A Pigment of the Imagination
In what ways is colour information?

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Abstract

The world is ablaze with colour, and for artists and designers the spectrum is both a vital tool and highly informational. Whether found in the circadian rhythms of nature or contemporary works of art, colour’s kaleidoscopic lens allows us to observe, experience, and understand the tessellation of information present in our environments. More practically, art libraries provide artists with access to colour information resources, which are used for the purposes of reference and inspiration during the process of arts-based research. Through a combination of conceptual and visual analysis the research project explores colour’s informational properties by posing the question ‘in what ways is colour information?’.

The research rests on dialogues about the nature of information as it occurs across different domains, and where there is also an emerging interest in the visual arts. A literature review forms the necessary context by covering the nature of information, artist’s information behaviour, and colour theory. Conceptual analysis then uses a cohesive narrative style to tell the story of ‘information’ by exploring ‘what is information?’, ‘is information physical?’, and analysing Luciano Floridi’s (2010) General Definition of Information. This provides a deeper philosophical understanding and enables a better theoretical position to further explore the concept of colour as information. Visual analysis investigates immersive colour artworks and the use of colour documents in the studio works of Danish-Icelandic artist Olafur Eliasson. Further to this, a research trip to the Colour Reference Library at the Royal College of Art provides an analysis on the informational properties of colour order systems commonly found in art libraries.

The resulting desk research provides examples of colour as an informational concept and an information resource for artists and designers. Comparing colour to concepts of information theory demonstrates that properties of colour and art can be understood as both environmental and semantic information. Discussion formulates that experience and participation are closely linked to the meaning-making of visual information. The project highlights a further need for future research into visual literacy, information experience and concepts of ‘digital synaesthesia’ in immersive documents. The research provides a novel inspection of colour and information theory and contributes insight into the pervasive visual information environment that library and information professionals must now understand and support.
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1. Introduction

“It was Octarine, the colour of magic. It was alive and glowing and vibrant and it was the undisputed pigment of the imagination, because wherever it appeared it was a sign that mere matter was a servant of the powers of the magical mind.” (Pratchett, 2012, p. 228).

Open your eyes and you will see the world is an intricately woven fabric of information. Photons of light, sensations, shapes, and colours irradiate and weave the universe into pattern, tangibility, and meaning. Both the sensory and physical world sears our field of vision with a blaze of colour; from the candy sweet cerise of a rose petal, the sumptuous surface of paint flowing on a canvas, the ‘on’ ‘off’ glimmers of a traffic light, to the frosty actinic glare emitted by our smart phones. Colour talks, whether through sight or through the language we use to describe it. In both the natural and digital, it is communicative, informative, and experiential.

Information too is a notorious shapeshifter. It comes in many guises, from the base code of the universe, the spectral invisibility of intelligence zooming along optic cables beneath oceans, to the train timetable instructing you on morning commute to work. This environment of bits and bytes of information, whether clear and logical, or whispered and hidden, ultimately provides us with order, instruction, and the potential to make day-to-day life easier. Traditionally when we think of information in this context, it is rooted in communication theory, where through a textual or numerical form, information is expressed in a string of numbers or the written and the spoken realm of words. What about the spectrum of information that pervades our visual world? Despite the inescapability and pervasiveness both colour and information have in our daily lives, there is little understanding of them as one and the same in library and information science, and the concepts and philosophies of both are infamously mercurial appearing
interchangeably across different domains. In biology and physics, it could be argued that colour exists as physical and environmental information, a result of neatly organised light, elements, and chemicals, existing whether our eyes see them or not. Psychologists and philosophers on the other hand may disagree. They may propose colour is all but a pigment of the imagination and a phenomenon of the mind. (Kastan and Farthing, 2018, p. 1-4). For artists however, the scientific nature of colour has often been explored hand in hand with evocation of experience. Artists tell us what colour looks like, feels like, and use it as a language to communicate aspects of the world in a way that words cannot. (Bell, 2017, p. 125). With all this vibrancy and beauty, it is however equally messy, confusing, and subjective. The spectrum of colour is after all the spectrum of life. This research project therefore seeks to answer how we may begin to understand the evanescent phenomena of colour as information in today’s ubiquitous information environment.

1.1 Background & Research Context

The idea that information is pervasive has been part of the dialogue in the information and library sciences since the emergence of digital technology and come to be understood more fully by Luciano Floridi’s (2014) fourth revolution. The library and information sciences have instead started to turn from acknowledgement to understanding. (Bawden and Robinson, 2016b). Yes, information is omnipresent, but how do we begin to understand its influence on our lives? How do we experience information? What does information make us think and feel? How is it communicated across different domains? An examination of colour through the lens of information theory provides a unique opportunity to explore colour in arts-based research and contemporary art. Secondarily, this provides a more phenomenological and metaphysical approach to information theory. Colour can be integral in the production of arts-based research. Equally it may appear central to a material or document, it may make up the very composition of a material, or it may appear artificial, it may be applied, or it may transform the semantic or semiotic meaning or appearance of things. (Koolhaas, 1999, p. 215).
Historically, theories of information have had a focus on epistemology, but as our culture grows infinitely more informational, further research is beginning to emerge and explore how we can better understand and communicate with information in a semantic environment. (Floridi, 2013). This is also of great concern for the visual arts, from fine art and performance, to fashion, textiles, and design. The way we interact with documents and information is growing infinitely more experiential and immersive. (Robinson, 2015b). There are also emerging papers and discourse within library and information science that look at the nature of information as it is understood in the arts, such as through the semiotic analysis of information and documents. (Gorichanaz, 2019b, 2019a; McQueen, 2019). This research therefore rests on emerging concepts of art and information, information and document experience, and visual literacy in arts librarianship. The ways in which information is physical is widely accepted in the field of physics, and it may be possible to apply the same concepts to artists information behaviours. It may also be possible to start to understand colour as physical information too, which could be of further interest for artistic practice and artists information behaviour.

1.2 Aims & Objectives

The aim of this project is to explore the ways in which colour can be understood as information. While the focus of this is largely rooted in the arts, further concepts and philosophies will be drawn from other domains to compare and contrast, notably library and information science and physics. Secondary to this is to explore concepts of colour in artists information behaviour, therefore forming an understanding of information and information experiences outside of Library and Information science. This is achieved through the following objectives which were set out to help anchor and answer the research question:

1. To identify examples of colour as information and the contexts in which this has significance to artists, information theory, and information behaviours.
2. To explore overarching concepts of the nature of information
3. To compare and contrast concepts of information theory alongside the visual analysis of colour in contemporary art and colour documents.

4. To establish whether concepts of colour as information can have future links to visual literacy research. This is of growing significance in our post-digital visual culture where the production of immersive and multisensory documents now merges information, experience, and aesthetics.

5. To contribute to the increasing dialogue around concepts of art as information in the domain of library and information science.

1.3 Methodology

In the broadest sense, the methodology for this project is undertaken by traditional desk research. By analysing documents and texts through a combination of conceptual and visual analysis, the project takes an interpretive and phenomenological approach. Phenomenology is rooted in humanism, in which the goal is to describe and elucidate how the world appears through structures of experience and consciousness. (Biggam, 2018, p. 172-173). In the case of the research question, which is philosophical in nature, the interpretation in no way can claim to be absolute. In exploring the ideas present, the true value comes in trying to engender further debate on concepts of information and open the door to similar types of art meets information enquiry.

A literature review provides the context and foundational narrative for this research project. The review examines past and emerging discourse across library and information science and the arts, covering the three key areas; the nature of information, artists information behaviour, and colour theory.

Conceptual analysis allows the opportunity to examine the nature of information through deeper storytelling, asking the question ‘What is information?’ leads to the formulation of ideas of information as a physical property of the universe. This conceptual analysis ends with our semantic environment and a short analysis of Luciano Floridi’s General Definition of Information. This provides the most suitable means to formulate a deeper theoretical understanding of the nature of information.
Secondary to this, visual analysis is used to explore the informational properties of colour in contemporary art and colour resources. Visual analysis is a common methodology in the fine arts which employs principles of visual literacy. This interdisciplinary approach provides the opportunity for reflection, metaphor, and scope to further understand the nature of information in art. The method also presents compositional interpretation and therefore provides insight into the subjective and metaphysical experience of art, colour, and information.

1.4 Style

Clarke (2007, p. 22-23) explains, a descriptive use of language is potent for demystifying big ideas and can be either subjective or objective in style. The styles of writing in library and information science reflect this too due to the interdisciplinary nature of the field and the varied research methods used. For the purposes of this research, which deals with phenomenology and philosophical ideas, the use of language throughout leans towards a more narratively led account of explaining information, colour, and works of art. Describing visual experiences is a way of showing understanding within arts-based practice, and in attempt to apply interdisciplinarity, this project takes a similar approach of understanding and thinking through the ideas discovered and presented. A narrative style is appropriate for conceptual and visual analysis as the cognitive approach seeks to connect ideas into a temporally coherent story. (Alleyne, 2015, p. 40). Each analysis and observation are treated as an opportunity to see and combine the larger patterns in what is read during the research process. (Booth et al., 2016, p. 14-15). The style of writing therefore aims to show critical thinking by rearranging concepts and compelling ideas into new implications, connections, and complications. Secondarily to this, the project works to demonstrating an earnest fascination with the research question, treating it as a mystery to be solved.
2. Literature Review

Hart (2017, p. 12-20) describes the beginning processes of scholarship are akin to entering an apprenticeship in which the individual must take their time to develop their own ‘research imagination’. The literature review forms the basis of this imagination through discovering a broad view of the topic, being open to ideas regardless of how or where they originated, questioning, and scrutinising methods regardless of who proposed them and playing with different ideas to see where they may lead. It is a synthesis that links ideas or finds differences and this is important because it enables the interweaving of key strands and mixes them together in the context of the overarching research question. (Thomas, 2017, p. 62-63). A review of the literature therefore provides a painting of the state of knowledge and of the major questions within the domain, therefore guiding the further course of the research project. (Bell, 2010, p. 104). This section provides an overview of the relevant literature and ideas before propelling them forward into the main conceptual and visual analysis. As this is novel research within the field of library and information science, there is no specific literature currently written on the research question, however, three main areas have been identified and rationalised, which give the necessary context to explore colour as an informational concept.

- **The nature of information** – to contextualise changes to the philosophies of information and discuss the emerging research on the nature of information.
- **Artist’s information behaviour** – to highlight artist’s information behaviour and discuss the role of the colour in arts-based research.
- **Colour theory** – to clarify the significance of colour theories have on artistic practice.

2.1 The Nature of Information

We are now living in the information age, which Floridi (2014) describes as the ‘Fourth Revolution’. Through an increased reliance on information technology, artificial
intelligence, and immersive media, we are reconstructing the patterns of our lives; from our sense of selves and our relationships, to our society, morals, and ethics. Changes in the way we communicate have also profoundly affected how we see and understand the world. (McLuhan and Fiore, 2008, p. 8). It is a time marked too by the fluctuation of social change, and our dependence on the likes of iPhones and plasma screens places the lived experience under a phosphorous glare. In 1987, Baudrillard (2012, p. 19-30) wrote that the raw and inexorable light of information and communication would become inescapably pervasive. While the infosphere has proved to be a radical environment, this heady space of digital synaesthesia and information overload still poses a predominant dilemma; perpetual information without proper context or interpretation is overwhelming and can only perplex our sense of the world rather than enrich it and make meaning from it. These changes therefore require interdisciplinary thinking and the adoption of new theoretical approaches to analyse and comprehend the nature of information. (Bawden and Robinson, 2016c).

