 Colour Charts 94 Contrasting Colour Blind Experiments +Charts 96 Apple Complementary Colour Blind Experiments +Charts 98 Findings 103 Reflection

Interior Analysis



Dulux Interiors



DuluxAnalysisDiagram140GreenDuluxInteriors142BlueDuluxInteriors144Purple/YellowDuluxInteriors145



Key Learnings	152
Research Limitations	158
Strategies and Techniques for Architects and Designers	160
Future Research Development	162





xiii



This thesis aims to research spatial comprehension and perception of interior spaces through the diverse variables of colour, light, and volume.

Multiple experiments undertaken which focus on these variables and responses will be recorded and the data analysed.

The purpose of this thesis is to develop a series of strategies and techniques for architects and designers who are interested in applying colour, light and volume more effectively within interior spaces, and who are particularly interested in creating spaces with specific atmospheric qualities. It is envisaged that these will be valuable in the design of a range of architectural interior spaces for multiple purposes.

Objectives

- Investigate existing research within the field of human perception, focusing on colour, light and volume.
- Develop an appropriate research methodology.
- Conduct experiments focusing on the variables of colour, light and volume.
- Aim to develop a series of strategies and techniques for architects and designers who are interested in applying colour, light and volume more effectively within interior spaces.

Figures

- Fig 0.1 Resene Colour Swatches Board (Pescini, n.d.-bt)
- Fig 1.1 Diversity (Pescini, n.d.-v)
- Fig 2.1 Human Eye drawing (Pescini, n.d.-av)
- Fig 2.2 Human field of vision Brain to the eyes (Pescini, n.d.-aw)
- Fig 2.3 Prism light (Pescini, n.d.-bq)
- Fig 2.4 Eye to Brain imagery and light process (Pescini, n.d.-ap)
- Fig 2.5 Human Eye (Pescini, n.d.-au)
- Fig 2.6 Human field of vision- Height (Pescini, n.d.-ay)
- Fig 2.7 Human field of vision- Binocular vision (Pescini, n.d.-ax)
- Fig 2.8 Human field of vision- Width (Pescini, n.d.-az)
- Fig 2.9 Blind Spot (Pescini, n.d.-e)
- Fig 2.10 Secondary Colours (Pescini, n.d.-bs)
- Fig 2.11 Tertiary Colours (Pescini, n.d.-cg)
- Fig 2.12 Monochromatic (Pescini, n.d.-bg)
- Fig 2.13 Monotone (Pescini, n.d.-bh)
- Fig 2.14 Analogous (Pescini, n.d.-a)
- Fig 2.15 Red (Seabass Creatives, n.d.)
- Fig 2.16 Homelike (Kirill, n.d.)
- Fig 2.17 Super graphics (Saraco, n.d.)

- Fig 2.18 Super graphics 2 (Cenname, n.d.)
- Fig 2.19 Isolation effect (Alex, n.d.)
- Fig 2.20 Isolation effect 2 (Mingazova, n.d.)
- Fig 2.21 Façade Colours (Spratt, n.d.)
- Fig 2.22 Sectional Colour (M. Anderson, n.d.)
- Fig 2.23 Work Place (Kazantceva, n.d.)
- Fig 2.24 Yayoi Kusama (Llerena, n.d.)
- Fig 2.25 Gretchen Albrecht (Hall, n.d.)
- Fig 2.26 Mark Rothlko (Kim, n.d.)
- Fig 3.1 Connections (Pescini, n.d.-o)
 Fig 3.2 Adapted from; The Stanford's Design thinking process (Elmansy, 2016)
 Fig 3.3 Innovative Process (Pescini, n.d.-bb)
 Fig 3.4 Cycle (Pescini, n.d.-s)
 Fig 3.5 Repetitive (Pescini, n.d.-br)
- Fig 3.6 Infinite (Pescini, n.d.-ba)
- Fig 3.7 Design Ideas (Pescini, n.d.-t)

- Fig 4.1 Pleasantness (Owens, n.d.) Fig 4.2 - Pleasantness 2 (Sdralias, n.d.) Fig 4.3 - Pleasantness 3 (Rmah, n.d.) Fig 4.4 - Stimulating (Kim, n.d.) Fig 4.5 - Stimulating 2 (Barrett, n.d.) Fig 4.6 - Stressful (Flores, n.d.) Fig 4.7 - Stressful 2 (k. n.d.) Fig 4.8 - Stressful 3 (Mason, n.d.) Fig 4.9 - Depressing (Schwendener, n.d.) Fig 4.10 - Depressing 2 (N. Anderson, n.d.) Fig 4.11 - Depressing 3 (Leszczynski, n.d.) Fig 4.12 - Colour Categorisation (Pescini, n.d.-j) Fig 4.13 - Colour Categorisation Images (Pescini, n.d.-k) Fig 5.1 - Squared Light (Tyson, n.d.) Fig 5.2 - Leaf Shadow (Hoogenboom, n.d.) Fig 5.3 - Cup of Coffee (Wende, n.d.) Fig 5.4 - Sunlight Diagrams (Pescini, n.d.-ce) Fig 5.5 – Direction (Pescini, n.d.-u) Fig 5.6 - Body (Pescini, n.d.-f)
- Fig 6.1 Colour Collages (Pescini, n.d.-n) Fig 6.2 - Red Coat (Pescini, n.d.-bk) Fig 6.3 - Volume Experiments (Pescini, n.d.-cm) Fig 6.4 - Volume Experiment (Pescini, n.d.-cl) Fig 6.5 - Cube Experiments (Pescini, n.d.-r) Fig 6.6 - Cube Experiment (Pescini, n.d.-q) Fig 6.7 - Circles Experiments (Pescini, n.d.-h) Fig 6.8 - Circles Experiment (Pescini, n.d.-i) Fig 6.9 - Emotional Category Experiments (Pescini, n.d.-ao) Fig 6.10 - Emotional Category Experiment (Pescini, n.d.-an) Fig 6.11 - Stressful Experiments (Pescini, n.d.-cd) Fig 6.12 - Stressful Experiment (Pescini, n.d.-cc) Fig 6.13 - Tonal Experiments (Pescini, n.d.-ck)-Fig 6.14 - Tonal Experiment (Pescini, n.d.-cj) Fig 6.15 - Tonal Coloured Cubed Experiments (Pescini, n.d.-ci) Fig 6.16 - Tonal Coloured Cubed Experiment (Pescini, n.d.-ch) Fig 6.17 - Arrow Contrasting Colours Colour Blind Experiment (Pescini, n.d.-d) Fig 6.18 - Apple Complementary Colours Colour Blind Experiment (Pescini, n.d.-c) Fig 6.19 - Colour Charts (Pescini, n.d.-I) Fig 6.20 - Colour Charts and Colour Picking (Pescini, n.d.-m) Fig 6.21 - Contrasting Colour Blind Experiments + Charts (Pescini, n.d.-p)
 - xvii

Fig 7.17 - Duck Stacking (Coleman, n.d.) Fig 6.22 - Symbol, Object, Letter (Pescini, n.d.-cf) Fig 6.23 - Apple Complementary Colour Blind Experiments + Charts (Pescini, n.d.-b) Fig 7.18 - Wellington Map (Pescini, n.d.-co) Fig 6.24 - Apple Complementary Colour Blind Experiments + Charts 2 (Pescini, n.d.-b) Fig 7.19 - Wellington CBD Map (Pescini, n.d.-cn) Fig 7.1 - Wellington Map (Pescini, n.d.-cn) Fig 7.2 - Wellington Te Aro Map (Pescini, n.d.-cg) Fig 7.3 – Café Analysis Diagram (Pescini, n.d.-g) Fig 7.4 – Loretta Photography (Pescini, n.d.-bd) Fig 7.5 - Loretta Volumetric Drawings (Pescini, n.d.-bf) Fig 7.6 – Loretta Star Diagram (Pescini, n.d.-be) Fig 7.7 - Loretta Colour Scheme (Pescini, n.d.-bc) Fig 7.8 – Olive Photography (Pescini, n.d.-bj) Fig 7.9 - Olive Volumetric Drawings (Pescini, n.d.-bl) Fig 7.10 - Olive Star Diagrams (Pescini, n.d.-bk) Fig 7.11 - Olive Colour Scheme (Pescini, n.d.-bi) Fig 7.12 - Prefab Photography (Pescini, n.d.-bn) Fig 7.13 - Prefab Volumetric Drawings (Pescini, n.d.-bp) Fig 7.14 - Prefab Star Diagrams (Pescini, n.d.-bo) Fig 7.15 - Prefab Colour Schemes (Pescini, n.d.-bm) Fig 7.16 - Repetitive (Spiske, n.d.)

Fig 7.20 - Wellington Spring Spa Map (Pescini, n.d.-cp) Fig 7.21 - Spa Diagram (Pescini, n.d.-bx) Fig 7.22 - Spring Photography (Pescini, n.d.-ca) Fig 7.23 - Spring Volumetric Drawings (Pescini, n.d.-cb) Fig 7.24 - Spring Collage (Pescini, n.d.-by) Fig 7.25 - Spring Colour Scheme (Pescini, n.d.-bz) Fig 7.26 - Forme Photography (Pescini, n.d.-as) Fig 7.27 - Forme Volumetric Drawings (Pescini, n.d.-at) Fig 7.28 - Forme Collage (Pescini, n.d.-ag) Fig 7.29 - Forme Colour Scheme (Pescini, n.d.-ar) Fig 7.30 - SkinTopia Photography (Pescini, n.d.-bv) Fig 7.31 - SkinTopia Volumetric Drawings (Pescini, n.d.-bw) Fig 7.32 - SkinTopia Collage (Pescini, n.d.-bt) Fig 7.33 - SkinTopia Colour Scheme (Pescini, n.d.-bu) Fig 7.34 - Elderberry+kate Photography (Pescini, n.d.-al) Fig 7.35 - Elderberry+kate Volumetric Drawings (Pescini, n.d.-am)

- Fig 7.36 Elderberry+kate Collage (Pescini, n.d.-aj)
- Fig 7.37 Elderberry+kate Colour Scheme (Pescini, n.d.-ak)

- Fig 8.1 Dulux Analysis Diagram (Pescini, n.d.-w)
- Fig 8.2 Dulux Green Interior (Cohen & Leech, n.d.-e)
- Fig 8.3 Dulux Green Interior Tonal (Cohen & Leech, n.d.-f)
- Fig 8.4 Dulux Green Interior Volumetric Drawings (Pescini, n.d.-ad)
- Fig 8.5 Dulux Green Interior Colour Scheme and Tonal Values (Pescini, n.d.-ab)
- Fig 8.6 Dulux Green Interior 2 (Cohen & Leech, n.d.-b, p. 2)
- Fig 8.7 Dulux Green Interior Tonal 2 (Cohen & Leech, n.d.-g, p. 2)
- Fig 8.8 Dulux Green Interior Volumetric Drawings 2 (Pescini, n.d.-ae)
- Fig 8.9 Dulux Green Interior Colour Scheme and Tonal Values 2 (Pescini, n.d.-ac)
- Fig 8.10 Dulux Blue Interior (Cohen & Leech, n.d.-a)
- Fig 8.11 Dulux Blue Interior Tonal (Cohen & Leech, n.d.-c)
- Fig 8.12 Dulux Blue Interior Volumetric Drawings (Pescini, n.d.-y)
- Fig 8.13 Dulux Blue Interior Colour Scheme and Tonal (Pescini, n.d.-z)
- Fig 8.14 Dulux Blue Interior 2 (Cohen & Leech, n.d.-b)
- Fig 8.15 Dulux Blue Interior Tonal 2 (Cohen & Leech, n.d.-d, p. 2)
- Fig 8.16 Dulux Blue Interior Volumetric Drawings 2 (Pescini, n.d.-aa)
- Fig 8.17 Dulux Blue Interior Colour Scheme and Tonal 2 (Pescini, n.d.-x)
- Fig 8.18 Dulux Purple Interior (Cohen & Leech, n.d.-h)
- Fig 8.19 Dulux Purple Interior Tonal (Cohen & Leech, n.d.-i)
- Fig 8.20 Dulux Purple Interior Volumetric Drawings (Pescini, n.d.-ag)
- Fig 8.21 Dulux Purple Interior Colour Scheme and Tonal Value (Pescini, n.d.-af)

- Fig 8.22 Dulux Yellow Interior (Cohen & Leech, n.d.-j)
- Fig 8.23 Dulux Yellow Interior Tonal (Cohen & Leech, n.d.-k)
- Fig 8.24 Dulux Yellow Interior Volumetric Drawings (Pescini, n.d.-ai)
- Fig 8.25 Dulux Yellow Colour Scheme and Tonal Value (Pescini, n.d.-ah)

Fig 9.1 - Pleasant and Stimulating Diagram (Pescini, n.d.-I)



Introduction

CHAPTER 1 INTRODUCTION

This body of research delves into people's spatial comprehension and perception within interior spaces. People are all different and the way in which they read colour, light and volume depending on factors which include peoples personalities, genders, ages, cultures and human behavioural lifestyle choices. Fig 1.1 represents the diversity that this thesis encounters. Existing research is explored and analysed to

investigate what exists and what is absent in this field of research and design in the built environment. This dictates the direction of the experimentations to support and create a design tool for architects and designers. The research helps develop an appropriate and effective methodology to explore what strategies and techniques can be applied to a variety of diverse interior spaces. This research has been chosen because it has the potential to improve occupant's experiences and design application techniques to use architecture to tap into emotional responses and physical responses in a positive and

constructive way.

Thesis Structure

In Chapter Two the literature review delves into people's colour perception, colour in the built environment and a reflection of upon these findings.

Chapter Three looks at existing Methodology examples along with the selected methodology for this thesis research, finishing with a clear reflection on methodologies.

Chapter Four researches colour categorisation through the emotional categories of Pleasantness, Stimulating, Stressful and Depressing finishing with a reflection.

Chapter Five focuses directly on light and volume in the interior built environment upon reflection. Chapter Six is all about the experiments including; Colour Collages, Volume, Cube, Emotional Categories, Tonal, Stressful, Cubed, Arrow Contrasting Colours Colour Blind, Apple Complementary Colours Colour Blind and Colour Charts.

Chapter Seven looks into the interior analysis into

café spaces and spa spaces on how their design strategies and techniques achieve certain qualities within these interior spaces, reflecting upon the findings and the effects of these.

Chapter Eight analyses Dulux Interiors and how the marketing of their paint colours has been applied into interior spaces to provide customers with inspiration and ideas. Analysing the Blue Dulux Interiors, the Green Dulux Interiors with the Purple and Yellow Dulux Interiors. The reflection discusses colour, light and volume variables. Chapter Nine concludes this research with the key learnings, the research limitations, future research development and finally the strategies and techniques for architects and designers to apply to interior built environments.



CHAPTER 2 LITERATURE REVIEW

This literature review focusses on existing research on spatial comprehension and perception of interior architecture spaces through the diverse variables of light, volume and in particular colour. Looking at how the human eye and brain physically sees and understands light responding to volume, whilst also considering colour and how its attributes can influence a person's emotional responses through interior spaces, and how these responses can be controlled and influenced through design techniques and strategies. Zena O'Connor is an evidence based colour theorist, and her approaches and techniques are discussed in detail through this literature review. Artist's that use their art to entice their audience and to provoke certain emotional responses and views are also discussed.

Colour Perception

COLOUR PERCEPTION

The human eye is key in the perception of objects and spaces, absorbing and reflecting colours in different light forums and wavelengths. The system of how the human body perceives and processes light is how we understand and can differentiate a vast variety of hues. This comprises of three main parts; the eye, lateral geniculate nucleus and the visual cortex. These parts are essential in order for the body to process and understand the information the light waves are producing, which gives the perception of certain colours enabling us to differentiate different hues. Each human being is unique and our eyes and our brains react slightly differently, thus when we speak about colour we have to generalise, while many views remain subjective (Anderson Feisner, 2006). Colour is believed to be a visual perceptual property that plays an important role in the surrounding particular spaces (Yu & Yoon, 2010).

Figure 2.1 displays the front observation of the eye presenting the eyelid, sclera, pupil and the iris, commonly known aspects of the eye. The human field of vision slightly differs from person to person but is an essential aspect of how we perceive colour space and volume, which includes standard line of sight, maximum eye rotation and binocular vision in order to see maximum range of the human field of vision.



Fig 2.1 Human eye drawing

Perception of colour is the central component of primate vision. Object perception is facilitated by colour, while having an important role in scene segmentation and visual memory. Furthermore it provides an aesthetic component to visual experiences that is fundamental to how we perceive the world and how our emotions are triggered (Gegenfurtner, 2003). When first entering an

interior space you immediately identify the colours followed by the furnishing, using memory to correlate the relationship between object and colour (Anderson Feisner, 2006), Commonly artists, designers and architects want to use colour in their imagery and enable the occupants or viewers to see the colours simultaneously (Anderson Feisner, 2006). Examples of artists who practice colour to induce certain emotions and using colour in order to dictate movement, while telling a visual story are Yayoi Kusama, Mark Rothlko and Gretchen Albrecht, who are discussed further later in this chapter. These are just some of the artists who apply this purpose of colour. Art work is most successful when colour is used to allow the viewer to see the content and understand the true meaning (Anderson Feisner, 2006). Psychologically colour is the sensation of light waves which are transmitted to the human brain through the eyes. These light waves consist of energy through electrical pluses that travel at diverse wave lengths. The different tiny wavelengths of light are processed by the brain into myriad

nuances of colour. Colour allows us to interpret the visual language of nature, people, objects and spaces(Anderson Feisner, 2006).



Fig 2.2 Human field of vision- Brain to the Eyes

The human eye and brain is what distinguishes the hue, saturation and tonal value of colour we see through the light waves that are reflected and absorbed. Although the majority of what we see is based on memory, with other contributing factors like lightness and purity, we can perceive through how we have experienced it before. Yellows and greens are seen before other hues while red and violet are most difficult to perceive (Anderson Feisner, 2006), suggesting that it requires more work and energy to perceive red and violet when compared to yellow and green. This is deemed to be very important when considering the interior space colour application while creating a space with how people are physically affected. Yellow and green therefore might be better used in relaxation spaces. The eye is distinguished by colour after light has passed through the cornea and pupil and then strikes the retina. This subsequently passes messages to the fovea where they are then transmitted to the brain (Anderson Feisner, 2006). In the central part of the retina there is the fovea area, which contains the highest spatial concentration of cones. This allows the best visual activity in our human field of view, seen in figure 2.2 (Best, 2017).

Colour is processed not in isolation, but in combination with information about luminance and visual form, by the same neural circuits, to achieve a unitary and robust illustration of the visual world (Gegenfurtner, 2003). Colour vision within the human visual system relies on the presence of three types of cone photoreceptors in the retina, which contain a variety of overlapping wavelength tuning curves. The colour information is sent in three colour opponent channels from the eye to the brain. These 'cardinal' mechanisms, which are usually termed black-white, red-green and blue yellow have been characterised psychophysically and computationally to be independent and efficient (Gegenfurtner, 2003). The primary visual cortex seen in figure 2.3 (area V1), a large proportion of neutrons respond particularly to colour evidence. The majority of these neutrons respond to variations in the brightness of visual stimuli.



Fig 2.3 Prism light



Fig 2.4 Eye to brain imagery & light process

When light passes through into the eye it comes into contact with the covering near the back of the eye known as the retina. The retina is made up of layers of different cells, these include rods and cones. The function of the rods is to allow the brain to see dimly lit forms. They only distinguish black and white, no hues. However the cones help the brain to perceive hues. These aspects work together in order for the brain to process what the eyes are seeing. Shown in figure 2.4 is the multiple aspects that consist within the eye for it to function and send the image messages to the brain.

When light strikes a surface the certain wave lengths are absorbed and many others reflected by its pigments. This process is what gives a surface its colour, this is shown in figure 2.5. An example of this process is when a person sees red it is only red wavelengths reflecting off the surface of an object while the rest are being absorbed. The different combinations of reflected wavelengths form the multiple diverse colours a person sees. When all wavelengths are reflected the result is white. (Anderson Feisner, 2006). The area of the retina corresponding to the central two-degree human field of view is practically exclusively populated with cones, so at nocturnal illumination levels we lose the ability to comprehend over this area. The third state of adaption between photopic and scopic called mesopic, which is the light conditions at dawn and dusk. At this certain time of the day both rods and cones are operating, with rods contributing to the luminance signal but the appearance of colour still visible (Best, 2017).



Fig 2.5 Human Eye



The human field of vision as seen in figure 2.6 has a range of 62 degree horizontally and between 50 to 70 degrees vertically for a standard line of sight. When the brain combines the image it becomes 120 degrees, this is caused by binocular vision seen in figure 2.7. This can slightly differ from person to person (Georgiev, n.d.). The limit of the upper and lower visual field is between 50 and 70 degrees. While the maximum eye rotation above is 25 degree and downwards 30 degrees. The considered normal line of site is 0 degree, when sitting it becomes 15 degrees. Optimum eye rotation is between 25 to 30 degrees (Georgiev, n.d.). At different points within our vision we experience blind spots also known as the optic disc, this is located right at the back of the eye, seen in figure 2.4 and 2.9. The pupil is able to change diameter from 2-8mm to allow more or less light to reach the retina, in the membrane that lies in bottom of the eye where the photoreceptors are set (Best, 2017). To direct the light onto the retina the lens changes shapes while altering the focal

distance of the eye. The optical image is projected on the retina when we look at an object, this is displayed in figure 2.8 (Best, 2017). Our line of site controls how little or much we can see at one time, with the movement of the head and body the vision changes but the field of vision stays the same.



Fig 2.9 Blind Spot

Colour in the built environment

"Depending on context, colour can convey meaning often more effectively than words"

- Zena O'Connor
COLOUR IN THE BUILT ENVIRONMENT

Zena O'Connor, evidence based colour consultant, conducted workshops in Sydney in 2019 which covered the fundamentals and psychology of colour in the physical and psychological built environment. During these workshops O'Connor delved into the fundamentals of colour including terminology of hue, saturation and tonal value, examining the transformations between the colour wheel theories throughout history and how these are still applied now to art and design, some using evidence based research and others religious beliefs and views. In the realm of colour, there are many diverse colour theories which have come and gone throughout the decades. While going into some detail about the different types of colour that occur and how they can create varying different human responses towards negative and positive behaviours. To experiment and demonstrate dissimilar human responses, as a workshop cohesively a few activities were completed where participants were encouraged to compare and contrast the group's responses and choices,

analysing how individual participants came to their decision and the result. O'Connor discussed that when a design is conceived for a purpose, a range of techniques to support these purposes are utilised in order to receive the desired outcome. Although factors and contrasting variables make a great impact on how the colour is absorbed and perceived by an individual. Perception is key to viewing objects and spaces, while size, colour and mass can deceive the eye into identifying something as smaller or bigger, than its true magnitude. The attributes of colour are; hue, saturation and tonal value. These factors create human emotional responses and the visual appeal and stimuli attraction that occurs.

Hue is the category of colour, for example red, blue or yellow.

Tonal value is the lightness or darkness of the colour.

Saturation is the purity, or Chroma of the colour. All attributes fall under three categories of colour:

- Conventional colour is visual perception

 Substance colour that comes in the form of pigments and formula colour that manufacturing company's use for limited colours.

- Spectral colour, which is separate as it comes in the form of light waves and occurs in computers and televisions, often referred to as addictive colour (O'Connor, n.d.-b). The discussion of colour theory is constantly changing with new research discoveries. Theorists create their own unique colour models with many falling out of popularity over time. There are two main forms of colours that theorists use, the form of colour in light waves and the form of colour created by paints and pigments. Primary colours come from substance colours but differ depending on the colour form. The colour in paints and pigments refers to red, green and blue while the form of colour in light waves is red yellow blue and green. The form of colour in light waves and in paints and pigments are both scientifically proven and are accurate on their own colour forum.

There are countless altered types of colours, and blends of colours, which perform different actions causing multiple reactions. These include neutral, secondary, tertiary, monochromatic, monotone and analogous colours. Neutral colour is a relatively commonly used term. However there is no definite definition so the term can be used in various circumstances. It is generally seen to include offwhite, cream, beige, achromatic hues and various shades of grey. Neutral colour schemes are based on similarities of hue, tonal value and saturation, commonly seen as portraying a sense of calm when used in interior spaces. They can quite often appear clinical, sterile and even intimidating in certain contexts and settings. The communication of the colour through interior spaces depends on the objective of the project (O'Connor, n.d.-a). Secondary colours seen in Fig 2.10 are traditionally created by blending primary colours, according to some colour theorists.

Red hue + Yellow hue = Orange hues Blue hue + Yellow hue = Green hues Red hue + Blue hue = Purple hues

Secondary colours represent a wide variety of hues including many tints and shades.

Tertiary colours seen in Fig 2.11 are created by blending secondary colours. They contain a wide variety of hue variations.

Orange hues through to purple hues Purple hues through to green hues Green hues through to orange hues (O'Connor, n.d.-a)









Fig 2.11 Teritary Colours

Monochromatic colour schemes seen in Fig 2.12 revolve around one particular hue with a variation of tonal values. When tonal value is fixed the saturation level fluctuates adding visual interest to the human eye. Colour schemes using this technique have an overall cohesive influence. Strong tonal variations in the interior built environment provide differentiation that enhances the surrounding environmental visual literacy and legibility.

Monotone colour seen in Fig 2.13 is combining colours based on hues that sit as the same tonal value. Legibility can become problematic in data visualisation and graphic design. In the interior built environment monotone colours are considered to create a sense of calm due to the absence of strong contrasts, this can hijack visual attention.

Analogous colours seen in Fig 2.14 are combinations where colours share a similar hue. These are colours found alongside each other on the colour wheel models. These are often referred to as harmonious colours. Tonal value and saturations can enliven levels and textured effects (O'Connor, n.d.-a).

Monochromatic



Monotone



Analogous



Fig 2.14 Analogous

Colour, and human responses to colour, are subject to countless differing variables. Individual variables include age, gender, personality traits and mood. Cultural differences incorporate distinctions in social and cultural conditioning and colour belief systems. While humans can be strictly wired to respond to certain colours in specific and universal ways, beliefs about colours tend to play a pivotal role. In these underlying perceptions and feelings towards the variables affecting our comprehension to what our brain has been wired to.

Depending on the context, colour has the ability to affectively influence human behavioural responses to:

- Attract and divert attention.
- Encourage engagement.
- Support orientation and wayfinding strategies,

These variables all assist in the outcome of how human beings respond to visual indicators, if it has been through teaching, religion or self-discovery. Aslam is an example of colour symbolism, comparing Anglo-Saxon, Germanic, Nordic, Chinese, Japanese, Korean and South East Asia. The colour white in Anglo-Saxon is perceived as clean, pure and innocent, while in Chinese, Japanese, Korean and South East Asia it is perceived as death and mourning. This reveals how colour is perceived and dictated within different countries and cultures along with comparisons differing in meaning for colours. (Aslam, 2005).

Women and men tend to exhibit variances when identifying colours, varying in vocabulary. While members of the public tend to have a smaller vocabulary when identifying colour, compared with Support the safe operation of daily activities, those educated in art and design (O'Connor, n.d.-b). The diverse factors that need to be

> incorporated are perceptual and contextual factors. Perceptual factors include simultaneous contrast and isolation while contextual is the impact

of colour on human colour perception. Colour symbolism occurs on three levels; individual, cultural and universal.



Red along with warm colours have a massive impact on the behavioural and cognitive effect on human's perception, with an attentional advantage and grasped in search terms being faster for red, seen in Fig 2.15. These colours encourage ingress that attracts attention. This depends on the contextual colour, it physically draws participants further into a space, becoming more inviting and welcoming, sparking curiosity (O'Connor, n.d.-b).

Designing for assured commitments requires diverse colours to produce and receive a series of emotional responses. Residential colours seen in Fig 2.16 are referred to as 'homelike' colours that tend to support a sense of wellbeing in commercial and institutional space (O'Connor, n.d.-a). It is seen to encourage people to feel comfortable and at ease with familiarity. This is similarly looked at to be applied to institutional design as it has been proven to generate positive responses rather than sterile and depressing cold colours.