The library and information sciences are ultimately concerned with managing information environments and understanding the behaviours and literacies around those who create and interact with them. (Bawden and Robinson, 2012, p. 5). The traditional approach to the discipline is one of social epistemology which focuses on the study of knowledge and the evaluation of the social systems of information. These foundations went through a drastic shift with Luciano Floridi’s (2002) philosophy of information. Overturning much of the previous philosophy, Floridi instantiated that everything is ultimately informational, and library and information science should move towards stewardship of a semantic environment. (Fyffe, 2015). While Budd (2004), Cornelius (2004), and Hjørland (2018a, 2018b) argue in favour for the philosophical roots of social epistemology, Bawden and Robinson (2018) have since re-examined the prospects of Luciano Floridi’s Philosophy of Information as the conceptual foundation of library and information science. Ma’s (2012) research also highlights the importance in change of philosophical position. The longstanding epistemological focus in the philosophies and nature of information studies have led to the negligence of understanding the cultural and social aspects of information, such as how something is
considered to be or not to be information, and furthermore how it is experienced. A user centred, phenomenological approach to research, which also considers changes to the semantic environment, should therefore improve understanding and foster more meaningful social change. Adopting this philosophical approach to information theory is important for understanding the nature of information. It is the synthesis of creative thinking, evaluation of concepts, and the trial and error of ideas that can help to identify gaps, differences, and contrasts. After all, philosophy is responsible in the chain of knowledge production and its capacity as an incubator for ideas will help plant the seeds for further enquiry and research. (Dixon, 2019).

In order to illuminate the implications of our new semantic environment and the impact the fourth revolution, it is vital to adopt a philosophy of information and to review and return to the fundamental theories which support the discipline. The most profound and foundational of which concern the understanding of the very nature of information itself. (Bawden and Robinson, 2012, p. 63-64).

“IT is hardly to be expected that a single concept of information would satisfactorily account for the numerous possible applications of this general field.” (Shannon and Weaver, 1975)

Information is notorious for its’ elusive and mercurial definitions. From Gleick’s (2011) Information, a History, a Theory a Flood to Peters’ (2015) Marvellous Cloud: Towards a Philosophy of Elemental Media, it is no surprise to discover that in and outside the field of library and information science, watery and elemental metaphors are awash. The literature reflects information’s conceptual pervasiveness and fluidity. To complicate our understanding further, the many meanings, associations, and varying accounts of information also depend on the domain from which the perspective is adopted. (Capurro and Hjørland, 2005). However, it is in the mystery of its nature that lies a wealth of opportunity and excitement for library and information researchers. Those who wish to apply interdisciplinary methods and explore the nature of information across varying disciplines can find plenty of discourse surrounding the idea. As Robinson’s and
Bawden’s (2013) research suggests, the discontinuities in understanding of information has limited scope if researched in the field alone, and interdisciplinarity and cross-examination of the core informational concepts across domains will widen our understanding.

Robinson and Bawden (2013) further explored the ‘gap’ in understanding through the examination of concepts of information across five different domains, in each of which information is regarded as a central concept: communication technology, physics, biology, sociology, and philosophy. The importance of this research is in providing an opening for researchers to address the original question ‘What makes meaning?’ posed by the physicist John Wheeler. The nature of information is further explored again by Bawden and Robinson (2015) in which information and complexity are examined through Shannon’s and Weiner’s opposing theories of information. Here the duality of the nature of information is inexplicably associated with pattern and order just as much as chaos and entropy. Furthermore, this suggests there is a subtle relation between information and entropy, objective and subjective, order and chaos, and simplicity and complexity. The Thellefsen’s and Sørensen (2018, p. 381) suggest these dualities and tensions between objective and subjective perspectives stand in the way of formulating a clear informational concept. Viewing information as signs through semiotics reveals information has multiple possible interpretations from multiple personal perspectives. More importantly however, the possibility precedes the interpretation, which suggests information can be understood as a simple interaction of chance and engagement. The literature suggests the ‘gap’ may never be closed, but most importantly we can establish that information will be what is it, by itself, and with itself.

In the later writings of Bawden (2016), and Bawden and Robinson (2016a), the benefits of researching conceptions of information provide clarification and reflection. It is suggested that through the trial and error of bridging ‘gaps’ emerges a greater prevalence, that progress in revealing the nature of information works towards greater focus of understanding in the field. However, the pursuit of acquiring understanding of
the nature of information in domains outside of information science is a remarkably challenging quest. It requires bridging connections between a plethora of theories, from mathematical communication and physics, to philosophy and the humanities. Creating a unified concept of information across domains is even more of a task of grand design. Instead a deeper perspective might first be gained by pursuing smaller-scale integrative connections. In an environment where information is a fundamental aspect, Bawden and Robinson (2016b) further state that restoring the layer of understanding in the field should be a priority for future researchers.

2.2 Artist’s Information Behaviour

In the essay titled Fantasia and the Library, Foucault (1980, p. 90) conjured the significance of the library as a space for facilitating the imagination and gaining understanding:

“The imaginary now resides between the book and the lamp. The fantastic is no longer a property of the heart, nor is it found among the incongruities of nature; it evolves from the accuracy of knowledge, and its treasure lie dormant in documents...”

Here Foucault romanticises the transformative power contained in the pages of books, as well as the liminal experience the library provides. This idea of information and documents providing inspiration is poignantly relevant though when thinking about artists and their creative practices today. Artist researchers utilise visual and practice-based research methods and by doing, trying, developing, and making, they chase the fantastical, inspirational, and serendipitous. (Clevis, 2017, p. 25-26). Springer and Turpin (2016) too imagine the library and its collections of documents as places of fortuitous discovery, as well as sites of epistemological and phenomenological inquiry. Qualmann (2017) identifies such examples of artists information behaviours through examining the harmonious relationship between the library and the artist. Both library and artist collect
and juxtapose ideas together that do not naturally seem completely connected and in turn remix documents into new and novel forms of art or practice.

One important way in which this symbiotic relationship facilitates the imagination is through access to colour. Art and material libraries are dynamic environments whereby artists can access specialist colour and material information. Physical contact with colour and material resources are especially important for artists and designers, and these spaces also allow for an intimate and tactile means of exploring potential visual narratives. (Glassman and Dyki, 2017, p. 119). For instance, Peterson’s (2019) research into inspiration highlights the use of colour embedded in her instruction as an academic librarian. Delivering research sessions to textile design students on Josef Albers’ 1963 Interaction of Color feeds directly into deeper research projects on the use of colour in printed and woven textiles. Similarly, Brown et al. (2016, p. 71-73) establish in visual literacy standards for libraries that colour is one of seven key ‘design basics’ which combine to make the formal elements of creative research. Colour is a catalyst of the design process and impacts the delivery, interpretations, and meaning of visual information.

“There is a long tradition of the co-opting and absorption of scientific knowledge by artists in their practice, with the likes of optics, colour theory, and natural sciences. (Cazeaux, 2017, p.33-35). However, artists information behaviour and the use of colour also extends far beyond just to remit of research, theories, and the library. They too draw inspiration and connection from the microcosm and macrocosm of the inner and outer world. Looking up into the lucid blue sky above, painter John Ruskin described ‘not dead, flat colour, but a deep, quivering, transparent body’ whose blueness he recognised in one of painter J. M. W. Turner’s works as ‘breaking, mingling, melting hues...”
[...] infinite and immeasurable. (Harris, 2015, p. 317). Mason and Robinson (2011) research into the information behaviour of practising artists draws out these less obvious modes of seeing, referencing, and rendering information and colour. Here artists seek inspiration and information from the natural world; the earth is a vivid jewel of colour and such sources of information include the hues of the sea and sky, precious metals, minerals and gems, natural forms and textures. This extends further to the interior psyche too, where lurid colours and abstract shapes are also found in dreams, memories, sounds, and the imagination. The boundaries of what counts as ‘information’ to an artist are thin and this lack of limitations in form highlights the need for the further study and investigation of these concepts.

Gorichanaz (2019b, 2019a) has made significant contributions to understanding artists use of information through recent phenomenological studies. Here an examination of artists information behaviour is explored more successfully through document theory. Gorichanaz also identifies the need for further research on how artists work with and experience information in the art-making process itself. This also links back to Bawden's and Robinson's (2016b) earlier heed for the establishing understanding in and outside of the practice of library and information science. These studies are pivotal because they work towards building a better comprehension of art and information phenomena in the infosphere. The study of colour as information is therefore something that can add to this growing understanding not only of the nature of information, but its significance within art and artistic practice.

### 2.3 Colour Theory

From hidden messages of the spectrum, secret lives and languages colour, to stories and symbolism; a survey of the wide and multidisciplinary literature surrounding colour reveals its theories and treatise are surrounded with mystification and wonder. The concept of colour, like information, is full of enigma. Theories pull threads of knowledge from all directions, including the arts, psychology and sociology, natural and physical
sciences, the arcane, spirituality, and religion. (Gage, 2000; Eckstut and Eckstut, 2013; Clair, 2016; Evans, 2017; Paul, 2017; Kastan and Farthing, 2018). Romantic poet John Keats regarded colour with the same awe, seeing it as substance beyond scientific observation. It is no surprise then that Keats was horrified by the efforts of Isaac Newton to “unweave the rainbow”, in which he lamented scientific study would reduce the splendour of colour to just another item in “the dull catalogue of common things”. (Kastan and Farthing, 2018, p. 10). Nevertheless, Newton splitting the sunbeam marked a revolutionary change, by discovering a scientific poetry in the patterns of nature, as well as reifying the study and theory of light and colour. (Dawkins, 2006). Until Newton’s optical trick with the curtain, much of Western understanding of colour was cosmetic and its’ fantastical haze seen as frivolous or dangerously sensual. (Batchelor, 2000). Despite this romantic tendency to keep colour in the ether of divine nature, and the early trial and error of colour order systems, it now holds true today that colour has very practical communicative properties and applications that transcend across cultures and domains. (Adams and Stone, 2017).

Outside of formal arts education, few of us are taught entirely about colour properties, and yet somehow we do seem to possess an innate sense of it and are aware when colours are used informationally to communicate. (Baty, 2017, p. 20).

“...In representing and communicating information, how are we to benefit from colour’s great dominion? [...] putting a good colour in a good place is a complex matter. (Tufte, 2013, p. 81)

While it may appear like artists too have this innate sense of colour, there is a more cerebral and considered effort going on behind the scenes. Painters, graphic designers, fashion designers and photographers, all scrutinise over the subtle and powerful effects colour and light have on their research and the way it is perceived. The treatise of contemporary colour theories, which are still present and taught today in British art schools, came with emergence and influence of the Bauhaus School of Art. (Llewellyn and Williamson, 2015; Alexander, 2019). Bauhaus founded in April 1919, gave rise to a
modernism that was rooted on the principles that the teaching of art and design could be more closely linked with an intimate knowledge of physical, biological, social, technological systems. (Weber, 2019). Notable guides produced by Vanderpoel (2018), Itten (1985), and Albers (2013) disrupted historical ways of understanding colour into patently engineered applications of colour. Colour theory takes the principle of the primary colours red, blue, and yellow mixing together to create all other colours. Hue, saturation, and complimentary tones are organised and executed into didactic and inspiring optical exercises, providing aesthetics and information for researchers to easily follow and apply. (Adams, 2017, p. 12-15).