Fig 2.16 Homelike



Fig 2.17 Super graphics



Fig 2.18 Super graphics 2

Research indicates that colour super graphics humanise an environment and are highly visually appealing to children, as they prefer bright and saturated colours. It inspires engagement and aids to relieve stress and anxiety bringing familiarity to children, and adds a sense of joy and playfulness within workplace environments additionally within educational settings, which have their advantages. Coloured super graphics seen in Fig 2.17 and 2.18 have the capacity to transform urban environments, encourage engagement and support orientation. Coloured lighting can assist in enhancing social interactions. Hushed tonalities are subtle tonal graduations within a space, create an inherent sense of calm. It establishes a sense of tranquillity by minimising strong contrasts and excessive patterning and design details. This design technique is particularly suited to introverts who tend to prefer peaceful and tranquil spaces. The isolation effect seen in Fig 2.19 and

Fig 2.20 occurs when an object contrasts strongly with its surroundings, strong hue, saturation and tonal value contrasts. This technique is often applied in the built environment to help differentiate key areas to occupants and users, the human eye will focus on an object in peripheral vision that is brighter relative to its surroundings, this is seen when red draws attention to the operation dial on products (O'Connor, n.d.-b).

Colour contrast and visual complexity consists of multiple contrasts, hue, saturation and tonal values. Excessive patterning and visual design details equals' visual complexity in the designed built environment. This is due to the mechanics of visual perception and saccades. The perception and operation of saccades is constant and frequent sweeping movements of the eye as we view an object or space. The eyes are attracted by strong colour, contrast, movement and the search for figures or objects that provide meaning. If an interior space has too many contrasts then this creates visual distraction and visual complexity, causing errors in visual tasks. This results in a negative impact on orientation, wayfinding and daily activities for people occupying and moving through the space (O'Connor, n.d.-b).



Fig 2.19 Isolation efffect



Fig 2.20 Isolation efffect 2



Fig 2.21 Facade Colours



Fig 2.22 Sectional Colour

O'Connor describes colour perceptions having the capacity to influence perceptions of size and mass with areas of design in the built environment. Applying lighter and brighter colours that are relative to contextual colour can make an object appear larger, while darker colours make a silhouette appear slimmer. When you use facade colours that tend to make a building look smaller, this is used to colour camouflage industrial buildings seen in Fig 2.21. Sectional colour is an evidence based strategy used in design and the built environment to reduce apparent visual mass. This provides opportunity to reflect colours in the setting of current trends in colours, materials and finishes seen in Fig 2.22. This technique is effective in larger buildings including apartments and commercial buildings (O'Connor, n.d.-b). During the Sydney workshop, numerous activities encouraged participants to engage with one another, instructing them to choose and create different colour connections. Comparing and contrasting colour choices, it appeared that personal preference and personality come through

strongly in people's pairings and decision making. Perhaps this is why researching colour is so challenging, because of individual preferences, seen through the colours (subjectively) aesthetically pleasing nature or through a positive memory. Through the diverse activities, many participants chose colours within the same hue and tonal values. Participants own experiences and views generated different colours and combinations that varied in emotional reactions and behavioural responses. When a diverse contrast is applied to different scenarios, it generates a range of emotions and atmospheric qualities that humans respond to physically and psychologically. Colour variety is the variation of individual personality traits with different work tasks and colour strategies, these are used to differentiate the dedicated zones. while supporting wellbeing and creativity.

Key recommendations that were discussed for workplace colour design unite a mix of moderately colourful spaces featuring a range of hues and saturations and tonal value levels. Although quiet work spaces need minimal colour and contrast to minimise visual complexity and distraction. Incorporating blank canvas surfaces and exterior window views allows visual respite. Plants and surfaces that feature green hues inspire nature, by providing nature and views of nature supports a sense of wellbeing and improves concentration with universal preferences of Biophila design seen in Fig 2.23. Biophilic design represents the strong attraction and sense of affinity for nature and living systems. It suggests that we are hard wired to seek out connections with nature and other forms of life (O'Connor, n.d.-a).

The following section presents and discusses the colour application and creativeness of several well-known artists.



Yayoi Kusama



Infinity Mirror room, Phalli's Feild, 1965

Fig 2.24 Yayoi Kusama

Yayoi Kusama at almost ninety years old is astonishingly consistently prolific. She is one of the most significant and well recognised contemporary artists, born in 1929 in a rural town called Matsumoto, Japan (Pound, 2018). Kusama is a mayerick artist who channels her obsessive neuroses into art that transcends cultural barriers. as she is haunted by her fears and phobias. Yet she determines to maintain her position at the forefront of an elite artist (Kusama, 2013). The attributes that she is most wellknown for are her infinity nets, reoccurring dots and protruding phallic objects seen in Fig 2.22 (Manatakis, 2018). Her mother often snatched drawings from her before she could finish them, which may explain why she has an obsessive creative drive causing her to rush to finish her work before it can be taken from her (Pound, 2018). The feelings of self-obliteration manifested itself in the form of hallucinations, at age ten she recalls experiences where fabrics and patterns would consume her in vivid hallucinations, while flowers starting to speak to her. Kusama

believes that translating her hallucinations into paintings she has been trying to cure her disease (Manatakis, 2018). Rather than allowing her mental illness to consume her she used it as a point of empowerment. Art is a way for Kusama to purge her childhood trauma and hallucinations, to produce the world's most psychological artworks (Manatakis, 2018). The way Kusama is able to harness her traumatic life experiences and project them through art has not only brought her some peace from a cruel world but also brought visual delight to others. It creates a symbol for how art can be a vehicle for eradicating negative and false stigma's surrounding mental health (Manatakis, 2018).

Gretchen Albrecht



In a shower of gold, 2011 Fig 2.25 Gretchen Albrecht

Gretchen Albrecht is a leading New Zealand Artist, with an honours degree from Elam School of fine arts. She continues to investigate the endless possibilities of abstraction, a testament to her sustained artistic and spiritual explorations ("Gretchen Albrecht biography," n.d.). The abstract shapes that Albrecht has created shows swirling worlds of colours, while balancing between light and dark. The colour bands slice across the surface acting as a hiatus, drawing attention to the artist's process seen in Fig 2.25. Albrecht created spatial layers and provided contrasts between geometric and gestural, combining aspects of the cerebral, the spiritual emotional. Threshold art pieces bring joy and are threshold motif. There is a sense of two forces, human and vegetal counterpointing each other ("Gretchen Albrecht biography," n.d.).

Mark Rothlko



White Center, 1960

Fig 2.26 Mark Rothlko

Mark Rothko was born in Russia, he was a well-educated and academic man who spoke four languages. With his next to nothing training in painting and drawing his skills were largely innate (Mark Rothko-Artist Gallery of career highlights including his most famous paintings, n.d.) He also painted many theatre scenes. There is a lack of symbolic reference but a sense of intimacy to Rothko's paintings. When you stand close to the canvas you can empathise with emotions provoked. There is intention to stimulate deep emotion. Without colour, form and space we cannot be imaged or visualised because god is invisible. Rothko expresses total freedom about birth and death. The person with light and with gaze of an outsider, on another they are also confrontation between the quests for spiritual renewal. Rothko speaks about how art is an adventure of exploring the unknown, creating masses of layers which gives the perception of glowing, within depicted rectangles seen in Fig 2.26.

Collectively these artist models all use colour, volume and light to convey their messages and evoke certain emotions through participants experiencing their work. They all consist of various techniques and visual attributes that are mutually efficacious and strong in their own unique way. Kusama demonstrates infinity nets, reoccurring dotes and protruding phallic objects. These reoccurring shapes and colours through her work create visual confusion and speak to the viewers through the emotions she feels as she paints these artworks delving into the deep physiological barriers of peoples understanding through how they see and interpret her artwork. Albrecht provides abstract shapes and swirling motions of colour that generates a sense of two forces of human and vegetal counterpointing. This sort of visual display is enticing, the large size of the paintings are captivating to the eye, bringing the viewers curiosity and interest further into the emotional responses the artist desires. Rothko may lack symbolic references but expresses freedom and encourages the sense of intimacy and intention to

stimulate deep emotional responses. The depicted rectangles pull the viewer in with the colour combination causing slight confusion which pulls the viewer in further to depict the imagery.



CONCLUSION AND REFLECTION

This literature review reveals many important factors through the perception and comprehension of light, volume and colour in interior spaces through the built environment. The sensation of light waves give the perception of certain colours, transmitted through enabling our eyes and brain to differentiate altered hues, seen as visual perceptual property. The perception of colour is the central component of primate vision with scene segmentation as visual memory. This has the capacity to influence size and mass within the built environment. Objects will appear lighter or darker depending on the level of light in a space. Sectional colour reduces visual mass providing opportunity to reflect colours. In space people identify colours first then followed by furnishing, the memory correlates to the relationships between object and colour with artists using a visual story within their work to apply purpose to colour. We are seen to perceive how we have previously experienced a space before (Anderson Feisner, 2006).

Communication of colour through the built environment depends on the objective of the project (O'Connor, n.d.-a). The human eye will focus on an object in peripheral vision that is brighter relative to its surrounding.

Yellows and green hues are seen before other hues, whereas red and violet hues are physically more difficult to perceive. In the retina the fovea area holds the highest spatial concertation of cones, providing the best visual activity in our human field of vision (Gegenfurtner, 2003). Colour is not perceived and processed in isolation but in the combination of information and luminance and visual form, but the same neutral circuits to achieve a robust illustration of visual space (Gegenfurtner, 2003). Neutrons respond to variations in brightness and visual stimuli. Rods and cones in the eye work together to perceive hue and dimly lit forms and volumes. This function sends messages to the brain. Our line of site controls how little or much we see at one particular time, with the movement of the head and body the vision changes but the human field

of vision stays the same. Visual complexity is due to one's perception. This is due to an individual's constant frequent sweeping movements, used to view an object or interior space, known as saccades. Geometrics anchor the eye contrasting spatial layers.

Conventional colour is visual perception, substance colour is the form of pigments and spectral colour is the form of light waves. When the tonal value is fixed the saturation levels fluctuates adding visual interest, this results in a cohesive influence. Strong tonal variations enhances the built environment. Hues that sit in the same tonal value become problematic in legibility and data visualisation. Although it is considered to obtain a sense of calm due to its absence in strong contrasts which hijack attention. Tonal value and saturations can enliven levels and textured affects.



The human behavioural responses can attract and divert attention, encourage engagement, support orientation and wayfinding strategies, support the safe operation of daily activities through visual indications. Perceptual factors, simultaneous contrasts and isolation while contextual is the impact of colour on human perception.

The hue red, encourages ingress and attracts attention depending on the contextual colour. Physically red draws participants further into a space. This creates an inviting, welcoming environment and sparking curiosity. Homelike colours protrude positive responses. Coloured super graphics humanise with high visual appeal to children, aspiring engagement, relieving stress and anxiety, creating joy and playfulness. Coloured lighting boosts social interactions. The isolation effect makes objects with strong contrasts in its surroundings differentiate key areas. The eyes are attracted to movement and the search for figures. Biophlic design represents strong attraction and a sense of affinity for nature and living. This suggests that people are hardwired to seek

out connections with nature and forms of life (O'Connor, n.d.-a).

Through these discoveries, a methodology will be developed to direct multiple experiments through the variables of colour light and volume. The existing research demonstrates that in terms of physics, human perception and light, it is well covered. Although what is missing is the post-occupancy and emotional responses to spaces research, along with experimentations and application into the built environment. The experiments will focus on these attributes and analyse the results.



Methodology



Fig 3.1 Connections

CHAPTER 3 RESEARCH METHODOLOGY

The methodology for this research project is anomalous, as the process of the experimentation dictates the next move and decisions on how to inform the human observational understanding of the results.

Subjective methodology processes enable researchers to objectively comprehend physiological phenomena (Ratner, 2002). It consists of personal opinions and interpretations with people's point of view, including their emotional perspectives and grasps on the present view. Qualitative research is exploratory research, while gaining understanding of underlying reasons and opinions. Subjectivity can be dictated by the chosen research methodology in managing the research reviews, while qualitative methods necessitate a level of subjectivity in research reviews. They are less structured than quantitative methods, which consist of statistics and numerical data, though qualitative researchers often interact closely with participants within the field (Allen, 2017). When large amounts of information is accumulated the

researchers will rely upon their personal cognitive frameworks to identify and make sense of patterns to articulate the meaning of certain social behaviours and responses this is diagrammed in Fig 3.1. Qualitative research can depend on the researchers subjectivity and how it must reflect the meanings participants attach to their own words and actions (Allen, 2017). To allow for a successful subjective perspective, the interpretive openness and flexibility is through a process by which the researcher acknowledges the performed prejudices, biases and stereotypes. By doing so the researcher identifies and determines the scope in which they have built their interpretation from the given data (Allen, 2017).

Objectivism integrates subjectivity and objectivity, as it argues that objective knowledge requires active, sophisticated processes, such as perception, analytical reasoning, synthetic reasoning, logical deduction and the distinction of essences from appearances. Equally subjective processes can enhance the objective comprehension (Ratner, 2002). The diverse viewpoints are important in order to generate innovative ideas that are eventually sifted out to produce the most accurate, logical and verifiable choice at that present point in time. The finest one commands general agreement because all observers are striving to comprehend the same, definite object. Diverse and pluralism are stepping stones to gathering general validity and agreement. These are not goals and neither constitute a state of scientific success (Given, 2008). One is not objective simply because one amuses a diversity of perspectives. On the contrary, maintaining a diversity of perspectives precludes discovering the highest representation of the single reality that confronts us (Given, 2008).