Alexandra Loske’s (2019) recent survey of colour assembles documents from this long colour history; from artists, scientists, and philosophers, and their attempts to order the visible colour spectrum into a unified theory. This monograph demonstrates that concepts about colour, the way we see it, and the way we use it, have changed most significantly with developments in print to digital technology, not unlike the changes to concepts of information highlighted earlier. Bock von Wülfingen (2019) provides a further perspective on the achromatic knowledge of colour gained through the sciences. This too also identifies that even objective attempts of applying colour for informational use are inseparably bound by social, cultural, political, and technological systems.

Can colour’s inherently multidimensional quality therefore be used to successfully express information in equally multidimensional documents? Tufte’s (2013, p. 81-82) envisioning information makes this link between colour’s application to data and documents clearer. Here a topographic map is used to show the fundamental uses of colour in information design which may be very easily taken for granted; colour is used to label (blue distinguishes water from stone, ice from grass), to measure (darkening hues and lines indicate altitude and height), to represent or imitate reality (rivers ripple and mountains shadow hachures), and to enliven or decorate (the colour enlivens the document beyond what could be done with black and white alone).
Titmarsh (2014) highlights that what remains unstated in current research of colour theories is how to establish the differences of colour in today’s semantic environment. What is the critical difference between the colour of a building’s facade, the colours of mass consumption and design of a logo, and the free use of colour in an immersive work of contemporary art? While the medium of art is important for exploring and translating information beyond language, there still appears little agreement on colour’s informational properties. As colour so often lacks the formal or set parameters of language which we are so often accustomed to ascribing to information, thinking about colour informationally therefore may provide a greater insight into the differences and alterations of its communication. Furthermore, the duality of the scientific and artistic use of colour, its objective and subjective meanings, and its source in colour order systems versus the nature world, may also prove to be relevant when further unravelling the concepts of the nature of information. This review of relevant informational and colour theories has provided the opportunity to chart how concepts of colour and information have changed alongside technological advancements, and the importance both play today in our informational environment.
3. Conceptual Analysis

Conceptual research aims to develop hypothesis and features an ongoing process of creativity, elaboration, and the interpretation of tricky phenomena or core concepts. The new understandings of a given phenomenon are explored in context and are typically characterised by complexity, ambiguity, and a richer depth of storytelling. This type of research is appropriately identified to answer the research question, because the nature of it seeks to preserve the form and content of the nature of information, rather than subject it to formal transformations. (Connaway and Radford, 2017, p. 213-214). It is from this point on that research leans towards an interpretive position, whereby concern is focused on the nature of information. It is important to re-iterate too that the point here is not just to clarify terms and describe the existence or appearance of information and colour, but to formulate a deeper theoretical perspective and understand why these ideas are of significance to the way we approach information theory and artist’s information behaviour today.

3.1 What is information?

Just off the horizon of your mind, on the shores of your imagination you have an idea forming. It is only natural that you should want to share it and there are a multitude of ways that you could do so. You could scribble a sentence, formulate an equation, send an e-mail, create a painting, capture a photograph, sing a song, perform a dance. How do these ways of communicating an idea into a form differ? Equally, why are these things also the same? The conceptual analysis will narrate the story of the fundamental particle of all forms of communication, information.

To begin, let us first take for granted the existence of the tangible and familiar matter of our world. All the objects and documents that surround us such of the likes of books, smartphones, chairs, rivers, mountains and stars. What ties these things together are
their physical forms, they occupy space with their shape and size, they may be things we can touch, smell, taste, hear, and even imagine. (Mumford, 2012, p. 14-16). In addition to these objects there also exists abstract entities that communicate the properties of their being, for example, a rose and its’ redness, beauty, vitality etc. (Ney, 2014, p. 60-61). These are also all things that contain information, but what exactly is information? These ideas form some of the basic principles of metaphysics, however, following this idea of the form of things will help to enrich and contextualise understanding.

Both Von Baeyer (2006, p. 18-27) and Capurro (2019) provide a microscopic view of the nature of information through analysing the etymology of the word itself. An x-ray vision unveils the roots of the word and provides the skeletal framework of information by introducing a clear proposition; information concerns the property of things, and the flow of form (ideas/messages/properties) from one medium to another. What makes a form though? It is worth examining this through the eyes of philosophers. For the Athenian philosopher Plato, forms existed entirely by themselves, in an ethereal world, a world of ‘ideas’. (Sedley, 2016). Plato’s idea of forms bordered the metaphysical or spiritual and present the innate essence or property of a thing, such as the ‘blueness’ of the sky, the ‘green’ of envy, the ‘purity’ of light etc. Aristotle too later claimed that our formation of reality and understanding of the material world depends on having some sort of form or idea in our intellect, and that these abstractions or concepts cannot simply be reduced to the material alone. (Peramatzis, 2015). These ideas are made more tangible today by Democritus and his atomic theory. His distinction of the flow and form of things was that everything in the world could be reduced to atoms. However, we know there is more than just atoms and the void, what really matters is the way in which these atoms are combined and relate, one in kin to another. (Chalmers, 1998, p. 70). Therefore, a set of atoms can hold information, in the technical sense, about another set of atoms. The world is not just a cosmic soup of swirling matter randomly colliding; the universe and the visible spectrum are a network of complex relations reliant on the communication of form (ideas/messages/properties) between altering and fluxing physical and semantic systems. This both occurs on an infinitely small and planetary scale continuously in every moment and in every place; photons of light that pour into
our eyes carry information about the materials which it has danced across, the colour of the sea has information on the colour of the sky above it, the colours of a map tell us what is land and what is ocean. (Rovelli, 2017, p. 212–213). So how do these ideas translate today and helps us to understand contemporary theories of information and communication? To answer this, it is worth jumping ahead in time to the birth of information technology.

From paper, to electricity, to fibre optics, during the radical technological shifts of the early twentieth century the raw matter of information buzzed into everyday life. This world of coded letters and messages, sound and moving images, news and instructions, statistics and facts, signals and signs, is one we recognise today. No one theory neatly encapsulated all the messy noise of hybridising data and circuits, until mathematician Claude Shannon began assembling a theory for information. “Off and on” Shannon enthusiastically wrote to Vannevar Bush at MIT in 1939, “I have been working on an analysis of some of the fundamental properties of general systems for the transmission of intelligence”. (Shannon, 1993, p. 445). The mathematical theory of communication by Shannon and Weaver (1975) published in the Bell System Technical Journal 1948, took the idea of communicating intelligence, and discovered that when distilled, refined, and counted into bits, information was to be found everywhere. Suddenly the communication of forms and ideas had a reified theory. Shannon’s theory laid the foundation for our understanding of today’s concepts of information, the communication chain, and built a bridge of between communicating the form of matter, information and uncertainty, information and entropy, and information and chaos. (Soni and Goodman, 2017, p. 165–169).

Norbert Weiner was especially concerned with the philosophical implications of Shannon and Weavers’ work and later observed “society can only be understood through a study of the messages and the communication facilities that belong to it”. (Wiener and Heims, 1989, p. 16). This has of course always been the case, from cave wall paintings and Egyptian scrolls, to tomes and telecommunications. Information allows us
as individuals and as societies to break intelligence, our ideas and thoughts, down into a series of small conceptual chunks, in any medium we so choose. These chunks are typically externalised and given form using language or symbols. We have learnt to express ourselves using a series of sound and physical actions, so do chirping birds, waltzing bees, voluptuous flora, and man-made machines too exchange messages in a dancing waterfall of electrical vibrations. Nature also expresses itself in a complex dance of cadences, rhythms, colours, and sounds. (Malkavio, 2014). All are different forms of one thing, information. Information allows one mind or system to influence another. This connectedness is most simply explained by Buckland (2017, p. 22) who breaks information into three categories; information as knowledge, information as process, and information as thing or form. At an etymological and conceptual level, information can be thought of as the transfer of the form of things, or the flow of ideas, or the communication of messages between things. This then raises the question, if information is everywhere, and is tied to flow of everything we see and communicate, is information physical?

3.2 Is information physical?

Microscopic particles and electromagnetic waves, governed by the laws of quantum mechanics, bring to light some of the most pressing questions about the nature of our underlying reality. (Ananthaswamy, 2018). Does information and colour at the smallest scales of nature exist independent of observers or observations? Is information and colour created upon observation? Does information make up the physical world?

The ex-stasis of galaxies

so out from us there’s no vocabulary

but mathematics and optics

equations letting sight pierce through time

into liberations, lacerations of light and dust
Rich’s lyrical description of the confetti explosion of stars captured by the Hubble Telescope reminds us of the revealing power that colour possesses; it allows us to pierce the temporal and spatial armour that conceals information from our sight. In 1990 the space probe Voyager 1 turned its camera from a headlong rush out into the universe back to its point of origin. Captured there through the static, flare, and electric noise was a small pinprick of light with a bright blue hue. This image captured the first existential shot of our little home, Earth, which Carl Sagan famously immortalised as ‘The Pale Blue Dot’ (Scharf, 2015). Space with its velvet black curtain, is not as colourless or devoid of information as may appear. Artists and scientists have for a long time provided us with a telescope through which we can see the universe and a glowing tessellation of colour. Each silver star spilling across the sky is brimming with the colour of time and further than that lies unseen matter, radiation, and waves perceivable beyond our own visible spectrum. The sun baths our lush blue planet in a colossal amount of light and while we once thought of its’ pure immutable white light as the absence of colour, the opposite turned out to be true. Light is not just a marker of energy, but also colour, and in turn information on the separate wavelengths of light (Vukusic, 2007). Astronomers learned to read the information contained in light to discover the chemical composition of matter and stars. Like Newton first did with his prism, astronomers bend the light of star to break it into its colour spectrum. Spectrographs form an array of rainbow coloured documents that map out this information and the dark lines in the spectrum mark the presence of specific chemical elements, each of which absorbs specific wavelengths of light. Fizzing scarlet light tells us of ancient stars, whereas dazzling cerulean light marks the birth of new ones (Hemmingway and Czerski, 2019).

With the poetry of colour and starlight in mind, we can begin to formulate a more profound understanding of the nature of information. As a combination of mathematics, the language of physics, and perception, the language of participation; information is physical. In his pioneering paper ‘Information, Physics, Quantum: The
Search for Links’, theoretical physicist John Wheeler (1989, p. 313-314) explored this friction between information and perception by proposing that “all things physical are information-theoretic in origin and this is a participatory universe [...] observer participancy gives rise to information.” At the very microcosm of things there exists deep-down immaterial information, and it here is again that we can also return to the notion of form and flow. Information then starts to become a concept that is extraordinarily foundational; it is the elemental unit of participatory sense making and our experience of the objects, events, and phenomena that create our reality are the result of the very simple interaction between invisible binary decisions. Information is not static, it is a dynamic process of duality and energy; yes/no, true/false, on/off, one/zero, as a result of observation and communication. (Bawden and Robinson, 2013, p. 6-7). Information then is not just an abstract form carried by our imagination, it exists by being carried, experienced, and encoded, therefore behaving according to the laws of physics. Furthermore, the concept that information cannot be divorced from the physical world, is no way a hinderance. It can be stored in any physical system we choose, from the light of the sun, pigments of paint, to paper, electricity, and fibre optics. The medium that contains information gives it unique properties, allowing any number of possible transformations or methods of communication. (Al-Khalili, 2012). Every great work of art, every green leaf turning autumn red, every little particle, field of force or beam of light, even the grains of sand of time, derive their function, meaning, and existence, from an active exchange of physical systems and perception. Davies (2010) integrates these ideas into the following paradigm for thinking about information:

Information → Laws of physics → Matter

Importantly, this relationship marks not simply a larger technical change in perspective but represents a radical shift in the way we view and understand the world. The laws of physics, colour included, can therefore be examined as informational statements. This shift in understanding too is present in current theories of information, which brings us to Floridi (2010, p. 20) and presently the general definition of information.
3.3 General Definition of Information

From the physical and wonderous we now turn to the most recent and relevant conceptions of information. Detailed introductions to the nuanced differences of various types of semantic information emerged with Floridi’s (2002b, 2010, 2013) *philosophy of information*. Floridi proposes that such content of semantic information is specifically characterised as well-formed and meaningful data. This conception has resulted in the definition ‘general definition of information’ or GDI.

The GDI therefore defines \( x \) as information if and only if:

- GDI.1) \( x \) consists of one or more data;
- GDI.2) the data are well formed and;
- GDI.3) the well-formed data are meaningful.

In GDI.1 we understand that information can be composed of a single bit of data to a whole cluster of different bits and things. In GDI.2, ‘well formed’ means that the data is formed following the rules and structure of a chosen system, code, or language. What determines this form can be broad, the construction, composition, or structure may be equally variable and applied differently across domains. In GDI.3 is where semantics is important, and again ‘meaning’ must follow the set meanings of the chosen system, code, or language. (Floridi, 2013, p. 84). The ways in which data can come to be ascribed meaning can be complicated and often is subjective based on the context of the system in which it is based. For instance, putting this into context of colour, the RGB code and selected shade of colour, our data, taken from a Pantone colour chart, our form, are highly informational for a designer, but for anyone else may just be a random string of numbers with no use or relation to the colour. Furthermore, Floridi (2010, p. 22) suggests that information can be meaningful independent of an informee or observer, which again ties into earlier concepts of information existing in an environmental or physical system.
The general definition of information puts the emphasis of understanding data at the centre, and because of data’s pervasiveness, provides multiple possibilities for understanding. Floridi’s ‘structured’ and ‘meaningful’ approach to both physical and semantic information, seen in Figure 1, is not restricted by linguistics either and therefore is an appropriate model for mapping and understanding information as art, energy, processes, patterns, experience, and communication.

Dinneen and Brauner’s (2015, p. 396) detailed conceptual analysis emphasises the practical and philosophical strengths of adopting Floridi’s general definition of information for the use of library and information science. This importantly concludes that information need not be absolute truth, and that meaning can be made through understanding the identifiable differences in how data is formed. Floridi (2004, p. 662) explains that the nature of library and information science is concerned with the “contents understood as meaningful data [...] connected with activity of stewardship of a semantic environment.” Bate’s (2006, p. 1034) definition of the nature of information is an interesting parallel, which also conflates information with data, and she describes information as “some pattern or organisation of matter and energy as it exists in the universe and in living beings”. This may seem abstract but reflects what was discovered during the literature review of artists information behaviour; the definition of what
counts as information and inspiration to artists is broad. To highlight again Peterson’s (2019) research, the library is a vessel for vibrant and varied collections of documents, especially for artists, and as such the information contained is often subjective and contextual based on the required use of the researchers. The fact artists are observing the existence of patterns of information does not imply that their understanding of that existence is absolute, complete, correct or the only potential understanding. Nor does this deny the subjective and uniqueness artists individuals’ perception of information. For example, the elaborate patterns of frost shimmering on the surface of a window may present valuable information and communication for the eyes of a photographer or a painter.

Labaree and Scimeca (2008) also support a more metaphysical approach to the study of information, whereby broader philosophical thinking also informs critical thinking about social epistemology and the structure of experience and reality. In which case we can use both Floridi’s and Bate’s definitions of information to construct understanding from a data-based description of nature and documents. Adopting Floridi’s general definition of information also allows this conceptual freedom to explore how meaning is constructed. We can identify information as fundamentally composed of data, little patterns and fields of differences, with material objects and their meanings constructed as a complex secondary manifestation. (Floridi, 2010, p. 70). As Bawden and Robinson (2014, p. 3) pose the question “should we [library and information science] be concerned as being outed as potential metaphysicians?”. Certainly not, and for the purposes of studying of colour as information this approach will be beneficial.

So where then should we settle on the nature of information? As abstract and intangible as information may have first seemed as a concept, the following position can be made through Floridi’s general definition of information and synthesising understanding. Information must consist of data, patterns or organisation of matter, that is processed into meaningful form, and can be either embodied in a physical or semantic system.
4. Visual Analysis

Visual analysis requires researchers to apply the lenses of context, form, and content.

- **Context** refers to the circumstances surrounding the creation of a work, and may contemplate the artist, temporal or geographical location, and the philosophical, social, cultural, and political systems that contribute to the work.
- **Form** lies in the object of analysis itself and relates to formal elements of light, perspective, medium, technique, arrangement, and composition.
- **Content** refers to the informational component and considers the language of the work; what does it mean? what are its effects on the viewer? The aim is to move beyond literal description to explore symbolism, metaphor, and the duality of meaning. (Mannay, 2016, p. 12-13).

The reading of images and visual signs through visual analysis is a qualitative act, which is concerned with a humanistic reaction to visual forms and experiments presented. It is personal and subjective. (Noble and Noble, 2016, p. 92-94). Here then we ask the questions, what does the art or documents show or mean? What associations does we have with the art or document? What themes or concepts arise that are similar to what has been uncovered through the literature review and conceptual analysis? (Rose, 2016, p. 63). This section therefore uses the visual analysis of contemporary art and colour documents to build on the understanding gained so far in the research project.

Two research trips were carried out to undertake this method. The first to the Tate Modern, London, 08 August 2019, to analyse artist Olafur Eliasson’s retrospective exhibition ‘In Real Life’. The second to the Colour Reference Library at the Royal College of Art, London, 23 September 2019, to analyse colour systems documents. The method of visual analysis therefore allows the opportunity for reflection and metaphor, consequently synthesising ideas and providing examples of colour as information.

- **Olafur Eliasson ‘In Real Life’ Retrospective** – Analysis of Olafur Eliasson’s art exhibition explores aspects of immersive colour, information experience, and ideas about physical/environmental information.
• **Colour Order Systems (Colour Reference Library)** – Analysis of Pantone & Munsell Colour Systems end the visual analysis with practical examples of colour as information.

### 4.1 Olafur Eliasson ‘In Real Life’ Retrospective

The Danish-Icelandic artist Olafur Eliasson’s retrospective at the Tate Modern presented a timely and accessible opportunity to carry out visual analysis, therefore further exploring and reflecting upon the ideas previously encountered in the literature review and conceptual analysis. The research trip took notable concerns of colour and information as physical phenomenon, and colour’s importance as an informational resource during studio and practice-led research.

A search of the literature surrounding Olafur Eliasson’s kaleidoscopic art works reveals a few common themes; colour, light, body, experience, storytelling, climate, nature, and technology merge into a captivating body of work. Eliasson’s interest in phenomenology also ties these themes together. (Grynsztejn and Birnbaum, 2002, p. 44-45). In the lead up to the retrospective, Tate Modern’s director of exhibitions Achim Bordardt-Hume praised Eliasson’s achievement for condensing “very complex ideas into seemingly simple, extremely accessible images and experiences.” (Brown, 2019). The exhibition brought together over forty works of such art works made between 1990 and today. This body of work includes immersive installations, sculptures, photography, and paintings. The materials he uses too are equally diverse, ranging from the elemental such as light, fog, and glacial meltwater, to light, pigment, and reflective materials. Throughout Eliasson’s artistic practice underlies research into colour theory and geometry, and further metaphysical investigations into how we perceive, feel, and shape the world we live in. (Tate, 2019). One artwork that stood out especially was ‘Din Blinde Passager’ in which its immersive colour allowed the opportunity to think abstractly about colour and apply it metaphorically to ideas about information and experience. An initial reflective analysis from the visit on 08 August 2019 can be found in Appendix 8.2.
4.1.1 ‘Din Blinde Passager’ 2010

Figure 2: Inside view of installation art ‘Din Blinde Passager’ (Eliasson, 2010). Photographs taken by author.

The immersive installation ‘Din Blinde Passager’ titled after the Danish expression for ‘stowaway’, arose from Eliasson’s interest in experience, how we orientate ourselves in our environment, and the information we gather from our senses. Eliasson recognises the impact technology, information, and artificial light play in our daily lives. The installation can be understood as a response to disconnect from the infosphere and recalibrate how we engage with colour, information, and our senses. (Brown, 2019).

The installation forms a 39-metre long tunnel filled with densely pigmented fog. The low visibility requires the spectator to traverse and orientate through using a mix of senses. The artwork is entered through a threshold of black set doors against an equally dark room. This liminal entrance provides a starker sense of contrast upon entering. This is a
transitory space that is reminiscent of what Augé (2008, p. 86-88) describes a ‘non-place’ whereby a sense of coming and going tangles together in stark contrast to the excess of information we are usually used to. Immediately the installation disorients spectators, who when engulfed by a white fog, must navigate through this non-such space with no recognisable route, form, or material, other than dense colour.

Figure 2 shows the transient walk through the installation, wherein the light and colour change from soft powder white, through pale blue, to a lurid and burning amber at the centre. The installation uses many types of colour that we associate with light; foggy winter light and deep blue twilight, through to golden sunrise, bright daylight, and vermillion sunset. The intensity of the colour becomes stronger towards to centre of the installation, before vanishing back to white upon the exit, where the viewer gains a sense of full circle. These subtle changes in light occur naturally and subtly in the sky and in our everyday environment but are paced so slowly that in our busyness we hardly notice them. ‘Din Blinde Passager’ condenses an entire day of light into a purified and intense experience. With all the distractions of life’s hectic surroundings removed, and the limited space given for visibility, it is possible to experience raw colour in an embodied and physical way. This is important because it allows the viewer to slow down, requiring attention, participation, and lingering to grasp meaning and form understanding. The information present is not quick or as instructional as say the neon orange letters and numbers on a train timetable display. Instead the colour replicates the abstract physical information found in the natural environment, pointing more towards recalling personal and emotional experiences.

Emotions are normal responses to information, which are not altogether subjective because they can too presuppose recognition of specific features of the environment. (Freeland, 2017, p. 245). People may encounter similar experiences such as provoking memories of a bright summer’s day, the tingling feeling of warmth you get when you close your eyes and stare at the sun, or the cold air of mist-cloaked walks in the winter. The need to participate and engage with the work in both a physical and emotional way
therefore raises interesting questions about the relationship between information and experience.

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Eliasson on experience: “Experience[... is a way for information that is present in the world to become accessible.” (Godfrey, 2019, p. 155)

Eliasson’s perspective is noteworthy in relation to Wheeler’s *it from* bit theory of information outlined earlier in the research. Here arises a similar concept, with the emphasis on experience, that information is made accessible only through some kind of active engagement or participation with systems or environments. ‘Din Blinde Passager’ introduces this in a very subtle but simple way. Information, whether sensory or physical, can be gained from interaction with colour in the environment. This extends beyond just sight, for information can also be gained through an intermingling of touch, smell, and sound. The colour we receive from and experience in the environment is informational, in so much as it enters our vision and stimulates the senses, but it is much more complicated than that. Suppose for example we return to the chilly blue light that marks the entrance of ‘Din Blinde Passenger’. Does the colour blue make us happy or sad? Often blue is sad, we know that cold light contains a majority of blue wavelengths that both hit the biological clock to make us more alert and awake as well as induce low mood. (Godfrey, 2019, p. 43). Blue can also dazzle us with how lucid it is. Blue can express the jubilation of a clear, sun bleached sky, as well as liberation, spirituality, and freedom. (Mavor, 2013 p. 141). Freeland’s (2017, p. 245) response to the installation is similar and distinctly recognises that our response involves acknowledging the distinct features of what it is we are attending to. The play of meaning in any such given artwork or installation is set in motion by its relation to visible and self-constructed contexts (Rebentisch, 2012, p. 251). When we interpret the informative qualities of art reflectively, we confront our own autonomy and understanding of how we interpret information in the real world. (Lehrer, 2012, p. 5).