Fig 3.2 Adapted from; The Stanford's Design Thinking Process

The Stanford d.school Design Thinking seen in Fig 3.2 is a methodological model for hands on design challenges that focuses on building skills in design thinking processes. Encouraging innovative solutions through chasing ordinary thinking (Elmansy, 2016), their example contains the stages of Empathy – Define – Ideate – Prototype – Test – Iterate, each providing a new iterative stage to learn, think and to act. Another suggestion contains; Understand – Observe – Point of view – Ideate – Prototype – Test. These different stages are in order to improve the final product or design. The process may not flow

in a linear fashion, as the iterative process may lead to jumping between processes (Elmansy, 2016). This will be utilised through this research methodology to enhance the iterative and design process to its full potential. Qualitative research methodology with the inclusion of objectivism has been utilised for this research because it consists of both subjectivity and objectivity, balancing the reasoning's and perspectives of the experiments and results. The research reflects interpretive openness, whilst interpreting the scope in which the interpretation of the data is built on.











Fig 3.6 Infinite

Continuous repetitive process.

The overlapping of the process through the reflection of what has been undertaken.

Endless cycle.

The process utilised throughout this research, displayed in Fig 3.3 takes the following form which has been adapted from The Stanford's design process (Elmansy, 2016);

- Proposed - Initial research question which informs first exercise and the following

- Analysis Analysis of data experiments
- Reflection Reflection on data

- Informs - Experiment - informs the first experiment and the following experiments

- Undertaken - Reflection on data and results to drive the next experiment

The input is proposed, the data is analysed and reflected upon, and the output informs the next step. This is repeated in a continuous cycle shown in Fig 3.4 is undertaken to obtain the subjective and objective methodology through objectivism. This process involves objectivism integrating the required knowledge for action with a clear process involving the subjective process that enhances the objective comprehension. The diversity of perspectives and discovering the highest of representation is incorporated into the qualitative research methodology articulating emotional responses and comprehension. A cognitive framework has been created to identify light, volume and colour qualities to articulate the meanings of the certain social behaviours and emotional reactions, including physical and psychological behaviours. Fig 3.5 demonstrates the overlapping of the process through the reflection of what has been undertaken through this research to ensure the right actions are taken. The undertaken is overlapped with the reflection process. The Fig. 3.6 displays the endless cycle of the reflection process and continuous cycle. Fig 3.7 shows a representation of the different design ideas and how the continuous process contains a variety of sizes and shapes that connect and reflect in the action and reaction of design decisions.





REFLECTION

This methodology research demonstrates a vast range of imagery and experiments where comprehension interpretations are gained through knowledge and understanding of the emotional perspectives through light, volume and colour. This qualitative research has proven to be successful with the application of objectivism, using subjective and objective perspectives together in alliance. The cognitive framework has provided a clear process for the methodology through this research.



Colour Categorisation
CHAPTER 4 COLOUR CATEGORISATION

For the purpose of this research, four human emotional behavioural responses; pleasantness, stimulating, stressful and depressing, have been selected to represent the seven generalised human emotions, gathered from; Anger, Fear, Disgust, Happiness, Sadness, Surprise and Contempt(Suzuki, 2019). A variety of references of existing research have been used to categorise the four specifically chosen human emotional behavioural responses inspired from these. The four different human emotions selected condenses and represents the diversity and spectrum of emotions for human beings, and include;

- Pleasantness which signifies tranquillity and calm

- Stimulating which signifies motivation and feeling alert

- Stressful which signifies agitation and increase in anxiety

- Depressing which represents discouragement and isolation.

Colours, and how people's perceptions of colours effect their psychological and physical reactions, have been placed into these four emotional behavioural response categories This method of categorising has been created in order to develop a system and guide to follow to achieve certain emotional and atmospheric qualities within interior spaces. Literature sources such as Zena O'Connor's work will be used to support colour evidence based strategies, and experiments from colour research and application, Aslam, Xin, Janet Best and places of Soul will also be considered These sources discuss the relationship between colours, emotions and volumes. Some findings align with each other and others contradict one other. While numerous support each other's assured claims for how certain colours or combinations of colour induce and entice definite emotions for people, it is important to note and acknowledge that these sources represent a combination of subjective and evidence based research.

 \mathbb{P}] \mathbb{Q} a s a n t n \mathbb{Q} s s The feeling caused by agreeable stimuli; one pole of a continuum of states of feeling .



Fig 4.1 Pleasantness



Fig 4.2 Pleasantness 2



Fig 4.3 Pleasantness 3

The pleasantness category has a strong relationship with blue, green and yellow, including some examples of purple representing quiet and love seen in Fig 4.2, 4.3 and 4.4. Blue is perceived as trustworthy, affectionate, calm, soothing and even restful (Aslam, 2005). It can similarly be understood as an open and peaceful environment that encourages experimentation containing solutions (Best, 2017). While blue can be calming, it is at risk for being too cold (Day, n.d.). The combination of blue and green is understood as a highly visually pleasant combination, consisting of light saturations (Carter et al, 1997). Green is perceived as portraying happiness (Aslam, 2005), while also portraying calmness, restful and refreshing (Xin et al., n.d.) (Day, n.d.). Yellow evokes happiness, with cheer and joy (Aslam, 2005) (Xin et al., n.d.). It correspondingly radiates vitality, light and cheerfulness. Though it can be joyous it risks the space to become too active and visually distracting (Day, n.d.). Finally purple is seen to be associated with love, although it is believed that

purple is the quietest colour in a room or space but human perception risks it to be perceived as not appropriate for everyday use to consume within an interior space or room, although it is hard to define accurately what appropriate means to represent. O'Connor's evidence based research determines that minimal colour contrasts provide quiet work spaces while blank surfaces and windows create visual respite. Homelike colours and hushed tonalities create calm and tranquillity, including minimising excessive patterning and details. To incorporate natural light into a space allows the space to open up freely.

Stimulating The feeling caused by rousing or quickening activity or the senses.



Fig 4.4 Stimulating 1



Fog 4.5 Stimulating 2

The stimulating category is dominated by red through all of the references and Fig 4.5 and 4.6. Red is understood to be alert, adventurous, sociable, powerful, protective and exciting (Carter et al, 1997) (Xin et al., n.d.). Red creates warmth and stimulation additionally along with providing passion and aggressiveness (Day, n.d.). Red has an attentional advantage, commonly seen in hazardous and warning signed. Bright saturation colours are proven to relieve children's stress and anxiety, while encouraging engagement. Tonal value variations aid in the stimulation of the colour within the space (O'Connor, n.d.-c). Blue can be comprehended as trustworthy and green as reliable, but do these colours contribute to stimulation being reliable and trustworthy? (Aslam, 2005).



Fig 4.6 Stressful



Fig 4.7 Stressful



Fig 4.8 Stressful

The stressful category is strongly associated with red and black seen in Fig 4.7, 4.8 and 4.9. Black is seen to be represented by fear, while red has an association with fear and anger (Aslam, 2005). Red commonly is linked to danger and caution (Best, 2017). Orange is regularly seen as full of life but it jeopardies being too forceful aesthetically inside interior spaces (Day, n.d.). Visual complexity causes stress visually, while having too many colour contrast and excessive patterning in the design details They contribute to emotional stresses (O'Connor, n.d.-c).

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Fig 4.9 Depressing



Fig 4.10 Depressing 2



Fig 4.11 Depressing 3

The depressing category has a combination of green, yellow black and brown seen in Fig 4.10, 4.11 and 4.12. Green is associated with fatigue while the blend of yellow and green has a low pleasantness level (Carter et al, 1997). Yellow can be connected jealousy with dull and low saturation levels (Aslam, 2005). Black can be linked to mourning and lacking visual pleasantness (Xin et al., n.d.) (Best, 2017). Brown can risk being too oppressing and heavy within spaces (Day, n.d.).



CONCLUSION AND REFLECTION

The Colour Categorisation seen in Fig 4.12 demonstrates some contradictions in existing research, displaying how yellow hues and green hues appear in both pleasantness and depressing categories. While red hues are dominant in both stimulating and stressful categorises. There may be similarities within hue choices but the tonal and saturation values are what have deciphered them into the different categories and that is the main purpose of the research and categorisation. Differentiating the values and emotional effects of these values will require cognitive frameworks.

PLEASANTNESS	STIMULATING	STRESSFUL	DEPRESSING
Tranquil - Calming	Motivating – Alert	Agitation - causing anxiety	Discouraging - Isolating
COLOR RESEARCH AND APPLICATION- Light saturation Blue & Green= high combination ASLAM-Red = love & happiness	COLOR RESEARCH AND APPLICATION - Red is alert ASLAM- Blue= trustworthy	COLOR RESEARCH AND APPLICATION - warm colours Dark saturation ASLAM- Black= Fear	COLOR RESEARCH AND APPLICATION - Green=fatigue Dark saturation Yellow+ Green= low combo ASLAM- Yellow= jealous
Blue= Trustworthy Yellow= Happiness Green= Happy Purple+ Love	Green= reliable	Red- fear & anger	Dull with low saturation
ZENA- Minimal colour contrasts= quiet work spaces Blank surface + window= visual respite Homelike colours Hushes tonalities/ mono tone colour= calm & tranquillity Minimising excessive patterning & details Natural light= open space	ZENA- Bright saturation colours relieve children's stress & anxiety- encourages engagement Red= has an attentional advantage Tonal value variations	ZENA- Visual complexity Having too many colour contrasts Excessive patterning & design details	
XIN- White= purity Yellow= cheerful, jovial, affectionate, impulsive Green= calm & restful Blue= affectionate, pleasant, soothing, restful, calm	XIN- Red= adventurous, sociable, powerful, protective, exciting		XIN- Black= mourning
JANET BEST- Blue= open, peaceful environment- encourages experimentation with solutions		JANET BEST- Red is linked to danger	JANET BEST- Whiteness and blackness lacks pleasantness
PLACES OF SOUL- White can be calm, life filled, joyous, timeless Blue can be calm but risks being cold Yellow can be joyous but risks being too active Purple is the quietest colour in a room but perception risks it being perceived as not appropriate for everyday use Green=calming and refreshing Yellow= vitality, light and cheerfulness	PLACES OF SOUL- Red= warmth, stimulation, passion and aggressiveness	PLACES OF SOUL- Orange can be full of life but risks being too forceful	PLACES OF SOUL- Brown risks being too heavy and oppressing

Fig 4.12 Colour Categorisation

Fig 4.13 exhibits all four of the emotional category images alongside one another to visually show the hue, tonal value and saturation hierarchies between them, supporting the findings of these experiments.

The next step is to use visual experiments and qualitative research methodology to determine the aspects of these colours, arranging them to belong within a certain human emotional behavioural response category. To distinguish aspects surrounding the hue using tonal value and saturation levels to do so. The purpose is to see how the variables of colour. Light and volume determine human comprehension and perception within interior spaces.

The categories of pleasantness and stimulating are the emotional variables that have been selected for further experimentation. To further research how the spatial comprehension of perceived interior spaces can be altered with volume, light and colour to encourage a pleasant and stimulating space.



These have been chosen because these categories are ones that can help improve and assist in positive effects on people's wellbeing. Experiments will be conducted in order to see how people perceive and comprehend different combinations of volume, light and colour in order to create a guide and recommendations for designers in order to achieve these certain atmospheric qualities of pleasantness and stimulating emotional behavioural responses in interior spaces.





Pleasantness

Stimulating



Stressful

Depressing

Fig 4.13 Colour Categorisation Images



CHAPTER 5 LIGHT AND VOLUME

The involvement of volume and light needs to be taken into consideration, as this creates numerous variables from site to site and effects the visual perception and spatial comprehension within interior spaces to the human eye. Anter claims that without light there are no colours, and without colour contrasts there is no possibility of visual spatial comprehension. Colour, light and spatial experience are thus dependent upon each other, and all are absolutely fundamental for our existence as human beings. Each aspect supports and complements each other and can determine whether an interior space is successful or not. The three dimensions of colour, saturation, hue and tonal value are systematically manipulated in an attempt to ascertain their relationship to the dimensions of colour meanings (Anter, 2008). Research confirms that colour has the ability to influence people's perceptions of the size and mass of an object, this can occur across all areas of the applied design and the architectural built environment (O'Connor, n.d.-b).

The Figures 5.1, 5.2 and 5.3 all demonstrate a variety of light and volume examples in the built environment presenting different experiences and human emotional responses. The images contain a diverse range of colours, saturations, tonal values, shadows, reflections, refractions and absorbencies, These all contribute to the visual effects of the interior built environment and how the differences and variety can fluctuate so dramatically to the eye. Fig 5.1 shows a repetitive pattern of square tiles along a wall with light passing through to reflect and create a strong shadow of rectangular light, differing the colour tonal value of the wall and flooring. The straight lines and defined light and dark areas create a visual direction and attraction to the eye. Fig 5.2 displays a leafy plant with soft features and coloured light reflection across the wall with dark saturation and tonal levels, creating multiple shadows. The lack of defined visual perspective and comprehension is due to the darkness and lack of light in the interior space.

Fig 5.3 demonstrates a window sill with direct sunlight coming through against a cup of coffee and a pot plant. The direct sunlight causes lengthened shadows through the objects on the window sill. The sunlight has reflected the image of the coffee cup on the window confusing the dimension and depth of the image. Although the warm coloured hues and light through the mid saturation and tonal values define the human perspective clearly to comprehend the space and features vividly.



Fig 5.1 Squared Light

Fig 5.2 Leaf Shadow

Fig 5.3 Cup of Coffee







Fig 5.4 Sunlight Diagrams

Light is a major aspect of the appearance of colour and volume. During the year, the sun changes its height through the seasons, Summer, Autumn, Winter and Spring. The height of the sun will change the direction and intensity of the light coming through into a space. Poorly designed buildings with the effects of limited natural sunlight and poor indoor air quality continue to affect the health of the building occupants (Boubekri, 2008). Daylighting apertures allow building occupants to connect with the exterior, without this feeling of connection we feel as though something may be missing (Boubekri, 2008). Studies show that we spend 80% of our lifetime indoors (Boubekri, 2008). Humans are dependent on light for perception, so it is natural for light to affect us psychologically. Sunlight gives us a sense of time and a connection to the rest of the world. Our inner biological clock often desires this connection (Boubekri, 2008). According to the Auckland design manual, the average sized bedroom is 2900mm by 2800mm.