Floridi (2014, p. 25) indicates that one of the most remarkable features of our fourth revolution is technologies ‘in-betweenness’ and its ability to come between human and nature.
McQueen’s Floridian definition of art as information ties into this concept too and consequently, ‘Din Blinde Passager’ does exactly this also. The installation provides an interesting example of ‘in-betweenness’ and colour as information. The information presented is not in the robust, measurable way we often associate with numbers or letters. Instead, the technology provided by the installation grants an accessible embodied experience that grants the possibility to understand colour found in nature that may seem removed from our everyday information environment. In the hands of artists colour is wielded to define objects and information, but often so completely that colour and information fuse. As Dewey (2005, p. 211) describes, “the colour is of the object and the object in all its qualities is expressed through colour.” Given all that we have learnt about the nature of information, we can come to this position, colour as information, experienced in art, can help us to reconnect with our sense of self and our own associations, and additionally make meaning of our informational environment.
4.1.2 The Expanded Studio

Figure 3: Section of ‘The Expanded Studio’ (Eliasson, 2019b). Photograph taken by author.

‘The Expanded Studio’ demonstrates the open-endedness of arts-based research and the sprawling amount of information and inspiration collected during artistic practice. The expansive list of resources forms an installation of its own merit. These documents, such as in Figure 3, demonstrate how Eliasson and his team of researchers and craftspeople collate information into searching questions and storytelling: pinning up images like butterfly specimens, grouping relevant concepts and theories present in academic papers and articles, and collecting colour charts and personal notes, all help to create narrative and respond to themes currently under the artist’s investigation. (Souter, 2019). Analysis of ‘The Expanded Studio’ provides a significant way to expand understanding from what was discovered during the literature review of artists information behaviour, most notably how colour is referenced as a source of information during practice-based research.
Figure 4 shows the contrast between the colour order systems and samples found in ‘The Expanded Studio’ (Eliasson, 2019b) and how that information translates directly into the product of the research ‘Colour Experiment No. 80’ (Eliasson, 2019a).

‘The Expanded Studio’ collects together various colour order systems, but a range of cyanometers stand out markedly for their link to further projects created by Eliasson. These simple handheld devices where invented by Swiss physicist Horace-Benedict de Saussure in 1789 and have been replicated numerously over the centuries. The serenely blue pigmented sky-discs are aesthetically beautiful documents in their own right but do provide useful information. They feature numbered sequences of shades of blue which are used to measure and record the distinct variations of colour present in the sky. (Loske, 2019, p. 216). These documents therefore present colour as information in a more conventionally recognisable way, being relatively simple man-made tools that
help capture, chart, and communicate observations of natural phenomena. They also link directly into further studio-based research. As a continuation and experimentation of colour theory, Eliasson used the cyanometers presented in ‘The Extended Studio’ to develop a new colour theory based on prismatic colours. This work began principally in 2009, where Eliasson worked with colour chemists, fusing artistic practice with a materials science approach. The colour presented in the cyanometers was then used as a source of information to mix and match oil paint to the exact colour for each nanometre of light in the visible colour spectrum. (Eliasson, 2014a). This process also informed further research into painter J.M.W Turners use of colour.

“They are one of the great artists when it comes to ephemeral atmosphere dematerialisation [...] I try to understand that what is was that Turner was in fact working on colour and light.” (Eliasson, 2014b)

There is a meticulous quality to Eliasson’s research into colour. In each of Eliasson’s colour experiment wheels, we see the compressed and essential colours of the natural environment; boiling sunsets, seething seas, and billowing rainstorms, are blurred and almost atomised down to the nanometre. The dematerialisation of colour from natural sources into singular modalities and experience ties in again to Eliasson’s concerns with experience. Here we are presented with densely pigmented and abstract colour, and yet subjective experience and engagement with the very material presents opportunities for reflective, even meditative, clarification and understanding of the information we found in our natural and physical environment that we may miss or not even notice.
4.2 The Colour Reference Library

A research visit to the Colour Reference Library provided the opportunity to carry out visual analysis on a select few colour order systems. This gave the capacity to think critically about colour’s informational properties and to continue the narrative of the research project. The research trip was also used as a fortuitous way to serendipitously discover literature and to synthesise findings.

The Colour Reference Library at the Royal College Art, London, is a treasure trove special collection that forms one of the world’s largest collection of published works on the subject of colour. The collection brings together notable published works of colour theorists outlined previously in the literature review, such as Isaac Newton, Wolfgang von Goethe, Josef Albers, Mary Gartside, and Emily Noyes Vanderpoel. (Parkinson, 2014, p. 297). Figure 5 demonstrates just a small section of the collection, in which colours ability to camouflage itself across domains is evident; published works span the rainbow from new, historic, unusual, and rare texts that extend across art, psychology,
the natural and physical sciences, to the more obscure domains in music, synaesthesia, healing, and the arcane.

4.2.1 Colour Order Systems

Figure 6: Examples of colour order systems held by the Colour Reference Library. Photographs taken by author.

Collections of colour samples are used by artists and designers to create works of art, designs, and even garments of clothing. These documents provide tangible examples of colour as semantic information. Colour order systems come in an eclectic variety of forms and range from flat to lushly tactile documents. Patches of paint, pads of paper, or printings of inks provide the necessary framework for paint and graphic research. (Hunt and Pointer, 2011, p. 155). Similarly, coloured swathes of textile samples and tangible materials are important information resources for designers to seek
combinations that stimulate emotional, physical and sensory experiences. (Wagner, 2018, p. 8). These colour order systems provide vital interpolation needed between samples of colour, helping to distinguish choice and aid with the communication of colour.

One example, Top Right Figure 6, is Werner’s Nomenclature of Colours. (Syme and Werner, 2018). The book was originally published in 1821, with the aim of constructing a system or taxonomy for colours found in the natural world. The new edition is a curious and tactile document compiling together 110 colours as depicted in the plants, minerals and the animal kingdom. Colours are grouped together and broken down into evocatively named shades, expressive of their occurrences in nature. (Loske, 2019, p. 56). The system used to name the colours is split between animal, vegetable, and mineral. From the mundane to the bizarre, the document brings together interesting relationships between disparate aspects of nature. (Public Domain Review, 2019). For example, in the section devoted to shades of grey, the colour ‘Ash Grey’ is also attributed to ‘Breast of long tailed Hen Titmouse’, ‘Fresh Wood ashes’, and ‘Flint’. These may appear to be quite obscure references but visualise the multitude of ways in which colour can be found in the natural world and interpreted by the individual observer.

With visual information like this, there is an interesting tension between the need for definition and ambiguity, objection, and abstraction. Visual information and colour especially have still not escaped the protective clothing of language, no matter how ambiguous or obvious they seem, it is as if without a cloak of written explanation, the information is non-existent. (Williams, 2014, p. 22-24). Pantone form one of the most prolific producers of colour language and information systems today. Their products range from fans and chip books with thousands of solid pantone colours, and guides showing shade combinations that match solid colours. (Kuehni and Schwarz, 2008, p. 185). The Pantone ‘Fashion, Home & Interiors’ found, see Top Left Figure 6, contains over two thousand colours and is an example of the extensive range of colour information provided by modern colour order systems. It may be hard to imagine that so many colours could exist given that in day to day life we only use seven words to describe each of the colours of the spectrum. Within the vibrantly hued fan is the colour ‘Phantom’, a
dark grey reminiscent of heavy thunder clouds. Like all other shades in the volume, it is paired with an individual code, in this case, 19-4205TPX. The code is used to locate RGB, HEX/HTML, and CMYK codes, which are the exact digital colour information needed to avoid deviation and discrepancies. (Adams, 2017, p. 12-13). This may at first seem trivial, but in a world of uniform and mass-produced design and print, colour consistency is extremely important. Every emerald green logo printed on a Starbucks coffee cup, or detailed image printed in an artist’s monograph is printed with the exact same codes of colour information for standardisation and uniformity.

Colour as object is earthly material stuff, and as such the physicality of paint and pigment is a tool which artists, designers, painters wield to make a work of art or communicate information. Tools need instructions, and over time the nomenclature of colour has developed to form one in a wide pool of systems that use their own language and coding. Colour order systems provide the codified information of fundamental colours which our linguistic and scientific models do not allow us to reduce any further. (Eckstut and Eckstut, 2013, p. 16). It is never just blue, it is ‘cerulean’, not green, but ‘malachite’, not grey but ‘elephant’s breath’. (Sillman, 2016, p. 105-106). The mythic language of colour reflects a myriad of subjectivity and defines not only the eye of the culture from which it is observed, but also how it is interpreted and understood as information. It is possible that linguistic differences may be the cause of alterations in perception and the understanding of visual information. The complexity of terms is rooted in the culture of a place, and therefore also alter and flux as the historical, social, and political culture changes. (Deutscher, 2010, p. 213-231). The basic elements of language are physical too, the noise that words make, the sounds, silences, and rhythms that mark their relationships. (Le Guin, 2015, p. 1-3). Words are powerful and make colours sound delicious, enthralling, repulsive, fearsome. The language we use to describe colour therefore stores historical and social information and allow ideas to transcend the distance of time.
Despite the multitude of practical ways in which colour order systems provide fundamental colour information, their abundance can cause ‘information overload’ and stagnation. In *Library of Light* Joelson (2019, p. 71) interviews practicing artist David Batchelor who finds colour more profoundly informative when located in the environment. Despite the visual allure of colour systems attain in their tactility, Batchelor finds them too strictly bound by the structure and limits of language. Batchelor reminds us that “language is extraordinarily weak when it comes to colour: the human eye is able to distinguish about ten million different gradations of colour whereas most languages have only up to 11 basic colour terms”. This returns us then to the importance of locating colour serendipitously from environmental information. Colour as an informational resource can be more poignantly located in natural and social phenomena. Colour evokes the sublime, and there is obviously a huge asymmetry between what you can see and what you can say.
5. Discussion

5.1 Colour as Information

Colour as information is a juxtaposition that hovers between evanescence and permanence; from withering star light and dense earthly pigments, to colours located in the scales of a fish and the pages of a book. It is found in the microcosm and macrocosm of things and is therefore deeply tied to our visual and informational environment.

“He looked into the water and saw that it was made up of a thousand thousand and one different currents, each one a different colour, weaving in and out of one another like a liquid tapestry of breathtaking complexity.” (Rushdie and Birkbeck, 1993, p. 72)

In ‘Haroun and the Sea of Stories’, Haroun the protagonist discovers a wide and wavering ocean of light and colour. These dazzling waves provide an allegorical tandem for layers of storytelling, but they also form a rather poignant metaphor for seeing the multitude of colours visible in nature and a glimpse of colour revealing information as a physical entity. Chirimuuta (2017, p. 11) states that “it is hard to escape the conclusion that we only see what our sensory organs and classifying minds make available to us, and that this is unlikely to be the same reality that is described by physics.” However, colour has a peculiar property to bridge this gap between the conscious and the physical. Water is the great eye of the universe, absorbing and reflect colour, and as our protagonist Haroun demonstrates, by seeing the multitudes of colour and patterns in it, he able to perceive some sense of fluid dynamics, albeit at the limits of his own perception. If we focus solely through the lens of information theory and given all that has been understood through conceptual and visual analysis in the way artists see and refer to colour, then yes colour is absolutely information. More than that, it is a powerful way of interpreting, evidencing, and communicating both natural, environmental, and semantic information. (Henderson, 2018, p. 37-38).
When we look into the hued ripples of water we are seeing fluid dynamics at work, when we see a rainbow in the sky we are seeing the diffraction of light, when we see the gilded ochre of the sun we are seeing thermal dynamics and the expending of heat and energy. These ephemeral and intangible experiences of colour actually reveal something very solid and foundation, that is, the fundamental aspects of the physical universe. Colour pervades physical surfaces. If our eyes can be trusted, the radiant fluxes that stimulate our retinas reveal the complex chemical and physical interactions between light and matter. This is interesting from an information-theoretic perspective, because if we stand by the concept that information is the communication of messages between physical systems, then colour itself is information. In the study of colour and perception Mausfeld and Heyer (2003, p. 477) conclude “as concerns knowledge of [colour], there is no substitute for experience.”

From a more practical perspective, colour as information is also vital information resource for artists. Through our vision we are able to see millions individual variations of colours, but our perception of them is inherently bound by the strict limits of language. Analysis of Floridi’s general definition of information revealed information is made up of data and given meaning form by the systems of its context. This helps us to understand the way in which colour order systems arrange the raw data of wavelengths of light into shades of digital coding, which in turn allow artists, designers, and creative practitioners to communicate more meaningfully and uniformly with colour. The understanding we gain from standardised use of colour information is often taken for granted but is vital for how we engage and function in the world, as well as influencing culture, our wellbeing, and our experiences. The information we get from colour enables us to judge the freshness of ripe fruit, it helps us to identify the weather and atmosphere, it helps us to identify birds, insects, flora, and fauna, it warns and it signals to go, it marks territory to navigate space, it allows us to express our emotions and aspirations. (Eiseman, 2017, p. 8-11).
5.2 Immersive Documents and Digital Synaesthesia

Visual analysis of Olafur Eliasson’s ‘Din Blinde Passager’ revealed a more interpretive way of seeing information. Information is received through the senses in active participation with the world. While this is notably present in contemporary art and immersive performances, it is not uncommon to experience this ‘digital synaesthesia’ in other aspects of day to day life.

Synaesthesia is an intriguing multi-sensory phenomenon in which the stimulation in one sensory mode causes a sensory experience in another mode. For example, this manifests in some people as a colour sensation from visual stimulation such as words and letters from the alphabet. For others it may come from the sensation of sounds, where different sounds evoke different colours. (Mather, 2016, p. 389-390). To illustrate this, imagine hearing a song and experiencing a landscape of fireworks fill your field of vision, or your mind’s eye. The gentle tap of a piano string may produce an icy cool colour or feeling, or the letter ‘L’ may be distinctly sunflower yellow. Synaesthetic individuals describe the experience of sound, letters, tastes etc with coloured shapes, scintillating and fading, or to be subjected to a kaleidoscopic montage of coloured photisms. (Cytowic and Eagleman, 2011, p. 87-88).

For a long time, this kind of involuntary phenomenological response to colour was thought of as fantastical, but as we have come to understand the complexities of the brain, synaesthetic thinking has become a way of building sensation and multi-modality into new, immersive documents. New technologies have transformed the colour spaces of our cities and our homes. All the familiar tools and objects we use daily, from smartphones and gaming systems, to radiant alarm clocks and sound systems, can now operate through a blended mix of colour and sound. (Batchelor, 2014, p. 42). The colour we experience in our digital lives is almost entirely artificial too, formed from digital realities and projections of binary codes. (Gsöllpointner, Schnell and Schuler, 2016, p. 7). We are exposed to a synthetic rainbow, so how has technology changed how we
perceive and communicate with colour? If the techniques of the internet and mechanical reproduction give us numerous replicable documents, then the digital production of digital documents has potential to reconnect us with the aura of art and object. (Groys, 2016). As analysis of ‘Din Blinde Passager’ discovered, contemporary art is a powerful way to engage in subjective, multisensory information experiences, in similar ways that can experienced in nature. The transformation of art as material and object, into practice and production of something digital, pervasive, and sensory is an emerging and exciting concept within the field of library and information science. Immersive experiences are intensely personal, and therefore this raised the question; should future research include phenomenology to allow information behaviour and experience to be understood from individual experience? (Robinson, 2015a, p. 117).

5.3 Information Experience

Seeing is something we do innately, and we continue to learn how to do it, our perspective and perception subtly changing with experience. We put together an understanding of the world that makes sense to us through gathering information and gaining knowledge. (Mirzoeff, 2015, p. 73-77). Information therefore is intrinsically linked with perception, which from a neurological point of view is defined by receiving, selecting, acquiring, transforming, and organising the information supplied through our senses. (Barber and Legge, 2019). Colour of course is central to this and to the visual aesthetics that profoundly affect our emotional state and formation of reality. (Gregory, 1995, p. 119). If we continue along the thread that reality is ultimately made up from interaction with information, then it becomes essential to consider how we experience it. What is the value of examining experience though? Philosopher Democritus hinted at this disparity of knowledge and experience through a debate between the intellect and the senses:

The Intellect: By convention there is sweetness, by convention bitterness, by convention colour, in reality only atoms and the void.
What Democritus makes evident here is that all evidence, even scientific, requires collection and processing through the facilitation of the senses. It seems implausible therefore to separate the study of information and the development of our information systems from the study of the senses, for the physical and informational world is deeply tied to human experience. Shannon and Weaver’s mathematical model for information made evident that information is encoded into signals and senses to be decoded by a receiver. This thinking is present still in Floridi’s (2019, p. 27) philosophy, whose approach to experience is conceived through the logic of information and the following conceptual design; reality provides the data, to be understood and transformed into information by human and machine alike. It is here that the emphasis of experience is important. Humans are innately semantic machines, but our ability to understand and make meaning comes from the facilitation of experience and engagement with systems of an informational environment. (Cobley, Jansz and Appignanesi, 1998, p. 115-116).

Janich (2018 p. xiv-xv) describes this as the “as such” of the objects and systems that make our culture. What Janich identifies is that in any given object or system there is a deep expression of human intention, which includes the ordered process of its making. This resists the temptation to consider any finished concept as the origin or truth of the practice that led to it. Instead the “as such” is understanding the information derived from documents comes from the sum of the processes in making. This idea of considering process may be worth investigating more deeply for the purposes of information experience, and even more so for performative artmaking. A more humanistic view recognises the significance of human experiences, choices, and intentions that take place in the construction of art and research.

For colour too, it is not hard to talk or think about processes and decoding and receiving experience. Colour is not apart from us, but a part of us. The multi-model capacity it has to spark social, emotional, and intellectual associations is not incidental. From the
clothes we choose to wear to the food we eat, colour plays an important part of our mind, body, and informational environment.

“In biological systems, there is deep unity between structure, function, and origin. You cannot make very much progress understanding any one of these unless you are paying very close attention to the other two.”

In *The Tell-tale Brain*, (Ramachandran, 2011, p. 75-116) connects the dots between creativity, synaesthesia, and the architecture of brain. While the neural linking of colour and emotion is an evolutionary adaption, perhaps more importantly is the ability for mediating sensory information and co-opting associations, abstractions, and metaphors. When formulating theories about how humans communicate with and experience information, intellect and objectivity alone are not enough; aesthetics, action, consciousness, and perception are part of the process too. (Edelman and Tononi, 2001, p. 208-212).

Art in particular is a unique vessel for containing human content, the information it contains is not wholly isolated from us, it is received and communicated through our sensory experiences. What is important is how this information takes form and provokes us to reconfigure how we think about our world and ourselves. (Lehrer, 2012, p. 4-9). Gorichanaz’s (2017, p. 505) novel dialogue between epistemology and aesthetics reminds us that individual experience uses the lifeworld as a point of departure as well as to influence culture. To experience information is engage in a dynamic act of participation between systems, sensory documents. and the body itself.

“My body is a sort of open circuit that completes itself only in things, in others, in the encompassing earth.” (Abram, 1997, p. 62)

Abram’s prompts us to remember that colour and the senses are not necessarily experienced through singular modalities, but through an intertwingling. One thing that can be understood from thinking about information and experience too, is that the
world is intrinsically interwoven. If we dive deep down beneath the surface, we see that in colour, art, music, performance, and all the webs that weave culture, information is possibly the most intrinsic form that reflects ourselves and our quest for answers and connection. As society scrambles forward in the infosphere, the new information systems of the future are increasingly cross-sensory and being designed for this same tangled connectedness. (Morville, 2014, p. 107-108).

Lord (2014, p. 172-174) observes that the values associated with each new source of energy or technology stay with us as long as we continue to use it; technology and digital environments allows for greater transformation of information into visual imagery, no longer are documents immobile or flat, but multi-model and experiential. Artist information behaviour is changing too, as they are broadening their definition of art materials and contexts in relation to information environments and deeper connections with scientific and technological research. (Wilson, 2003, p. 34). From digital colour generators to artificial landscapes, sources of inspiration and reference now increasingly include information technology, virtual reality, and light-based installations. McQueen’s (2019) recent research utilises Floridi’s philosophy of information to further explore the nature of information as understood from the perspective of art. Art and the experience of it helps us to interpret and understand ourselves in our pervasive information environments. As technology interrupts and interfaces our engagement with the real world (Floridi, 2014, p. 25), library and information professionals must therefore rise to the challenge of understanding individual, organisational, and environmental synaesthesia.
6. Conclusion

The research project is a journey of discovery, not just as a way to investigate theory and gain understanding, but also a personal expedition into terra incognita. Research is therefore an exploratory process, one that requires curiosity, imagination, creativity, enterprise, and no small amount of determination. (Walliman, 2018, p. 1-3). The conclusion forms the important cyclical closure for this process. While the literature review and research methods expanded the imagination, contemplation and reflection are now vital to demonstrate understanding of what was learned. The learning process does not end here however, as understanding inspires new implications, questions, and possibilities for future research. (Biggam, 2018, p. 246-247). A critical and personal reflection is therefore important for deepening understanding of the raw material of research, making sense of experience, and relating this to future theory and practice to advocate change and transformation. (Cottrell, 2017, p. 187-189).

This research project asked the question ‘in what ways is colour information?’ This was grounded by a focus of understanding the nature of information and the use of colour in artists information behaviour. The nature of the posed question therefore required an interpretive and phenomenological approach and was carried out through conceptual and visual analysis. These methods allowed the scope for richer storytelling and critical thinking through exploring philosophical concepts and describing the subjective experiences of colour and information. Before summarising findings let us first refer back to the following objectives set out at the start:

1. To identify examples of colour as information
2. To explore overarching concepts of the nature of information
3. To compare and contrast concepts of information theory alongside the visual analysis of colour in contemporary art and colour documents.
4. To establish whether concepts of colour as information can have future links to visual literacy research.
5. To contribute to the increasing dialogue around concepts of art as information in the domain of library and information science.

6.1 Research Findings

Understanding is word that appears again and again throughout this research project, and the early discovery of Bawden’s and Robinson’s (2016b) research paper undoubtedly made an impression on the direction of the rest of the research project. The heart of the research question is ultimately posed to form understanding. A deeper theoretical exploration of such shifting subjects as information and colour has been placed within context of library and information science, the result of which provides insight into colour as information and gives rise to further realms of relevant research.