The sunlight diagrams seen in Fig 5.1 and 5.3 are based on these measurements with a north facing window of 900mm by 1000mm (Auckland design manual, n.d.). The diagrams display Summer, Equinox and Winter with three different times of the day 8am, 10am and 12pm. These diagrams display how the time of day changes the height of the sun, affecting the sunlight value within the interior space and built environment. This can cause changes in the light qualities, colours and spatial comprehension with the time of day and seasons differing throughout the year and constantly changes these variables.







Fig 5.5 Direction



CONCLUSION AND REFLECTION

Without light there are no colours, without colour contrasts there is no possibility of visual spatial comprehension. This is fundamental to our visual existence. The hue, tonal value and saturation levels are systematically manipulated in an attempt to ascertain their relationship to the dimension of colour meanings. Humans are dependent on light perception, it is natural for light to affect us psychologically. Sunlight provides a sense of time and connection to the world.





Pilot Experiments

CHAPTER 6 PILOT EXPERIMENTS

This chapter presents a series of experiments exploring colour perception using the methodology discussed in chapter three.

Intention. The intention of these experiments is to discover how people's spatial comprehension and likeability to a space changes through the dissimilar variables of volume, light and colour. Focusing directly on pleasant and stimulating emotional driven experienced spaces, improving people's atmospheric experiences and perception within interior spaces.

Purpose. The purpose is to discover whether these spatial variables impact people's spatial comprehension either negatively or positively, and can direct certain emotional experience within interiors, impacting people's emotions and attitudes.

Why. I am conducting these experiments to illustrate how certain colours, volumes and the incorporation of light, dictate how we perceive an interior space. This will enable designers to shape how people comprehend and provoke atmospheric qualities through emotions within interior spaces.

How. The experiments will follow a clearly processed qualitative methodology using objectivism to subjective perspective and objective interpretations. This cognitive framework goes through a repetitive cycle of; proposed, analysis, reflection, informs and undertaken.

Variables to keep in mind throughout include the following;

- Volume- shape and form within 3D and 2D imagery in interior spaces

- Light- the Summer, Equinox and Winter seasons. 8am, 10am and 12pm- morning times of the day window facing north

- Colour- Using existing research to determine which hues to use in order to receive certain outcomes.

- Spatial comprehension- How the human

eyes and brain perceives and understands a space depending on what attributers and altered variables are contributing to the perspective and interpretation.

This research looks at how, instead of being conformed to form, colour merges with light and generates an unearthly effect on space. Colour should be considered as an instrument of design, as a system for generating form and organising space. While it is capable of enhancing volume with the potential to destroy it, we as designers can capture these aspects and channel them positively. (Safont-tria et al., n.d.). The initial pilot experiments were conducted to investigate a series of variables including colour, light, shape, people, transparency, layering, patterning and tone. They all focus on different aspects and display a range of visual indications and further questions to explore to determine how these variables may contribute to people's perception and comprehension experiencing interior spaces.

They include the following;

- Colour Collages
- Volumetric Experiments
- Cube and Circular Experiments
- Emotional Categories
- Stressful Emotional Category
- Tonal Experiments
- Tonal Coloured Experiments
- Colour Blind Experiments
- Colour Charts and Colour Swatches



Fig 6.1 Colour Collages

The colour collages seen in Fig 6.1 were created to determine how human interaction within environments or advertised products produce unalike colour schemes that precept perception and emotional behavioral responses, negative or positive. The aspects that were evaluated and observed were; hue, saturation, tonal value, focusing on shapes and volumes with manmade and natural material elements. They establish human expression and body positioning arrangement, seeking the approachability and comfort relatability provides the viewer. The contrasting colours contain the isolation effect through the contextual impact.

Fig 6.2 is an example of an individual colour collage. This was created by taking an image of a figure and extracting the hues, saturation levels and tonal values from the image to create a collage. The hues are pink, black, tan and red. The red coat has an attentional factor with the high saturation levels and the combination of low and mid tonal values. The repeated word "Red"

is in a black hue, creating some visual complexity and delivers another question, if you would still read the word red if it was in a blue hue? The figure in this image is portraying a feeling and emotion with a large grin, the indirect line of sight seems to be less aggressive and invasive to the viewer. If this collage did not have the figure as a point of reference then would it have the same effect, through the relatability and the feelings conveyed, I think not. Through the colour collages I learned that contrasting colours have an attentional advantage and visual complexity can come in different forms of imagery and in text. When figures portray certain emotions it creates approachability and relatability mirroring the emotion to the viewer with a point of reference.





Fig 6.3 Volume Experiments

The first three volumetric experiments use primary, secondary and tertiary colours as a base for saturation, tonal value and hue seen in Fig 6.3. The next three are contrasting colour combinations. The following are all complementary colours, finally the same hue with differing tonal values. This experiment explores the colour combinations and values through how they affect the depth of perception and differentiate the volumes of how the viewer comprehends them through visual indications following the same volumetric pattern.

Fig 6.4 is an example of a volume experiment. This is looking at the complementary colours green and yellow with a black tone. The green and yellow highlight the volumetric values, while the black shadows and shapes the form of the object. The various patterns and objects are easier to perceive with the stronger contrasts in hue and the defined lines. Through the volumetric experiments I learned that strong saturation creates further depth and defines lines, while low tonal value is harder to perceive with visual complexity. Colour contrast attracts attention and distraction.



The cube and circular experiments seen in Fig 6.5 and 6.7 have extracted colours -from selected natural aspects, using images of plants, flowers and flaxes to extract hues from these. emphasising shape, volume and transparency. The cubes range in tonal values, as do the hues from nature. Due to the differences, the perception and attentional advantages the cubes change between appearing to be looking at the interior of the cubes and looking at the exterior of the cubes. The diverse colour contrasts and tonal values. either create depth or appear shallow with the isolation effect. The circular experiments use the exact rated colours from the cube experiments. The circles not only differ in tonal values but in transparency levels and size looking at behavioral cognitive effect. This incorporates layering, the layering introduces the colour combining with lower transparency levels overlapping on the top, altering the hues. The strong tonal value variation images display the diversity in tone within the multiple hues and their effect enhances overall perception and emotional reaction to the images.

Fig 6.5 Cube Experiments

Fig 6.8 Circles Experiment

Fig 6.6 and 6.8 are examples of cube and circular experiments. Fig 6.6 displays a cube containing blue, green and navy hues with mid to dark saturations. Due to the darker saturation levels it is easier to perceive the defined edges of the cube and switch your vision between the interior of a cube and the exterior of the cube changing your depth of perception. Fig 6.8 contains very low tonal and saturation levels. Grey, blue and yellow are the three hues applied to this experiment. This creates minimal contrast and visual complexity to the eye displaying a calm image with the fluency of the circular curves and transparency levels. Through undertaking the cube and circular experiments I learned that colour can affect depth of perception and transparency levels, viewing interior or exterior views or seeing the foreground or background initially. This can lead people through spaces and direct attention to certain elements that the designer desires. The more variation in tonal value and strong saturation gives the perception of a more defined space and depth to define edges, while similar tonal values in colour create less definable spaces and shallow perspectives.

Fig 6.7 Circles Experiments



Depressing

Stimulating

The emotional category experiments are comparing the existing research on colour and related emotions and benefit from the research, to divide colours into the emotional categories created, seen in Fig 6.9. These emotional templates were constructed from my subjective perspective and interpretations guided from objective evidence based existing research. The first image on the top left hand side of the page symbolises pleasantness, using blue tones and curvature with overlapping fluid shapes and differing tonalities. The second image on the top right symbolises stimulating. Applying red hues creates ingress and attracts attention with repeated rectangular shapes in distinctive sizes. The third image on the bottom left symbolises stressfulness. Applying red and multiple patterns and volumetric shapes to create visual complexity. The fourth image on the bottom right symbolises depressing. Using green and yellow hues in bold shapes and colour blocks with dull and low saturation levels. Discouraging interaction and engagement advantage.

Fig 6.10 is an example of an emotional category experiment representing pleasantness. Blue with differing tonal values creates calm and interest with the combination of the easing curves. Although many prefer organised and structured as a peaceful visual to view. This then comes down to more specifics like people's personality and personal preferences to what they deem to be pleasant. Through the emotional categories experiments I learned how important subjective personal experiences to the emotionally driven responses and memories play when perceiving images and creating your own experience through them. Even though the hues may differ, the shapes and tones of the images still express preference and control over the emotional responses to the images that have been objectively comprehended.



ig 6.12 Stressful Experiment



Continuing on from the emotional categories experiments. The excessively patterned experiments are fixated on stressful evoked patterns and colour combinations, hijacking attention and confusing hierarchy, while impacting the operation of saccades frequent eye movements seen in Fig 6.11. A large contribution to these patterns looks at repeating the equivalent shapes over and over with characteristics of illusions, creating visual complexity confusion in visual tasks causing errors.

Fig 6.12 is an example of a stressful experiment. The hues are orange, red, black and white. This image has opposing tonal values through the orange and red hues. The complex repetitive patterning creates visual complexity and agitation to the eye, to try and comprehend and understand the patterning with the contrasting hues. Through undertaking the stressful experiments I learned that the visual complexity of patterns overrides the colours within them, while adjusting the colours amplifies the agitation or can decrease but not eliminate.

Fig 6.11 Stressful Experiments
When the eyes struggle to understand and strain to comprehend, that is what causes the stressful emotional reaction. The human eyes make saccadic movements and stop several times, causing rapid eye movement as both eyes simultaneously move between two or more phases. The more complex the image and pattern the faster the saccades move.



Fig 6.14 Tonal Experiment



Fig 6.13 Tonal Experiments

The tonal experiments use tonal values to create shape and dimension without resting on the importance of using colour seen in Fig 6.13. These experiments look at creating large contrasts to show depth and enhance defined shape. The experiments with larger diversity in values show more definite shapes and become easier to read compared with slight differences in tonalities. If the tonal value stays the same it becomes problematic in legibility and data visualization.

Fig 6.14 is an example of a tonal experiment. The black background pulls the depth of the view deeper while the two other opposing tones create the different depths with the lighter tone being in the foreground. The angles of the volumetric shape add to the perspective of the 3D element. Through the tonal experiments I learned that you can create shape and illusion through tones and can generate 2D imagery into a 3D perspective. The darker the tone the deeper and further the depth of perception can go. Confusion can be created through tones, which can add interest and potential curiosity to the viewer.



Fig 6.16 Tonal Coloured Cubed Experiment







Fig 6.15 Tonal Coloured Cubed Experiments

The tonal coloured cubes experiments are based on the layered cube tonal value experiment, earlier where colour has been applied to the image seen in Fig 6.15. Using the pleasantness emotional categories research, yellow, green and blue hues have been applied with differing saturations and tonal values applying a variation in tonal value while the saturation fluctuates, creating visual interest resulting in a cohesive influence. This enlivens textures and levels effects. These images test the viewer's spatial comprehension and perception of the cubes within the cubes and how the different colourings and layers change the aesthetics and appeal of the image to their leveling interpretations.

Fig 6.16 is an example of a tonal coloured cubed experiment, based upon the cubed tonal experiment where colour has been added to the imagery. The analogous colour scheme contains a combination where colours share a similar hue, found alongside each other on the colour wheel. Although within the colour scheme of each hue multiple variations in tonal value have been created for each layer of cubes to improve comprehension and perception of the imagery. The organised and repetitive order of the cubes allows for the brain and eyes to interpret the legibility faster and more accurately. The mid-level saturation levels of the colour scheme reduce distraction, but also reduce direct attraction within the harmonious colours. Through the layered cube experiments I learned that variation in tonal value differentiates diverse levels and overlapping layers of hues, while harmonious colours reduce direct distraction, with mid saturation contrasting to assist in legibility. The repeated shaped cube made for a clean comprehension of the image.



Fig 6.17 Arrow Contrasting Colours Colour Blind Experiment



Fig 6.18 Apple Complementary Colours Colour Blind Experiment

The Colour blind testing imagery is used to create circles repeated continuously in a circular shape seen in Fig 6.17 and 6.18. The hues and saturation levels were changed and altered to create testing for people with colour blindness. This method is used to compare and contrast people's perspective and visual comprehension between contrasting colours and complementary colours enticing and distracting attention. How certain combinations are harder or easier to see than others. Colour blindness is a genetic mutation that alters the colour vision of people by decreasing the sensitivity to certain colour wavelengths, this depends on the defect (Poret et al., 2009). There is a large spectrum of colour blindness forms. This ranges from monochromacy to the most common, red, green. There are three degrees of colour blindness, monochromacy, dichromacy and trichromacy.

Monochroacy - rare and vision is limited to the equivalent of a black and white movie.

Dichromacy - rare and is the absence of one of the three cones which causes the total loss of vision of that certain wavelength.

Trichromacy – most common form of colour blindness. Simply is the defect of one of the three cone systems. Middle green and long red wavelength sensitive cones are more likely affected, resulting in difficulties discriminating reds, yellows and greens. Commonly called red, green colour blindness (Poret et al., 2009).



Fig 6.19 Colour Charts

People who suffer from colour blindness have difficulties in the modern society with infrastructure like traffic lights, paint swatches and digital images. Some places have started to aid the colour blind by adding blue hues to the green hue in traffic signals and orange hues are added to the red hue traffic light to help people distinguish the three colours from one another. However with modern image processing technology, it's possible to create designs that will enhance the colour blinds perception of colours in everyday situations (Poret et al., 2009).

These colour charts where designed through extracting of hues from the colour wheel of pigmented colour. The white segmenting lines help differentiate swatches and systematically read where the saturation and tonal value is high and low. When the tonal value is high and the saturation is high that is the full pigmented colour of the hue in the top right hand corner of the square chart. These charts have been designed to be used in order to keep a consistency through the different hues, saturation and tonal values when comparing and contrasting.

The colour swatches begin with contrasting hues in a symbol an object and in a letter. The swatches are pulled from the colour charts using high saturation and high tonal value. These swatches are evenly distributed along the chart extracting High four swatches for each. The colour charts purpose is to colour pick from

the swatches. Fig 6.19 shows how the swatches are extracted from the chart.

Number one is high saturation and high tonal value,

Number two is mid saturation and mid tonal value, Number three is low saturation and low tonal value,

Number four is low saturation to mid saturation and high tonal value to mid tonal value, Number five is low saturation to high saturation and high tonal value to low tonal value.

Colour Charts and Colour Picking





Fig 6.20 Colour Charts and Colour picking



The ishihara colour test has been applied because it is considered to be the standard colour blind testing methodology. There are several types of colour vision test plate design tests. Out of all of the types of colour vison tests, these have the greatest choice in variety, it is seen to use the most generic approach in order to understand the underlying principles (Poret et al., 2009).

The form of colour vision testing can be classified under the four subtitles of;

- Pseudoisochromatic plate tests
- Arrangement tests
- Matching
- Naming tests

Fig 6.21 are all colour blind testing images, using contrasting and commentary colours. Along with each of the hues they have four variations in tonal value and saturation. There are four various sized circles creating a larger circle. Within the circle is either the letter U, an arrow symbol or an apple as the object. The colour charts are displaying what coloured hues have been picked and from where for the colour blind images.

Fig 6.21 shows contrasting colour blind experiments and charts. The contrasting hues are yellow, purple, blue, orange, red and green. The two separate symbols that are displayed are the letter U and the other is the symbol of an arrow.

Fig 2.22 is displaying a symbol an object and a letter. An arrow an apple and the letter U have been used within the Colour Blind experiments.

SYMBOL

OBJECT









 $\bigcirc \bigcirc \bigcirc \bigcirc \bigcirc \bigcirc \bigcirc$



Fig 6.23 displays the apple complementary colour blind experiments and charts. The complementary coloured hues are blue, green, yellow and purple. The object displayed is an apple in the centre of the circle.

Fig 6.24 illustrates apple complementary colour blind experiments and charts. The complementary coloured hues are purple, blue, green and yellow. The object displayed is an apple in the centre of the circle.

There are eight different types of plates. The selected plate is Psuedoisochromatic plate because it is best suited to the purpose of this experimentation having a broader range. An object delineated by a colour difference with a background of the same luminous reflectance, to avoid colour clues. The object may be a number, a letter, a symbol, a stylised object, an optotype or a pattern to be traced to see what light is reflected and absorbed. Printing variations and the individual modifications in spectral sensitivity, means that there are, almost inescapably luminous

reflectance differences between the figure and background. Designers introduced variability of luminous reflectance with figure and background, which masks any systematic alterations.

From undertaking these experiments, I learned that although human perception differs from person to person regarding a range of variables. The physical aspect of colour blindness controls what the body is able to achieve altering ones perception without control. Colour combinations count for what experience you achieve and how affective that is. The colour charts are a great indication of where the hues are coming from and with what saturation and tonal value. The visual chart is easier to understand than verbal or written, with the segregation lines assisting in that.

FINDINGS

The multiple visual experiments display combinations for subjective interpretation, which occur when viewing colour through light and volume within interior spaces. The experiment results enlighten many perspectives through ones individual subjective view and memory in association with what they perceive. Colour collages have revealed that contrasting colours have an attentional advantage and visual complexity can come in different forms of imagery and writing. When figures portray certain emotions it creates approachability and relatability mirroring the emotion to the viewer with a point of reference.

The volumetric experiments have discovered that strong saturation creates further depth and defines lines, while low tonal value is harder to perceive with visual complexity.

The cubed colours and circular experiments show how depth of perception and transparency levels, viewing interior or exterior views or seeing the foreground or background initially. This can lead people through spaces and direct attention to certain elements that the designer desires. The more variation in tonal value and strong saturation gives the perception of a more defined space and depth to define edges, while similar tonal values in colour create less definable spaces and shallow perspectives.

The emotional category experiments reveal subjective personal experiences to the emotionally driven responses and memories play when perceiving images and creating your own experience through them. Even though the hues may differ, the shapes and tones of the images still express preference and control over the emotional responses to the images that have been objectively comprehended.

The stressful emotional category experiments expressed two notable outcomes. The first is the visual complexity of patterns overrides the colours in the relation to the confusion of hierarchy in the visual perception. The second is that adjusting colours can amplify the agitation or can decrease but not eliminate. When the eyes struggle to understand and strain to comprehend that is or decrease the individuals feeling of agitation but cannot eliminate the stressful reaction created by complex patterns alone. The human eyes make saccadic movements and stop several times, causing rapid eye movement as both eyes simultaneously move between two or more phases, the more complex the image and pattern the faster the saccades move.

The tonal experiments create shape and illusion through tonalities and can generate 2D imagery into a 3D perspective. The darker the tone the deeper and further the depth of perception can go. Confusion can be created through tones, which can add interest and potential curiosity to the viewer.

The layered cube experiments displays that variation in tonal value differentiates diverse levels and overlapping layers of hues, while harmonious colours reduce direct distraction with mid saturation contrasting to assist in legibility. The repeated shaped cube made for a clean comprehension of the image. The colour blind experiments express how human perception differs from person to person regarding a range of variables. The physical aspect of colour blindness controls what the body is able to achieve altering ones perception without control. Colour combinations count for what experience you achieve and how affective that is. The colour charts are a great indication of where the hues are coming from and with what saturation and tonal value. The visual chart is easier to understand than verbal or written, with the segregation lines assisting in that.



REFLECTION

The experiments pull through diverse variables of interior values and testing colour in various ways applying a range of techniques. Opportunities open diverse questions to ask beyond what this thesis is able to research. The methodology discussed in chapter three has been applied and analysed throughout these experiments to help guide the succeeding experiments. This has been successful through the learning from each experiment being applied to the next.

The element of an interior space and real life attributes need to be incorporated in order to narrow the scope and give the experiments variables more direction and critical scope. The experiments provide a range of concise variables that is their focus. If these experiments were to be conducted again with further analysis, it would be beneficial for the scope and direction to be narrower. This would allow for added details on these important aspects, with no site or specified place, meaning they are not within a controlled environment. Colour can enter a domain between visible and invisible, depending on the light qualities and intensities in which they are being reflected or absorbed onto certain shapes and volumes within spaces (Safont-tria et al., n.d.). The following chapters aim to investigate and reflect on with the above scope in selected spaces of café and spa interiors located in Wellington

CBD.



CHAPTER 7 INTERIOR ANALYSIS

Following the completion of the multiple pilot experiments, an interior analysis of two types of spaces was undertaken. Methods of analysis were informed by the findings from the literature review research (chapter two), the colour categorisation (chapter four), the light and volume experiments (chapters four and five).

It was envisaged that the space analysis would illustrate how the research experiments and findings could help to form and structure a space analysis with meaning and insight into a physical space, applying everything that I have learned up to this point into the space analysis.

For the purpose of the interior space analysis, the categories of pleasantness and stimulating were considered in the selection of spaces. Two types of spaces were identified, these were café interior spaces and health spa interior spaces. The atmospheric purposes of the spaces are why they were selected. The activities that take place in these two types of spaces are very different but both strive for the same experience of a pleasant and stimulating space for viewers.

When occupying spaces the observer does not remain on the outer edge of a project, but becomes part of the composition through activities participation and appreciation. The viewer enters into a dialogue between the space and their perception of the sensations, how the viewer subjectively sees and experiences the space (Safont-tria et al., n.d.). Colour endows design with potential for variations of perception depending on such circumstances as light, movement or volume. When people see colour they are actually seeing a play within light, and on a body of refracting, reflecting, and absorbing light- something many are rarely aware of. This constantly is happening in all surrounding environments. Several experiments in existing research on the perception of colour indicates that people do not perceive objectively but rather compose colours in the brain in a manner that is affected by many subjective circumstances and stimuli within their memories and personal experiences (Safont-tria et al., n.d.).

Colour is an instrument that can distort our reality in subtle ways, in mystical ways and can enliven composition and characteristics within a place or space. These aspects are what drive and create the experiences and the perception of spaces and control how we comprehend these spaces to what we see and feel. These aspects have been considered and used in order to analyse and appreciate the selected café interiors. Retrieving the shapes and volume aspects, while analysing the light intensities and directional values. Finally the colours that occur within the café or the combination of all three and how they can be comprehended and understood through the human eye and brain, attracting, distracting and diverting attention.

"I treat color concepts like the concepts of sensations"- Wittgenstein.

Hence the experience of chromatic sensations unfolds a mystical and psychological effect, which might be the reason colour has the ability to be a great resource for creativity and aesthetics throughout history. Colour may have no shape but is fused with light to acquire new and ethereal effects throughout interior spaces, so without light you cannot perceive and embody colour (Safonttria et al., n.d.).



Cafe Interiors

CAFÉ SPACE ANALYSIS

This process through qualitative research presents the subjective responses through objective educated and informed comprehension. The succeeding café interiors were selected because of their known appreciation and enjoyment from the architecture and design community within Wellington CBD seen in Fig 7.1. Loretta, Olive and Prefab all demonstrate pleasant and stimulating emotional responses for their design decisions which have been further researched through the detailed cognitive framework, focusing on the direct variables of light, volume and colour. The cafes remain inside the Te Aro suburb in Wellington CBD seen in Fig 7.2.



Prefab Cafe

Olive Cafe

Loretta Cafe

Fig 7.2 Wellington Te Aro Map

Cafe Analysis Diagram



used colour

The café analysis diagram demonstrates the layout in which the results and findings from the analysis will be shown. seen in Fig 7.3. The café photography of the interior spaces is placed next to the volumetric drawings so you can evaluate and compare the line work with the full imagery of the built environment. The colour scheme is pulled right cross the bottom of the page to be able to easily refer back to and give a clear understanding of the most commonly used colour and the least commonly used colours. Underneath are the tonal values of the colour scheme to show the lightness and darkness of the hues. The star diagrams are rating the light, volume and comprehension levels of the café interior spaces, from 1 satisfactory to 5 outstanding. The colours representing the section in the diagram is extracted from the most commonly used colours in the cafe.

Loretta



Fig 7.5 Loretta Volumetric Drawings

Fig 7.4 Loretta Photography

Loretta was chosen because of its charm and how the space is seen to be enjoyed more than the food itself. The distinctive dimensions of spaces provided for patrons with the weaving of new into old and the revealing of old materials creates a rewarding atmosphere for the occupants to inhabit. The star diagram graph displays 4/5 for light, colour and spatial comprehension while scoring volume 5/5 for effectiveness according to the results provided. Loretta's main colour scheme of hues consists of beige, brown, gold, grey, orange and green. These coincided with concrete, wood, straw and metal materials. They all contain low saturations levels and low tonal values. The hues occur from the materiality, as the wood is brown and the concrete is grey. This raises the question about the colour application decisions. The light qualities enter the space through either end of the interior. Streaming through the back of the space and penetrating the stained glass, producing magical beams of coloured light waves.

The light travels through the long rectangular space while artificial lighting supports the atmospheric qualities within the space, not relying simply just on natural lighting to complete the desired atmospheric outcome. The volume qualities consist of linear vertical and horizontal lines evenly distributed, curved through shapes of repetitive patterning and stacking of objects consciously. This tolerates the space to be easily objectively comprehended for the human eye and brain to appreciate.

This produces a calm and reassuring emotional response, as the repeated stacking does not require to be calculated because the brain processes the pattern and COMPREHENSION distinguishes how it will continue.



Fig 7.7 Loretta Colour Scheme

0 I i v e



Fig 7.8 Olive Photography

Fig 7.9 Olive Volume Drawings

Olive was chosen due to its high ceilings, indoor plants and beautiful memorising outdoor area. The spacious atmosphere, light and interesting spatial arrangement enlightens a natural feel. The star diagram graph displays light scoring 5/5, colour and comprehension 3/5 and volume at 4/5. Olive's main hue colour scheme consists of Olive green, brown, grey, gold and green. These colours have low saturation levels and remain in low levels of tonal value ranges. The main materials are wood, stone and metal. These colours and materiality consist of neutral and natural tones with the colour application of olive applied on the surrounding walls, while the remaining colours derive from the materiality. The light qualities through the space are dispersed with large street facing windows and an outdoor area at the rear, supplied with direct sunlight with shading implemented. The interior is supported throughout with artificial lighting in multiple different sizes and heights.

The volume qualities within the cafes space contain vertical linear lines and curvature through the lighting. The high ceilings pull your eyes through the space and provide a spacious feeling to the occupants. A range of depths and heights of solid volumes does not allow a clean view through the whole interior, which segregates the interior depth of the human field of vision.



Prefab



Fig 7.12 Prefab Photography

Prefab was preferred above others because of its nice atmospheric qualities and subtle use of materiality providing worthy aromas. The star diagram graph displays light colour and volume scoring 4/5 while comprehension scored 5/5. Prefabs main hue colour scheme comprises of brown, black and grey. The leading materials are wood, metal and glass. The colour scheme derives completely from the choice in materials, the wood is brown, the black and grey is metal. These have a range of low and high saturation levels. The theme throughout is very simple and crisp, pleasing a wide range of occupants with little risk taking in design decisions. The light qualities through the space are very bright and provide sufficient luminance. The interior is surrounded by substantial windows with the sunlight streaming through all day long. The hanging artificial lights keep the lighting within the interior stable at all times, providing comfortable and concise lighting.

Although because of the large windows it is difficult to control the direct sunlight coming into the interior and its strength. The volume qualities in the interior are open and offer repetitive patterns within objects and stacked produce. The linear lines through the interior provide a clean and easy to comprehend interior to understand and navigate during these repetitive stacking and open plan design.



Fig 7.15 Prefab Col<mark>our Schem</mark>e

Cafes Reflection



REFLECTION

The Wellington interior café spaces demonstrate specified atmospheric qualities through the colour, light and volume detail decisions to produce an experience, some more prosperous than others with opposing composition and characteristics. Similarities between these cafes interiors include. reoccurring and repeated objects in stacking motions and particular patterns, application of natural and nature elements with neutral tonalities through colour application and the materiality. The natural and artificial lighting in all interiors maintain the same luminance's throughout the day to keep the experience preserved and the quality continuous. The whole experience through these interiors contain themes to keep the atmospheric quality constant and to keep the navigation and comprehension clear, without visual confusion to the human eye and balancing the drive and indication of reflecting, refracting and absorbing light fragments. Fig 7.15 and 7.16 display the repetitive and reoccurring shapes in different compositions in the built environment and how the shape and colour differentiates the perspective and view of the image.



Fig 7.16 Repetitive



Fig 7.17 Duck Stacking



All of the cafes have their own strengths and weaknesses throughout the unlike variables and contain their own experiences and atmospheric themes. In my subjective opinion I believe that Prefab has the highest light qualities because of its surrounding windows and large natural sunlight penetration throughout the whole day. Loretta has the most successful volumetric design, as it pulls you through the space with pieces or segmented areas for privacy, but repetition throughout cause's aspects to be easily comprehended, while keeping the viewer intrigued and stimulated. I also think it has the most successful colour palette as it has a neutral colour palette base with added variations in tonal value and saturation. The natural materiality elements provide a soothing hue to the interior space. The greens, blues and oranges create a pleasant and stimulating built environment, causing positive emotional behavioural responses to the atmospheric qualities.

The data required for a more in-depth analysis would be a complete sun path of the interior spaces.

An evaluation and observation of how people move reduce clutter will reduce visual complexity and through the space and occupy the space at all times of the day. Further analysis of the volumetric features and how they work together to achieve certain experiences. The materiality, texture, smell, taste, sound and temperature, are just some other variables that can be further investigated to receive a more in-depth analysis and data.

Some ways these café spaces could be improved, I would suggest adding softer materials and tonalities into the design with some fabric. To maintain a consistent colour scheme is very important throughout. I would also recommend more personalised elements into the spaces instead of the standardised elements such as wooden chairs and grey flooring. This creates individuality and something to set the space apart from others to be a more memorable experience. When there is limited natural sunlight penetration, then you need to have a clear open path throughout the space to enable easy comprehension and wayfinding skills. Adding in biophilic elements will help support comfort and relief to viewers. To

unnecessary distractions to the eye, creating a more pleasant atmosphere.



N

HEALTH SPACE ANALYSIS

These spa interiors in Wellington were selected for their creative and experience driven interior architectural design decisions. Four were photographed and analysed to see what colours, volumes and light attributes are applied to these interior spas to create these qualities. Spring Spa, Forme Spa, SkinTopia and Elderberry+Kate are the selected Spas that have been analysed using the qualitative research and cognitive framework.

Fig 7.18 Wellington Map


Fig 7.19 Wellington CBD Map





Tonal Values in main colour scheme

Least commonly used colour The spa analysis diagram demonstrates the layout in which the results and findings from the analysis will be shown. The spa photography of the interior spaces is placed next to the volumetric drawings so you can evaluate and compare the line work with the full imagery of the built environment. The colour scheme is pulled right cross the bottom of the page to be able to easily refer back to and give a clear understanding of the most commonly used colour and the least commonly used colours. Underneath is the tonal values of the colour scheme to show the lightness and darkness of the hues.

The spa collages demonstrates the volumetric drawings and the colour scheme being blocked to show a clear understanding of how the two work together.

Spring Spa



Fig 7.22 Spring Photography

Fig 7.23 Spring Volume Drawings

Spring Spa is located on Tory Street, it is a well-known spa destination in Wellington City. The hue colour scheme comprises of creams, beiges, browns and white with applied pops of colour through cubed seating, orange, blue, green and yellow hues seen in Fig 7.24. This neutral base colour scheme with low tonal values allows the pop of colour with high saturation levels to accentuate and excite the finer details. This draws the occupants further into the space, sparking curiosity and interest to the eye without becoming overbearing. The materials are wood, stone and concrete with an array of fabric. They all work together in the application of colour through material, although the pops of high saturation of colour have been selected through paint pigments. The light qualities in the space are well lit and bright throughout as it is surrounded by frosted windows, providing privacy with a sufficient amount of light penetration. The light is reflected off the white surfaces while the high saturation colours keep the depth and shape maintained.

The volumes and shapes are reoccurring throughout the interior with alike patterns and forms seen in Fig 7.22, helping the navigation and comprehension of the dimensions. The forms are below the human field of vision dimensions. the protruding wooden planks lift your field of vision upwards directing you to experience the whole space.









Forme



Fig 7.26 Forme Photography

Fig 7.27 Forme Volume Drawings

Forme Spa is located on Victoria Street, right in the heart of Wellington CBD. The hue colour scheme expresses a low to medium saturation pink/red with medium tonal value that dominants the interior seen in Fig 7.28. Brown, gold, black and white then complement the remaining interior using these neutral colours and tones. The use of the bold colour with low saturation entices attention without it becoming distracting and intensifying the saccads work. The natural element of wood supports the pleasant and calming feeling, while the gold can be seen to represent quality and wealth. The materiality is wood, metal, fabric and features of straw. It appears that the colour choices in this interior have not been proficiently chosen because of the materials but supported through these decisions. Concentrated light qualities are through the main front windows which stream the light into the total space. The dominant reflections off the gold shiny metal plate react as a mirror. The remaining interior is lit with artificial lighting keeping the lighting dim but remaining

bright enough to see all forms and experience the interior at its fullest emotional capacity. Prevailing rectangular shapes and vertical lines create form and direction through the space to segment areas seen in Fig 7.26. The complementary circular arrangements soften the space allowing balance. The extruded hallway leads traffic clearly without confusion and clear wayfinding qualities for clients.



Fig 7.29 Forme Colour Scheme

SkinTopia



Fig 7.30 - SkinTopia Photography

Forme Spa is located on Victoria Street, right in the heart of Wellington CBD. The hue colour scheme expresses a low to medium saturation pink/red with medium tonal value that dominants the interior seen in Fig 7.28. Brown, gold, black and white then complement the remaining interior using these neutral colours and tones. The use of the bold colour with low saturation entices attention without it becoming distracting and intensifying the saccads work. The natural element of wood supports the pleasant and calming feeling, while the gold can be seen to represent quality and wealth. The materiality is wood, metal, fabric and features of straw. It appears that the colour choices in this interior have not been proficiently chosen because of the materials but supported through these decisions. Concentrated light qualities are through the main front windows which stream the light into the total space. The dominant reflections off the gold shiny metal plate react as a mirror. The remaining interior is lit with artificial lighting keeping the lighting dim but remaining

bright enough to see all forms and experience the interior at its fullest emotional capacity. Prevailing rectangular shapes and vertical lines create form and direction through the space to segment areas seen in Fig 7.26. The complementary circular arrangements soften the space allowing balance. The extruded hallway leads traffic clearly without confusion and clear wayfinding gualities for clients.









g 7.33 SkinTopia Colour Scheme

Elderberry + kate



Fig 7.34 Elderberry+Kate Photography

Fig 7.35 Elderberry+Kate Volume Drawings

Elderberry+Kate is located in the Spark Building on Willis Street, Wellington. The colour scheme is dull with low saturation colours as the accent pieces within the space seen in Fig 7.36. The lavender arm chairs contain low saturation and low tonal value. There are pops of green through plants while the remaining colours are neutrals tones. The marbling wall covering is grey and cream, black and white. It is distributed through the rest of the interior. The materials are, stone, fabric and wallpaper with small accents of wood. The colours that are applied are through materiality and pigment application choices. Light qualities are artificial with differing luminance's sizes and shapes. A large amount of light reflectance on the white surfaces is balanced between the black matt surfaces absorbing the light. Lighting appears very bright and in some spaces very dark, this imbalance between spaces causes disorientation and issues with navigation and wayfinding, but is also a technique to differentiate spaces and their atmospheric qualities. The volumes have

reoccurring objects and different levels of shapes attracting the eye to diverse elements and sections of spaces seen in Fig 7.34. The soft tonalities of the objects covered in fabric bring softness to the rigid objects. The marble patterned wallpaper produces volume and pattern in its own dimension as the depth of the wall is designed to add visual texture.



Fig 7.37 Elderberry+Kate Colour Scheme

Spa Reflection



REFLECTION

These Wellington interior spas establish particular similarities and variances when analysing their colour, light and volume attributes. They have neutral tonalities with the combination of a bold colour occurring frequently through the spa interiors. They also feature reoccurring shapes and patterning throughout. Defined edges are exposed exhausting shape and colour to help way find and navigate through the spaces with ease and direction. The balancing of natural light and artificial is detrimental to cohesively reading the segregations and paths between light and dark perspectives. The regulating shapes and forms are rectangular and circular, the mixture between rigid and structured adjusting soft and streamline volume. There is an equilibrium between colour application through materials and the application of materiality through colour. Both are viewed to be successful application tools to exhaust in interior spaces.

The data required for a more in-depth analysis would be a complete sun path of the interior spaces. An evaluation and observation of how people move through the space and occupy the space in all times of the day, more often than not people are lying down in spas which mean they are facing and looking at the ceiling. Further analysis of the volumetric features and how they work together to achieve certain experiences. The materiality, texture, smell, taste, sound and temperature, are just some other variables that can be further investigated to receive more in-depth analysis and data.

Some ways these spa interiors could be improved. I would suggest less colour blocking and further incorporation of the colour scheme throughout the interior space with more shape, texture and layering to add further depth and unity. More variation in tonal value is needed to generate visual interest and easier spatial comprehension. Spas often have limited natural sunlight penetration while ensuring privacy. A clear open path throughout the space is needed to enable easy comprehension and light to pass through. Adding in biophilic elements will help support comfort and connection to the exterior. To reduce clutter will reduce visual complexity although within spas there is a large quantity of products displayed so the stacking and repetitive behaviour of the layout matters.



CHAPTER 8 Dulux 9

Dulux provides a colour forecast for each year using interior imagery and a Dulux colour palette of paint pigments which they predict to be popular throughout the coming year. This imagery provides relatability and visual promotion for their paint colours to entice and deliver people with new inspiration every year. This display is coupled with words and a blurb to describe the objective and feeling these colour applications entice to the human emotional perception and how we process them, made through an individual designers subjective point of view. The selected Dulux imagery comprises of blue, green, purple and yellow hues to analyse and evaluate how the variables of light, volume and colour have affected the emotional responses and words selected.

Dulux analysis diagram

Dulux colour interior	Dulux colour interior Volumetric drawing	
		First Dulux Colour
Dulux colour interior colour scheme	7	
	Dulux's objective word	x 2
Dulux colour interior colour scheme tonal values		
		Second Dulux Colour
		Fig 8.1 Dulux Analysis diagram

The Dulux analysis diagram demonstrates the layout in which the results and findings from the analysis will be shown. The imagery of the Dulux coloured interior is on the left hand side with the tonal value image besides showing the lightness and darkness of the space. The colour scheme is underneath with the tonal value image following. The Dulux colour interior volumetric drawing is to the right to compare and refer to, while Dulux's objective word is followed underneath.

Green



Fig 8.2 Dulux Green Interior







Fig 8.4 Dulux Green Interior Volume Drawing

"Cultivate"





Fig 8.8 Dulux Green Interior Volumetric Drawing 2

"Repair"

Fig 8.9 Dulux Green Interior Colour Scheme and Tonal Values 2

The green Dulux images seen in Fig 8.2 and 8.6 show living room interior spaces. The light qualities are controlled within both interiors as the natural light directs through the sides of the spaces. The natural light enhances the high saturation of the green hue on the back wall, which is supported through the neutral tones of the furnishing, as colour is seen before furnishing. The geometric shapes are defined through the strong saturation and the tonal values creating ease of navigation for human perspective. Both spaces are supported through added natural elements of biophilic design. The tonal images highlight the lightness and darkness where they are consistent with accents of change. Dulux's objective for the space is to cultivate and repair. They use the green hues to represent nurture and regeneration connecting to nature, applying the comparison to nature and where this colour can be remembered from or through people's memories and experiences. In my subjective opinion I think the mid tonal values and high saturation levels are successful in this interior keeping interest and comfort for a living space.

The biophilic aspect adds to the comforting experience and a natural connection to the exterior. I think these interiors would benefit from the incorporation of another hue, which would help add some segregation into the space to allow the hues to breathe with one another. The green hue on the wall creates a high contrast between the beige wood and the wall generating visual hijacking to the space as the green is in isolation.

Blue





Fig 8.12 Dulux Blue Interior Volumetric Drawing

"Comeback"





Fig 8.16 Dulux Blue Interior Volumetric Drawing 2

"Essential"

Fig 8.17 Dulux Blue Interior Colour Scheme 2

The blue Dulux images seen in Fig 8.10 and 8.14 show a living room and a bedroom space. The light qualities in the first blue image show strong direct sunlight resulting in intensified saturation and shadowing throughout the space. The second blue image shows a steady luminance of natural light coming from the side with little shadowing. The geometric shapes in the first image differ with more complexity than the second containing a repetitive nature of rectangular geometrics. The complexity of the first image still remains consistent with tonal value with one variance in change and the second remaining the same in tonal value shown in the interior tonal image. Dulux's objective for these images is to comeback and essential, the experiences are blending contemporary design with vintage and the other to calm and nurture, to slow you down and feel lighter. Yet they are using similar hues but differ in the saturation values, as one has elements of strong saturation and the other does not.

The bedroom image uses the same tonal values in order to maintain the calm emotional human perspective response without the need for strong navigation skills.

In my subjective opinion I think that the rug in the first image ties the colour scheme together cohesively within the space having the high contrasting colour of the chair as the main attentional piece. If the background blue lowered in saturation levels then the space would have less contrasting distractions to have a sense of calm.

Purple & Yellow



Fig 8.21 Dulux Purple Interior Colour Scheme and Tonal Value



Fig 8.20 Dulux Purple Interior Volumetric Drawing

"Reflect"





Fig 8.24 Dulux Yellow Interior Volumetric Drawing

"Identity"

The purple Dulux image seen in Fig 8.18 shows a lounging space. The light qualities are dimmed and natural lighting streams through the back lightening up the background to shape the foreground volumes of dark purple hues and their tonal values. The light enhances the geometrics of the furnishing with some shadowing. The black and white image demonstrates dark tonalities throughout with differing tonal values. Dulux's objective is to reflect with the experience providing moody hues and to blend your past with your present. The dark hues and tonal values assist in the moody emotional human responses.

The yellow/orange Dulux image seen in Fig 8.22 shows a dining space. The light qualities are well lit with a consistent luminance and natural light penetration. The lighting intensifies the white tonalities and the yellow saturation levels while shadowing the defined features. The geometric shapes through the furnishings are scattered and indeterminate through the same value tonal values causing loss in navigation skills. Dulux's objective is to identify, experiencing a bold and built spirited identity through the emotional human responses. In my subjective opinion the purple interiors' hues are very dark and with some variation in tonal value the depth and quality of the spatial layers would increase. Some personalised features would assist the space to feel more homelike and to have biophilic aspects to support the need for connection to the exterior. The yellow interior provides strong contrasts in order to navigate through the dining area. The yellow's tonal value needs to be decreased and the hue altered to provide an invigorating interior with a purer yellow hue.



REFLECTION

The purpose of these images is to sell Dulux paint colours, to entice and encourage people to buy their colours in a creative manner. The hues are perceived as pleasant and stimulating hues. The images reveal when the light qualities contain natural lighting through the interior built environment, it enhances the saturations levels of the hues and defines the foreground and background volumes. When the geometric shapes occur within a repetitive nature, defined by strong saturation and consistent tonal values with accents of change, increases navigation skills and understanding. Including support through the space of natural elements of biophilic design. The objectives define the human emotional responses and how we deem to experience and perceive the interior space. The variables work together to affect one another in the overall outcome of the design and success of the experience provided. From analysing these images I have learnt the importance of the relationship between the objective and the application of colour, light and volume to enhance the occupant's experience.

It is important to design for the purpose of the space and the needs in which it requires. Colour can be applied to define multiple emotional reactions supported through lighting and volumetric shapes. The contrasting of hues and the tonal value levels differ with the purpose of the interior and the objective.



Key Learnings

KEY LEARNINGS

The key learnings for this research illustrates an assortment of interior derived variables and design insights into the comprehension and human emotional perception of colour, light and volume in the interior built environment.

The sensation of light waves provides the perception of certain colours, transmitted through enabling our eyes and brain functions to differentiate altered hues, seen as visual perceptual property. The perception of colour is the central component of primate vision enabling scene segmentation as visual memory, a way the eyes process an image. Scene segmentation influences size and mass within the built environment. Peoples memory and personal preferences correlates to the relationships between object and colour, with artists practising a visual story within their artwork to apply purpose to colour. We are seen to perceive how we have previously experienced and remember an experience before (Anderson Feisner, 2006). Yellows and green hues are seen and understood before other hues, whereas red and violet hues are physically

more challenging for humans to perceive. In the retina the fovea area holds the highest spatial concertation of cones, contingent upon the best visual activity in our human field of vision. Colour is not perceived and processed in isolation but in the combination of the information and luminance of visual form (Gegenfurtner, 2003). Our line of site controls how little or much we see at one particular time, with the movement of the head and body the range of vision changes but the human field of vision remains the same. The eyes are immediately attracted to movement and the search for figures. Biophlic design represents strong attraction and sense of affinity for nature and living. People are hardwired to seek out connections with nature and forms of life, while in interior spaces (O'Connor, n.d.-a). Visual complexity is due to the perception and operation of saccades as constant frequent sweeping movements of the eye as we view an object or interior space. Geometrics anchor the eye contrasting spatial layers. Without light there are no colours, without

colour contrasts there is no possibility of visual

spatial comprehension. The hue, tonal value and saturation levels are systematically manipulated in an attempt to ascertain their relationship to the dimension of colour meanings. Humans are dependent on light perception, it is natural for light to affect us psychologically. Sunlight provides a sense of time and connection to the world. The hues of green, blue, yellow and purple are professed to be pleasant and stimulating hues. Natural lighting through the interior built environment enhances the saturations levels of the hues and defines volumes. Geometric shapes with reoccurring objects in a repetitive nature, defined by strong saturation creating ease in navigation, while anchoring the eye in contrasting spatial layers. The consistent tonal values with accents of contrasts increases navigation skills. Including support through the space of natural elements of biophilic design. Objectives in the built environment define the human emotional responses and how we deem to experience and perceive the interior built environment. The multiple variables work together and affect the relationship with one another in the overall outcome of the design

success of the experience.

The methodology enforced is a repetitive cycle design process which allowed innovative design ideas and strong analysis of experiments and research findings to remain on a repetitive cycle. Through this methodology process I have learnt that a sharp end to the analysis and process would help conclude the results more successfully. The pleasant and stimulating diagram seen in Fig 9.1 is displaying the experimental and research results from this research in a simple diagram to show the relationship between the variety of variables and how they can affect one another's performance in their perspective on people's comprehension. The variables within colour, light and volume are shown in diverse sized circles with the size of the circles and the overlapping of the circles demonstrating the relationships and importance of each variable.

The built environment is connected to all the variables, as this affects all aspects and controls the navigation of the experience and perspective in view. The neutral homelike tones tend to support a sense of wellbeing, it demonstrates familiarity and comfort, generating positive human behavioural responses. Natural sunlight connects humans to the exterior and create a connection as we depend on light for perception. Sunlight provides us a sense of time and a connection to the rest of the world. The human field of vision differs from person to person as our line of site controls how little or much we see, with the movement of the 154

head and body vision changing but the field of vision stays the same. Strong saturation value attracts attention and increases navigational skills through interior spaces. It has even been proven to relieve children's stress and anxiety. While consistent tonal value creates a sense of calm and tranquillity, with some tonal variation it can aid in visual stimulation. The objective of the project controls and sets the purpose for the interior built environment and the achievements necessary to present a certain experience. Biophilic design has a sense of affinity for nature and living systems. People are hard-wired to seek out connections to nature.

The central focal point is human perception and personal behavioural responses to the interior built environment. Between strong saturation consistent tonal value and tonal variation it is maintaining a sense of calm with the level of tonal values, while stimulating visual tasks with strong saturation levels. The combination of strong saturation value and natural sunlight causes the sunlight to intensify the saturation levels and purity of the hue. The neutral tonalities are supported through the natural daylighting, which adds to the sense of comfort. Natural lighting and biophilic design cause people to seek out nature through the different forms of light. Geometric shapes with defined saturation and tonal value creates ease of navigation that anchors the eye in contrasting spatial layers, maintaining calm. The human field of vision demonstrates the objective of the project is to dictate the experience of the human perspective and comprehension. The built environment and human field of vision creates memories and experiences along with personal preferences that influence our human perception and emotional response.

Pleasant and Stimulating



Ultimately people's memories of certain aspects and experiences in their life along with their personal preference will always create various variables. The variables within this pleasantness and stimulating diagram can help guide and dictate further designs to the experience required for the particular interior space and to achieve a successfully architecturally designed space. This research is important because it has affected me as a designer by presenting me a utterly diverse approach and line of variables to consider when designing interior spaces for a particular objective and experience. This has allowed me to be further educated and knowledgeable in this field of research and design to improve my understanding of the choices and the consequences of these choices in design, if they may be positively received or negatively. The interpretation in spaces can be vast, so I have learnt to expect and plan for these perceptions and comprehensions, through design decisions tackling colour, light and volume variables.

Conclusion Research Limitations

To conclude this research on the spatial comprehension and perception of architectural interior spaces through the diverse variables of colour, light and volume, the limitations and the potential future research opportunities are thoroughly discussed. The aims and objectives of the thesis are considered, and how this could be developed out further.

RESEARCH LIMITATIONS

The possible limitations in this research are discussed and reviewed, looking at how existing research, observations, experiments, methodology and the concluding results were affected by these likely limitations.

On reflection, I was over-ambitious for how much research and experimentation I could achieve within the given timeframe. This topic is huge, however the current field of research is limited. Existing research lacks the experimentation and interior application examples I desire for my research, so I was unable to build upon any existing research on colour, light and volume through perception and comprehension and their application in interior
spaces. This opened up a considerable pathway for multiple variables and opportunities, which became a limitation due to the lack of guidance from existing research material, while creating a vast scope. I believe that I was naive at the beginning assuming that I could be guided through current research to shape the thesis's direction. The interior observations only look at cafes and spas in the Wellington area. The observations are limiting due to the differences and trends between cities and their community requirements and experience objectives. There is only a small handful analysed within New Zealand let alone the world, this does not provide enough thorough understanding of the variety and visual opportunities that can arise between interiors and their relationships between their cities. The anonymous survey was only answered by those in the Wellington region, limiting opinions and views upon cafés and spa spaces. The data collection was through a controlled, online anonymous survey.

Controlled results provided answers through what

was provided within the surveys to the participants. I could not identify any existing research from which to develop a type of tool for the experiments, and this caused conflicts of my subjective perspective on the investigations. Even following the methodology, there is still a certain aspects of subjectivity with objective analysing to take into account. The methods for analysing and data collection is on a repetitive and organic development cycle. The first stages of the experiments were productive, although further on in the experimentations, more structure and direction was required, to receive concise results and conclusions for the work to be developed. Lack of financial support limited the experimentation and the possibilities, with building physical models, paints and materiality.

These results must be interpreted with caution due to the limiting factors mentioned above, but nonetheless, they provide a good springboard for further research in this area.

On reflection, it may have been useful to focus on a particular site for analysis and experimentation to conclude with a design showing how the strategies and techniques could be applied to an architectural interior space, focusing directly on the objective, experience and occupancy of the design. Choosing a topic that provided more insights and that built on existing research would have helped shape my research and further explored opportunities.

Strategies and Techniques

STRATEGIES AND TECHNIQUES FOR

ARCHITECTS AND DESIGNERS -For pleasant and stimulating spaces

Experiences based on memory hinder on personal preferences influencing our human perception and comprehension. The following strategies and techniques are to help architects and designers to achieve certain atmospheric qualities within interior spaces serving to the objective and experience purpose of the space. Specifically looking at pleasant and stimulating human emotional responses. The objective of the project dictates the experience of the human perspective and comprehension. Some overview techniques when designing for pleasant and stimulating spaces include the following;

- Consistent tonal values within interior spaces create a sense of calm. When strong saturation and mild tonal variation is included it stimulates visual tasks, while still keeping a calm atmospheric value.
- Tonal variation and neutral tonalities combined with natural sun lighting adds depth to an interior space and forms the spaces volumetric features in a non-abrupt manner.
- Tone, shadows and highlights derived from lighting is what extenuates and shapes volumetric features in interior spaces.
- Yellow, green, blue and in some cases purple are the most successful hues to apply with low to mid saturation levels and low to mid tonal values, with yellow and green being the first hues to be seen before others.
- Contrasting colours eases people's level of comprehension, with minimal amounts allows the space to avoid visual hijacking.
- When sunlight is collective with strong saturation levels it intensifies the purity of the hue.
- Humans depend on light for a sense of time and without light there is no colour. The application of light is vital for the comprehensions of interior spaces, artificial or natural.
- The application of biophilic elements, such as flowers and plants is successful in a comforting experience of a space, as people seek out nature through different forms of light.
- Geometric shapes application with defined saturation and tonal value anchors the eye in the contrasting spatial layers, maintaining calm and ease of navigation.
- Human eyes are attracted to movement and figures. To attract attention to certain elements apply movement.
- Reoccurring objects in a pattern and repetitive shapes increase readability and ease of navigation with the eyes being able to predict the continuing pattern.
- To avoid visual complexity evade from the combination of excessive patterning, contrasting hues with tonal variation and illusion characteristics. This amplifies agitation and confusion between hierarchies, impacting the operation of the saccades.

Future Research

FUTURE RESEARCH DEVELOPMENT

This research provides a good foundation for those interested in furthering their knowledge and design application skills in colour, light and volume to achieve certain atmospheric qualities, resulting in pleasant and stimulating human emotional responses. The next steps for the future in continuing this research is applying the findings applications and techniques into physical interior built environment spaces to test the findings and applications in a real-life scenarios, while continuing the diverse combinations of a range of variables which affect our comprehension and perception in human behavioural responses specially pleasant and stimulating emotional responses.

If this research were to continue I would recommend;

Choosing a specific site to analyse the visual variables within to specify certain strategies and techniques to the particular space and what attributes it contains. To then conclude with a new design displaying how the strategies and techniques can be applied to an architectural

interior space. The designs would demonstrate visually and physically how these applications are successfully implemented and how the occupant would see and experience the space. To further explore the psychological effects and their impact on people's perception in interior spaces, how peoples human emotional responses and the variables can play a role in their understanding and connection to a space. Psychology is seen to be the base line of how we perceive and comprehend as humans. This is through the connection of the eyes to the brain. To apply the strategies and techniques from this research into interior spaces with the objective of pleasantness and stimulating as a human emotional response, to spaces such as; educational spaces, spas. voga/ exercise studios. offices. rehab facilities, counselling spaces, meditation spaces and retreats. It would be beneficial to then research all the human emotional responses and what strategies and techniques can be applied due to their desired outcomes.

To create individual physically modelled spaces to a 1:1 scale to perform various experiments with colour, light and volume, even adding in other variables to compare and contrast with, to then strengthen the research and create more accurate findings. Then to investigate the relationships between different variables in which affect one another and affect the variables of colour, light and volume to expand the research. To test, observe and experiment with a wider variety of people and people who may not have any experience or expertise in architecture or design, to see how their perception may differ from those who are educated within the field of design.

To generate a tool or app which goes further than current 'pick a colour' for people. The tool or app would educate and guide people through their design decisions about the interior space they desire and require. It will enable them to place their objective, the experience and requirements in, to receive what strategies and techniques they should apply to the space to achieve their desired outcome. The impact of conducting this research on participants is potential improvements in experiences and people's comprehension of the design and objective of a space. Harnessing the true essence and emotional response people have through their human perception and increasing it. This research investigated existing research within the field of human perception, focusing on the variables of colour, light and volume. An appropriate methodology was developed through the research and applied to the experiments and observations. The research carried out multiple experiments, with responses recorded and analysed. The series of strategies and techniques were effectively conducted for architects and designers. It has demonstrated how people can create specific atmospheric qualities while being able to apply these valuable strategies and techniques to a range of architectural interior spaces in the built environment.

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