Conceptual and visual analysis revealed various examples of colour as information, from the natural world, works of contemporary art, to colour order systems. A conceptual analysis that began with the question ‘What is information?’ helped to form a narrative about the nature of information. This story provided a rich context from which information and colour could be compared and contrasted. This also concluded that Floridi’s general definition of information is currently the most relevant and accessible model for library and information science researchers to gain understanding of different types of information. Furthermore, conceptual analysis allowed colour’s chameleon-like quality to settle and hover somewhere between environmental and semantic information.

Visual analysis of Olafur Eliasson (2010) ‘Din Blinde Passager’ synthesised some of the more slippery and abstract concepts of information and provides a metaphorical example of environmental information. This gave rise to further discussion about multisensory documents and the need for additional research into information and experience. Visual analysis of colour order systems positioned colour as semantic...
information, understood through Floridi’s general definition of information. Colour order systems take codified colour terms, and millions of variations in hues, and order them into meaningful documents for artists and designers. This highlighted that colour as semantic information is inexorably bound by language, and therefore raises ethical issues about the social, cultural and historical terms used to describe colour. Above all, the research has been able to pull threads of interdisciplinary literature into a cohesive narrative about our pervasive information environment and the ways in which we may understand the vibrant and multiplicities types of information that now surround us.

6.2 Limitations

While the chosen research methods allowed for richer story and the ability to formulate deeper theoretical understanding, they were strictly tied to interpretive and phenomenological understanding. Biggam (2018, p. 172) explains that interpretative research assumes that there are many, equally valid, interpretations of reality dependant on the context. With this in mind, much of the focus of the concept of colour as information was rooted in the arts, and therefore cannot wholly be separated by a particular way of seeing and understanding the world. Given the demands on time, desk research was the most appropriate means by which the most understanding and opportunity to learn was possible. The ideas and findings presented where therefore limited by the literature and could have been further enriched by extending qualitative methods. Interviewing artists about their use of colour and information during the art-making process may have provided more insight. Given all of this, the research project makes contributions to further understandings of visual information and links between art and information. Fellow researchers in library and information science may be able to use this research to find similar ideas or concepts of interest, or to challenge, unpick, explore, and enquire about the nature of information with fresh perspectives and approaches.
6.3 Future Research: Information Experience and Metaphysical Approaches to Information Theory

Through exploring concepts and clarifying ideas during the literature review, this project demonstrates that the field of information theory is a potential wellspring for applying metaphysical thinking. Artists draw information and inspiration from all aspects of the physical and interior world; further research could be done through combining fine art and practice-based research methods and using them to explore the concept of information as part of physical reality. Visual analysis of Olafur Eliasson’s art demonstrates that aesthetics, experience, and participation are intrinsically linked to how we make meaning from information. During the discussion information and experience was synthesised. With systems, technology, documents, and senses intertwining, further studies of information experience may help to provide further insight into the nature of information. Art, science, and technology need not be dichotomised into separate fields, especially since they are more closely linked in many art libraries and institutions. Holmes (2018, p. 261) rightly observes that interdisciplinary methods of interpretive and art-based research can extend our knowledge and understanding of science. Colour and art are shown as powerful semantic tools for uncovering the hidden flows of biological, environmental, and physical information. From biochemistry, thermodynamics, fluid dynamics, light, data science, there is a whole world of information itching to be visualised. Further interdisciplinary collaboration between artistic practice and information theory may help to recognise the pathic, emotional, and inceptual side to information. (Gorichanaz, 2017, p. 506). Furthermore, it would allow other ways to see and understand our pervasive sensory world and its information systems.

6.4 Future Research: Colour and Visual Literacy

“Seeing comes before words [...] it is seeing which establishes our place in the surrounding world; we explain that world with words. but
John Berger’s magnum opus ‘Ways of Seeing’ is seminal text for the concept of visual literacy and a reminder of the power of visual language in today’s information society. The principle that seeing comes before words is important for artists and their information behaviour. Information embodied in a physical system must be encountered to be a construct of reality, similarly, aesthetics is primarily defined as an encounter and can be seen as a recognisable process of sentient engagement. As this research has uncovered, artists draw colour and visual information from various different sources. As our culture grows infinitely more visual, library and information professionals will need to incorporate other ways of thinking about these kinds of information into their information literacy instruction.

Visual information prompts inquiry and discovery helping researchers to situate their ideas and inspiration into arts-based research. A greater and fuller understanding of how to use colour and other forms of visual information are empowering ways to help researchers think about ways to use them as part of everyday research processes. (Brown et al., 2016, p. 147). Material research libraries are also becoming a sight more seen in art institutions and architectural firms, and there will be a further need to understand colour theories and embed them into information literacy practice. A recent insight written by Lloyd-Jones (2019) shows how new and experimental pigments and colours are being introduced into the material library at Central Saint Martins, University of Arts, London. Practitioners in art and design experiment with a range of tactile colour materials, and this haptic process is included in a multitude of making activities. Be it a potter who works with glazes, a fashion designer who works with textile samples, or an artist or designer who works with colour matching guides. Colour as an information resource at the heart of artistic practice. (Howes and Laughlin, 2012). From physical to digital, natural to synthetic, and ephemeral to enduring colour; colour choices are also intimately tied to our planet’s present and future health, and so further research into
pigments and colour as documents, including where they come from and who is creating them, could also form interesting research. By looking at colour and materials informational potential we can shape new meanings, with positive social change, environmental, economic, and political benefits. (Solanki, 2018)

A further suggestion would be to more closely examine colour through embedded librarianship. For example, Salisbury’s (2018) recent ‘out of the stacks and into the studio’ approach allowed successful opportunities for Librarians to enter the studio environment and assess artists research methods and information seeking behaviour. By meeting with artists directly, library and information professionals may garner more insight into how information is used, and how information is experienced during artistic practice. This kind of research can therefore strengthen meaningful understanding of the multi-faceted ways colour, visual information, and inspiration shape the art-making process.

6.5 Personal Reflection

The subject of this research project has been an endless fascination to me, and one I will carry forward beyond just this project. For most of my education I have shied away from the tricky confines and rules of words, sticking to the familiar comfort of examining and describing the world through art. Over the course of studying MSc Library Science, and though completing this research project, I have gained a deeper appreciation and respect for the craft of writing. I still feel I have a huge amount to learn, but it has been a revelation to discover all the ways of looking at the world that I observed at art school are present too in written research. Ask a big question, imagine, observe, think, feel a way through the blank canvas, sketch out a form and structure, liberally apply the expressive qualities, before abstracting, redacting, and editing the words that have appeared. This process has re-imagined what I thought research was and what I am capable of. My time studying at Master’s level has taught me that research can be fun; it is creative, imaginative, interactive, and collaborative. From reading, observing,
writing, watching, thinking, deleting, redacting, chatting, combining ideas, to going on copious amounts of little ‘thinking’ walks. I have learnt that research is an active, constant, and contemplative process. I feel very lucky to have to discovered this and can take the lessons I have learnt forward within me in my career in Librarianship. Research is lifelong learning and I hope to grow, build resilience, and expand my thoughts and experiences.

I originally thought of information theory as a completely foreign concept; the construct of a cold, codified, mathematical world. Having now studied and explored the *it from bit*, I have found a wonder and excitement in the fundamental nature of information theory. Perhaps the greatest surprise of all was discovering links between concepts of physical information and the way artists draw information from nature. This is a participatory universe, and the idea that information is a thread that looms together life, nature and colour, is a revelation and rather wonderful one at that. Every little observation - the ice rings dancing around Saturn and the luminous ring around the iris of my own eye, each byzantium thread weaved in haute couture and sinuous vein of cobalt in lapis lazuli, the blueness of the sea mirrored by the big sky, each stone that washes up in the tide, every grain of sand that made the glass prism from which Newton split the sunbeam, all the facts and figments of the imagination by which we attempt to understand the world and connect with others – is connected by information.
7. References


8. Appendix

8.1 Research Proposal

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<td>A Pigment of the Imagination – In what ways is colour information?</td>
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| We live in a world ablaze with colour and saturated with information, from art and astrophysics, to textiles and technology. The aim of this project is to explore the ways in which colour is information and to use colour as an example of how we may begin to understand information experience. Despite the inescapability and pervasiveness in our daily lives of both colour and information, the concepts and philosophies of both are notoriously mercurial and may appear interchangeable across different domains. In biology and physics, it could be argued that colour exists as physical information, a result of neatly organised light, elements, and chemicals, existing whether our eyes see them or not. Psychologists may argue colour does not exist at all and be a phenomenon of the mind. (Kastan & Farthing, 2018). For artists however, the scientific nature of colour has less relevance, what matters here is what colour looks like and how it communicates feeling. (Bell, 2017, p. 125). Colour may appear integral to a material or document, it may make up the very composition of a material, or it may appear artificial, it may be applied, or it may transform the semantic or semiotic meaning or appearance of things. (Koolhaas, 1999, p. 219).

The mysteries that colour present have fascinated artists and scientists for centuries and is still today very much subject of interactive contemporary art. (Brown, 2014). From the complex subjectivity and semiotics of installation and light art, to the actinic glare of smart phones and virtual reality; colour and information now pervade our physical and post–digital lives through rapidly developing technologies, networked systems, and multi-sensory interactions. (Robinson, 2015). This therefore poses many interesting challenges for aesthetics, information theory, and visual literacy. My interest in the links between information theory and colour stems from both a personal passion and from my professional practice. On a practical level, I aid visual arts higher education students with their contextual research. Having gone to art school myself, I have long empathised with the fascination of visual information, how artists use colour as a source of information, and how they intend to communicate with it. I believe pursuing this type of research, will provide me with a foundation and deeper understanding for the information behaviour of visual artists, which is particularly important in the roles of subject librarianship.

The idea is to find out how colour can be situated within information theory. This project forms part of an emerging discourse of study about the philosophies of
information and how we come to understand concepts of information in the arts. This project will aim to build upon current explorations of these concepts, situating colour in relation to contemporary information theories and artistic practice.

Aims & Objectives

The aim of this project is to review concepts of information and colour theory and to identify the ways in which colour is information. Secondary to this, the project aims to contribute to emerging ideas of information experience and aesthetics.

This will be achieved by exploring the following objectives:

- To identify examples of colour as information and the contexts in which this may be of significance to information theory and information behaviours.
- To explore overarching concepts of aesthetics and information and the effect colour has on information/document experience.
- To compare and contrast concepts of information theory alongside colour theories. Although the bulk of literature surrounding colour will be routed in the visual arts, an analysis of conceptions of colour across different domains will be provide contrasting insights into its significance in library and information science.
- To establish whether concepts of colour as information also has links to visual literacy. This is of growing significance in our post-digital visual culture where the production of immersive and multisensory documents now merge information and aesthetics.
- To contribute to an increasing dialogue around concepts of information in the domain of the arts.

Scope & Definition

The definitions of colour explored in this research will have much of their scope focused in the visual arts. While colour systems and theory have a long-standing history from Newton to Goethe, much of the contemporary colour theories practiced and understood today in the visual arts have been developed post 1960s by Albers (2013) and Itten (1970). Further definitions of colour will also be explored in domains such as astrophysics and biological sciences, which will be important for forming critical thoughts on how we may begin to understand colour as information outside of aesthetics.

The concepts and theories of information and documentation will be strictly limited to definitions and philosophies founded in library and information science.

Research Context/Literature Review

The initial stages of this project will start by building up an analysis and understanding of the concepts of information. There are many texts and authors that explore the definitions of information, beginning with Claude Shannon and Warren Weaver. (Floridi, 2010, p. 1–2). I will lightly explore these historical concepts of information early
on in my review, but much of the relevant literature will be drawn from contemporaries Luciano Floridi, David Bawden, and Lyn Robinson. Floridi’s (2013) writings on the philosophy of information will provide the foundation. There is a wealth of literature to choose from regarding information theory, but I believe reviewing Floridi’s GDI model (general definition of information) will form an important and integral structure through which I will be able to map colour and begin to understand it through the lens of information science. At present, I have found no literature the investigates colour in information theory, however, there are a number of examples that explore art through information models. (Nake, 2012).

More recently there are emerging papers and discourse that look at semiotic analysis of information, as well as concepts of information/document experience, and the ways in which information is physical. (Bawden & Robinson, 2013) (Gorichanaz, 2017) (Robinson, 2014) (Thellefsen, M., Thellefsen, T. & Sorensen, 2018).

The second stage of this project will look at literature surround colour theory, much of which I will be able to source from visits to the Colour Reference Library at the Royal College of Art. The span of literature around colour is extensive, ranging from historical and contemporary, to practical and theoretical. Current research and knowledge production in the visual arts is led through practice-based methods (Borgdorff, 2010, p. 55-58). Analysis of literature such as Gsollpointner, et al. (2016), as well as a research trip to ‘Olafur Eliasson: In Real Life’ retrospective exhibition at Tate Modern, will form a strong context to discuss colour in immersive and interactive art projects. This fulfils some of the objectives set out earlier and will in part help to answer the research question and why it is relevant for library and information science.

Methodology

The most appropriate methodologies for this project are desk research and visual analysis. The desk research will be integral to the analysis of both information theory and colour theory. Conceptual and philosophical analysis will be adopted and are a highly suitable approach for this project. As Bawden & Robinson (2010, p. 316-317) explain, they from the most theoretical form of desk research, but are invaluable for setting out the analysis and clarification of terms, concepts, and issues within information science.

A historical analysis of colour theory will also be important, as this will provide the opportunity to chart how concepts of colour have changed, and the importance colour plays today as both information and aesthetics in contemporary works of art and multi-modal documents. Secondary to this will be visual analysis, a common methodology in the visual arts that employs principles of visual literacy, providing the scope to read and unpick the semiotics of images. (Ledin & Machin, 2018, p. 15-37). This method will be particularly useful after visiting Olafur Eliasson’s retrospective at Tate Modern, whose installation and light art is immersive and experiential. The method will provide compositional interpretation and will be needed to solidify the
subjectivity of colour and build the context for ideas on information experience and aesthetics. (Rose, 2016, p. 56-66).

**Dissemination**

The opportunities to blog and use Twitter during the course of CityLIS have been invaluable during the course of my research. I aim to extend the opportunities provided by this supportive network by using Twitter and Instagram as platforms for disseminating work-in-progress. The use of social media will provide opportunities to blog, feel out ideas, seek council, and gather feedback from peers. I hope this will also promote interest in my studies as well as advocate the wider discourse and research that surrounds CityLIS.

In anticipation that this research project is successful and produces relevant research to add to the dialogue of information theory, I will aim to contribute it to the collection of open access documents on CityLIS Humanities Commons.

Concepts and philosophies of art, colour, and information have grown to become a passion area of research for me, and I foresee that after the completion of the dissertation, the research will inform not only my professional practice, but also my artistic practice. I hope that this could be used as a foundation for any practice-led research I may carry out in the future.

**Workplan**

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<th>May</th>
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<td>13/05/2019</td>
<td>Stage One: Literature search</td>
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<td>13/05/2019</td>
<td>Stage Two: Analysing information theory</td>
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<td>Stage Three: Analysing colour theory</td>
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<td>Visits to Colour Reference Library</td>
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<td>Visit ‘Olafur Eliasson’ at Tate Modern</td>
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The workplan set out gives relative flexibility and time to explore the intricacies in the philosophies and concepts that arise by nature of this project. I believe it will allow me the time to reflect and gain understanding, as well as allow for some creativity and serendipitous discovery, which I find important to the way I work and write.
I intend to use the month of June to carry out the literature search, giving myself a good amount of time and flexibility for discovery, but not too much as to get overwhelmed by material.

The second stage of the workplan is to spend July to mid-August analysing the literature on information theory and Floridi’s GDI. This time will be spent understanding, reflecting, and notetaking on discoveries and analysis.

The second stage will steer the direction of the third stage in mid-August to September, which will involve analysing colour theories and visual analysis of art works. This period will also coincide with visits to the Colour Reference Library at Royal College of Art and a visit to ‘Olafur Eliasson: In Real Life’ at the Tate Modern.

Having gathered extensive information and a wide generation of notes from the first three stages, I will use these from October to compile concepts and findings, with the aim of finishing the writing process mid-December. From this point, I aim to give myself enough time to review and amend any necessary changes before the submission in January.

**Resources**

Textual resources and printed materials for this project will largely involve seeking relevant information from web and libraries. The majority of printed and electronic material will be accessed from City University Library, through my employment at West Kent College LRC and University of Kent Libraries.

Outreach to the Colour Reference Library at the Royal College of Arts will form a major source point for resources on colour theory. There may also be hardcopy materials sought and accessed through other London art schools, universities, and libraries during the project.

Visual resources for this project will involve visiting art galleries and museums in London and the UK. I intend to visit a major retrospective of Olafur Eliasson at the Tate Modern in July and expect to gather photographs, visual materials, and notes for visual analysis during this visit.

As I live in Kent, there will be travel expenses to visit London libraries, galleries, and museums. So as not to affect my research, I will factor these expenses accordingly into my personal budget on a monthly basis.

**Ethics**

There are no human participants required or involved in this research project, and so an external ethics committee will not be required. During the course of the desk research and visual analysis, it is not anticipated that sensitive, confidential or personal information will be viewed. This research may involve the study of blog posts,
artworks, and social media postings. There is no risk that obscene or illegal material or documents will be accessed for this research.
I can confirm that this project will abide by City University’s guidance and I will work hard to produce original and imaginative research. I will actively strive to avoid academic misconduct and plagiarism by giving myself plenty of time for reflection, paraphrasing as much as possible, and utilising reference management software to provide consistent and standardised citations and referencing during all stages of the dissertation.

Confidentiality

Due to the philosophical concepts and chosen methodology of this proposed research project, I do not foresee issues regarding confidentiality to arise. The literature reviewed will be available as published, accessible works. Photographs taken during visits to libraries, galleries, museums or archives and subsequent works of art that will be analysed will be appropriately credited and referenced. This research is largely philosophical and conceptual in nature, and so external participants or disclosures of any kind will not be required in the process of completing this research. There will be no use of confidential material. Communications to organise visits to Colour Reference Library, or any other London libraries, will be open, professional, and polite, and will be documented for evidence.

References


8.2 Reflective Blog Post – 13 August 2019

The following blog post was published on author’s personal blog and formed a reflective part of the visual analysis research method. The original post can be found at https://boyinaseaofbooks.com/2019/08/13/pigment-of-the-imagination.

I am currently undertaking my dissertation titled ‘Pigment of the imagination: in what ways is colour information?’. We live in an age of multiple, overlapping ‘informations’ and there is a growing dialogue in the field of LIS on the concepts of information across different domains. (Janich, 2018). In library and information sciences the philosophies of information have a particular focus on communication and semantics. (Ibekwe-SanJuan & Dousa, 2014). Colour, which is semiotic by nature, is integral to artistic research, practice, and communication, and through this research project I hope to understand it is a form of information. Perhaps it is the artist in me too, but I have always been fascinated with colour and the cadences of the senses, and since I started the MSc I have been drawn to the idea of what information means within the context of visual arts.

As part of my own research it felt necessary to carry out some visual analysis to explore these ideas. It will also help me to understand and find any links with the philosophies of information science, colour theory, and aesthetics. I could therefore not have asked for a sweeter treat than the Olafur Eliasson retrospective at the Tate Modern. Eliasson is widely known for his interactive socially engaged art and for exploring the signals and flux of the natural world; all the while twinkling in multi-colours like the jewelled wrappers from a box of quality street. (Godfrey, 2019). Smoke and mirrors aside, ‘In Real Life’ is an important retrospective and full of intriguing ideas relevant to LIS, from immersive experiences, documenting ephemerality, phenomenology, and revealing the vital documentary and studio processes that are an important part of practice-led research.

The first time I saw Eliasson’s work was on a school trip back in 2003. I still remember the awe of standing under the ambient faux-sun of ‘The Weather Project’, the calescent colour limning the turbine hall in amber. Returning to this retrospective filled me with that same giddy schoolboy wonder I had felt over a decade ago; art meets science,
technology, and illusion. Din Blinde Passager ‘Your Blind Passenger’ 2010 was a colour work that especially stood out and got me thinking more abstractly about information, experience, and aesthetics. The installation forms a long, narrow corridor where visitors are temporarily blinded by a brightly illuminated fog, requiring them to rely on other senses to orient themselves. Stepping into the stark white mist I felt excited and afraid, immediately I thought of Stephen King’s novel ‘The Mist’. The power of the threshold should not be underestimated here in terms of creating the experience. The moment I walked through the door I was instantaneously transported into something transitory, metaphysical, and even a little sci-fi. All sense of direction and perception was lost becoming an information black-out with no point of reference other than colour. Moving forward the fog began to change, tinging slowly from powder white, flesh peach, to ochre yellow and through to the densest burnt orange. Bathing in the rusty atmosphere felt uncanny, like I was walking on Mars or through the atmosphere of an alien planet. The strangeness was marked with happiness and laughter too, not just because I could not help but smile as people bumbled past each other in a daze, but because of the overwhelming warmth the colour evoked. Like the warmth of laying under a summer sun with my eyes closed, or the feeling of being embraced by a loved one, this was a powerful and evocative use of colour.

Clearly this work is a highly subjective example of colour, my reaction to it based on my own social, cultural, and personal experiences. However, if colour can communicate an emotion, summon a memory or delight a sense, is that not then informational by nature? Eliasson’s work is interesting in that it draws this tension between feelings and facts, the invisible and communicative, and the mental and physical. During my literature search I have found a pool of interesting texts on information as a physical and fundamental aspect of the universe, information appears to be just everywhere! The physicality of information is an interesting idea in relation to colour; what is the difference between the orange colour of a star, a traffic cone light, and Eliasson’s ‘Your Blind Passenger’? The colour a star emits can indicate the complex alchemy of chemical elements present in the atmosphere, the traffic cone light beams a warning or a indicates a barrier, and the work of art is a subjective and personal experience. All are sources of colour, but what are the distinctions between them being physical, informational or purely
aesthetic? Other questions also spring to mind, how do we construct meaning from the perception of colour? How integral is colour to the way we experience documents? Are all aspects of colour well-formed and processes of communication? How is information theory understood in art and semiotics?

The course of reading literature for the dissertation has been like opening Pandora’s box, each time I begin to think I am understanding and starting to answer my research question, the curiosity of engaging with research unleashes a hundred more questions. I will be carrying out a more detailed visual analysis in the dissertation itself, and to help me find my focus I will also carry out a conceptual analysis of Floridi’s General Definition of Information. The next update will coincide with a visit to the Colour Reference Library at the Royal College of Art. I will be looking at more conventional forms of colour information from colour charts and taxonomies, to colour theories and models.

References:

