Virtual-Actual:

A non-dualistic investigation into the effects of light on surface in a 3D digital space

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Abstract

My practice-led research investigates the interplay of light and shadow on surface in a 3D digital environment. The research examines this algorithmically determined space that provides opportunities to explore photography within this unique 3D digital realm. My research operates on the peripheries of traditional photographic practices, the photographic images are generated in the 3D digital software and rendered as large scale digital projections and screen images. The research primarily resides in recognising and foregrounding the fundamental agency of the computer as a photographic apparatus.

Virtual-Actual is the title of a series of photographic images that uses software processes to enable practice-led research that aims to transcend binary oppositions and open non-dualistic interpretations of photographic images. The terms Virtual and Actual are borrowed from Henri Bergson (1912) and Gilles Deleuze (1988) to describe two essential states that are inexorably entangled. *Virtual-Actual* is a title that suggests a unison of interdependent states that requires non-dualistic approaches. This is articulated through both the method and the methodologies of the research. The research critiques dualistic models that are expressed in different ways in each part of the thesis. Throughout there is a decentring of the photographer that allows for multiple agents to be acknowledged and recognised through creative and thoughtful processes.

My research explores the complexities of spatial and non-spatial multiplicities that lie at the heart of the work *Virtual-Actual*, achieved through the unifying nature of the digital image. This is interpreted though subtle use of tone, hue and intensities to open perceptual experiences that operate across and through the virtual and actual. The research proposes an alternative approach to established temporal notions of the photographic and interrogates the inner time of duration and the connected method of intuition.

Virtual-Actual is a unifying project that connect my thesis and practice through thinking and making, opening a way of perceiving spatial and non-spatial photographic images.

Acknowledgements

TABLE OF CONTENTS

1. Introduction

Virtual-Actual is my practice-led PhD research project investigating the interactions of light, surface, and objects in a 3D digital environment. The visual methods for my research, which explores the intersections of light and shadow on surfaces, is practised within the digital environment of the computer using specific 3D software. This algorithmically determined space provides the creative potential for exploring non-human agents in co-creation and co-production with human agents. My research questions have evolved iteratively as the research has progressed and revealed new possibilities. Central to my research is the question:

Can light generate photographic images on surfaces in a 3D algorithmically determined environment through non-dualistic agency?

A guiding principle for my research is photography's ability to reference itself. That is, photography as a self-determining process. Treating photography as an exploratory process recognises and embraces the agency of photographic technologies that offer the potential to create images that speak directly to the aesthetics of these technologies. This creates unique possibilities not to approach photography as an external creative tool but rather to actively co-produce with the system to make photographic images that are driven by the impetus of assemblages.

Virtual-Actual is a research project that explores and interrogates binary oppositions to reveal the potential of non-dualistic conclusions through theory and photographic practice. Virtual and Actual are terms borrowed from Henri Bergson (1988) whose philosophical writings feature throughout my thesis. Bergson's proposition of the Virtual is an idealist concept. The Virtual is the field of potential that precedes actualisation: a force that is real, but prior to perception. Bergson's philosophy places time over space and harmonises mind and matter. The Virtual and Actual in the context of my research represents a process that is an indivisible and inter-dependent whole which I represent using the hyphen in *Virtual-Actual* that unifies these dualistic concepts. The Virtual, in the context of my research, is not referring to 'virtual reality'

(where computers and software are used to create a simulated version of the world), rather it is used to describe a process that explores how light, shadow, intensities, hues and colours coalesce to generate non-figurative images that result in ineffable perceptual experiences.

My research project has grown from my consistent and continuing fascination with the interactions between light, object, and surface. This field of exploration has been constant from the beginning of my practice as a photographer. The still life has also, through different exploratory iterations, featured consistently in my photographic work; more specifically, the action and reaction of light on the surface of things. At the beginning of my research, my interest in light, object, and surface was articulated through a specific interest in visual illusion that formed the initial inspiration. This interest in visual deception resulted in the creation of images that were expressions of visual trickery. I touch on this more specifically and in more depth on page 19 of the thesis through my discussion of *Trompe L'oeil* painting. Of interest to me in the early stages of my research was the intersection between what we see and how we perceive: images that cast doubt on the veracity of our senses. In my previous photographic work, this has been articulated through visual depth, or lack of depth, and perspective, or lack of perspective. *Virtual-Actual* explores an alternative understanding of what we perceive as illusion. Rather than illusion being interpreted through dichotomies of visual truth or falsehood – reality or deception – it can, instead, be simply the experience of absolute and pure sensory data; images that we perceive in the immediate interpenetration of memory and the present. This investigation has led me to philosophical concepts that can contribute to questions of what constitutes instantaneous perception. These philosophical questions are explored across all three parts of the thesis.

Methodology

In the early stages of the research, I drew extensively from the phenomenological writing of Maurice Merleau-Ponty, specifically his seminal book *Phenomenology of Perception* (Merleau-Ponty, 2002). This provided a theoretical underpinning of my

initial research that was primarily more concerned with optical depth, perspective and illusion. This continued as a methodology during the early stages of my research prior to its transition into the 3D digital space. Merleau-Ponty's contribution to the field of phenomenology and perception is undeniable, particularly his notion of intersubjectivity and embodiment, and his non-dualistic approach to an understanding of human experience. During my research, however, I became increasingly sceptical of his phenomenological approach. Merleau-Ponty's phenomenology seems to lack sufficient insight into the temporal element that is central to my research. It also lacks adequate explanation of the dynamic interactions of lived experience beyond embodiment. The psychical constituent of my research became an increasingly important aspect of my thinking and understanding. As the research progressed, the writing of Henri Bergson (1859-1941) and Gilles Deleuze (1925-1995) increasingly began to shape and reshape my thought processes. The insights from these philosophers have paved the way for a fresh understanding of perception that resides more appropriately in the context of my research. This has helped me to position my approach to, and understanding of, images that hold the key to unlocking a deeper comprehension of time. Bergson's work acts as a portal to a novel temporality of the photographic image that transcends the conventions of spatial time. Furthermore, it moves beyond the traditional subject-object oppositions and begins to reveal the truly monistic concept of the image that privileges it as a fundamentally unifying entity. This approach enables a reimagining of how images function and their deep connection to time in their making and in their perception, offering a more cohesive conceptual framework that enhances the theoretical underpinnings of my research.

My research therefore explores the intricate connections between visual imagery and corporeal reality. Traditionally, the photographic image has been treated as either a 'window onto the world' that offers glimpses into things beyond it, or as a mirror that reflects the social, and its associated cultural norms. Neither of these speculative approaches are appropriate to my research. *Virtual-Actual* is concerned with the process of photography itself. In the context of my research enquiry, it is a process that is concerned with what the image *is* as well as what the image *does*. My research has been influenced by artists who have placed process at the heart of their practice. The work of Gottfried Jäger who is considered as the pioneer of concrete and generative

photography, has provided insight into the internal nature of the photographic process, concepts I explore in more detail on page 29 of the thesis. I also draw from the work of Josef Albers, in particular his experimental visual work on the *Interaction of Colour* (Albers, 1971) that accompany his book of the same name. Albers' work is discussed on page 89 of the thesis. The work of William Henry Fox Talbot and artists such as Ad Reinhardt, Thomas Rüff and Hiroshi Sugimoto are also discussed in the thesis. All these practitioners share a common interest in the image as a process, where the image extends beyond the abstract to becomes self-referential: images about images.

Intuition as a methodology

Virtual-Actual is a research project that insists on an alternative relationship with the image, one that enables a 'sympathy' with the image itself. I therefore pursue a more speculative inquiry of the photographic image, where images can be experienced from with-in. This is discussed in depth in part three of the thesis. Henri Bergson offers valuable insights into how this question might be approached through his method of intuition.[1] Intuition offers a way of exploring the process of inquiry not from the perspective of subject/object, but through adopting a position of introspection. Bergson theorised intuition as an uncomplicated experience of 'sympathy'. Through this unique form of intellectual engagement, one places oneself within an object, aiming to coincide with its intrinsic essence – something that defies expression through ordinary language. In other words, intuition allows us to penetrate the inner being of an object, grasping its ineffable and singular qualities. Intuition, as a method, calls into existence the conscious making of time (duration) to unfold and present absolute perceptual experiences. In fact Bergson makes this irrefutable link clear: 'to think intuitively, he says, is to think in duration' (Bergson and Andison, 2007). In the context of my research *Virtual-Actual* acts as a portal into an intuitive understanding of the image. This is understood as the experience of a certain reciprocity between the projected image and the body as image. The characteristic subtleties of intensity, tone,

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[1] Deleuze (1998) recognises Bergson's technique of intuition as a 'fully developed method, one of the most fully developed methods in philosophy' (p13).

colour and hue, as well as the reflective qualities of the images within a specific environment contributes to this connection.

Bergsonism: the Virtual-Actual condition

Throughout my research I draw extensively from the philosophical insights of Henri Bergson to help theoretically articulate my research enquiry. Over the past decades there has been a renewal of Bergson's ideas, initiated in the 1980s by Gilles Deleuze's important appraisal of his contribution, *Bergsonism* (Deleuze, 1988). Interest in Bergson's contribution has continued throughout the past three decades to the present through the writings of Keith Ansell-Pearson (2018) and Suzanne Guerlac (2006) who have helped to resurface Bergson's philosophy during a period when the concept of materiality has been under scrutiny, not least more recently by academic interest in New Materialisms. Bergson's voice features strongly throughout the thesis. His hypotheses are vital in the context of this thesis not least because of his insistence that matter is a concept, and objects in the world that we perceive as matter, should be understood fundamentally as images:

> [By] "image" we mean a certain existence which is more than that which the idealist calls a *representation*, but less than that which the realist calls a *thing* – an existence placed halfway between the "thing" and the "representation." (Bergson, 1988, p9)

Bergson's notion of images is not limited to visual perceptions; it encompasses the entire material world and its interactions. The body for example is considered an image amongst other images, albeit a rather privileged image and the centre of action. Bergson's images are, therefore, a unifying idea that bridges the gap between subject and object, perception and reality. *Virtual-Actual* contributes to this unity by exploring the link between the psychical, expressed through qualitative nature of our experience of time, and the physical as a quantifiable condition of space.

Bergson is considered, amongst others,[2] to be a 'Process' philosopher who is concerned with multiplicities and the non-spatiality of experience. Process philosophy is opposed to the tendency in traditional philosophy to concentrate on matter, which is static and concerned with the 'what' and 'where', the 'this' and 'that' of things. Process philosophy instead reveals the potential for a temporal flow of perceptual experience. Bergson makes a major contribution to this thesis through his concept of 'Duration' (1912) which I interpret as our non-spatial inner experience of time that is linked directly with memory. Bergson's process philosophy informs the methodology of my research enquiry, where creative activity is a process in and of itself. It therefore helps to articulate both my field of thinking and of practice. The process that generates image as immediate data, gives rise to perceptual experience that extends beyond intellectual understanding (an activity that Bergson deems spatial and therefore fixed). Bergson expresses the relationship of the virtual and actual as a dynamic process, like the recollection of a memory that can be summed up through his use of his now well-known metaphor to describe this process:

> *Whenever we are trying to recover a recollection, to call up some period of our history, we become conscious of an act 'sui generis' by which we detach ourselves from the present in order to replace ourselves, first, in the past in general, then, in a certain region of the past – a work of adjustment, something like the focusing of a camera. But our recollection still remains virtual; we simply prepare ourselves to receive it by adopting the appropriate attitude. Little by little it comes into view like a condensing cloud; from the virtual state it passes into the actual; and as its outlines become more distinct and its surface takes on colour, it tends to imitate perception.* (Bergson, 1988, p134)

Bergson teats the virtual and actual as interchangeable states. To expand on his analogy, the camera can also be defocused, and the condensing cloud can return to

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[2] The other preeminent process philosopher is Bergson's contemporary, the English philosopher Alfred North Whitehead who asserted that reality consists of processes rather than material objects, not fixed things but a system of dynamic change independent of space and conventional understanding of time. Whitehead, A.N., (1929). *Process and Reality*. New York: Macmillan.

vapour, the process of virtual to actual is not fixed, but open and dynamic. My research is informed by this in-between state of flux and change which I repeatedly return to this concept throughout the thesis.

3   My research as a photographic practice

Positioning my research.

Throughout my thesis I refer to my research as photographic practice. By way of positioning the work within the discipline of photography, I am using the term photography in its most essential condition, taking literally the etymology of photography as 'writing with light' to describe my practice in this specific digital space. I expand on this in part two of the thesis. To understand photography as a purely technical practice, however, would be to underplay the immense impact the medium has had historically and culturally. My research is not an investigation of photography within a specific sociocultural field and therefore does not draw extensively from traditional and established photographic and cultural theory. It does, however (at points throughout the thesis), reference relevant historical and contemporary practices and draws from specific photography theorists to enable the work to be positioned within the field of photography and photographic practices. As outlined in the introduction to my thesis, my approach to research is through the practice of photography within the technological realm of 3D digital environment. Traditional photographic processes were born out of early experiments with optics and chemistry, specifically the developmental and exploration of how chemicals involving silver salts were applied to paper to make it sensitive to light. Further chemical processing then enabled the processing of the silver halides that had been exposed to light to turn black, enabling an image to form. This process of chemical experimentation with light sensitive materials became increasingly sophisticated throughout the 20th Century. The technical development of photography has since its inception been in a continuous state of flux, however, the link between the chemical and mechanistic processes of

traditional photography and the processes of the digital photographic image can, arguably, be said to be broken.

Digital photography developed separately from these chemical-based technologies of so-called analogue photography. Digital photography has its roots predominantly in computing, computer engineering, electronics, and video imaging.[3] It follows then that any contemporary reference to the development of photography as a chemical-based medium, though relevant, is tenuous as they developed from different roots. The more recent term 'post-photography' attempts to make this distinction. Rather than post-photography referring to the photography after traditional photography, it treats digital photography as an entirely different medium. Digital photography becomes part of an expanded field of imaging, able to cross boundaries and occupy shared territories.

In November of 2019, I was invited to present my work at an International Conference titled 'The Post-Photographic Apparatus', hosted by Lucerne University of Applied Sciences and Arts, Switzerland. My presentation used Vilém Flusser's notion of the photographic apparatus which he refers to as a 'black box'. The black box of the photographic apparatus plays a collaborative, agential role in the programming of the photographic image. The apparatus also contributes to the programming of the photographer by setting the systematic procedures, 'programs are games' Flusser insists (Flusser, 1984, p55).

My proposition for the conference was to recognise the latent, virtual agents at play in the processes of my photographic practice within the 3D digital environment. The aim of the conference was to attempt to establish an understanding of photography that has been transformed through new apparatus, both technical and cultural. The term post-photographic that emerged in the 1990s is one that attempts to

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[3] Whilst this is the case, it must be acknowledged that the first digital camera was created by Steven Sasson in 1975. Sasson was an engineer working in R&D at the Eastman Kodak Company. The camera used an early SSD sensor to capture the image. The camera used magnetic cassette tape to record the image. Though patenting many inventions in the digital camera development, the camera was not developed further by Kodak. Sasson commented "They were convinced that no one would ever want to look at their pictures on a television set." Estrin, J. (2015) *Kodak's First Moment*. The New York Times: New York Time. Available at: https://archive.nytimes.com/lens.blogs.nytimes.com/2015/08/12/kodaks-first-digital-moment/ (Accessed: 29.08.23 2023).

provide a new space to understand photography in its more expanded field.

The presentation of my paper at the International Conference in Lucerne signified a pivotal moment, marking a transition from understanding photography as merely a medium of capturing light to recognizing it as a complex interplay of technologies, perceptions, and creative practices. The shift towards a post-photographic era, as conceptualized by delegates at the conference, allowed me to re-evaluate the very essence of the photographic research I was presenting, urging me to explore the medium beyond the conventional boundaries set by its historical lineage. It is within the context of this transformation and questioning that my research is situated, delving deeper into the realm of what constitutes multiplicities of photography and how photographic images can be experienced. I will therefore provide, in the following section, a critical examination of the post-photographic condition, where the boundaries of the image are continually reimagined and redefined.

Postphotography

Andrew Dewdney has made a significant contribution to the intersections between photography and technologies, not least through his instigation of the Centre for the Study of the Networked Image that has brought researchers together who share an interest in exploring the links between art, media and technologies. In his recent book *Forget Photography*, Dewdney (2021) claims that in order to recalibrate our understanding of contemporary photography within the digital realm, we need to 'forget photography' and accept that the 'mathematical logic' of computational images has totally disrupted established culturally codified meanings of the image. According to Dewdney we must recognise that 'photographic discourse now conceals more than it reveals about the state of culture, society and the agency of the image'(Dewdney, 2021 p12). Following the advent of photographic production operating within the digital realm, what remains of our former understanding of photography and the photographic is, according to Dewdney, the 'afterlife of photography' (p12): a zombified version of its former self, a state somewhere between being both alive and

dead, present and non-present. Dewdney and others stress the need to 'unthink' photography and provide new conditions for the image and a new mapping of its histories. Dewdney adopts the term 'networked image' (p13) that situates the photographic image within computational systems. [4] This is informed by Daniel Rubinstein and Katrina Sluis' (Lister, 2013) attempt to situate photographic representation within the so-called 'algorithmic turn' (p25): Rubinstein and Sluis recognise photography as computational process

Actual-Virtual is research that is informed by these insights and has emerged from an investigation of a photographic process within a 3D digital space. As such it is, therefore, inappropriate to impose codified or semiological/linguistic reading onto the images; effectively the chains of signifiers have been broken. As Rubenstein and Sluis have proposed,

> Because the image is not given as meaning to an existing audience
> but establishes the idea of audience by demanding participation, a
> certain reversal is taking place: it is not the human subject who
> receives a ready-made image but the image that makes (or
> unmakes) the subject (p33)

The process, operating exclusively within this algorithmic space with no external referent, recognises that the images are not indexically linked to the world; neither bound to the world or cultural systems, they are images that reference only themselves and the computational system, images not 'taken' but 'made.' Here, by using the word made, I am referring to the co-creation of the images between myself and the computer, its software and other contributing agents. My early experiments in the 3D digital space utilised material planes and forms as subject matter, directly exploring the action of light on 3D digitally generated geometric forms.

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[4] Dewdney here subverts the title of Victor Burgin's highly influential seminal book, *Thinking Photography* (1982) that encouraged and inspired a generation of photographers and cultural theorists to interpret photography and photographic representation through highly codified linguistic, political, and culturally specified means.

As my research has developed, references to defined forms become progressively less defined, and the anchor to any reference more tenuous. In the later work such as *XI-1-2* (2022) – see figures. 21 and 22 – shapes and forms give way to more nebulous images, produced as the effects of shadows (created by the trace of digital objects that were removed from the final rendering process) have lost their reference to the raw data of the system.

As Rubenstein and Sluis have observed, when not conforming to indexicality, 'the image is both formed and deformed at the same time through the agency of computation' (p29). The networked image is unfixed and lacking location, 'both formed and formless, both finite and infinite, both rational and irrational' (p36). According to Rubenstein and Sluis, 'each packet of data the image carries is inscribed with its own time frame, its own "time to live" (TTL), its own internal duration'. [5] The networked image seems to exist outside of time, coming into existence in locations where the image is actualised on screen.

The current phase of the post-photographic not only challenges but also redefines the boundaries and essence of photography in the digital era. The insights I gained from the International Conference on 'The Post-Photographic Apparatus' and the engagement with thinkers such as Vilém Flusser were pivotal in shaping a more coherent understanding of photography's futures. As my practice is embedded in this concept of the post-photographic, a digital practice devoid of external referents, it is imperative to examine how the digital transformation has altered not just the technical aspects of photography but it's very conceptual underpinnings. This shift towards viewing photography through the lens' of computational processes and the networked image signals a profound departure from traditional photographic methods and theories. In this context, Andrew Dewdney's provocations in *Forget Photography* serves as a critical moment in the development of photography that prompts a re-evaluation of what photography has become in the digital realm. An invitation to navigate the 'afterlife of photography' underscores a need to reassess our theoretical and practical

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[5] Time to Live (TTL) quotation taken from *Cubitt, S. (2011) 'Time to Live', ISEA International Symposium Proceedings, San Francisco, CA: Leonardo. Available at: www.leoalmanac.org/wp-content/uploads/2012/04/ISEA_proceedings-sean-cubitt.pdf (accessed 4 September 2012).*

approaches to the medium in a world where the lines between the creator, the viewer, and the image have become increasingly blurred.

Soft Imaging

The development of my research has charted a transition from established photographic practices – dominated by the physicality of the camera and the physical objects of its observation – to the dynamics of the digital space, which is defined by the internal interactions of the machine and software. The mechanisms of photography, notably the camera and other traditional photographic devices (along with chemical-based processing), have all but disappeared from mainstream photographic image making, giving way instead to electronics and software processing. Through the shift in digital imaging and the photograph as a screen image, the notion of the still image has become questionable.

Hoelz and Marie (2015) insist there is now no difference between the still and moving image and that the perspectival principles that the photographic paradigm was based on are now not relevant. Photography has made the shift from geometry (optical) to algorithm (digital), from projection (perspective) to processing (data).[6] Photography no longer has a direct relationship with the world but instead has 'synchronic data-to-data relationships' (p4). Hoelz and Marie propose that the photographic image is not just part *of* a programme but actually *is* a programme, a programme that is based on its own 'operational code': they term this the 'softimage'. Algorithms become the governing factor of the user interactions on the screen, according to Hoelz and Marie:

> '[T]he algorithm does not proceed the image, but instead is part of
> the image, thus we can no longer separate the image from the
> interface, representation from computation, sign from signal.'
> (p74).

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[6] Hoelz and Marie assert that projection is now both shared by film and photography. As digital image, photography has been decoupled from its static state as print.

As photography bursts free from its spatial and temporal confinement as a still image, Hoelz and Marie seek to pave the way for a new temporality of photography, a new *photographic now* that exists as an endless looped present. Therefore, it should be noted that a digitally screened or projected still image is never still, but in a constant state of renewal through the refresh rate of the image being screen or projected.[7] Effectively, the image is 'only the optical illusion caused by the display of a continuous signal' (p38). The image coincides with the screen as its display platform which then becomes its form. The image shifts from being a still reproduction to becoming a dynamic image determined by the technologies and the effects of its display: the image *is* the screen, and it appears not *on* screen but *as* image-screen.

The screen has become my primary space of image creation and production: a darkroom and a studio in one (photographic workspaces that were previously clearly defined are now conflated into a single digital realm). This has significant impact on the making of the work and how it is experienced which I will now discuss further.

The 3D studio as an experiential practice space

An important consideration in the positioning of photography within my research is my own history and experience as a photographic practitioner. I bring to this digital space a personal history, experience and expertise of analogue photographic practices and methods, working in and with photographic spaces and resources and directly experiencing how it 'feels' to be making images in spaces and its visceral operations. The physical studio can be a place where objects are collected and stored, it is also the space where the work is first encountered. In the 3D digital environment of my research practice, this translates into the acquisition of digital object and assets that reside in the digital realm of latent or potential images. The act of engaging in the process of photographic practice is often overlooked when photography is inspected

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[7] This is determined by the refresh rate of the screen or projector, generally above 60Hz will provide an image that appears still.

entirely through cultural and socio-theoretical lenses. The experience of working in physical studio spaces as a studio photographer unsurprisingly has a direct influence on how I work within a 3D digital studio space. Experience of working with light, objects and materials in physical spaces translates well into the spatial realm of the 3D digital environment. Working in a studio space within the 3D software interface has similarities to working in physical spaces, albeit within a very different yet familiar environment. In his article, *The Function of the Studio*, Daniel Buren (1979) discusses the artist studio, describing it as a particular place of production. He writes, 'The work is made in a specific place which it cannot take into account. All the same, it is there that it was ordered, forged, and only there may it be truly said to be in place' (p53). The studio, for Buren, is its own domain: it should be a private space and out of bounds for the public or other interested parties, a place of production not a place for consumption. The digital 3D studio I operate in, however, is a solitary studio practice space but a space of co-creation and co-production, I treat it as an exploratory environment, a space/place for open collaboration of human and nonhuman agencies.

Virtual-Actual recognises the importance and value of an intuitive approach to practice-based research. It is research that is experiential through the action of making and experimenting with the process of perception in the space. In the 'Concept of Flow' (Snyder and Lopez, 2002), Nakamura & Csikszentmihalyi consider 'Flow' to be attention to the present; Nakamura & Csikszentmihalyi observe that 'The passage of time, a basic parameter of experience becomes distorted because attention is so fully focused elsewhere' (p92). Flow, like duration, is a state experienced and impossible to measure and it is easily destroyed when interrupted physically and spatially. Because flow is a state of mind it is essentially an inner experience and one that has become, for me, a significant feature of working in the 3D digital space and experiencing the work in actual space.

4. Research beginnings

Trompe L'oeil Painting

The initial inspiration for my research project was an interest in 17th Century *Trompe l'oeil* painting. Most succinctly, *Trompe L'oeil* might be described as a historical sub-genre of still life painting; they are paintings where according to Norman Bryson:

> 'Things present themselves as outside the orbit of human
> awareness […] it is as if we were seeing the appearance the
> world might have without a subject there to perceive it.'
> (Bryson, 1990, p140-143).

The use of light and shadow in these paintings is different and captivating. They are born of a light that Jean Baudrillard (1990) suggests is 'mysterious' where 'something other than the sun shines on these objects, a brighter star without an atmosphere (p62). Baudrillard describes *Trompe l'oeil* painting as occupying a different universe, one 'without horizon or horizontality' (ibid). The *Trompe L'oeil* is therefore the result of a particular approach and technique through painting, a visualising process that extends beyond the mere representational. *Trompe L'oeil* painting is determined by its ability to deceive the eye, its capacity to borrow from the three dimensional world which is then reduced to almost complete flatness, a two-dimensional surface, that according to Ferretti (2020), we perceive only unconsciously.

In response to this, my research began to investigate specifically how a two-dimensional surface can depict objects in a way that suggests three-dimensionality, by providing a sense of depth by exploring techniques of the interactions of light and shadow. *Trompe-l'oeil* painting inspired my research through playful trickery where two and three dimensions became, at least temporarily, interchangeable. This was in response to my initial research question:

In what way can multiple viewpoints and perceptual shifts in perspective generate within the embodied beholder, a sense of illusion in physical spatial contexts?

My initial explorations produced images of graphic shapes that introduced the notion of suspension and gravity inspired by Juan Sánchez Cotán's painting titled, *Still Life with Quince, Cabbage, Melon, and Cucumber*, c. 1602 (see Figure 1).[8]

Figure 1. 'Quince, Cabbage, Melon, and Cucumber,' oil on canvas by Juan Sánchez Cotán, c. 1602. San Diego Museum of Art, gift of Anne R. and Amy Putnam

The shift to a 3D digital space

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[8] Cotan's painting has inspired visual interpretations by a number of contemporary practitioners, specifically Ori Gersht's spectacular, durational slow-motion video 'Blow Up' (2007).

My early research began by exploring some of the basic graphic elements of the painting. The notion of suspension and the stillness of these suspended items in the painting was of particular interest to me. The shadow blackness and what seems to be an infinite void in the painted space was also fascinating. I began by creating and photographing constructions using card to build vertical planes that were placed at different distances from the camera to create illusions of depth, Figure. 2.
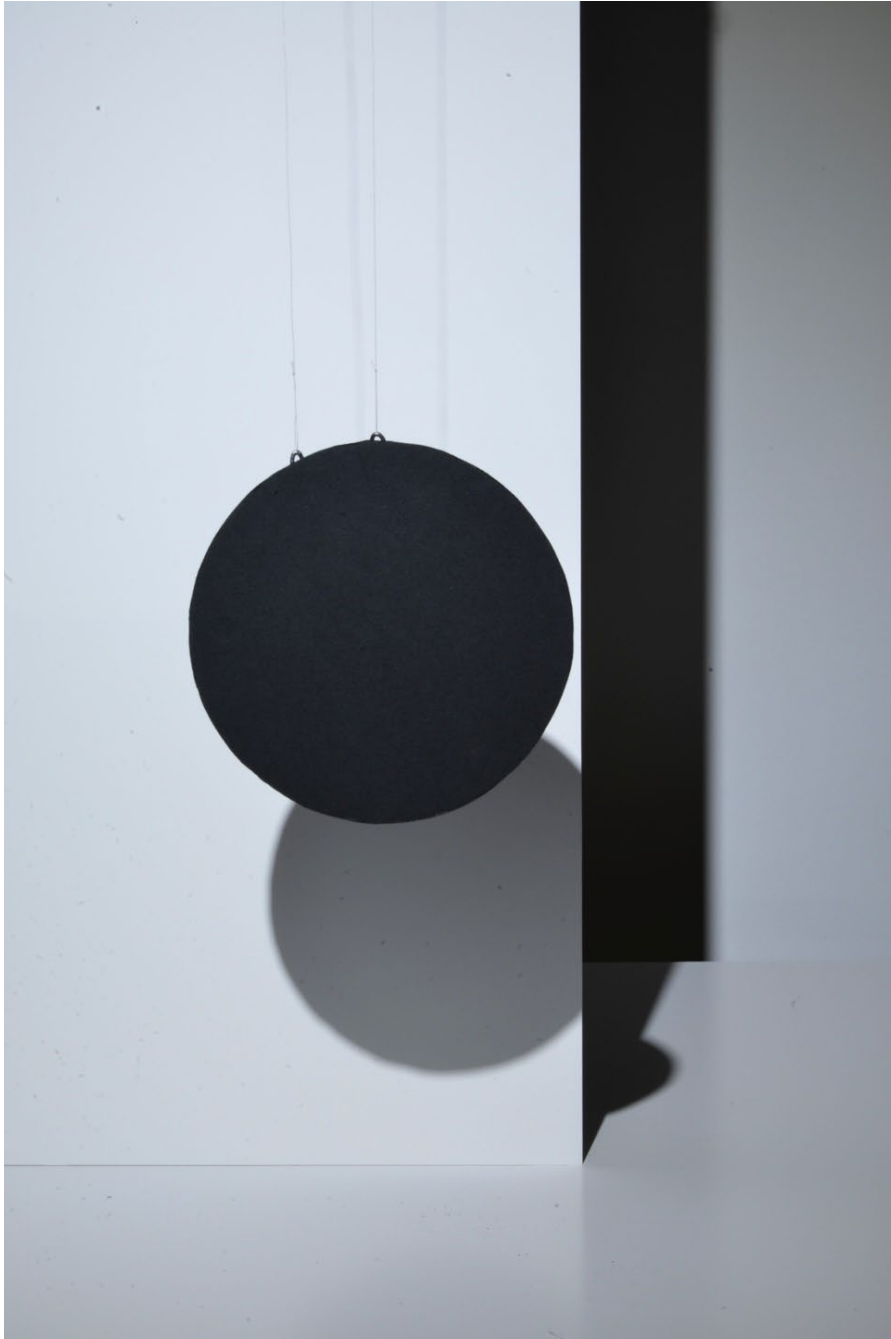
Figure 2. Card Construction with suspended sphere, after Juan Sánchez Cotán, Paul Proctor (2016).

The test results, though providing interesting interactions of light and shade to suggest depth, were – however – marred by an inability to produce images that eliminated physical camera lens aberrations and distortion of the planes. The images also lacked the capacity to extend beyond reproductions of what were obviously card constructions made in a studio environment. It was at this point in the research that I began to explore how digital solutions could enhance the construction images. Initially this was through basic editing in Photoshop where I used filters to clean up and straighten lines in the image. This became a rather time consuming and laborious retouching exercise that produced images that were more technically acceptable but visually lacklustre. The turning point in the research happened when I began to explore 3D imaging software used by architects, animators, and games developers. This software opened-up new possibilities, not just in the way it produced images but in the way in which it created a new workspace that I had not previously experienced. This space opened possibilities to explore objects within an environment that was devoid of gravity and existed within an infinite space. My first test in this space was to return to the card contraction of the Cotan image, Figure.3.
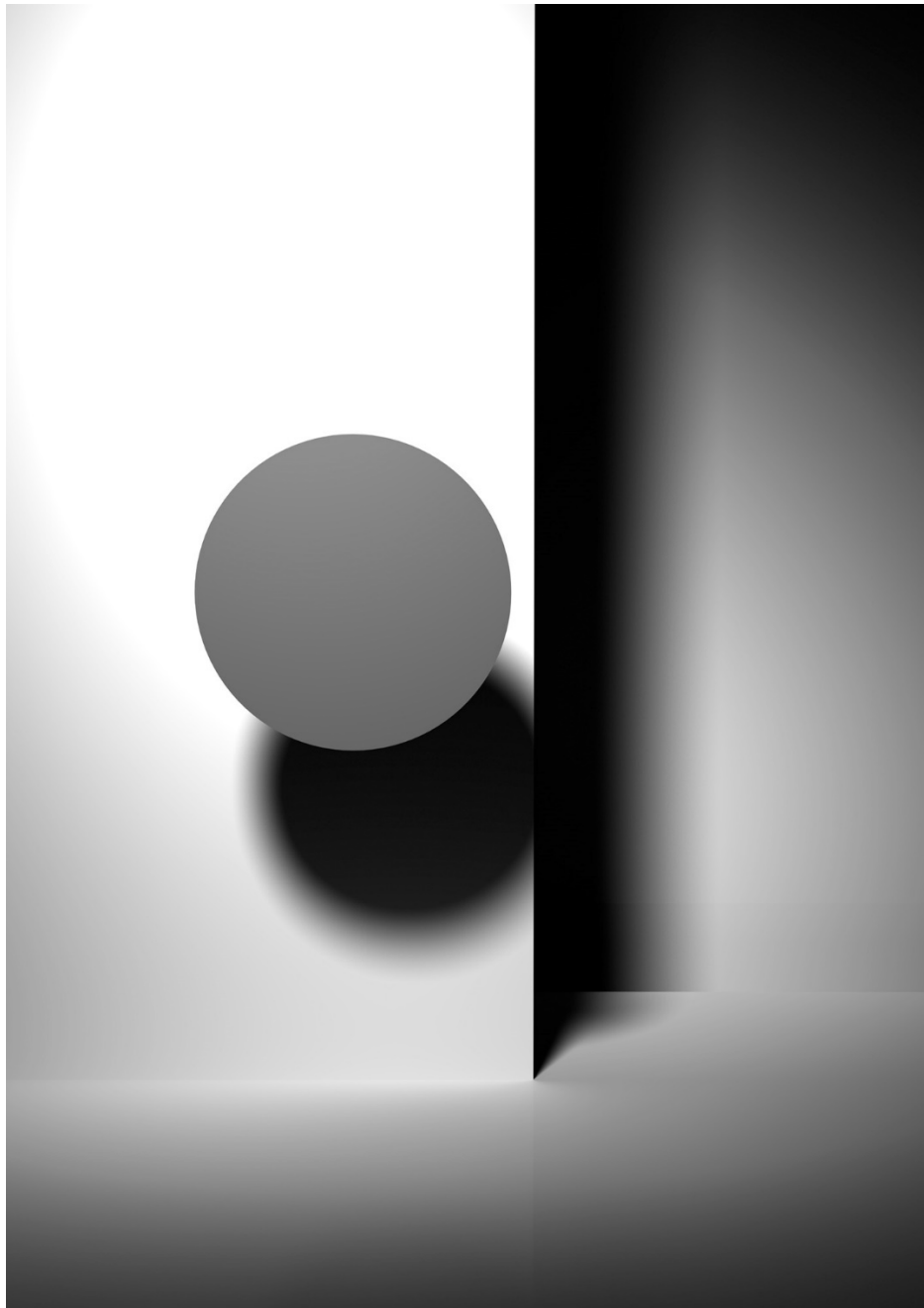
Figure 3. 3D Digital Construction with suspended sphere, after Juan Sánchez
Cotán, Paul Proctor (2016).

The 3D digital workspace was revelatory, revealing what appeared to be infinite

possibilities. The 3D digital space conflates the photographic studio and darkroom and

allows me to work by moving digital objects, lights, and surfaces in real time within an

infinite digital spatial environment. The software provides a three-dimensional

interactive space that differs considerably from the flat and layered workspace of

Photoshop. The 3D software interface is compelling as a workspace as it creates an

illusion of three dimensions on a two-dimensional screen. This software has become

my primary digital workspace. It offers the ability to create shadows though

algorithmically defined properties, behaviours, and interactions of flat plane surfaces, objects, and colour as well as light reflection, refraction, and dispersion. The menu controls and options provide creative possibilities that stretch beyond that which can be achieved in a physical studio environment and enables me to work within a space that has no gravitational influence, allowing the perpetual suspension of objects within the space. My research in this 3D virtual environment began by exploring digital objects and the way in which they interact with planes and surfaces when virtual light sources are introduced. Adopting the 3D digital environment as a new workspace has marked a considerable shift, from the physicality of the studio environment to a new physicality articulated in a digital realm. This shift has provided a process driven space for an interrogation of light, objects, and surfaces.

Light on surface as Photogram

This virtual space became a studio environment where things were placed within an arrangement, not dissimilar to a tabletop arrangement in a conventional photographic studio. As the research has progressed, however, I have become increasingly more interested in how shadows on surfaces are created by these objects in the space. In order to explore this further I returned to the physical environment of the studio to make simple paper studies to explore how folds and creases affects light and shadow on the surface, Figures 4-7.

Figure 4. Paper fold study #1 Paul Proctor (2016)
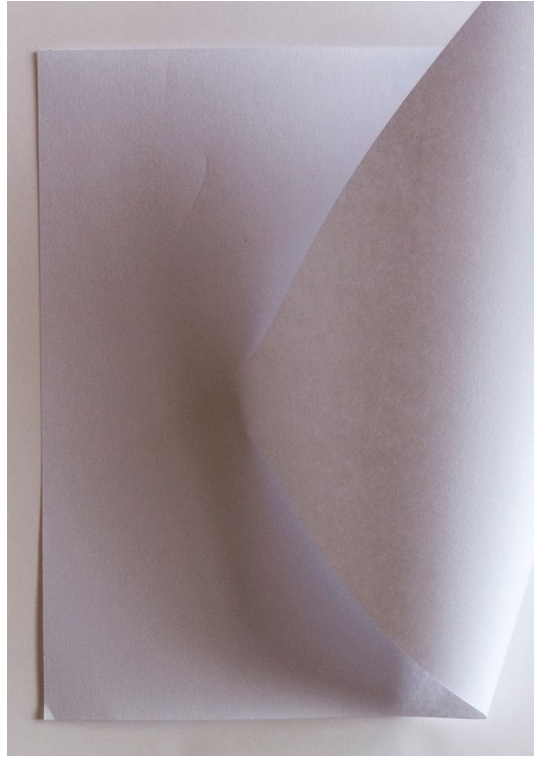
Figure 5. Paper fold study #3 Paul Proctor (2016)
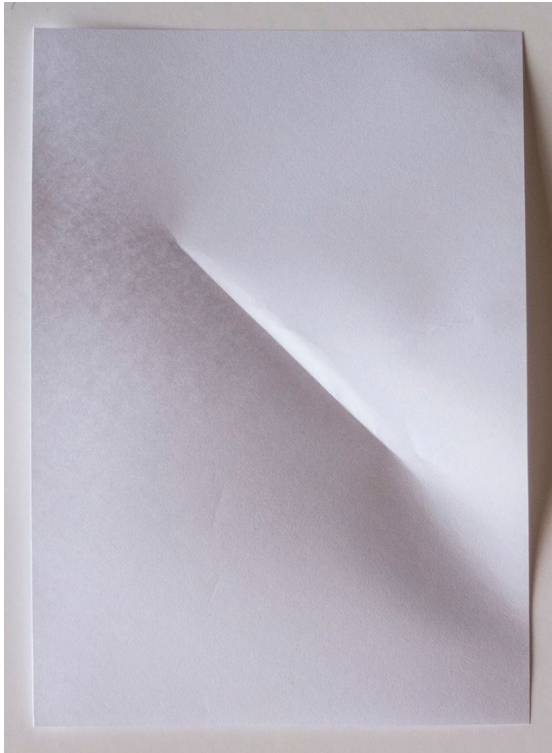
Figure 6. Paper fold study #2 Paul Proctor (2016)
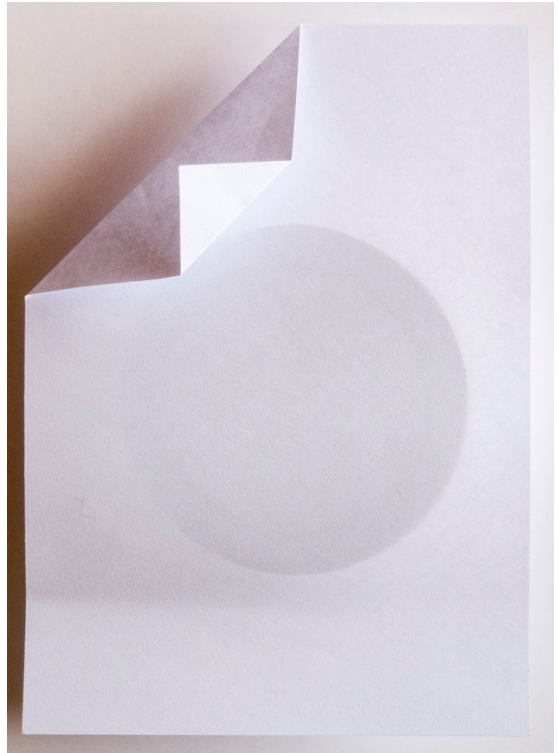
Figure 7. Paper fold study #8 Paul Proctor (2016)

These studies created a further exploration of the digital space where light and shadow on surface became the central focus of my research. This shift in working practice and method demanded that I review my research question to:

Can light, shadow and objects on surfaces in a 3D digital space generate photographic images?

This investigation over time has allowed me to use the 3D software more as a darkroom rather than studio environment. Treating the digital environment as a darkroom has enabled the research to become more distilled and has allowed for a more intense exploration of the space though experimentation of the interactions of surface, objects, light, and shadow. These key elements form the basis of the photogram, the most fundamental of photographic images. Traditional photograms are created by placing objects onto light sensitive paper and exposing them to light. Once fixed through chemical processing, a monochromatic photograph is produced that depicts shadow traces of the objects that were placed there. This virtual space provided the environment in which I could explore the digital photogram. The second milestone in the research emerged when I recognised that the digital objects used to create the shadows on the surface could be removed before the high-resolution image is rendered, leaving just the object's shadow remaining and referencing more directly the shadow left by physical objects in the traditional photogram. This created the basis on which I could explore surface light and shadow in a virtual space where the object is present in the system as raw data, but not visible in the rendered image. This simulates in digital form the absence of a physical object in traditional photograms that leaves only a trace of its former presence in the form of a shadow. The digital trace is paradoxically a flattened abstraction of a digital object. In response to these new findings, my research question has evolved iteratively over the course of the research to become:

'Can the effects of light on surfaces in a 3D digital space generate non-dualistic photographic images?

This recognition of the profound influence of the algorithmic nature of the 3D digital image space provided the impetus to explore the influence of the apparatus itself and begin to integrate this into my research thinking. This opened valuable and lucrative ways to articulate the connection between my research method and methodologies, both in terms of the making of the work and the experience of it in space.

5. **Thesis Parts**

There are three distinct parts to the thesis which I will now introduce.

Introduction to Part One

Part One of my research forms an interrogation of the locus of the apparatus in the creative process, which I claim is too often overlooked. Specifically, the role that the apparatus plays in the development of creating images as part of a wider coalition. I reveal the apparatus as something that extends beyond being a mere tool for the enabling of images, and instead recognises its potential as a creative agent coalescing both virtually and actually into the wider assemblage of other human and non-human agents to generate images. This part of my research provides an opportunity to acknowledge and bring into play multiple agents in the creative process that should be considered co-creators and co-producers within the photographic process, a process where the human contributor is one among many. This effectively brings into question the central and privileged role that the photographer has traditionally been granted. This part of my research highlights and discusses photographic image making as a process that is not a means to end but an end in itself; the *process* is the creative act. By means of investigating this, this first part of my research discusses key photographic practitioners who work with light and light sensitive materials and who use different photographic methods and approaches.

The photographic work and writings of William Henry Fox Talbot forms a fundamental influence in my initial research. Fox Talbot – who is credited with the British invention of photography – also made experimental photographic images prior to and following from the announcement of his invention. These images form the historical foundations of the medium and were the result of Talbot's deep exploration and consequent invention of his photographic process. Put simply, Talbot's early experiments with light and light sensitive materials were an attempt at fixing the shadow (Talbot, 1839), sometimes without the aid of an apparatus. This was achieved by exploring the effects of the interactions of light, light sensitive materials, and objects. Broadly termed 'photogenic drawings' by Talbot (ibid) this process forms the basis of my visual investigation of light, surfaces, and objects explored digitally within the confines of a

3D digital environment of computer software. Talbot's insight into the agency of light and the automation of photographic image making directly informs my working methods and methodologies.

The photographic image making and writing of Gottfried Jäger also forms an important and influential element in my investigation. Jäger's practice and unremitting exploration of the effects of light on photographic surfaces to form concrete images is a key processual factor to my investigation. Central to this is his systematic working process of 'generative photography' (Jäger, 1986) that he uses to articulate his photographic image making method and methodology. Jäger's images are almost exclusively the result of the effects of light on light-sensitive photographic paper with only minimal intervention of physical elements such as filters and masks. They are images that are primarily a representation of the process itself. Jäger is a key practitioner in the field I am exploring not least because he forms the link between images made in the physical environment of the darkroom and those made with the aid of digital technologies. He differentiates between these two practices by using the definitions light images and data images, the former working with physical materials, the latter working with imaging software.

Throughout the thesis I draw inspiration and insight from a range of photographers and artists who explore photography within the realms of digital imaging. Of note here is the work of photographic artist Thomas Rüff and his collaboration with software engineer, Wenzel S. Spingler. This collaboration has resulted in a series of digitally simulated large-scale printed photograms that have been widely published and exhibited. Rüff's photograms provide an interesting investigation into image size and scale that impact on the relationship between viewer and image proximity that I explore in greater depth on page 72.

Part One also draws from the philosophical writings of Karen Barad. Barad's key work, *Meeting the Universe halfway* (Barad, 2007) opens out a deeper discussion about how human and nonhuman observers influence the way the world of images are brought into being. Barad's contribution is significant as she draws from her professional background as a particle physicist, directly referencing the established field of quantum

theory to introduce the phenomenon of entangled virtual and actual agents. At a deep level this is articulated through the way that subatomic particles behave differently depending on if and how they are observed. Barad uses the uncertainty principles of quantum theory as a potential model for how we might attempt to reimagine our actions and behaviours in the macroscopic world we inhabit. Finally, the philosophical writings of Vilêm Flusser are of particular importance in Part One. Flusser has written extensively on the photographic apparatus and its agential role in the making of images. Flusser articulates the relationship between the apparatus and the photographer as a kind of game with systematic rules. He outlines the notion of the 'black box' (Flusser, 1984, p11) of the apparatus as a hidden system that is the programmable interlocutor between the photographer's input and the system's output. The apparatus, according to Flusser (2011), is linked to the actions of the photographer and photographic process to the point at which they are inextricably entangled.

Introduction to Part Two

In the second part of my research, I interrogate how light, objects, and surface interact within the environment of the 3D digital space. In photographic and graphic editing software such as Adobe Photoshop, the interface tends to be designed in a way that facilitates working in the two-dimensional realm of layers. The process more commonly begins with an imported image, the software then enables this image to be divided into multiple layers. A range of graphical tools can be used to manipulate the image though a process of adding and subtracting digital information. This is the model of production that most photographic photo imaging software uses. It treats the image as multiple layers built on top of each other that can be edited prior to the layers, then flattened to produce a finished two-dimensional photographic image file. This contrasts with 3D digital imaging software which has a dynamic, spatialised, perspectival interface and is mathematically co-ordinated software. This enables the creation of a

scene that can be navigated by shifting perspectives from the fixed point of view of the computer screen.[9] This is software that enables multi-perspectival three-dimensional objects to be created, manipulated, and moved within the scene. Surface planes can be added to create surfaces, and light sources introduced to illuminate these digital objects. The software offers the ability to use a 'virtual camera' that behaves in the digital space in a similar way to that of a traditional physical camera that incorporate optical lens with focal lengths and aperture controls. The software that I have adopted to make the series *Virtual-Actual* (Autodesk Maya) is used primarily for generating 3D modelling for animation or Computer-Generated Imaging (CGI) moving images. A dynamic image generating system is one that mimics the physical studio environment where objects can be created, moved and illuminated utilising a range of light sources and viewed from multiple angles and perspectives. The interface incorporates a range of settings that can be changed in 'real time' enabling the scene to be populated by digital forms that are illuminated using millions of colours and infinite light intensities.

Part Two of the research follows the development of the research as it explores these dynamic possibilities, enabling the illumination of objects to create shadows on surfaces that become increasingly elusive as the research investigation progresses. This reveals the importance of multiple thresholds, the points at which the shadow comes into and disappears from perception. This part of the research explores the edge at which light and tonal ranges become differentiated and shadow colours combine and coalesce with surfaces to produce gradations that are fluid during the act of making and fused when rendered as an image. Part Two also discusses traditional approaches to imaging objects directly onto photographic surfaces to form the digital equivalent of photograms. The photogram is a sub-genre of photography that has followed photography's ability to produce direct images onto surfaces without the use of a camera. The photographic work of Modernist image makers such as Lázló Maholy-Nagy and Alvin Langdon Coburn are discussed in relationship to the photogram. The work of Thomas Rüff is also discussed in further detail in respect to these artists, too. I discuss these distinct, delineated images that are created in both physical darkroom and digital

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[9] In the context of 3D software, a "scene" refers to the digital workspace where various elements such as models, lights, cameras, and digital objects are assembled and organized to create a virtual environment.

environments in contrast with my research which becomes more concerned with the threshold at which shadows begin to oscillate between the visible and non-visible. This is brought to the surface through my discovery that objects which create shadows in the scene within the 3D software can be removed prior to the final image rendering process, leaving only their shadow trace in the image. By way of understanding the oscillating effect and persistence of the images, I draw from Gestalt theory to investigate our fundamental yet fragile perception of figure and ground, discussing its multistable effects. This part of thesis also discusses the contribution of Johann Goethe's *Theory of Colours* (1967), in particular his exploration of after-vision which is a purely experiential and poetic exploration of a range of effects pertaining to brightness, darkness and colour. Henri Bergson's insights into intensities also provide useful interpretations of degree of intensities of luminosity and colour to introduce the notion of differences in degree and differences in kind, where colour (rather than being interpreted in terms of specific hue) is treated as part of a range of degrees of colour that form a spectrum with infinite sequences where no singular definition of colour is possible. This part of the investigation borrows ideas from Joseph Albers' seminal book *Interaction of Color* (1971). Albers' book chart his experiments and conclusions of colour relationships and interactions. The book uses different colour swatches in a range of combinations and juxtapositions that create distinct senses of colour harmony and discord. Albers' experiments also raise the veracity of human vision and one's ability to only see colour in specific contexts. This provides an opportunity to discuss my research and its relationship to perception and the thresholds of colour saturation, intensities, and tonal ranges.

Part Two of the research concludes with a discussion of the paintings of Ad Reinhardt, specifically his later work known as his 'black paintings' (1960-1967). Reinhardt created large-scale matt black paintings that included and integrated subtle tonal ranges and intensities of blue pigment. They are paintings that teeter on the edge of perception and therefore suggest a way in which my research might similarly be approached. As my research progresses it becomes more evident that the images gain the potential to become more like experiences (not photographs to be looked at or looked through): images that might be perceived as being experienced from within.

Introduction to Part Three

Part Three charts the development of my research from images made on screen, to images presented in physical spaces. I discuss the work through various display tests and methods explored within different physical spaces. I assess how the work functioned in these test environments with particular emphasis placed on how the work is perceived and experienced. I start by discussing the selection of images to be shown on a gallery wall space as large scale physical prints. Photographic print provides opportunities as well as challenges: large format prints require high resolution image files to meet the desired print quality. This required further research into image rendering processes that enabled the production of large image files that can be further digitally processed to produce image files recognisable for print production. I discuss photographic paper types and surfaces and methods of hanging with display lighting. The effects of ambient light on print surfaces are also interrogated, specifically the ambient light reflection from the gloss and matt surfaces of the print and the impact this has on the viewing experience. The research is examined in terms of the delineated image and a light reflection image: two different images, an image with a second image inflicted upon it. This raises questions pertaining to the image surface and the delineated image which generates a discussion of how this might be resolved.

The research at this stage also raises important questions relating to image/viewer proximity and the effect that this has on perceptual experience. Perception of the images as print with ambient reflection is radically affected by body movement and perspective. The body in motion in front of the print creates moving images on the surface as ambient light and reflections change in relation to differing perspectives. The tests highlighted how proximity of the viewer in relation to the print also affects image perception in this display space. Drawing from the writing of Gernot Böhme (1993) this part of the thesis continues by discussing light reflection and light emission, the non-material possibilities that light emission might bring to the perception of the images.

Lastly, image perception and temporality is explored through Henri Bergson's notion of our inner, non-spatial experience of time as duration (Bergson, 1988). This raises the possibility of direct access to the image, calling for a reassessment of the printed image as the primary method of display. The work is then tested as large-scale projected images and as images on monitors in darkened spaces. This display method is explored and investigated in terms of the perceptual experience of the work. This exploration considers the body/image duality and the possibility of a coalescence of these through a method of intuition where the image is to be perceived from with-in.

Part One

The Photographic Apparatus

Introduction

Central to Part One of my thesis is an investigation propelled by my photographic practice as research, an enquiry that seeks to unravel and redefine the role of the photographic apparatus. The research navigates the confluence of digital technology and creative expression and serves as the catalyst for a deeper exploration into the agency of the apparatus itself. This inquiry is driven by a critical engagement with the apparatus not merely as a tool for image creation, but as an active participant that brings to image making its own intrinsic agency. Through the metaphorical 'lens' of my practice, I explore the nuanced dynamics between artistic practice and apparatus, critically challenging current perceptions of their roles in the creative process. Drawing on insights from the intersection of art, philosophy, and quantum science, this part of the thesis illuminates the transformative position of the apparatus that extends beyond its physicality. The theoretical underpinnings of Karen Barad (2007) alongside Niels Bohr's experiments in quantum mechanics, provide a framework through which the Virtual potentialities of the apparatus emerges not just as an observer or mediator but as an actual co-creator, deeply entangled with the phenomena it helps to produce. This perspective is not merely academic or intellectual but is rooted in the visceral experiences and explorations within my research, which encounters and examines the apparatus's capacity to influence and contribute to the research outcomes.

My investigation in this part of my thesis also interrogates the apparatus's *black box* (Flusser, 1984). I explore its opaque inner workings and challenge the traditional boundary between the creator's intent and the technology's agential contribution. By adopting the concept of *intra-action* (Barad, 2007), my discussion marks a departure from simple interaction, highlighting a complex entanglement of human and non-human agencies that underpin the creative act, with the use of hyphens here acting as a reciprocal connecting device. This entanglement is not a theoretical abstraction but a

lived reality within my photographic practice, where the unpredictable and often inscrutable nature of digital processes informs and enriches the creative journey.

At the core of this part of the thesis is an ambition to forge a new ontology of the photographic apparatus, inspired and informed by my engagement with photography within the digital realm. This reimagined understanding posits the apparatus as a symbiotic partner in the creative process, acknowledging the intricate intra-actions of agencies that give rise to the photographic image. This exploration, grounded in my photographic practice, invites a re-evaluation of creativity in the digital age, suggesting a model of creation that embraces the entwined contributions of human imagination and technological innovation. Through this lens, my research not only interrogates but also celebrates the complex, dynamic relationship between artist and apparatus, offering new insights into the nature of photographic practice within the 3D digital space.

The photographic apparatus

My research asserts that the photographic apparatus can play a central role in the creative process. It also recognises the Virtual conditions of the apparatus and the multiplicity of assemblages that coalesce to generate images. The apparatus is not treated as an external device, but rather an integrated and integral agent in the co-creation and co-production of *Virtual-Actual* as a creative project. This acknowledgement is one that is brought to the fore through the nature of my research, that of working within a non-representational 3D digital environment. If there is representation at all, then it is a representation of the apparatus itself, or the enactment of its own computational condition. The computer as an apparatus in my research is not considered to be simply a passive device, tool or instrument, but an active actor in the process of image generation.

The agency of the photographic Apparatus

Working in a 3D digital environment has formed, for me, a different connection to the apparatus. The camera as a mediator – a separate physical entity – is removed, enabling a more symbiotic relationship to form. The apparatus becomes the digital visual space acted out in the scene of the imaging software. The apparatus extends beyond being an interpreter of the world but rather becomes the world itself that contains its own and unique potentialities.

Working in this space, it has become clear that the apparatus I use embodies its own paradigms. The notion of subjectivity is usually contextualised through the privilege of human agency that defines the individual; the apparatus conversely signifies the objectivity associated with what is often considered to be an inert machine. My research, however, investigates the apparatus as it enacts its own dynamic agency on the making of the work with its own variables, and as such opens a space for rethinking subjectivity in a way that might extend to non-human sources. I explore this further though an exploration of the role of the apparatus in the field of science, particularly the significance of measuring instruments in the exploratory field of quantum science. Karen Barad, in her book *Meeting the Universe Halfway* (2007), discusses the role of the apparatus as co-creator, starting with an account of Niels Bohr's philosophy-physics. Barad provides an account of the role of the apparatus in Niels Bohr's experiment in quantum mechanics at the turn of the twentieth century. Bohr's experiments were instrumental in providing an understanding of quantum mechanics in the early part of the twentieth century. His quantum theories provided a profound insight into the influence of not just the agency of the apparatus in experiments, but the entanglement of the apparatus in the production of results. Bohr provided a thought experiment based on a phenomenon observed by Thomas Young in 1801. Known as the double slit experiment, the modern version of this experiment, Figure. 8, uses two slits that are placed very close together on a small metal (diffraction) grating that are illuminated by a laser light source. One of the slits is covered and the light photons pass through to form a distinct line of light on the screen behind. When, however, both slits are uncovered, it does not produce two distinct lines of light on the screen as one might expect, but rather a series of distinct light and dark striations on the screen which is clear indication of a diffraction pattern and therefore, wave-like behaviour.

Single-slit pattern

Double-slit pattern
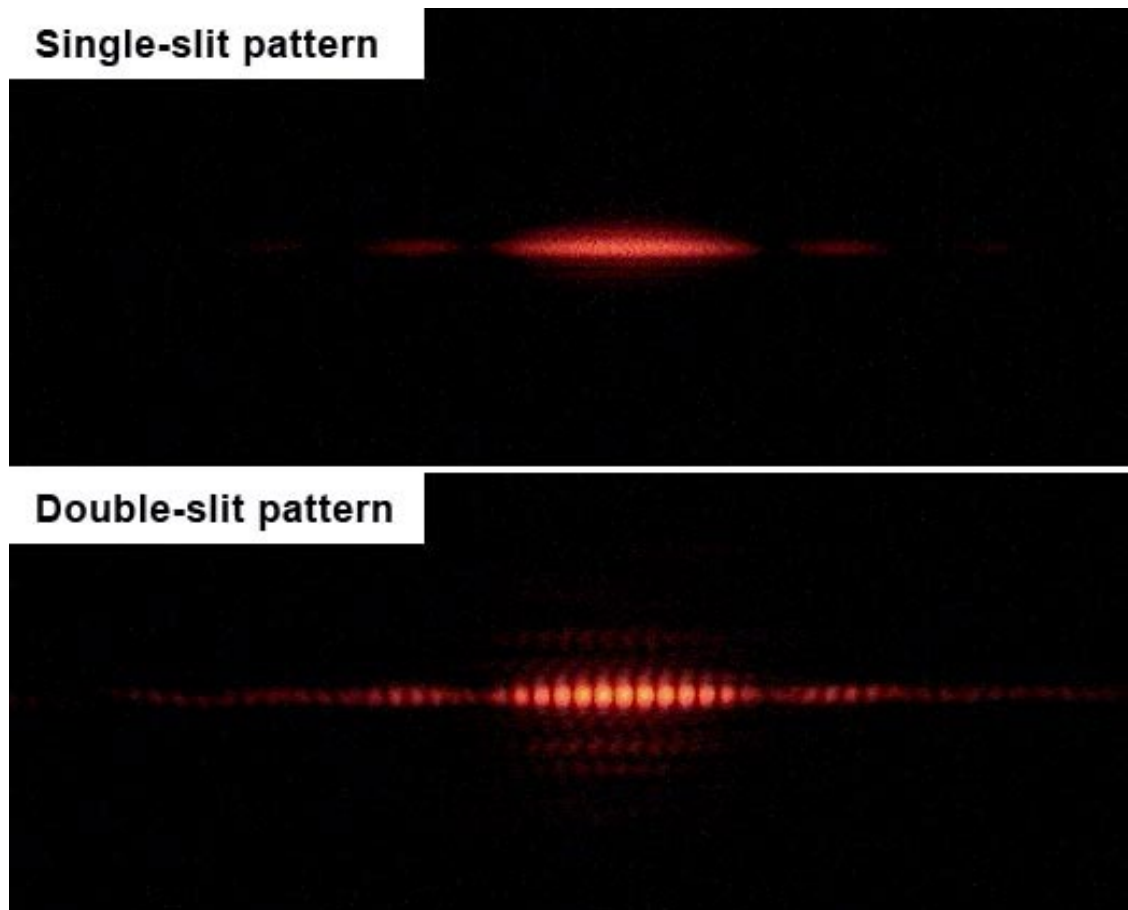
Figure 8. Results of the double slit experiment. The above image shows the result of light entering just one slit of the grating. The bottom image both slits are open.

The light photons entering the two slits converge to form a diffraction pattern on the screen. Bohr's thought experiment follows the path of single photons as they are fired at the grating and predicts that it will still form a wave pattern on the screen. If an apparatus was able to observe which of the two slits the photon passes through, however, the wave function collapses and just two lines of light appear on the screen. Bohr discovered that a measurement of a photon taken with one apparatus shows it as a particle, and a measurement with different apparatus shows it as a wave. When Bohr's thought experiment was confirmed through real experiments in the 1990s (when it became possible to fire single photons at the grating) his prediction proved to be correct. This has profound implications: it indicates that the photon (or indeed any subatomic particle) collapses from being a wave into becoming a particle when it is observed. Significantly for my research is that this experiment also clearly shows that light waves, when in phase, produce light on the screen and when out of phase produce a true blackness. This effectively means that two light sources directed at a

screen can in fact produce complete blackness which is counter intuitive. I will expand on the notion of blackness as a range of intensity in Part Two of thesis (page 96).

The outcome of this and subsequent experiments shows that the apparatus has the capacity to alter physical behaviour; it is not simply an observing instrument but a player in an indeterminate creative space. This is also not simply a theoretical assertion; practical scientific experiments show clearly that the wave function of a photon or electron collapses into a specific locality when measuring apparatuses observe it. As Barad notes:

> Apparatuses are not passive observing instruments; on the
> contrary, they are productive of (and part of) phenomena (Barad,
> 2007, p143)

Engagement with apparatuses are not simply a consequence resulting from human command but what Barad terms 'intra-actions' between humans and non-humans, 'the mutual constitution of entangled agencies.' (Barad, 2007, p33). Intra-action as a term is used to differentiate from 'interaction', the word used to indicate two separate and distinct participating agencies. Intra-action denotes agencies that are indistinct and emerge from their intra-actions and are only distinct in relation to their mutual entanglement; they don't exist as individual elements. Intra-activity denotes a lively and dynamic entanglement of agencies, where the apparatus becomes an integral part of the phenomena. According to Barad:

> phenomena are the ontological inseparability/entanglement of
> intra-acting 'agencies' (Barad, 2007, p148)

An electronic, programmed, and programmable apparatus such as the one I use in my research is not then merely a data generating device, but a discursive participant in the actualization of images. Thinking intra-actively opens out potential for a new ontology of photography that challenges traditional notions of causality and determination by, instead, considering indeterminacy to be a fundamental principle of reality. Considering the role of the apparatus in the photographic process does not mean

substituting human for nonhuman agency but rather to recognise a mutual and discursive interweaving of both whilst realising that agency is not a thing and therefore not a property of something, it is an enactment.[10]

My research is a discursive engagement between human nonhuman agencies; human and technological agents that are usually conceptualized as opposing entities. The modern use of the word technology has come to represent operational entities that are related to, but uncoupled from, human activity. In his essay 'The Question Concerning Technology' (1977) Martin Heidegger provides a critique of how we have become inextricably linked to technology. His consideration of the root of the word technology ('techne') is helpful here. Its etymology stems from the Greek verb τεχνώμαι which means to be produced from seed or to construct (technique). An artisan is referred to as technon and an artist as Kalitechnis. 'Techne' denotes human craft and fabrication, such as textile or text, 'a weaving together of words and thoughts […] in the earliest forms of ancient Greek, techne meant an aptitude or practical skill' (Hughes, 2018). Though Heidegger sets up an opposition between physis and Techne – human physicality and machine technology – techne is a direct reference to active human agency: we are 'Techne' inventors, creators and sense makers. In his essay, Heidegger considers the material agency of the artefact and how it is crafted. By extending the meaning of techne, Heidegger incorporates its meaning with *poiēsis* a word that refers to something that is brought forth into presence, from which we derive the word 'poetry'. He recognises that 'Technology is therefore no mere 'means'. Technology is a way of revealing: '[t]echne belongs to bringing-forth, to *poiēsis*; it is something poietic.' (Heidegger and Lovitt, 1977, p12).

It is worth noting here in the context of my working method that, according to the Oxford English Dictionary, the definition of a computer is 'a person who makes calculations or computations; a calculator, a reckoner' (Simpson and Weiner); as such the line between computer as machine and computer as human reckoner becomes entangled. Techne is, then, a weaving together; an entanglement of human and non-human operations: technology is part of the human experience. Still today in modern

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[10] See Dolphijn, R. and Tuin, I. v. d. (2012) *New materialism: interviews and cartographies.* Ann Arbor: Open Humanities..

Greece children are referred to as 'Techna', things that are begat, or have emerged from seed.

Assemblages

The photographic camera, as an apparatus has traditionally been considered a tool used as an extension of the eye, is not normally treated as a co-creating entity that can enact its self-organised agency in the process of creating images. Fully recognising the role of the apparatus as a generative element of the research, however, opens opportunities for deeper consideration of a human-nonhuman relationship in the making of images. When the creative process becomes the result of an assemblage of both virtual and actual participants, liaisons and alliances between things and people can occur, with symbiotic, sympathetic acts of co-functioning happening. Deleuze refers to this as a *haecceity* (Deleuze, Guatarri 2016, p304), which is a term that recognises the characteristics or virtues of assemblages. For example, Deleuze describes his collaborative work with Félix Guattari as 'like a haecceity': not two separate individuals but rather a multiplicity of interconnecting entities of ideas, experiences and complexities; a non-personal individuality (Deleuze, 1995, p 141). In the context of my research I consider *haecceity* to be an aggregate of virtual forces and creative agents that are defined not by what they do as singular entities – or as social factors – but rather as elements within the creative process or as what Deleuze would refer to as an individuation or 'event'.[11] The concept of the creative process as a haecceity decentres the human as the central singular creative genius. Authors and creative individuals are not self-contained agents, but compositions of haecceity. These extend beyond material things into complex multiplicities of atoms, molecules, events, operations, accidents, memories, experiences, and other people's thoughts and influences. None of the haecceities operate in normal clock time, they are forces that, in terms of our individual experience, occur in duration (which I will explore further in Part Three of

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[11] Deleuze's term 'event' here, however, refers to something that is not a person or object but a kind of activity of multiple forces and agents. All human individuals should be seen as a combination of haecceities, not a single person or object, but a collection of events that have happened in their making.

the thesis (Page 102)). This is important in the context of my research as *haecceities* are the unseen collective forces that are implicit in the work, forces that are Virtual and therefore usually not recognised or acknowledged yet have a crucial bearing on the process of image generation.

A key concern for my thesis is, therefore, the implication of these assemblages on my research. Can the notion of assemblages offer an opportunity to acknowledge and enable the forces that come into play in generating images for *Virtual-Actual*? The concept that there is no single auteur in the creative process may, for many, be at odds with the proposal that the photographer is the central protagonist in the creative event. By contrast, working as an assemblage is an approach to creative practice that recognises all virtual participants – the semiconductor engineers, designers, programmers, the internal electrical impulses of the machine, the materials, and the workers on the factory assembly line as collectives – as vital to the process of generating the work. In her book, *Vibrant Matter*, (2010) Janet Bennet describes assemblages as:

> ad hoc groupings of diverse elements of vibrant materials of all
> sorts […] Assemblages are not governed by any central head: no
> one materiality or type of material has sufficient competence to
> determine consistently the trajectory or impact of the group. The
> effects generated by an assemblage are, rather, emergent
> properties, emergent in that their ability to make something
> happen. (Bennett, 2010, p24).

In my research the data image could be perceived as lacking the solid, vital materiality of the traditional photo-chemical process, defining itself instead through its non-material constituents such as electrical energy and data. Bennet asks us to consider, however, electrical energy as an 'actant' using the electrical power grid as an example of an agentic assemblage, 'a material cluster of charged parts that have indeed affiliated, remaining in sufficient proximity and coordination to produce distinctive effects.' (Bennett, 2010). Bennet's assessment of materiality, here, dismisses the perceived non-material nature of electricity and electromagnetic energy, something that the brain shares with the computer. Bennet goes on to comment that 'Electricity,

or the stream of vital materialities called electrons, is always on the move, always going somewhere, though where this will be is not entirely predictable' (Bennett, 2010, p28). In my research I consider these electrons and currents to be the raw material of my practice, and as such bring to it uncertainties of outcomes.

Apparatus as Co-creator and Co-producer

A conventional assessment of the role of the photographic apparatus is that of a device (such as a camera) that is *looked through* in order to visually interrogate the world beyond or, in the case of my research, a screen that is *looked at* but at the same time, *looked past.* In this sense the screen is a transparent device, with the surface of the screen a kind of substrate.[12] My research, as an assemblage, is more concerned with an apparatus that is *looked with* (Rexer, 2009, p11); I am interested in investigating the capabilities and internal conditions that constitutes the system. This is done essentially through the interface of the computer and software. The scene upon which all activity is actualised is a multifaceted perspectival space where objects, surfaces, and light interact in ways that are not entirely predictable, often generating outcomes that could not have been foreseen. In other words, the role of the apparatus is not merely a means to an end, but a confluence of entangled creative agents.

My research is not, therefore, directly concerned with the capability of stand-alone imaging devices or self-organising entities able to make images without the need for human intervention; rather, it is a co-partnership between the apparatus-human-nonhuman entity. In my research, the nonhuman does not refer merely to the passive apparatus, but a melding together of both the human and nonhuman, an entanglement between actors. This, I would argue, is a system in its truest sense: a confluence of interrelated and interconnected components that extend beyond material and biological boundaries.

My working practice has shown that the myriad combinations provided by the computer and software in the making of images requires complex navigation that can

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[12] My use of the term "substrate" here implies a foundational or base layer that other materials, organisms, or reactions interact with or are built upon.

be articulated as a kind of agential interplay. According to Vilém Flusser what distinguishes the apparatus from a tool is its programmability; the apparatus is capable of creating what he calls 'technical images' (Flusser, 2011) that are utterly different from traditional images which would be characterised, instead, by their two-dimensionality. Technical images can be used to describe my research, which are images that are generated from within a technical system, with no reference to outside dimensions. In *Comments on Generative Photography* (1986), Flusser proposes that:

> 'the apparatus does what man wants it to do, but man can
> only want the apparatus to do what it can do. In fact:
> apparatus and man form a single functional unit.' (Flusser,
> 1986)

Flusser's comment resonates with my research methodology. Working with the computer as a photographic apparatus has formed a symbiotic creative relationship where the machine and its internal algorithms provide direction and contribute to the image in a more nuanced way than a conventional camera – what Flusser refers to as 'creative *man-apparatus* interaction' (ibid). *Virtual-Actual* is work created in the spirit of this reciprocal relationship. It recognizes that 'subjectivity' is nascent in the machine as well as in myself and all other agents. The images that emerge from this relationship are what Flusser refers to as 'technical images' (Flusser, 2011). Technical images, according to Flusser, are images that are characterized by a shift from the two-dimensional practices of traditional images to technical images that are devoid of dimensionality: they transcend the two-dimensionality of the surface and are, instead, images constructed of 'particular' formless 'stuff'. This formlessness is characteristic of the images made in the technical space of 3D digital photographic imaging. Devoid of any apparent matter, and therefore tangibility, the degree to which it can be said that things are there at *all* is questionable. The transition from working with the physicality of traditional cameras to engaging with digital interfaces represents a significant shift in how I perceive and intra-act with photographic devices. This evolution underscores not only the adaptability required in modern photographic practices but also highlights an increasingly complex and deep relationship between the photographer and apparatus. Working in the 3D digital space I find myself at a juncture where the tangible and the

virtual converge, challenging preconceived notions of materiality and presence in the digital age. This shift towards a more intricate, programmable and cognitively aligned apparatus is an invitation to reconsider the essence of the image-making process, requiring an exploration that extends into the realm of the intangible, and where the boundaries of physicality are redefined by the limitless potential of digital creativity.

Flusser characterises the photographic apparatus as a programmable entity. Mechanical photographic cameras, for example, are programmable through the manipulation of aperture and speed of exposure which are operationally fundamental to the device. This was how I programmed the apparatus in the early stages of my research practice using large and medium format cameras. This required physical interaction and a knowledge of its programmable variables to dial in the correct settings to achieve the desired results. The mechanical camera, though very capable of enacting its own serendipity, felt like a predictable machine to work with: its principles could be easily understood, at least technically. The introduction of the physical digital camera has in recent years introduced more complex and automated process of photographic image making. The dichotomy between photographer and apparatus is under scrutiny. In *What is 21st Century Photography?* (2016), Daniel Rubinstein states that 'the "photographic camera" has already come to the end of its life.' – the photographic apparatus, according to Rubinstein, is now a different machine, one that is more aligned to our cognition rather than human corporeality. Rubinstein argues that:

> the new machines that we refer to as 'computers' do not operate
> within the categories of human reason, such as, for example,
> dialectics, subjectivity, or representation. Quantum physics did not
> obliterate Newton's laws, but showed that these laws apply only to
> a narrow segment of reality (Rubinstein, 2016)

The new photographic apparatus operates beyond our complete understanding, they are different optical devices that require a different relationship not based on the predictability of the solid material nature and expected behaviours of glass, mirrors

and tangible stuff, but on the possibilities and potentiality of electrons and electro-magnetic energy that demand a new understanding of materiality. The new apparatus emphasises processes that, according to Rubinstein, are 'by their own nature [...] less visible and less representational than objects' (ibid). The more we know about matter, the more difficult it is to determine what it is. It seems obvious at the macro level: it is the solid stuff that we engage with, that surrounds us, that *is* us. This, however, is our illusion. The reality of matter at sub-atomic level is largely determined by empty space, exchanges of energy where particles are simultaneously in and out of existence, are both virtual and actual, and in all places at the same time.

Virtual-Actual is, as a consequence, research that takes place within the virtualities of the computer apparatus where the algorithms are clustered in such a way that it is difficult, if not impossible, for even the software engineers to completely understand or indeed disentangle their actual operations. For Flusser, the programme is what characterizes the photographic apparatus and what he considers to be the virtualities that are eventually operationalized or actualised in the image. I take Flusser's use of the word 'virtuality' not as another term for the data that drives the programme but the 'game of combinations' (Flusser, 1984). As he states: [the programme's] "intention" is to code the virtualities contained within into images'[....] [as] it constitutes, point by point, a specific situation as it occurred during the "game" of combinations' (Flusser, 1984, p49).

The Black Box Photographic Apparatus

The computer apparatus I work with and that forms the research is a mysterious device that produces images resulting from the data created through electromagnetic energy. The system is self-determining and therefore somewhat removed from my complete control. The mystery of the photographic apparatus and its capabilities, what Flusser refers to as the 'black box' (1984, p16), is essentially opaque. According to Flusser, the black box requires deep critical insight though which we must illuminate ourselves of the potential of the technical image:

the coding process of technical images occurs inside this black box,

and every critique of technical images must concentrate on the

"whitening", of the interior of that black box (Flusser, 1984, p11)

In the 3D digital space in which my research is created, the software that provides a visual interface which translates the electro-magnetic fluctuations and voltages contained within the computer apparatus appear as actual images on screen. It is the software interface that enables a direct visualization of my interactions with the internal virtualities of the machine: the data image always has a virtual influence. Flusser refers to the inner workings of the photographic apparatus as the scientific 'black box', the role of which is to 'stimulate thinking' and should therefore 'remain – cybernetically – black' (2011, p35). The black box of the apparatus (and its internal system that are implicit in my practice research) has become impossible to fully understand. The internal workings of the programme as the unifying characteristic of all photographic apparatus are enacted through the actualization of the image's latent, virtual potential. The camera obscura, as the first iteration of an image-making photographic apparatus, literally translated the black chamber: the blackness is where the mystery unfolded. Early camera obscuras were designed to physically integrate the human observer, but the apparatus becomes more mysterious when the observer is physically excluded from this internal space, it becomes like a magic trick where what goes 'inside' is somehow transformed and is different to what comes out, making it at least appear indeterminate. The Flusser scholar Nancy Ann Roth refers to the black box as a bounded and fixed inaccessible system, where the only activity that influences the system occurs at two points, input and output:

'To call a camera a black box, then, is to point out that between

what goes in and what comes out, between all the concern with

positioning and adjusting settings on the one hand, and

photographs on the other, is "bracketed out" of almost everyone's

thinking about photography.' (Roth, 2019)

This bracketing out of the processes of the apparatus forms a kind of blind spot for the photographer and for the critique and understanding of the photographic process. It is

somethings that I address by considering the significance of the apparatus in my research. Inquiring about the camera settings a professional photographer uses for a particular photograph is frequently seen as a social blunder and is often regarded as a measure of the amateur. The question, however, is entirely valid because what is actually being asked is: what role did the apparatus play in the making of the image? The programme I use for my research records this level of information automatically: it is saved as a file, a record of the input of the menus and controls selected by the photographer-functionary during the making of the image. The data image is the manifestation of the data input and the virtual conditions of the programme. Data images fall neatly into Flusser's notion of technical images: 'All technical images', first and foremost he says, 'are visualizations' (Flusser, 2011, p44).

The black box as a virtual entity highlights another aspect of the photographic system: that of image latency. Discussed further in Part Two of the thesis, I describe the latent image as a virtual image that is characteristic of the traditional photographic process. It is the potential image that we assume to be present in the exposed photographic paper or film yet is hidden from view and requires actualization through an appropriate photographic procedure. Traditionally, this has been a chemical process that darkens silver halide crystals in the photographic material. The latent image in the photographic apparatus of the computer is nothing but the potentiality of the electrons and voltages to generate data that is translated via the system software to the screen. This latent (virtual) image is actualized through the rendering process of the computer programme.[13] The image is rendered little by little on the screen to generate the fully resolved, high resolution data image.

The Indexicality of 3D digital Images
Working with the computer apparatus and making images with it and within it, creates a closeness for me that extends beyond physical proximity and, though a certain physicality is involved, it is a relationship that pertains more to the realm of the internal

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[13] Rendering here refers to the process of translating the screen image into a high-resolution image file that makes the image photo realistic.

space of thinking, duration. Working with a traditional camera apparatus is mostly characterized by the need to distance oneself from the object of observation 'out there' in the world. An early research piece of work *Presence of Touch* (see Figure.9), was an exploration of the non-material haptic control of light sources across a screen.
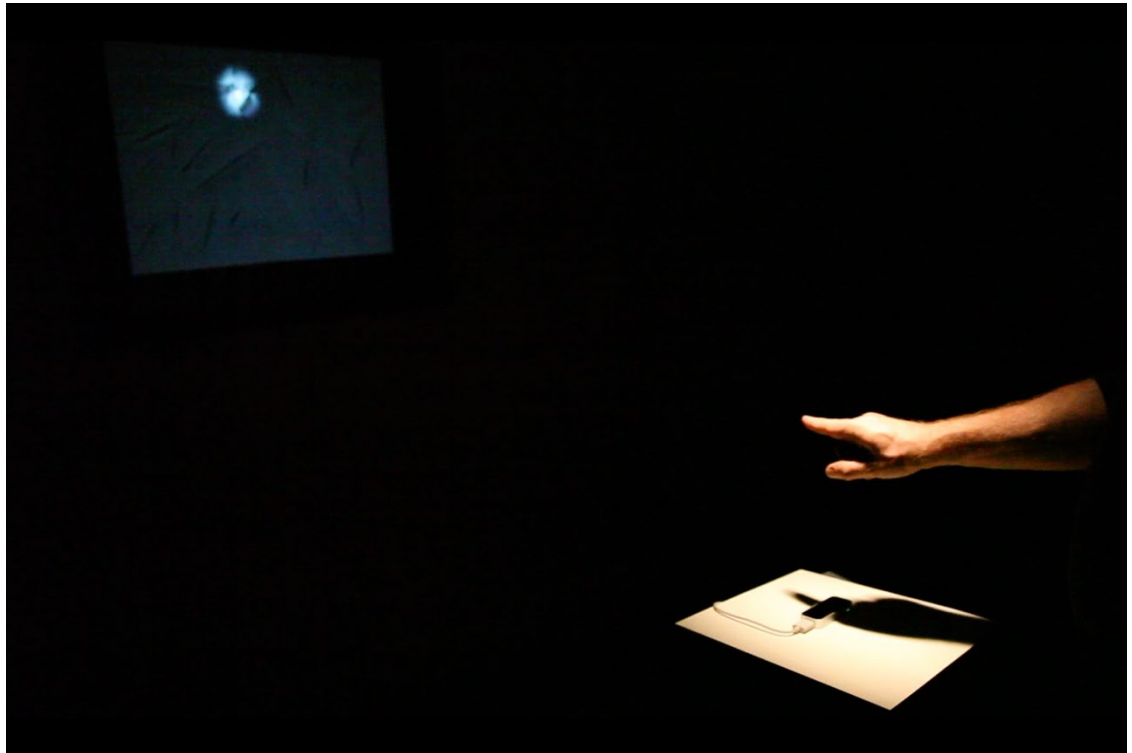

Figure 9. *Presence of Touch*, Interactive installation. Paul Proctor (2015) Available at
https://www.paulproctor.info/presence-of-touch

This installation explored interactions with an apparatus where the physical sensation of touch is removed, revealing just an act of proximity with devices. The piece used Leap Motion technology that allows the user to move a cursor by using their finger to directly point to a projection screen. [14] In the piece, the user gains control over an illuminated spotlight that can be directed across the surface of the screen. As the spotlight moves, it projects a shadow image onto a screen which is embedded with several physical cuts, transforming it into a combination of two-dimensional image and three-dimensional object, lending the cuts the illusion of depth. The work is an

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[14] Leap Motion is a device (developed in 2010), that is connected to the computer and replaces the mouse as a controller. It instead enables the user to navigate the screen using just hand gestures and movements.

exploration of interactions with an apparatus that privileges gesture over physical connection, but where the concrete haptic experience is removed. The finger is the digit that is more associated with pressing (the shutter release) to enable the photograph. *Presence of Touch*, by contrast, allows the image to be generated simply by virtue of pointing to the screen. It is as if the apparatus doesn't just respond to, but occurs in concert with, gesture. The work forms a bounded circuit where the *point* is a visualization of a literal indexical gesture by the finger to an apparatus that responds to the gesture. Touch is virtually present through interaction with the digital system of operation, as Mary Ann Doane has noted:

> The first definition of "digital" listed in the *Oxford English*
> *Dictionary* is "of or pertaining to a finger, or to the finger or digits."
> (Doane, 2007)

Traditional understanding of photographic indexicality has associated the photograph with a material connection to its object in the physical world. As my research has developed, however, it has become concerned more with an indexicality that looks inwards towards the system of the apparatus and process itself. Indexicality in the context of generative data images therefore refers to a rather different form of trace, as Gottfried Jäger has noted:

> [generative images] provide neither icons nor symbols but only the
> indexically authentic and permanently visible trace of
> electromagnetic radiation (light, warmth) on radiation-sensitive
> material (AgX, chip). Therein lies their potential. (Jäger, 2018)

The data image directs its indexicality towards the inner conditions of the programme, the resulting images referring to nothing other than themselves: it is auto-referential and auto-reflexive. It has only been through developing a symbiotic working method with the computer apparatus that the data images that constitute my practice research have been created. The apparatus is both a physical and conceptual prothesis; a corporeal and cognitive extension of myself as operator (or who Flusser refers to as the 'functionary'), the photographer therefore becomes totally implicit in it. This is what

has made my practice research working method with the photographic computer apparatus a practice of interactive game play, something that Flusser recognized as being characteristic of working with the technical photographic apparatus. The role of the programme is to provide the sufficient potential of combinations in order to create the play between apparatus and functionaries:

> 'The photographer is committed to the exhaustion of the photo-
> program, and to the realization of all the virtualities contained there.
> The program, however, is rich and nearly impenetrable. The
> photographer is committed, then, to discovering hidden virtualities in
> the program.' (Flusser, 1984, p19)

The software that is central to the programme I use for my research is one that is used as an engine for creating content for the computer games industry. I do not use the programme for this purpose, however, though the interaction with the programme is not dissimilar to that of a game. My research has generated images that have been created not from observations or abstractions of the world, but via intuitive ideas that are literally 'in play' with the internal conditions of the apparatus. Flusser likens the programmable apparatus to that of a game of chess that incorporates various moves and combinations through a partnership, even a convergence, of two agents: that of the programme and that of the functionary. The computer programme I use for my research provides controls and settings that offer a vast range of possibilities of using various controls. These affect colour, hue, saturation, shading, transparency, display, viewpoint, and distance, as well as behaviours that determine the way in which the digital objects that comprise the data image interact with one another or respond to light at various intensities. Unlike the relatively fixed programme of the mechanical camera, the 3D digital image space is one that is dynamic and capable of more intense interaction, where algorithms play an integral part in the game play of image making. Flusser states that the machine that is made of hard materials is not the game, rather 'it is the rules, the programme that make it a game' (1984, p30). As in a game of chess, as ability with the programme improves, it is intuition that begins to establish the lines of play and increase the potentialities of what the game offers beyond just the intent of the player. Working in the Autodesk Maya software space there is a sense of another

entity at play in the virtualities of the programme and its potential as an acting agent. I am aware of playing within this space, performing both the role of functionary and that of a programmer of the programme. I choose a surface, assign a property, create a light, and direct it on the surface. I make selections and the programme provides the visualization in response to that action that directs the next selection and so on.

Non-human Photography

The photographic process, since its infancy, has been entangled with nonhuman agents. Fox Talbot recognized this in his early experiments that he called sun pictures – or photogenic drawings – published in his book, *The Pencil of Nature* (Talbot, 1844). Fox-Talbot made a remarkable comment that still resonates with me and continues to inform my thinking about the work I make:

> The plates of the present work are impressed by the agency of
> Light alone, without any aid whatever from the artist's pencil. They
> are the sun-pictures themselves, and not, as some people have
> imagined, engravings in imitation. (Talbot, 1844)

From the beginning of his experiments, Talbot recognised the essential non-human components of the photographic process. The image is generated by the energy of the sun, effecting the light sensitive material. Although not articulated as such, Talbot brought to the fore the work of the nuclear forces of nature, in particular the impact that photons and electrons had on the photographic material he had developed. *Sun Pictures* (Talbot, 1845) are images drawn by light and light alone, according to Talbot. His role as functionary was to facilitate the making of the *Sun Pictures*, to help bring them into being as photographic images. Talbot also recognised the virtuality of the photographic image as viewed through the Camera Lucida, prompting him to reflect upon it as an apparatus:

> […] the inimitable beauty of the pictures of nature's painting which
> the glass lens of the Camera throws upon the paper in its focus—

fairy pictures, creations of a moment, and destined as rapidly to

fade away. (Talbot, 1844)

Fox-Talbot's *Sun Pictures* can be associated with the creation of the very first

photogram, an image made by recording the shadows and traces of objects by using

the agency of the sun as the primary source of illumination.[15] I draw parallels between

Talbot's understanding of the photographic process and digital photograms that

reference my research for *Virtual-Actual*. My research is the result of a confluence of

internal and external virtual influences where I recognise the action of these unseen

forces. My image making methodology that takes place within the 3D computer space

is not dissimilar to that of Fox-Talbot's method for generating his early *Sun Pictures*. A

surface plane is created in the software: this is the digital equivalent to the photo

sensitive paper used as the base for traditional photograms. The surface plane created

in the software has properties that respond to light in different ways, that is, reflective,

opaque, or transparent, colour or colourless and these properties are totally

controllable via the menus and functions through the programme interface. Next, the

light sources are selected. These are also numerous, differing in type and quality,

characterised by the way in which the source emits light, be it focused, flooding, soft,

hard, ambient, or directional. The light is pointed to illuminate the surface. The

distance and intensity of the light source determines how the light and shadow behave

with the surface, the number of photons emitted, how many penetrate the surface and

how many are reflected. A three-dimensional digital object is introduced, interrupting

the light of the surface creating a shadow. It is a feature of the programme that the

object itself can be hidden to leave only its fixed shadow. In his *Some Account of the

Art of Photogenic Drawing* (Talbot, 1839), Talbot recognises that what was central to

the image process was not the representation of the object but the art of fixing its

shadow:

'The most transitory of things, a shadow, the proverbial emblem of

all that is fleeting and momentary, may be fettered by the spells of

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[15] The term photogram was not used widely until the 20th century. A traditional photogram is a photographic image (made, usually in the darkroom) that records the shadows left by objects placed directly onto light sensitive material that is exposed (usually) by an artificial light source. The image is then processed in chemical developers and fixed.

our *"natural magic,"* and may be fixed for ever in the position

which it seemed only destined for a single instant to occupy'

(Talbot, 1839)

The digital photogram is similar in process to a traditional photogram in that they are both characterised by their ability to record shadows left behind by objects that occluded light, shadows that are characterised by the actual physicality of the object. The traditional photogram is a direct process that records the effects of light on light-sensitive materials as it interferes with objects to create shadows. There is no camera or hard apparatus involved, however, so the photogram still adheres to the features that according to Flusser determines the key principles of the photographic apparatus. The process is programmed: paper types are selected, exposure times are determined, chemicals are selected, temperatures are set. To extend Flusser's game of chess analogy, the pieces are placed and the movement of the objects on the photographic paper set the game in motion. Creating a digital photogram in the digital realm directly echoes this practice. The positioning of digital objects along with algorithms determined by the settings, create the potential for infinite combinations that the apparatus responds to in order to form a data image. The images are the result of experiments within an algorithmically defined digital space. The process is the material practice constituted by the almost limitless possibilities of the computer system in coalescence with me as functionary.[16]

Light producing Digital Apparatus

My research explores light on surface in a 3D digital software environment. This requires that the computer apparatus must independently generate light to affect and respond to surfaces and objects in this space. Light, therefore, is part of the programme, part of the apparatus, something that differentiates it from a mechanical photographic apparatus that draws light in from an external source. The digital apparatus generates the light source and digitally configures its behaviour. To understand my research in this space, it is essential to explore how the computer

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[16] Flusser's term. Flusser, V. (2011) *Into the universe of technical images.* Minneapolis, Minn.: University of Minnesota Press ; Bristol : University Presses Marketing [distributor].

apparatus generates light. The computer is a machine that cannot function without light. Optical fibers allow electromagnetic energy to flow across networks and computers generate low frequency radiation: non-visible light that is nonetheless part of the wider light spectrum. The computer monitor emits electromagnetic energy within the visible light spectrum that enables an image to be perceived. The computer apparatus, and in particular the software I use for my practice research, simulates light and light characteristic within the software programme (see Figure.11). The number of simulated photons within this digital space can be adjusted though the use of the menu controls and settings available on the programme interface, allowing a wide range of light sensitivities, intensities, hue and colour settings.
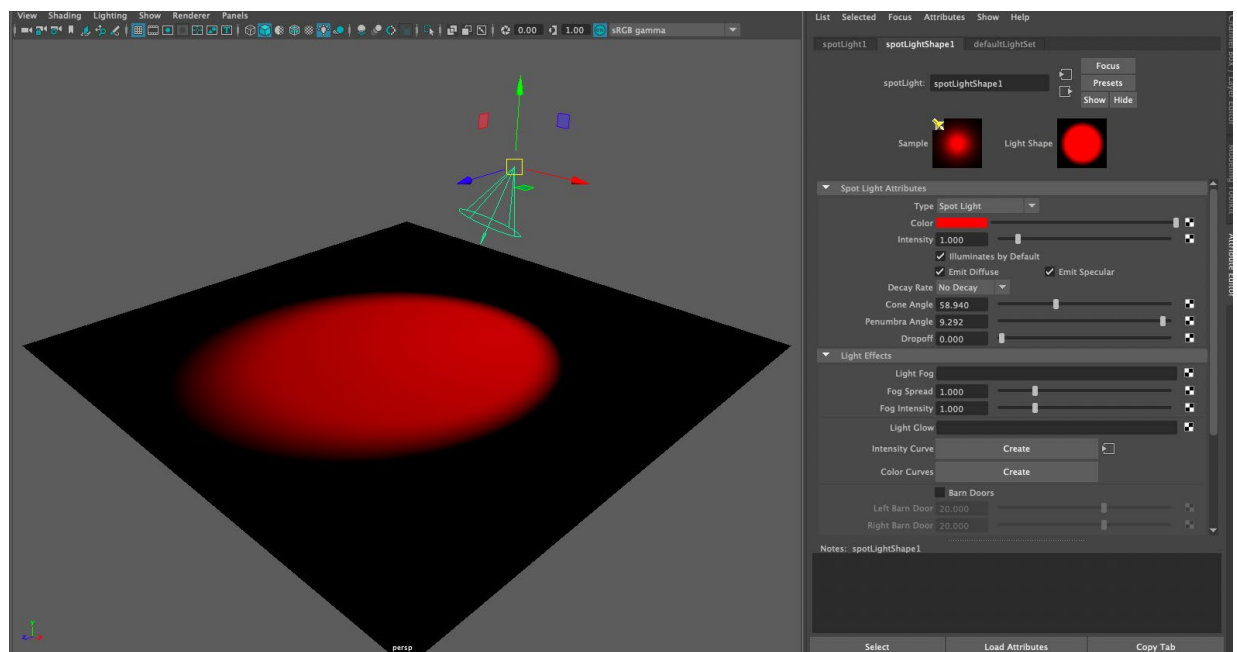
Figure 11. The Maya 3D Digital Interface showing a simulated spotlight, light source, and controls

Colour in the physical world is determined by a particular wavelength of the light, with visible light limited to a small range of frequencies within the electromagnetic spectrum. Light within the simulated environment of the 3D digital space is determined by the system's raw data, the bits and bytes of information that whirl around the machine at the speed of light. The intensity of light from natural source is determined by the number of photons. Digital light intensity in the 3D computer apparatus is generated through the selection range of the data set. The 'agency of light alone' that

Fox Talbot refers to in the *Pencil of Nature* (Talbot, 1844) is generated by solar energy that provided the 'raw material' for his sun pictures. This energy is essential to the programme of making the images prior to them being fixed. The computer apparatus, however, generates its own energy entirely within the system of the apparatus, creating effects, radiating, and illuminating objects within the simulated image space. In the computer apparatus objects and light are reduced to the same form of energy, the voltages and fluctuations that produce the data necessary to generate the image. In photographic parlance there are essentially two forms of light: The first is classified as natural light such as that emanating from the sun, or heat in the form of fire; The second is described as artificial light generated by electrical sources such as photographic lamps. I argue, however, that this is a false distinction: Light is created by photons that are the same photons irrespective of the nature of the light source. The photon is simply a packet (quantum) of energy. The simulated light that is generated in the 3D digital workspace, however, is the only truly artificial light source, which is latent until it is actualised as truly photonic light emitted from the monitor in the form of an image.

The Apparatus in Generative Photography

The work of Gottfried Jäger (b. 1937) has been a long-standing influence of my research practice. Jäger's work has, since the 1960s, evolved outside of the mainstream photographic canon in part because it is an approach to making that has cut through the structuralist view of photography as a medium that privileges representational purpose (that is to say, photography as cultured and codified through language). The term *generative photography* was used by Jäger in the 1980s to describe images as productions of a photographic generative system, a reciprocal contract between photographer and apparatus to create aesthetic objects. His work and writings have provided me with a more thorough critical understanding of the photogram, particularly from the perspective of the field of *generative photography*. Jäger is the first and foremost exponent of generative photography which was a reaction to what

he termed 'subjective photography' (Steinert[17]) or photography that placed the artist at the centre of the work with little if no recognition of its technological components. Jäger remains a key exponent in the field of *concrete* and *generative photography*, and I will address his photographic practice in more detail in Part Two of the thesis, but here I want to address Jäger's approach to *generative photography* as a working and thinking method in the context of the photographic *generative photography* and the digital photographic apparatus. *Generative photography* is a sub-category of *concrete photography* which is characterized by working directly with photographic materials, that are often displayed in their physical conditions as photographic images. Though concrete photography usually refers to analogue photographic processes, data images or generative images do share the same DNA as concrete images in that they:

> do not seek to reproduce or represent anything that goes beyond
> their own being. They are nothing but themselves […] Their
> reference is their programme. (Holsing, 2015, p33)

For my research, direct image translations of the world is not the aim of work. This has liberated and enabled me to disregard any representational constraints and limitations, allowing the apparatus as a free entity to become an active co-creator, to create an image of itself unfettered by the need to represent a world external to it. My research method allows the programme to become an active participant in the creative process through the reciprocal construction of images that is not programmed to imitate objects or scenes from the external world. The software algorithms respond to the instructional input which allows the apparatus to reveal its inner structures and conditions. The digital process realizes itself: the results are automated, auto-reflexive, self-determining data images. The works *IX-2-5* (2018), for example, are the result of a single spotlight source directed on a surface plane and the data images differ only in the response to control variations applied to the reflectivity and colour of the surface, and control shifts that vary the intensity, colour and penumbra of the light source. The light source produces a similar effect to that expected from a physical spotlight and produces a 'hot spot' in the centre where the light is at its most intense, gradually

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[17] Otto Steinert is credited with the term 'subjective photography' that was used as a title for several touring photography exhibitions in the 1950s.

losing intensity and changing its behaviour and response to the surface as it reaches the outer edges of the light source.

Jäger refers to generative photography as 'productive photography' (Jäger, 1986), which he differentiates from reproductive photography in that is more concerned with observation and representation, he states,

> Generative photography rejects the conventions of an established medium and can be regarded as an alternative model for treating an apparatus-based and data processing system in a creative fashion [...] do-it-yourself apparatuses combined with picture sequencing techniques and a clearly defined program. (ibid)

Generative photography treats the computer not only as an apparatus of technical production but places it at the heart of creative process as a functioning generative component, displaying 'its own independent program'. Generative photography is described by Jäger as 'image given, not image taken' (Jäger, 2011), talking of generative photography as a unity between photographer and apparatus to form a creative interplay, advocating a collaborative approach to science that ethically directs us towards genuine human needs: 'It is time', he says, 'to rekindle an earlier role of the artist, that of explorer and inventor' (Jäger, 1986).

Conclusion

The photographic apparatus as a self-determining system is a key element of my research. This investigation confirms that the apparatus is not simply a tool, but part of an engaged practice. As operator, I consider myself part of the programme, implicated and entangled in the multiplicity of its *haecceities.* The apparatus, like everything, has virtuality built into the system: latent forces and potentialities that become actualised through the act of generating photographic images. My research is a practice that recognises the agential non-human nature of the photographic process; that is a process that is both human and nonhuman at the same time. The intra-active process of working *with* the apparatus is one the central concepts my research and underpins

the work that has resulted in the series *Virtual-Actual*. What Flusser refers to as a 'game' (1984, p27) is important as it entangles the photographer and machine as playful agent of the process of generating images. The moves of the game, through the transferability of digital objects and light, constitutes the programme's raison d'être.

My research is also, I argue, an extension of Gottfried Jäger's generative photographic project, where photography emerges from a photographic system that is auto-reflexive, referencing its own internal conditions and indexing its digital self. What has emerged is a move toward a new ontology of photography where I am an inherent agent in the digital milieu. Matter is no longer a given, as our understanding of materiality, concepts, thoughts and digital production are material practices too.[18] This understanding opens new ways of thinking beyond dualistic dichotomies such as subject/object. Quantum literacy, or the diffractive methodologies that Barad (2007) actively promotes, may help promote a more holistic understanding of subjectivity and meaning, one that incorporates both human and nonhuman entities and where techne and technology intra-actively fluctuate.

This first part of my thesis has outlined the crucial relationships between the photographic apparatus and its symbiotic relationship with the creative process in my research. This initial exploration interrogated the complex entanglements of assemblages in the creative process, positioning the photographic apparatus not merely as a facilitator but as a potent creative participant, where the apparatus – empowered with agency – co-creates with other actors to the point at which it raises questions regarding the Catertesian dualism of subject and object.

In Part Two of my thesis, I will deepen this exploration by considering the more nuanced interactions within the 3D digital environment. This transition is not a departure, but an extension of the foundational inquiries established in Part One. The behaviour of digital objects, the interplay of light and shadow, and the new materiality of surfaces demands a reconsideration of non-representational photographic image making. This phase of my research interrogates a 3D digital space that extends beyond

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[18] See Introduction to *New Materialisms*, Coole, D. H. and Frost, S. (2010) *New materialisms : ontology, agency, and politics.* Durham, N.C.: Duke University Press.

mere simulation of the world proposing, instead, a realm where the Virtual and Actual not only intersect but coalesce, revealing new dimensions of making and perceiving.

I therefore continue to explore and re-evaluate the expansion of the role of the photographic apparatus in my research where digital phenomena, uncoupled from the constraints of physical space, offer a unique canvas for creative experimentation. This exploration is not confined to the technical or the tangible but encompasses a broader philosophical and existential inquiry into the nature of perception, and the creative act itself. As a consequence of this, part Two of the thesis explores the tentative link between the seen and the unseen, the tangible and the ineffable and the perceptual point at which the virtual and actual intra-act.

Part Two

Liminal space; towards a Virtual-Actual coalescence

Introduction

Part Two of my thesis is an investigation into how digital objects behave in the 3D algorithmic environment in which I am working. Through a discussion of the development of my research I will explore how the behaviours of light and surface within the algorithmic digital realm provides a re-evaluation of light on surface within this 3D software generated space. Part One of my thesis investigated what it is to work with an apparatus that is an active co-creator and agential creative producer in the process of making images in a 3D environment where the human and non-human coalesce, and where the photographer and apparatus become entangled within the creative process. In this part of my thesis, I will interrogate the thresholds between and within the dualities and the monistic liminal spaces that drives my research, namely: light-dark, foreground-background, tone-colour. I will explore the 3D digital workspace through a discussion of selected images that influence and mark the development of *Virtual-Actual*. This 3D environment, where objects are created and provided with characteristics and properties, is foundational to this research and important to understand. This environment determines how light sources in this algorithmically determined space behave and interact with objects: how both the colour of surface materials and the colours of illumination sources combine through differing levels of light intensities. Part Two introduces a further discussion of the photogram, which are conventionally described as photographic images that are the result of shadows formed by objects on light sensitive material: a fusion of light, object and shadow within a singular image. Similarly, the digital renderings that are generated in my research appear by blending light with surfaces to create interactions of colour using a vast range of selections and combinations offered by the menus within the system's software. *Virtual-Actual* explores not simply the threshold between light and surface, but rather their complete fusion and interdependence: what is explored is the threshold itself. In the digital workspace, this can be conceived as the point at which light illuminates and radiates, and where surfaces reflect and absorb. The research

suggests that any clear or sustainably defined duality within the 3D space is difficult if not impossible to determine, given that all objects at source are reducible to nothing but electrical signals and impulses.

I will begin, though, by discussing the digital realm that constitutes my digital workspace. Through a discussion of my research, I will then investigate the potential of the system to provide digital objects that bear the properties and characteristics that respond to light. By means of considering the complex notion of light, shadow, and surface and its effect on perception, I will draw from the Gestalt theory of figure/ground (page 83). Using this theory, I will discuss the threshold of fluctuations and oscillations of light and shadow that questions the degree to which figure/ground can be considered discreet elements within the visual field. I will also discuss Goethe's *Theory of Colour* (1967) and, more specifically, his discussion and explanation of 'after-vision' (page 86). By means of highlighting the effects of combining tones and colours in my research images, I will use Josef Albers' *Interaction of Color* (1971) as a key reference (page 89). Finally, I will draw on Henri Bergson's observations of intensities, multiplicities of differences in kind (Bergson, 1912) and the degree to which light should be considered in terms of quality or quantity (page 95).

These theorists and practitioners are brought together because of their individual accounts of light, surface, and colour. They have in common an experiential approach to their investigative work which is the result of their recording of immediate data. Primarily these theorists and practitioners tend to draw from their independent thoughts and experiences as the basis of their research, rather than grounding their work on scientific theories. In this way they were mostly uninhibited by the historical paradigms that constituted the 'scientific facts' of the different eras they worked in, and instead often used careful individual observations as the methodology to generate their theories. Part Two therefore also introduces and explores what is meant by light in the context of the 3D digital space which is discussed through the work of key practitioners. Firstly, however, it is important to provide a brief explanation of the different understandings of light and its behaviour that informs my research within the 3D digital space.

A summary of light and its behaviour

In traditional photographic practice the terms natural and artificial light are used to describe the difference between two key visible light sources. As the term suggests, natural light is assumed to be light that is created by or occurs from natural sources such as the sun, stars, or natural phenomena such as lighting. Conversely, artificial light is generally referred to as light that is generated by manmade sources such as candles, electrical lamps and lasers. All light, however, is radiation and is determined by particles called photons that operate at different intensities and wavelengths. As photons do not have 'natural' or 'artificial' identities, it is not possible to determine a difference between the photons that comprise 'natural light' and photons that comprise so-called 'artificial light' since both definitions of light are formed of identical packets of energy. In *Light: a very short introduction* Ian Walmsley (2015, p1) highlights the two key Latin words that describe the two denotations of light, *lux* and *lumen*. These words represent very different aspects of light: *Lux* refers to light as a physical entity – something fundamental to life that can be measured through levels of brightness, luminosity, and energy. *Lux* is used as a measurement in conventional scientific experiments to determine the number of photons falling on a specific point on a surface. *Lumen*, however, is a word given more to metaphysical interpretations of light, as it denotes the questioning of light itself. *Lumen* is light interpreted as a quality rather than a measurable quantity. *Lumen* pertains less to the measure of brightness and luminosity and more to the total light output. It is also associated with the aesthetics of light and its potential cultural and symbolic meanings. Both interpretations of light are relevant to my research: *Lux* pertaining more to the software system and its controls, applied to the levels of light produced to the scene through the range of menu options. *Lumen*, however, describes the results of my research which pertain to the qualitative experience of light as phenomena, something that is entirely non-material, non-physical and does not belong to the realms of measurable entities but to qualia.[19]

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[19] Qualia pertains to the mind that can be considered instances of subjective or conscious experience.

Walmsley (2015) book also covers the development of two different understandings of light and its behaviour. In the first, he discusses light understood as rays – streams of particles (photons) that follow predictable paths. This is known as Newtonian optics after Isaac Newton's experiments (1704) with light that led to the classical interpretation of light that is reflected, refracted, dispersed, and absorbed. Newtonian laws set out the behaviours of light that are predictable and measurable, and Newton's famous quote adamantly expresses this:

> 'Are not the Rays of Light very small Bodies emitted from shining
> Substances?' (Newton *et al.*)

Newtonian optics, however, does not answer all the questions pertaining to the behaviour of light. This required an understanding of light not as particles but as waves, the key contribution of which was made by James Clerk Maxwell in a paper to the Royal Society titled *A Dynamical Theory of the Electromagnetic Field* (Maxwell, 1865). In this paper Maxwell offered an understanding of light as oscillating wave forms of different lengths that correspond to colours of the visible spectrum.

In his second discussion of light, Walmsley introduces the most current understanding of light and its behaviour which is found in the field of quantum mechanics. Whereas previous interpretations of light relied on dualisms such as cause/effect and wave/particle, developments in the early part of the 20th century by Max Planck, Albert Einstein and, later, by Niels Bohr challenged this model. Perhaps the best way to explain the contribution of quantum mechanics to the understanding of light is Young's double slit experiment explained in Part One of the thesis. The conclusion is that when photons remain unobserved, they take on wave-like behaviour: they are everywhere and nowhere until they are observed, when the wave collapses into a particle with a fixed location in space. This has become known as the wave-particle duality where effectively light is both a wave and a particle at the same time, depending on if, or how, it is observed. Furthermore, it should be noted that this experiment works in the same way with electrons, so even particles that have mass behave like waves until they are observed.

This brief introduction to the nature of light is important to understanding my research. Light as modelled in the 3D digital space behaves in accordance with the cause-and-effect model associated with Newtonian laws of optics. Light in the 3D digital space responds to surfaces and objects with the same reflective and refractive indexes ascribed to light behaviour according to these conventional optical physics. I am referring here to photons as modelled in the software and their effect on surface materials and objects including their reflection, refraction, scatter, diffusion, and absorption under prescribed conditions. In other words, the double-slit experiment cannot be repeated using the common functions in 3D digital software. Light that corresponds to the Newtonian optical laws within the software are simulated through a rendering technique known as *raytracing*. This modelling technology ensures that each beam of light interacts with a range of materials in a way that can be predicted and expected using Newtonian optics. For example, raytracing models light behaviours according to its effect on the colour, angle of incidence, reflection, and refraction on material surfaces in the 3D digital software. Light on objects that create shadows in this space are actively, directly, and immediately affected by light sources as and when they are moved or repositioned. Therefore, all digital objects within the 3D digital space that are affected by light in the space can be treated as responsive to the software's dynamic operations.

The digital workspace

My initial approach to working in the 3D software is through an exploration of planar digital objects and the ability for the software to generate digital flat surfaces as well as three dimensional objects in the 3D space. These objects possess properties and characteristics such as shape, form, and colour as well as occupying a geometric position within the perspectival view of the scene. The software presents a range of basic digital objects such as polygons cubes, spheres, cylinders, cones, and planes that can be accessed through graphical controls (see Figure 12).

Figure 12. Maya software interface: surface plane ribbon

These digital objects represent the default digital shapes and forms within the space that are the starting point for most users to begin generating digital scenes. The shapes and forms are selected and placed into the spatial environment the *scene*. As digital objects they can be moved, intersected, and aligned within this 3D perspectival scene. These polygon shapes and digital forms must be assigned a material that has characteristics and properties that respond to light before they can be illuminated by a range of default light sources (see Figure 13).
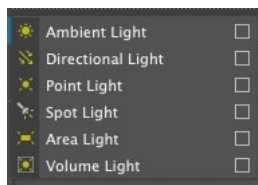

Figure 13. Maya software interface: light sources ribbon

Each light source possesses its own range of properties, behaviours, and characteristics. Light sources are generated to illuminate and interact with polygon shapes and forms within the space, creating what might initially appear to be a dualism predicated on a distinction between surface and light. These digital object selections create the starting point for my research by generating formed objects in corelation to other formed objects. The final *rendered* images are the result of forms, colours, characteristics, and properties of digital materials. They respond to selected light sources through the way they react to photons as they are reflected, refracted, or absorbed by the material. An example of these combinations of intersecting objects is an image made at the beginning of my exploration of the 3D digital space – see Figure.14. This shows a series of planes that are provided with transparent properties and characteristics that intersect with each other within the environment and respond to light in a way expected of transparent materials.
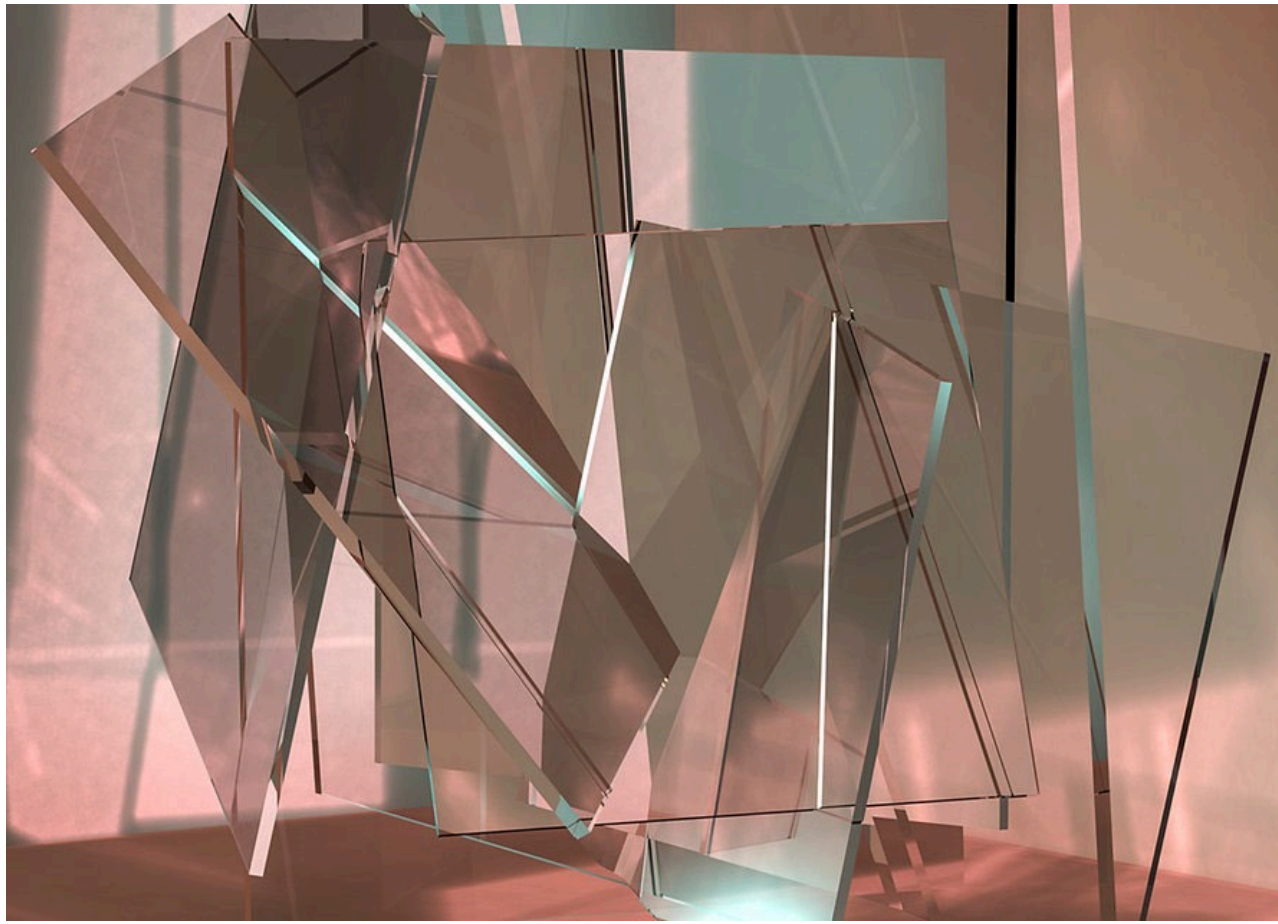
66

Figure 14. *VI-1.* Paul Proctor (2017)

These objects are responding to two light sources that illuminate both the objects and the wider environment and reflect, disperse, and refract the light, creating shadows across each other as well as on the surface planes behind them. The rendered image is one where the transparent objects and their interactions become a central object where light and shadow also become integrated graphical elements of the image.

Concrete and generative images

Within the contexts of contemporary photographic practice, my research is most accurately contextualised through the concepts of concrete and generative photographic practices as discussed in in the previous section. The series *Virtual-Actual* is comprised of non-representational, self-reflexive images and are images that reference only their own process and conditions. These images are 'generative' in the sense that they emanate from the data of the machine and this research explores the process of their inner conditions and potentialities

Much of what constitutes 'Concrete photography' may also be applied to generative photographic practices and the terms are often used synonymously. Generative and Concrete photography, Bernd Stiegler states, are 'kindred spirits' – both contribute to the 'freedom of photography […] to regain the autonomy of photography' (Stiegler 2014). Concrete photography can also be understood as an extension of Theo van Doesburg's *Manifesto of Concrete Art* (Doesburg, 1930), though the manifesto references painting as the core discipline and promotes six guiding principles:

1. Art is universal.

2. A work of art must be entirely conceived and shaped by the mind before its execution. It shall not receive anything of nature's or sensuality's or sentimentality's formal data. We want to exclude lyricism, drama, symbolism, and so on.

3. The painting must be entirely built up with purely plastic elements, namely surfaces and colors. A pictorial element does not have any meaning beyond "itself"; as a consequence, a painting does not have any meaning other than "itself".

4. The construction of a painting, as well as that of its elements, must be simple and visually controllable.

5. The painting technique must be mechanic, i.e., exact, anti-impressionistic.

6. An effort toward absolute clarity is mandatory.

Concrete photography, in line with the third principle of the manifesto, provides concrete images that refer only to themselves. *Virtual-Actual* (if this image series has any indexicality at all) would be indexical to the degree that it points to its own inner conditions or the conditions of the system from which the images were generated.

Referencing the second guiding principle of the manifesto, the images are not intended as representations of external cultural phenomena or concerned with semantics, instead they have no meaning beyond themselves, they are not intellectual images but intuitive (something I will discuss in greater depth in Part Three of my thesis (page 102)).

Gottfried Jäger (discussed previously) is generally considered to be the father of concrete photography describes concrete photographic images as 'independent, authentic, autonomous, autogenic, photographs of photography' (Jäger, Krauss and Reese, 2005, p15). Jäger's photographic work (which spans more than sixty years) continues to lead thinking about concrete and generative photographic practices today. Though there is a vast range of images from which to draw inspiration, Jäger's *Luminograms* are particularly relevant for the purposes of this research. The series 'Colour Systems' (though made in a traditional darkroom and chemically processed) – see Figure.15 – are images that exemplify the mission of concrete photography, based on the pure emanation of light on a photographic surface and the process of exploration and experimentation.
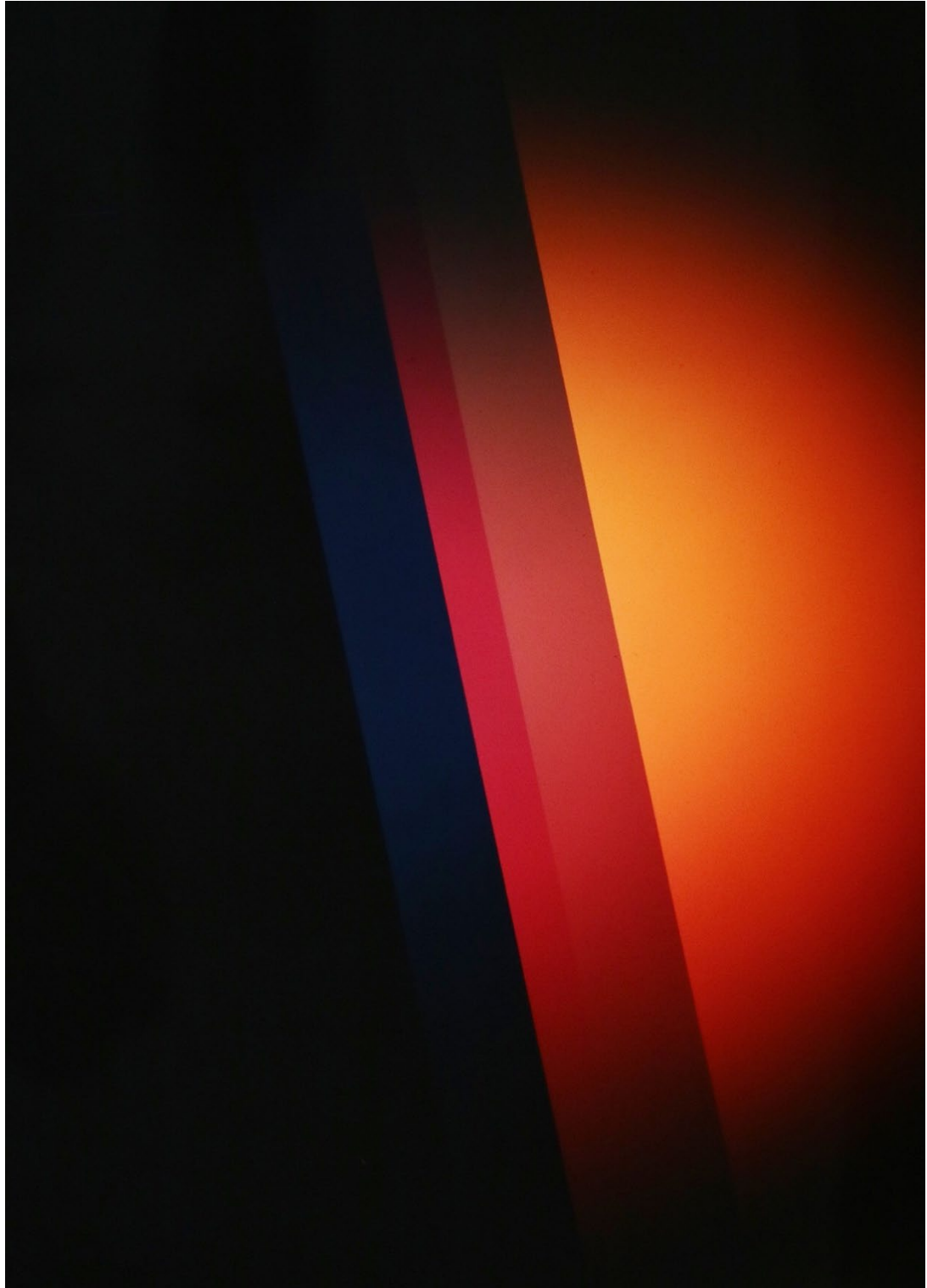
Figure 15. Gottfried Jäger, *Luminogram, VII.1* From Series *"Color Systems",* 1980 Pigment Glossy Print on Fujicolor 27.6 x 19.7 in

According to Jäger:

[The] concrete photo is a genetically necessary form of

photographic self- assertion, self-reflection and self-representation;

it is also a form of self-assurance, a reflex of an increasingly self-

confident, sometimes self-loving and absent-minded, but also self-

critical glance in the very mirror of photography… Concrete

photographs are auto- poietic; they are self-portraits of

photography. (Jäger, Krauss and Reese, 2005)

Stiegler (2014) has recognised the internality of Jäger's work which is a key component of concrete and generative photography. Gottfried Jäger, Stiegler notes, 'decides on the "inner world of the outer world of the inner world" '(ibid, p1), making the interior dimension of the photographic process the very subject of photography. Most importantly, Jäger understands that his photographic work is generated at the interface between Man and Machine and, therefore, as the interaction between these two agents. It is at the threshold between the two that the images establish their intrinsic logic.

The term *Generative* photography (which is often use synonymously with *Concrete* photography) is also a term used by Jäger to describe the process of photography 'not as reproductive, but as a productive, "generative" system' (Jäger, 1986). *Generative* photography is, therefore, an appropriate term to use for my research as it suggests the intrinsic and essential role of an apparatus-based, data processing system in the procedure of making. The photograph, Jäger states, 'can be considered an expression of the relationship between apparatus and artist and between the rational and emotional needs which the photographer tries to unite in himself and use to achieve effect' (ibid, p21). Jäger also recognises the work for the next generation of generative photographers whose:

[…] aim is to work inside the apparatus and to live within its

possibilities and relationships. 'Insight Into Photography' is the new

motto: This "within-photography" is one that evokes its own

intensified being. It is no longer (as during its analytical stage)

photography about photography, but rather, photography within

photography, a self-orientation, a self-absorption'. (ibid, p23)

(The notion of the 'within' of photography will be discussed further in Part Three (page

150) of the thesis where intuition becomes a key element in the engagement with the

research).

Interpretations of the Photogram

During a visit to the *Shape of light: 100 Years of Photography and Abstract Art*

exhibition in 2018, I saw the large scale digitally constructed photograms that

photographic artist Thomas Rüff made in collaboration with designer, Wenzel S.

Spingler in 2014. In an introductory conversation with Valeria Liebermann in his book

Photograms and Negatives (Ruff, Liebermann and Spingler, 2014), Rüff explains the

collaborative intention with Spingler to create a 'virtual darkroom' (p.9) where digital

photograms could be created through 3D visualisation – see Figure.16. This determined

Rüff's approach to generating digital photograms using 3D digital visualisation software

which could be described as a simulation of an analogue darkroom. Rüff's large scale

images are the result of digital objects placed on an artificial piece of digital material

which are illuminated by constructed digital light sources. Unlike analogue photograms

(where the size of the physical print is determined by the objects placed on the light

sensitive material (1-1)), digital photograms are not limited to the size of physical

objects; photograms made in the virtual darkroom are scaleless and, therefore,

unlimited in terms of print size – see Figure.17 – hence Rüff's decision to produce very

large-scale images shown in the gallery space.
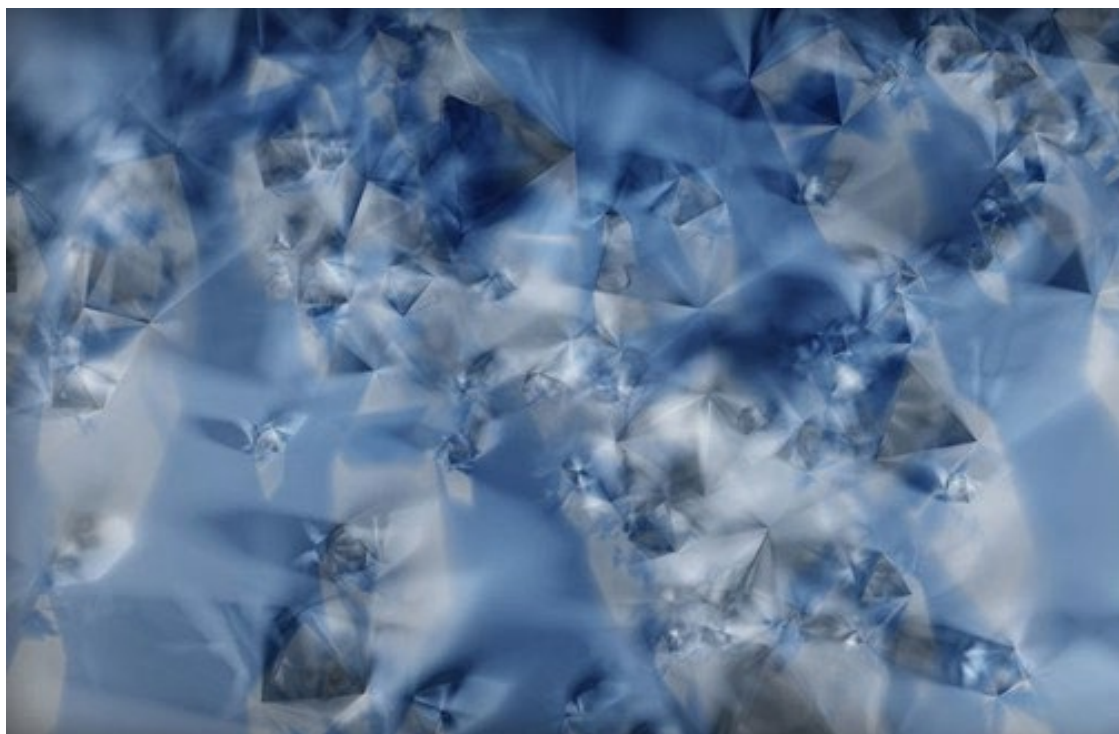
(Figure 16.) Thomas Rüff *phg.10_1* (2014) from Photographs and Negatives, Gagosian Gallery

(Figure 17.) Thomas Rüff *phg.10* (2012), r.*phg.07* (2013) Installation view Tate Gallery

Rüff's digital photograms are highly structured and digitally designed images that make use of the controlled environment that Rüff refers to as a virtual darkroom. I consider Rüff's image to be digital simulations of traditional photograms. They draw directly from the geometric structures and language of the photograms produced during the modernist era such as those created by Moholy Nagy in the 1930s and 1940s – see Figure. 18, and the Vortographs created by Alvin Langdon Coburn – see Figure. 19.

Figure 18. Lázló Moholy-Nagy *Untitled* (1940), Gelatin silver Photogram

Figure 19. Alvin Langdon Coburn *Vortograph (*1917), Gelatin silver Print

This is how I too might have continued working in a similar 3D digital space were it not for a key discovery within the 3D digital space. This created a key shift in my research method and thinking, initiating a new line of flight in my research that changed my

approach from the modelling of materials towards, instead, an exploration of the traces of their shadows.

The non-present present object: a research turning point

During the exploration of creating objects to form shadows on a surface – see Figure 20 – I discovered that within the software settings, polygons and other digital objects that interact with light could be independently hidden prior to the rendering of the final image. The digital rendering of an image is the process where algorithms set pathways to generate high resolution photorealistic images. These images can then be saved as image files capable of being digitally printed as photographs. Removing digital objects in the scene before rendering the image means that only the actions of light created by the object's reflections and shadows remain in the image, the object itself is retained within the system only as raw data, with the objects no longer visually present.
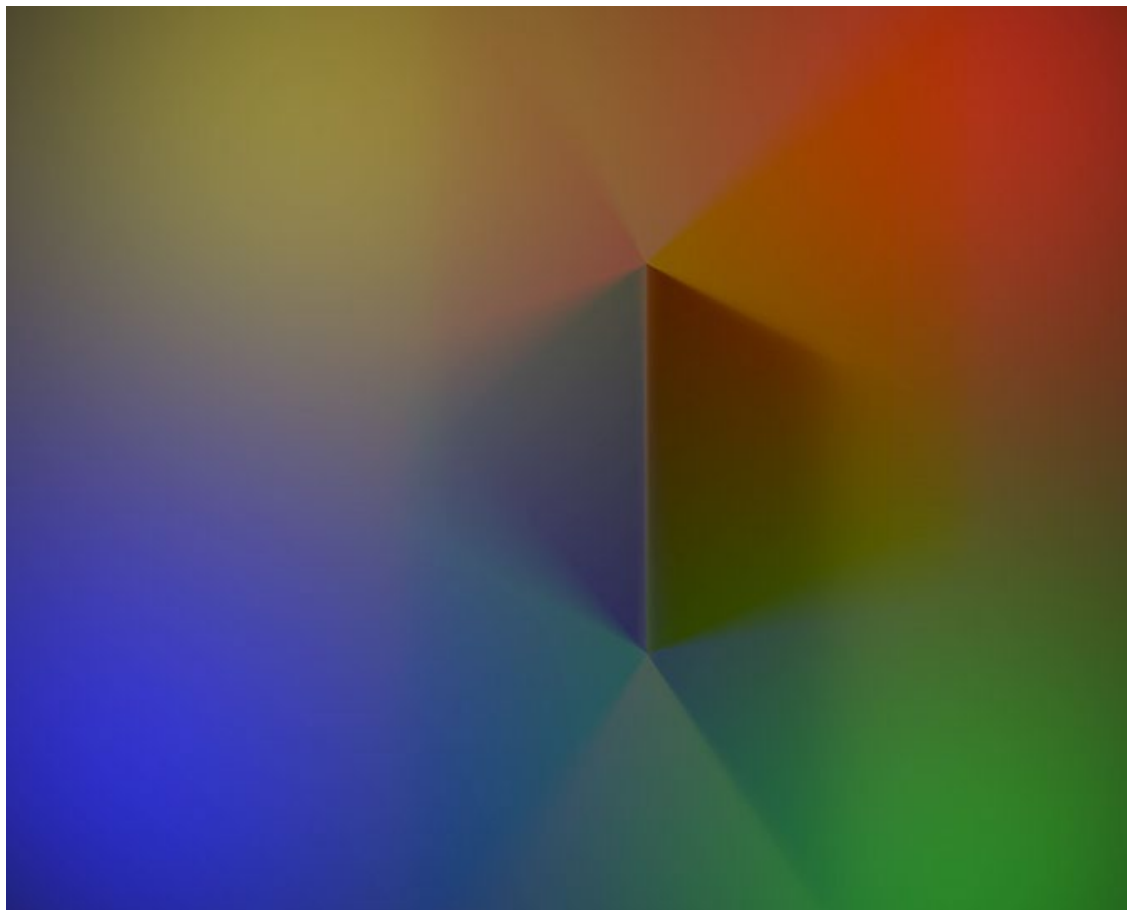

Figure 20. *VIII- 2.* Paul Proctor, (2017)

The image – Figure. 20 – began as a surface plane upon which another central plane (which I will call the object plane) was placed perpendicular to it. This object plane was illuminated by four different light sources placed at each corner of the frame. Each independent light source was allocated a different coloured filter. In the image, the object plane reacts to these light sources by generating reflections and shadows onto the surface plane. When the image was prepared for the final render, however, the object plane was concealed, leaving only a trace of its former presence and its response to light. In a similar way in which the traditional photogram is a trace of an object once present, the digital object (in the context of my research) has become a kind of *non-present presence*, a truly *Virtual* object that, though not actually seen in the image, is nonetheless a result of the algorithmic data process though not apparent in the render but latent within the system.

The ability to conceal digital objects from view prior to the rendering process opened-up interesting possibilities for my research. Firstly, it removed the necessity for digital polygon shapes to be visible in the final rendered image. Secondly, it removed the geometric design that polygon objects brought to the image and what I considered to be an imposed central design element of the image. Finally, it allowed light and shadow to become the primary image sources, rather than the material objects which was a fundamental characteristic of the photogram. My research from this point onwards became an exploration of light on surface, where illumination itself and the trace effects of unseen objects on surfaces was the central focus of investigation.

Light, and its effects on surface materials, generated the figurative forms depicted. Fox Talbot's often quoted comment in the *Pencil of Nature* (Talbot, 1844) 'the plates of the present work are impressed by the agency of Light alone, without any aid whatever from the artist's pencil' became highly pertinent to my research. Generative images automated though the controls of the digital interface were 'impressed' by the agency of the system alone. The exploration of light sources and the shadows of absent forms continued to drive the approach to my research. The digital surface plane material in the 3D digital scene, like physical light sensitive photographic material, is predominately flat. Objects may or may not be placed on the surface material that interacts with the illumination of the light sources. In the 3D digital software, the

default settings of the surface materials reflects the expected behaviours of photographic paper. The surface characteristics of the surface plane material is completely smooth, devoid of any texture, which enables the light to be reflected purely and evenly. The images are the result of light sources that either directly illuminate the surface material or illuminate it via interactions with digitally concealed objects. This rendering feature has created a shift in my research, allowing me to treat light and shadow as the key components. This allows for much greater emphasis to be placed on subtle and highly controlled use of light intensities to define the threshold between shadow and surface. I explored this threshold initially through tonal difference, it has since become, however, an exploration of thresholds between hue and saturation of colour. By means of describing these thresholds, I would like to now focus on discussing two images that were created within a short time of each other, Figures. 21 and 22.
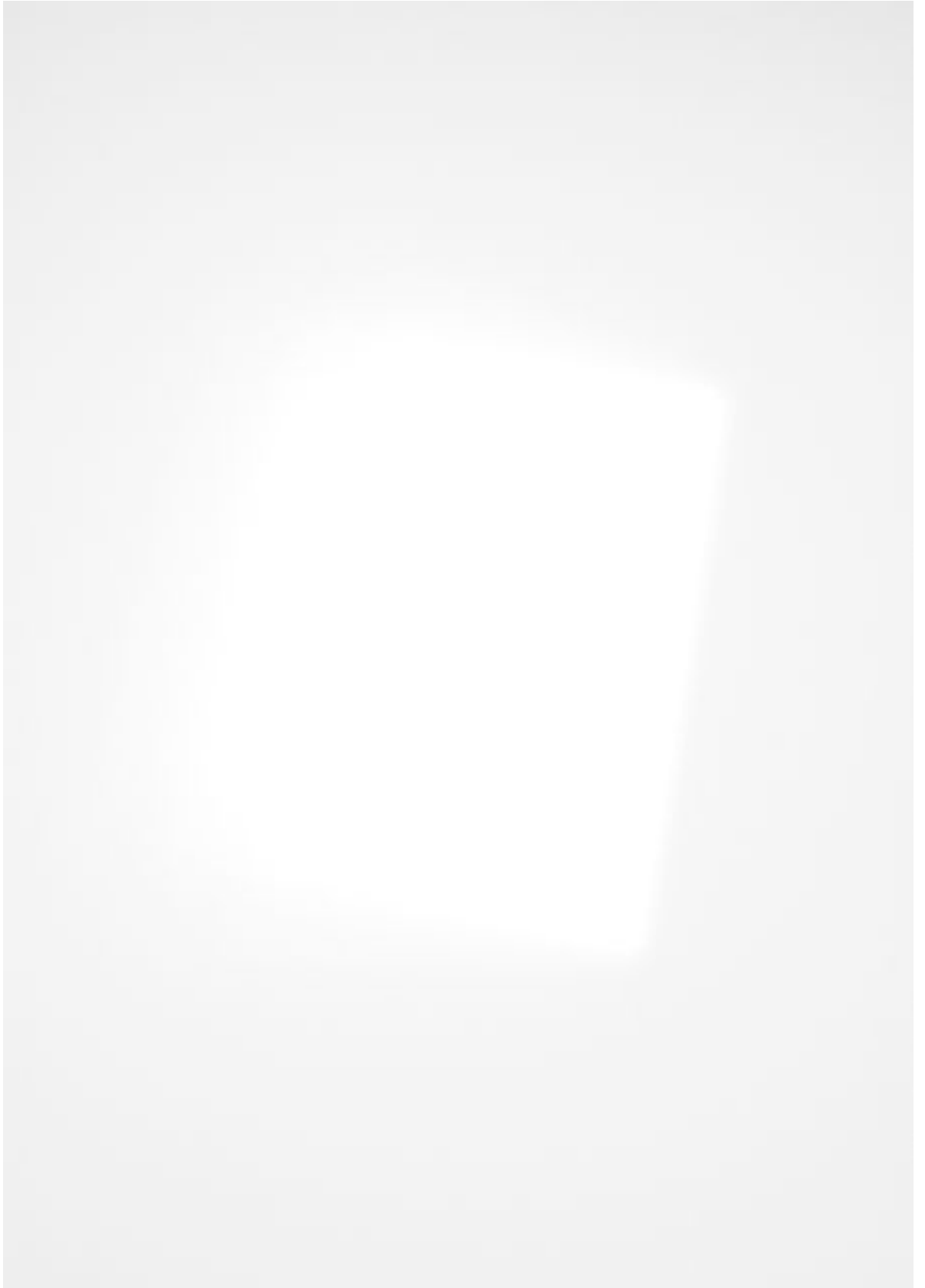
Figure 21. *XI-1* Paul Proctor (2019)

Figure 22. *X1-2* Paul Proctor (2019)

Image *XI-1* (2019) is paradoxically a light shadow. It is the result of two independent digital light source directly illuminating a flat digital surface material. A feature of the

3D software enables surface plane materials to instead be transformed into a light source. This means that the surface materials no longer simply respond to light though reflection and absorption but instead become light emitting sources. The surface plane can now be assigned properties and characteristics that are typically associated with light sources. Figure. 23 shows an area light (a) illuminating the whole surface material (b). Between these two surfaces a small light emitting plane (c) illuminates the surface material (b) locally. As the small light emitting plane surface (c) can be excluded from the final rendered image, this leaves only the action of the light on the surface plane material. The differential between the surface plane material and the light emitting plane source now becomes dependent purely on the intensity of the light (c) falling upon it.
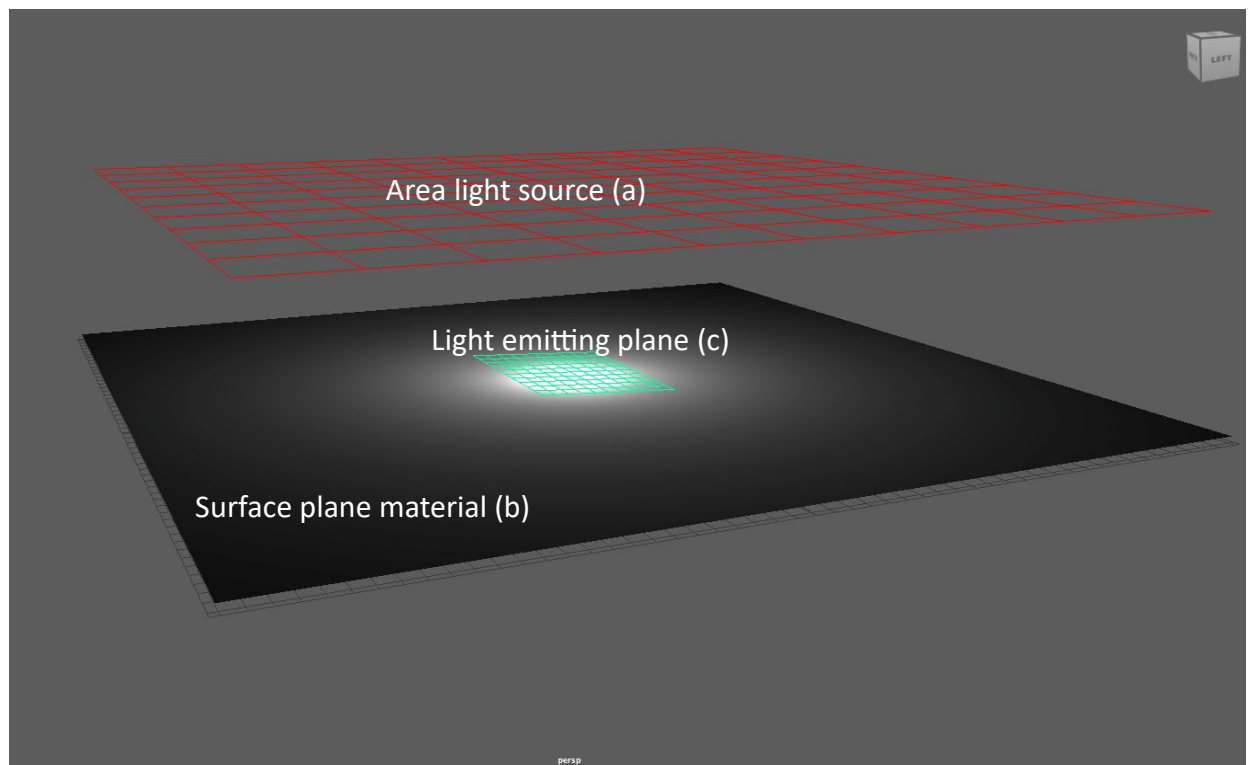
Figure 23. *XI-1* Scene view in Maya. Paul Proctor (2019)

This allowed for interplay between the surface plane material and the light from the light emitting plane falling upon it, creating a threshold between the visible light form and the surface background upon which it is created. The final rendered image provides the appearance of an oscillation between the background surface plane material (b) and the light emitting plane (c). The threshold is the pivotal point at which the intensity of the light on the surface material reveals what appears to be a 'form'

made from light. On a linear scale, within the lighting controls of the software, illumination within the light source controls can (at one end of the scale) be so low as to be unseen, and while no light can be *seen* present as data (although there are photons present), it is visually indeterminate (Virtual). As the illumination and photons are increased, light becomes determinate and visible (Actual). *XI-1* (2019) is an image that explores the tipping point of this perception, an image that is activated by the agency of light on surface within the 3D scene.

XI-2 (2019) is an image that shows a shadow form on a surface material. Again, the image is devoid of colour, drawing instead from very low light intensity and a very narrow tonal range. Figure. 24 shows the scene view of an area light source (a) illuminating the whole of the surface plane (b). The area light source is illuminating the surface plane material at low intensity. An object plane (c) is placed between the surface plane material and the light source, creating a light occlusion. This allows a shadow to form on the surface material. The intensity of the shadow is controlled by adjusting the luminosity of the area light source in the software control menu settings.
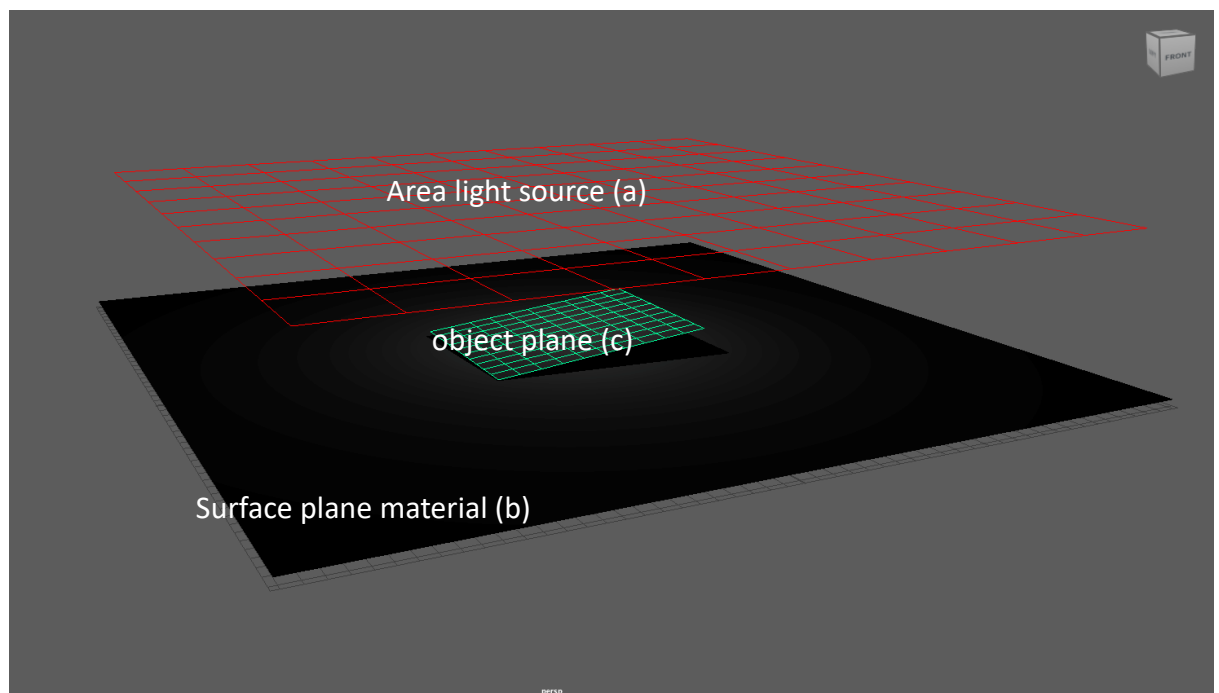

Figure 24. *XI-2* Scene view in Maya. Paul Proctor (2019)

The intensity is again carefully adjusted to find the threshold at which, when rendered, the shadow begins to oscillate between the shadow created by the object plane (a) and

the surface plane material (b). As the object plane (c) can be removed before the final rendering of the image, only its shadow remains. Though it is an image which is made possible by virtue of a light source, *XI-2* (2019) is an exploration of low-level luminosity, or low intensities of light, the pivotal point at which a shadow can still be perceived through the blackness of the ground.

On the verge of figure-ground

The notion of thresholds is vital to my research practice and the *Virtual-Actual* thesis. A threshold is usually determined by a duality, something to be crossed or exceeded, i.e., inside/outside or magnitude/intensity. In the context of *Virtual-Actual* I am visually exploring and investigating thresholds that suggest non-duality and where it is not possible to determine a clear line that divides two states. In my research I am searching for the monism – the *Virtual-Actual* – the point at which dualistic entities coalesce to become reciprocal and indivisible. The hyphen in *Virtual-Actual* acts as this axis, *both* Virtual and Actual together. It is the hyphen that is central and symbolises an entanglement of inseparable states. The most effective way to explore the threshold of *Virtual-Actual* is to experience the results of the research and the search for the most effective way to achieve this through my research will be explored in more depth in Part Three of the thesis.

Both images used as the examples above *X1-1* (2019) and *XI-2* (2019) – Figures. 21 and 22 – are characterised by the fragility of light and shadow and their ability to form light and shadow figures on a ground (surface plane material). The figure/ground distinction is well understood within the visual arts, and I use Gestalt theory as a theoretical tool to articulate my approach to the visual dynamics in my research. G*estalt* (literally translating from its Germanic roots as 'shape', 'form', 'figure'), is determined by a coherent object that appears 'in front of' the ground which is usually treated as less distinct. James Elkins, in his assessment of the development of figure ground relationships, references the early work of Gestalt psychologists Jan C. Bouman and Edgar Rubin, and noted that the figure/ground dichotomy recognised only positive/negative distinctions and left no room for an intermediate term: there is either figure or ground. As Elkins observes:

To Bouman, there is only one way of describing what happens at
the intersection between figure and ground. In either two or three
dimensions, "the part in the configuration which becomes figure
simply *detaches* itself from the part which is destined to become
ground" (Elkins, 1998, p94)

In Gestalt theory the figure, which is understood to be the dominant visual object,
appears to be above the ground. The ground is assumed to continue behind the figure.
What we take to be a two-dimensional image suggest the third dimension of depth. In
the examples of the work I have discussed, *X1-1* (2019) and *XI-2* (2019), the ground
that continues behind the figure (shadow or light) is virtual, its potential is there but is
not actualised, it is the dimension that gives way to the figure. The figure and ground
are far from separate, and in fact are completely reciprocal, interdependent, even
entangled: they are a fundamental singularity. The Gestaltists' assertion is that the
figure/ground phenomenon is fundamental because it is not learned, it is an innate
human perceptual capacity that most humans are capable of experiencing. The figure
in Gestalt theory tends to be the most prominent, however, not least because it is the
object of focus and definition, as Elkins has stated:

A figure without limits is unthinkable. We therefore speak always of
figures but rarely of grounds. (Elkins, 1998, p96)

Because of its apparent formlessness, the ground in images is often considered empty
space – inactive and redundant, devoid of substance – however, like the philosophical
Virtual realm, it is nascent, the very foundation of everything without which no form
can be made and perceived.[20] While the ground is often perceived as mute, inactive
and unresponsive, in the photographic process, however, it is the ground (photo-

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[20] See Bergson, H. (1912, p83) *Time and free will : an essay on the immediate data of consciousness.* 2nd
ed. edn. London: George Allen.

sensitive surface) that responds to light, or lack of light. The ground is therefore a dynamic and active plane.

Multistability

As the fragile relationship between what determines figure and what counts as ground has been pushed to the threshold of definition, a prolonged gaze at images *XI-2* and *XI-1* can create a visual oscillation between the shadow figure and ground where the distinctions in each image become ambiguous and function as figure-ground-together. Gestalt theory describes this visual ambiguity as 'multistability', one of the key principles of Gestalt systems.[21] This is the principle where there seems to be a perceptual 'popping' back and forth between two distinct visual possibilities. A well-known example of this was developed by Louis Albert Necker de Saussure in 1832. This Gestalt example has become known as the Necker cube – see Figure. 25. When observed for a prolonged period, the cube appears to flip from one perspective to another: a view from above to a view from beneath. There is a visual ambiguity implicit in the image that seems to defy stable perception. Though multistability is a useful visual theory for understanding images that exist between two possible distinct states on a ground, both *XI-2* and *XI-1* operate at the threshold of figure and ground. As a result, these multistable images pivot between figure and ground.

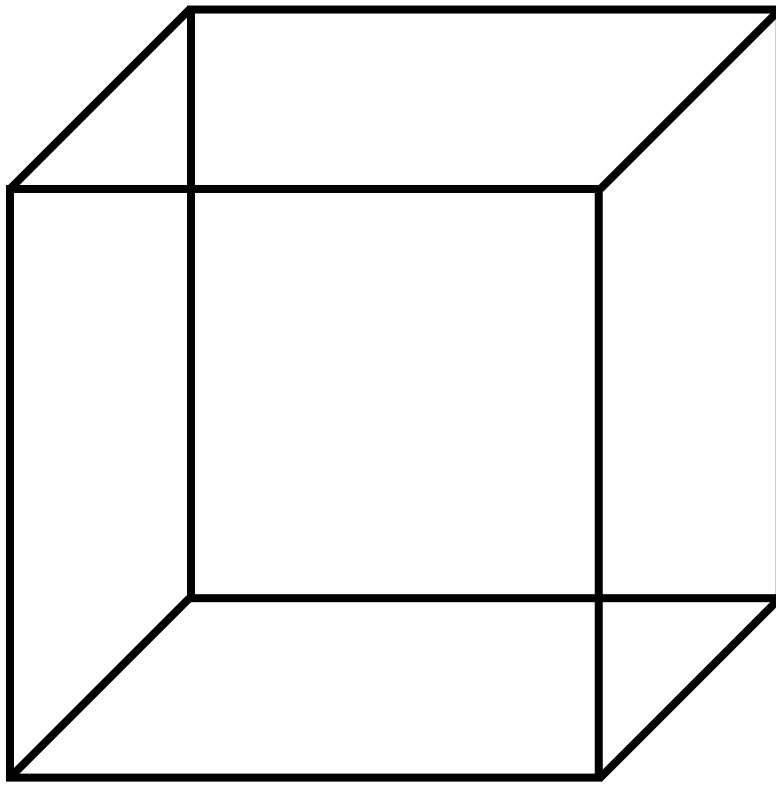[21] The other principles are emergence, reification and invariance.

Figure 25. *Necker cube illustration*

The Necker cube is an example of an image that is at the same time stable and dynamic. This state forms part of our visual perception and also includes the experience of afterimages. Afterimages are often created by the eye being exposed to a bright light for an extended period of time, prior to looking into a darker space or closing one's eyes. The image appears to persist, albeit in negative form. A dark object on a light ground, for example, will produce an afterimage of a light object on a dark ground. Even when the initial image is clearly no longer actually seen, it continues to be perceived in our mind's eye.

Johann Goethe writes eloquently of this experience in his *Theory of Colours* (1967). Goethe refers to this visual experience as 'after-vision' (p.17) which he addresses as the spirit of light itself and what he calls 'visionary impressions' (p.9). In my research, I am drawn to the purity in Goethe's writing which is experiential; Goethe is basing his experiments of light and colour purely on his observations. Goethe's observations, and the reflections of his experiences, are unburdened by cultural or scientific contexts, his only reference to the key contemporary theory at the time implies that this opens a

theory of colour through observation and experience.[22] His work on colour is an act of discovery through experimentation and his personal observations and intuitions (and the latter is something which I will discuss further on page 102 in Part Three of the thesis). Goethe's writing is the result of his experiences with colour and light that describes rather than explains what essentially pure phenomena is. Goethe's response to colour and light is visceral and he opens himself out to light, colour, and objects of experience. Goethe describes how impressions can be created through exposure to bright spots of light that then create floating visions when the eye is turned to a more 'dusky place' (p32). The after-vision is described as having qualities of colour and degrees of scale, as well as a durational element.[23] He proceeds to measure this experience through counting until the vision disappears by degrees and loses its identity as an object:

> The retina recovers itself by a succession of vibrations after the
> powerful external impression it received (ibid p. 17)

Goethe also acknowledges that this duration may differ according to the experience of different individuals. He also addresses the experience of darkness on the eye: In dark places a certain deprivation is experienced – 'the organ is abandoned to itself; it retires into itself' (p.3) – like the adjustment needed in the camera obscura. 'Black, as the equivalent to darkness', Goethe writes, 'leaves the organ in a state of repose' (p.5). The depravation and, conversely, the excitement of light necessitates an object of an opposing condition for the eye to fixate on:

> When darkness is presented to the eye it demands brightness, and
> vice versa: it shows its vital energy, its fitness to receive the
> impression of the object, precisely by spontaneously tending to the
> opposite state (p.16)

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[22] In his preface to the original publication of his book Goethe (1810) asserts that Newtonian theory 'has impeded a free inquiry into the phenomena of colours' (p.17).
[23] Goethe (1967) writes of 'dazzling colourless objects' (chapter IV) that indicates an impression that has a durational component.

The after-vision is a perception of light as its own phantom, a ghost or memory of its former state. As Goethe recognises, it can be 'constantly revived' (ibid p. 40) and be brought back into existence through the closing and reopening of the eye, which Goethe refers to the elasticity of the eye. The eye is perpetually alternating:

> The eye cannot for a moment remain in a particular state
> determined by the object it looks upon. On the contrary, it is forced
> to a sort of opposition, which, in contrasting extreme with
> extreme, intermediate degree with intermediate degree, at the
> same time combines these opposite impressions, and thus ever
> tends to a whole, whether the impressions are successive, or
> simultaneous and confined to one image. (Goethe, 1967)

It is this state of flux that my research resides – the work is both a catalyst and stimulus for shifts of perceptual experience. Light and shadow in these images are not anchored in a static perception, they appear to oscillate between presence and absence, to surface and recede, appearing and immediately vanishing from the figure to ground. The surface materials in the context of *Virtual-Actual* are used in conjunction with the notion of plane or ground. The surface plane in the digital space is a term that is given to a digital object prior to it being provided with algorithmic properties and characteristics that respond to light in myriad ways such as through absorption, reflection, and transparency. The surface plane is, therefore, a part of the same digital field as light and other objects in the 3D environment. When a surface plane is assigned a unique characteristic material in the software, it can react to light on a scale that extends from complete transparency with little – if no – reaction, to highly reflective and brilliant. The surface plane responds depending on its material ability to react to light. The surface threshold, that might denote the space between being perceived and not perceived, is determined by the number of modelled light photons it reflects. The digital space therefore allows a surface plane to have the capacity to be both invisible and, at the same time, possess the digital equivalence of material surface.

By way of analogy, it is useful here to consider the word 'surface' which in the Greek language translates as επιφάνεια (epiphania): *epi*, meaning *on,* or *upon*, and *phainein*

meaning 'to appear' or come into view. [24] The English translation of 'epiphany' therefore has a relevant meaning: that of a sudden insight, a visible bringing forth. Therefore, epiphany has illumination and vision directly embedded into its meaning. In photographic terms, the latent image that then emerges into the realm of appearances through the emanation of light could be considered epiphanic. The process of a surfacing of light is literally an epiphany, a realisation or, in the context of my practice research, an actualisation of a figure that emerges from a virtual ground. In the 3D digital space all digital objects, light, and surface materials are reduced to the internal raw data which in turn is determined by the algorithmic conditions in the system.

On Hue, tone, shade and complex colours

As my research has progressed, the manipulation of light, surface and shadow has become enhanced by a greater understanding of the complex combinations provided by the control of colour, light, and shadow intensity. The colour combinations in the software are estimated to be in the trillions of colours exceeding by far what the human eye can perceive as colour shift. [25] High-definition colour rendering of the images has opened possibilities of exploring how surface plane colours, shadow colours and light emitting surface plane colours merge to produce colour blending that produce entirely unpredictable results. The works – Figures. 30 to 33 – that I have discussed so far represent a significant reassessment of light on surface, where surface has become ground, and light has become the figurative element of the work that provides visual form, albeit multistable. Due to being devoid of colour, these works tend to focus attention on intensity of light and surface shade. The next images I will discuss are *XII-1-4* (2020). These images investigate the role of colour or, more specifically, hues that when mixed with other hues create secondary or complex colours that in turn create colour oscillations within the image.[26] *XII-1-4* (2020) is a series of images inspired by the work of Josef Albers (1899-1994), in particular his book *Interaction of Color* (Albers, 1971) and most specifically his series of paintings, *Homage*

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[24] Also worth noting is that phainein in the ancient Greek language forms the root of the word phenomenon.

[25] Lanier, L (2006) Advanced Maya Texturing and Lighting (p 266)

[26] Hue is defined here as pure colour. Secondary colours are a mix of two hues. Complex colours are a mix of more than two hues. Tone is defined as hue plus grey. Tint is hue plus white and finally shade is defined as hue plus black.

to the Square (1950-1976). In *Interaction of Color*, Albers presents an authoritative, systematic but subjective study of colour combinations that is a thorough philosophical, psychological, aesthetic, and phenomenological investigation. Albers' studies comprise largely of blocks of solid and transparent colour swatches that are juxtaposed, layered, interweaved, and compared. Albers' colour examples are remarkable because they illustrate dynamic colour combinations that generate perceptual interactions in the viewer, many of which result in a lack of perceptual stability and determinacy. Albers starts the book with a key opening statement: 'Color [...] deceives continually [...] experiences teaches us that in visual perception there is a discrepancy between physical face and psychic effect' (1971). As much of Albers' work centres around colour harmony and discord, I approach his studies of dynamic colour combinations as akin to musical notation that create melody and chords, indeed, musical analogies are threaded throughout his text. Some colours have tonal combinations, whilst others are tints; some can be experienced as harmonious colour combinations whilst others dissonant, 'hearing music', according to Albers, 'depends on the recognition of the in-between of the tones, of their placing and of their spacing' (p5). They are combinations that are sometimes in phase and resonant and at other times out of phase and neutral.[27] All of Albers colour combinations display their own specific characteristics of hue, tones, tints and shades. His colour examples are made through cut paper shapes and thus characterised by their acute sharpness and defined boundaries. There are edges to Albers colour combinations, clear juxtapositions and shifts from one colour palate to the next; and the sharp edges also determine differences between solid colour in his paintings too. For example, Albers *Homage to the Square* paintings are very clearly painted by hand and this provides each painting with different characteristics, however, the works are still defined by their clearly demarcated, geometric construction that creates formal colour boundaries that also manage to resonate with one another across these borderlines via their careful juxtapositions.

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[27] I am referring here to wave forms that, when combined are in phase, i.e., when the peak of sonic (or electromagnetic) waves matches each other. The term, out of phase, refers to a situation when the peaks are opposed, creating no resonance.

In my practice research, the series *XII 1-4* (2019) is a development of *XI-1 and X1-2 (2019)*. Through the investigation of colour, they extend tonal qualities and, specifically, light intensities to include and explore the additional elements of colour saturation.[28] This exploration has provided a deeper understanding of the capabilities of the 3D software and its agential ability to generate images. The images in this series were achieved through a deeper understanding of the functions of surface planes. The research was largely driven by the recognition that, apart from being provided with material properties that absorb or reflect light, surface planes can also be assigned light emitting properties that allow them to shift from being light reflecting objects, to light emitting objects. *XII 1-4* (2019), explores the capacity for surface planes to become light sources in themselves and can therefore be provided with light emitting properties that include the full colour range. A way to imagine this in a physical environment would be to take several sheets of paper and turn them – miraculously – into light sources, then place them at a short distance on top of each other under a directional light source. An example of this combination can be explained through a perspectival view of *XII-2* (2019) – see Figure.26.

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[28] Saturation is defined here as the brilliance or intensity of a colour.
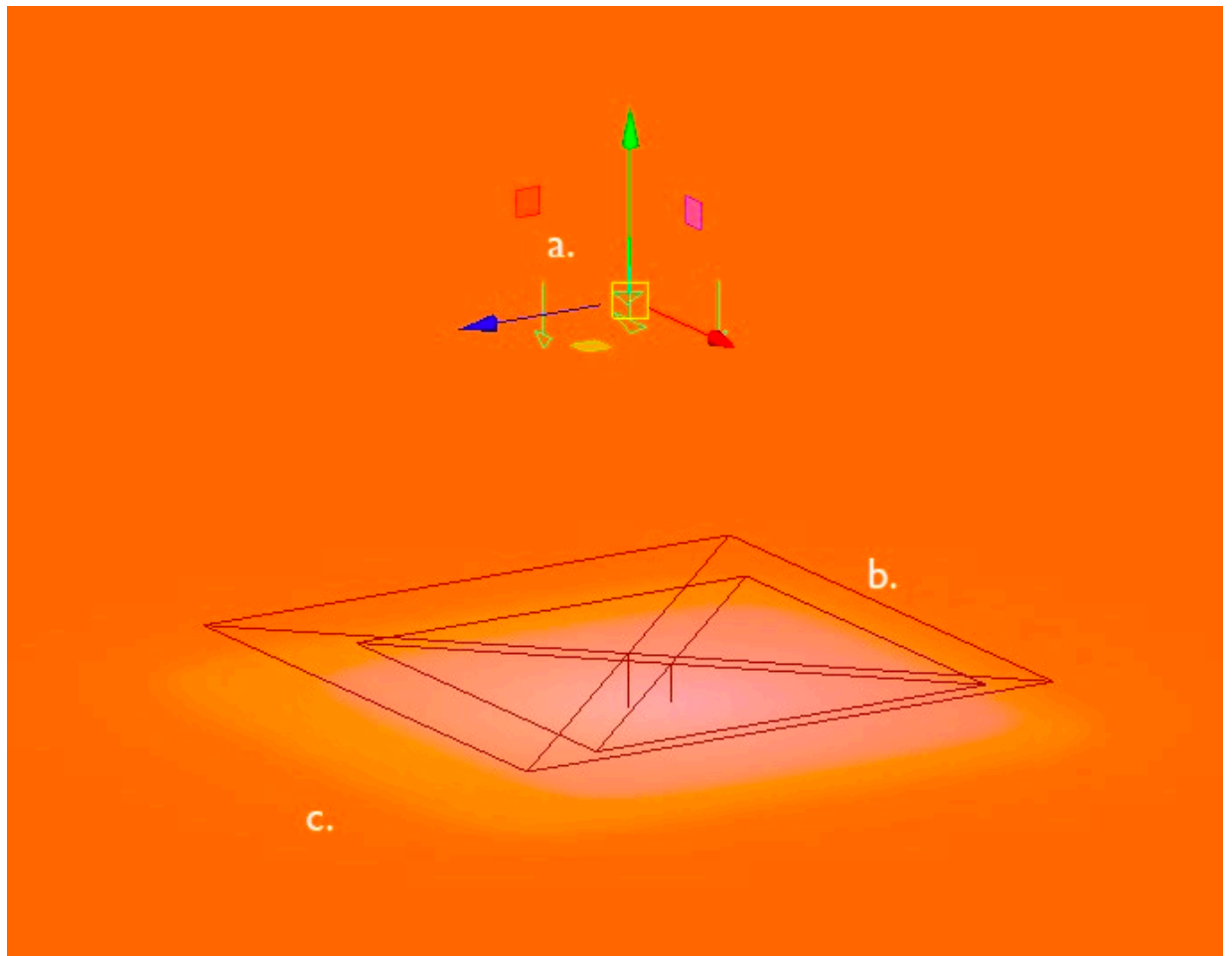
Figure 26. *XII-2* (2019) Pre-render Perspectival View

A key directional, orange-filtered light source (a.) illuminates two light emitting surface planes (b.) each with their own colour, light sensitive and light reflective properties. These are directed onto the surface plane material (c). This combination of emitting sources and reflective surface enable the light sources and their colours to combine to create boundaries, where hue becomes difficult to accurately determine and shifts into a multistable state, phasing and pulsating in and out of visual perception. The potential for planes to become light sources created the starting point for *XII* (2019), a series of images that continue to explore interactions of light, colour, and shadow on surfaces that are extended through the introduction of experiments with colour saturation and specific hues and complex colours.

In *XII 1-4* (2019) (pages 105-107), each image is initiated with a directional light of a defined hue placed above the surface material. Individual light emitting planes of reducing sizes are then introduced that illuminate the surface material with their

individual and specifically assigned hues. Because the planes are placed at a distance from the surface material, they create light 'fall off' that generates a soft area of light projected onto the surface plane material. [29] The complex colours that are the result of the hues of the light emitting planes amalgamate as they interact with the surface and are dispersed and reflected. The different values and intensities provided by the software are then controlled through menus and settings that determine specific colours, as well as providing the ability to alter the distance of the light emitting planes from the surface material. The final image – Figure.27 – is a rendered view of the planes from above, where the planes have again been hidden from view prior to final rendering, leaving only their remaining light emitting traces.

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[29] Fall off, or attenuation are terms used in photography to refer to the rate at which light intensity declines proportionately over a distance from a light source. Illumination is lost in an inverse way. It is measured using the inverse square law, e.g. if the intensity of a light is measured 1m for the light source, and then again at 2m from the light source, although the distance has doubled, the illumination has reduced not by half but by a quarter. The quantity of light is inversely proportional to the square of its distance.
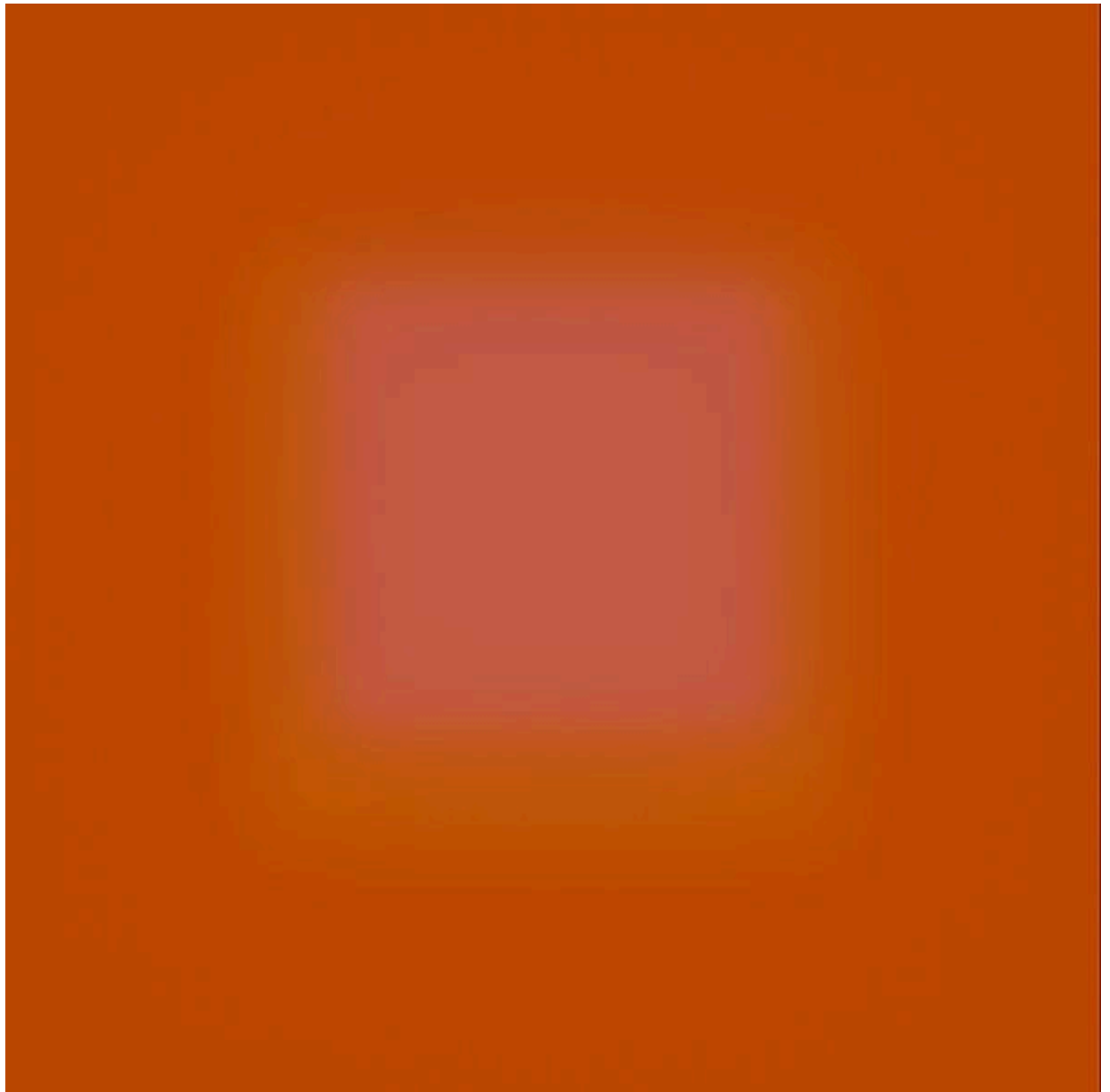
Figure 27. *XII-2* Paul Proctor (2019)

The series *Virtual-Actual* provided me with an insight into how the quality of light can change depending on its saturation when light intensity is articulated as quantity of light. This also applies to hue as, paradoxically, saturation can often be reduced to create more intense colour as colours merge. The subtle colours in *XII-2* (2019) have been achieved through careful alteration of the hue and intensity of the light emitting planes to create an image where the different hues interpenetrate and become a figure that disappears and reappears into the ground, each pulling and pushing one another like opposing forces, creating the effect of an oscillation. The final images are the result of alterations in the levels of hue and saturation that are provided through the vast

range of scale combinations in the system. Joseph Albers discussed this further in *Interaction of Colour* (Albers, 1971, p89) where he talks of colour tones being analogous to musical tones, which are defined and segregated from one another. Albers' defined colours and tones contrast with the blurring of colour boundaries in my own practice research which are less determinate. To follow Albers' musical analogy, however, the images that make the series *Virtual-Actual* are more polyphonic, pertaining to a harmonization of colour that gives rise to perceptions that we experience as an afterimage. As with Goethe, Albers' colour studies and observations are not driven by colour theory which he outlines in his introduction (p.1), rather it is clear from Albers' text that he recognises and celebrates, not theoretical or even artistic knowledge, but rather subjective introspection. Albers states that:

> As we begin principally with the material, colour itself, and its
> action and interaction as registered in the mind, we perceive first
> and mainly a study of ourselves. (p52)

My discussion of *XI-1* (2019) and *XI-2* (2019) at the start of this part of my thesis (and the following series *XII 1-4* (2019)) chart a personal re-evaluation of the perceived dualism of light and shadow, hue, and saturation. This investigation, through my research has provided new insights into my understanding of light, shadow, and colour, and has created a recognition that they are not dualisms (in the Cartesian sense), but instead should be articulated through a recognition of intensities that exist within a singular and continual non-linear scale that bonds intensities of light, hue, and saturation to aesthetic qualities. According to Henri Bergson, quantity is essentially spatial, measurable, indivisible, and objective (Bergson, 1912, p32). Quality, however, is internal, indeterminate, continual, and subjective and therefore relates directly to our perception that changes not though incremental steps, but through intuitive perceptual experience, or duration.

In *Time and Free Will* (1912), Bergson explores the concept of light intensities, questioning the dichotomy between quantitative measurement and qualitative experience, particularly through the lens of luminosity. Bergson argues that our perception of light and colour is fundamentally qualitative, subjective, and affective,

challenging the notion that such experiences can be reduced to mere quantities. He illustrates this point with the example of a sheet of white paper lit by candles (p55). As the candles are extinguished, the paper remains white, highlighting a qualitative change in perception rather than a quantitative change in light.

Bergson extends this argument to colour perception, suggesting that changes in hue are perceived not through the quantity of light but through qualitative differences in luminosity. This perspective underscores a fundamental aspect of Bergson's metaphysics – the distinction between fragmented knowledge that is objective and measurable, and the concrete experience of duration, which is continuous and subjective, emphasizing that our intuitive, experiential engagement with the world transcends measurable data. Bergson's work, therefore, invites a different understanding and experience in response to the qualities of light and colour. In essence, Bergson proposes that these experiences are shaped not by quantifiable intensities but by our subjective, qualitative perceptions.

In this way, in my research, the images made in the computer data system are not determined by the numerical attributes that determine colour, hue saturation or intensity, but through their visual aesthetic which is subjective, offering the experience of continual and indivisible perception.

Blackness

My practice research has developed through an exploration of boundaries, or the lack of boundaries, of colour and tonal ranges. The light and shadow in the images have evolved to the point at which they become formless and ambiguous, where colours, shades, and tones interpenetrate to take the images to the edge of definitive visual perception. It is the thresholds of light and shadow that are increasingly driving my research, aesthetically and conceptually. *XIII-1* (2022) – Figure. 28 – is an example of the resulting fuzziness when the threshold between colour and blackness, form and formlessness teeter on the edge of perceptual understanding. The shadow can be understood as an absence of light, but shadow can also be the mark of a presence. Following on from my early discussion (page 19) of Jean Baudrillard's poetic

assessment of *Trompe l'oeil* painting, (1990), Baudrillard talks of the objects in these early paintings as having 'lost their shadow (their substance) […] they suggest the transparency of objects to a black sun'. (p 62). In *Trompe l'oeil* paintings, objects lose their solidity, their mass and become defined by the fragility of light cast upon them. Light may be linked to visible presence of objects but also absence depending on the level of luminosity and intensity. Likewise colour lacks distinction in the mix of white light as it does in the depth of blackness. Barely discernible, the lack of definition in *XIII-1* (2022) – Figure. 28 – requires a perceptual openness when experienced. An openness that demands the temporal dimension of duration, as it does not immediately reveal itself perceptually.

Figure 28. *XIII-1* Paul Proctor (2022)

In a series of paintings made towards the end of his life, Ad Reinhardt (b. 1913 d. 1967) – see Figure. 29 – created what have become known as his "black" paintings. Reinhardt referred to these painting as his 'last paintings' (*Art-as-art : the selected writings of Ad Reinhardt*, 1975), perhaps not least because they have come to represent the culmination of his exploration of colour and blackness. Reinhardt takes his painting to the point at which figure and ground can no longer be perceived as separate entities but have almost merged to become figure-ground together, leaving what Liesbrock (2011) refers to as 'the tension between visibility and concealment' (p.6). Reinhardt was a friend and contemporary of Josef Albers, sharing his fascination with colour and an approach to making paintings 'as generators of perceptual responses in the eye and mind of the viewer' (1964). Reinhardt blurs the boundaries that defy definition, which marks his work out from Albers' colour swatches and paintings that are defined by their innate geometric construction, tonality, harmony, and discord. Conversely, Reinhardt's paintings are infused with what Liesbrock suggests is an 'aura of silence' (ibid p.7).

Figure 29. *Ad Reinhardt Installation View of the Exhibition (1991) Museum of Modern Art*

During a visit to Cologne in 2019, I was able to experience one of Reinhardt's 'Abstract Painting, 1954-1959' which is monolithic in scale and proportion, imbuing it with both physical and psychological presence. The blackness initially prevails until a figure reveals itself from the darkness of the matt surface of the painting that teeters on a razor edge of perception. Because of the intense subtleties of the colour and tonality of the figure ground elements of the painting, the image emerges over time through what Liesbrock refers to as 'autopoiesis: as if [its] formal structure has developed entirely on its own and no longer depends on an author's design' (2011). Autopoiesis might be described as a self-contained unity that is a self-creative, self-referential, and self-constructing, closed system.[30] Autopoiesis describes images that are self-constituting and constituted by the force of their own agency. In this way they are generative images that are emergent and sensually affective through perception. Autopoeisis is deeply embedded into the process, production and experience of the images that constitute *Virtual-Actual*, the result of the self-organizing apparatus that co-creates the process, and the images themselves that generate the experience. In the contexts of my practice research and the images that have emerged from it, autopoiesis describes the multistable tensions between the appearances of figure and ground in images that reveal themselves through the act of visual perception; they are in-dependent entities, they are autonomous images in need of an observer. Liesbrock asserts that Reinhardt's paintings 'demand a specially concentrated act of seeing' (2011), however, I would argue the opposite: it takes little more than simply allowing the light to enter my eyes and enabling the image to act. Actually, it takes virtually no effort other than to accept the images into visual perception through duration.

Conclusion

My research, as a photographer working in the 3D digital space, has allowed me to manipulate light, shadow, colour, and surface in ways that are impossible in the physical studio or darkroom environment. This 3D digital space blurs the lines between the physical world and the world as images, that has the potential to enrich

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[30] In their book *Autopoiesis and Cognition* (1972), Maturana and Varela describe autopoietic as "space defined by an autopoietic system" as "self-contained", a space that "cannot be described by using dimensions that define another space (p.89)

photographic experimentation in this space with new layers of meaning and expression.

My research, and consideration of Gestalt principles within the 3D digital space, has further emphasised the fluid nature of perception, which eludes definition, operating more appropriately within the field of potentialities. In this digital realm, I treat colour as a medium for exploring the edge of visual and perceptual boundaries, demonstrating how variations in hue, saturation, and light can transform the viewing experience.

My research has enabled me to produce images that challenge the viewers ability to navigate the shifting boundaries between light and shadow, figure and ground, foreground and background, inviting a more dynamic interaction with the visual field that reflects the complex interplay of the Virtual and the Actual.

In summary, then, Part Two of my thesis has investigated the behaviour of digital objects, light, shadow and surface under the algorithmic influence of the 3D digital space, revealing complex interactions that challenge traditional perceptions of what determines photographic imagery. The research reveals how the digital apparatus enacts its understanding of light and surface, pushing the boundaries of non-representational photography into new exploratory spaces. The reference to the photogram has served as a bridge between the analogue roots of photography and the 3D digital space in which I am working.

In Part Three of my thesis, the focus shifts from the intangible explorations within the confines of 3D digital working environment, to the palpable experience of the image outcomes in the gallery space. This shift is not merely spatial but philosophical, invoking Bergson's concepts of duration and intuition to provide further insight and deepen the engagement with the work. Exhibiting the images in physical space unveils a new dimension of interaction, where the virtual images, now freed from the apparatus, invites a shared experience of time and perception. The gallery becomes an experimental place for examining how the images inhabit our actual world and how they can transform our understanding of space, presence, and temporality. The

exhibition space becomes a site of convergence for the virtual and the actual, a place where Bergson's notions of duration and intuition become manifest, allowing the experience of the work to extend beyond mere spectatorship and to open a space where participants enter a temporal space of perception.

In Part Three of my thesis, I will also align Bergson's concepts of duration and intuition with my research. This investigation reveals that digital images made within the 3D environment possess a unique temporal and experiential quality, and that the viewer discovers their vital time though interactions with the work. The creation and viewing of these images engage with time not as a linear progression but as a multiplicity of interpenetrating moments, emphasizing the role of perception in the actualization of the Virtual.

Part Three

Images with-in non-spatial/spatial realms

Introduction

Part Three of the thesis is concerned with how the research operates when released from the confines of the computer apparatus and is displayed in physical spaces. Through the process of testing my research in physical spaces, I engage with the new materiality of the digital realm, exploring how the tones, hues, and forms conceived in the 3D digital space take on new experiences in spatial environments. This phase of the research journey invites a renewed evaluation of the experience of the work that takes place in different presentational contexts, fostering a dialogue that transcends the mere visual to explore the essence of perception and reality. Part Three of this thesis is, therefore, not just a discussion about the exhibition of digital works, but a philosophical inquiry into the nature of art practice, perception, and existence, guided further by the insights and discussion of Henri Bergson and realized through the interplay of light, shadow, and surface.

I begin by discussing a test of the images as prints displayed in a physical space. This includes a discussion of the image selection, the sizing, the choice of the print surfaces, display options, and groupings. I specifically explore the issues raised, and the questions posed, regarding the impact that ambient light, its reflection on the printed image surface, and its subsequent effect on the visual experience of the work. I also discuss the role of the physical body and how proximity to the image appears to enact shifts in perception that alters the experience of the images. I will examine the effect of ambient light reflections and how these raise questions regarding what it is that constitutes our understanding of surface. In this part of my thesis, I will also explore how images that reflect light differ from images that emit light and how the latter could provide potential for an intuitive experience of the images.

My research is an exploration of light on surface within the 3D digital space that uses light and shadow to generate the images. Part Three of the thesis provides an opportunity for me to explore how this translates into a final rendered digital image and its relationship with qualities of hue, tonality, and saturation. I will draw from Huppauf (2009) and his concept of fuzziness, specifically how this contributes to image indeterminacy based on differences in degrees, which create oscillations between figure and ground. This offers a different way of thinking about image focus that pertains directly to the experience of the images rather than the physical mechanisms of the photographic apparatus.

This final part of the thesis offers the opportunity to investigate how the images that have resulted from my research, that fall outside of traditional understanding of spectatorship, can be accessed. By means of exploring a method that ensures that the spectator is not merely a passive observer of the image, but rather an active participant in becoming, as part of the 'in-the-making' of the image. I again reference Henri Bergson's and Gilles Deleuze's concepts of duration (Bergson, 1988) and (Deleuze, 2013) as the mark of our psychic experience of inner time. Duration is central to the work because it offers an alternative to 'clock time', the time with which the photographic process is so inexorably linked. Duration here is promoted as the non-measurable, continuous psychic time of experience. I discuss duration and its inextricable link to Bergson's method of intuition (Bergson and Andison, 2007). Intuition provides a way to 'enter into' the image, a method by which the image is experienced not from multiple outside perspectives but from multiplicities within; what Bergson calls 'absolute knowledge' (2007, p 133). Intuition here is explored as a kind of antidote to intellectual 'relative knowledge' that is spatial and relies on the juxtaposition of things and concepts. Thinking intuitively is, effectively, thinking in duration. Because *Virtual-Actual* is practice research that investigates perceived dualisms, what and where is the point at which one thing becomes something else? To provide a useful model for understanding this, I will explore Gilles Deleuze's concept of the crystal image (Deleuze, 2013, p 71) which is an image that is constantly in the making, or 'becoming'.

Photographic print in physical space

In July of 2022, I had the opportunity to test some prints from my research in an exhibition space. This enabled me to consider a selection of images to test in a physical environment which offered the possibility of exploring and experimenting with different print sizes, surfaces, and display options. This was also an opportunity to experience the work in a corporeal spatial environment with some gallery lighting options. This opportunity also allowed me to consider distance and proximity to the image and the effects that this may have of the experience of the work. Testing the work in a gallery environment also draws attention to the tangible contexts of the work. The images in the 3D digital space exist within a conceptual void, an infinite, negative space. The gallery space offers a complex environment that inevitably impacts on the experience of the work within the physical realm.

A new technical method for rendering the digital image within the 3D software that I discovered in 2021 (known as batch rendering) created the ability to generate much larger image file sizes and this subsequently created the potential to produce high resolution images of much larger print sizes. I settled on two large format print sizes, 1m x 1m and 60cm x 60cm. For the 1m square prints, I chose seven images from across my practice research images portfolio Figures. 30-36.
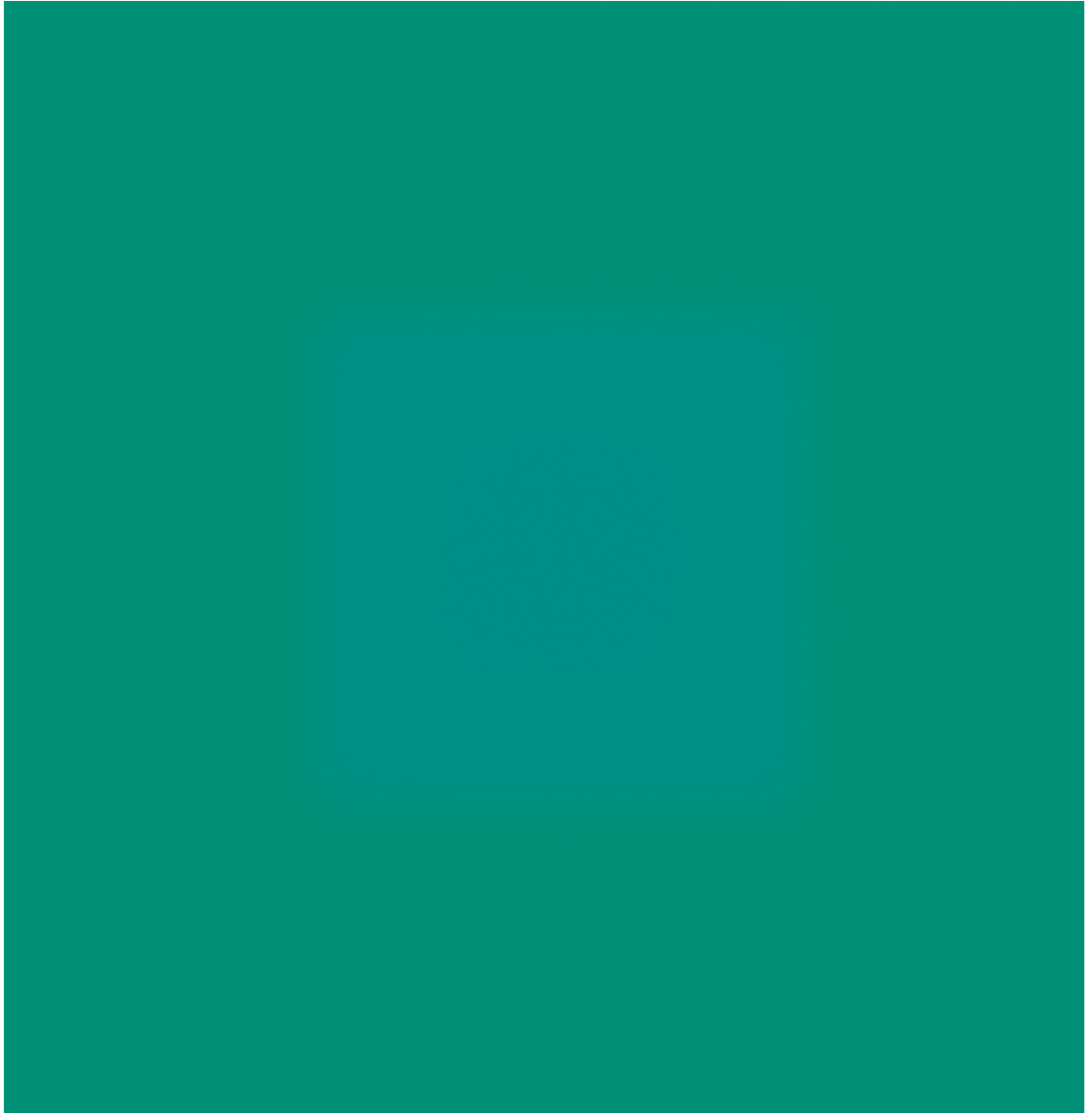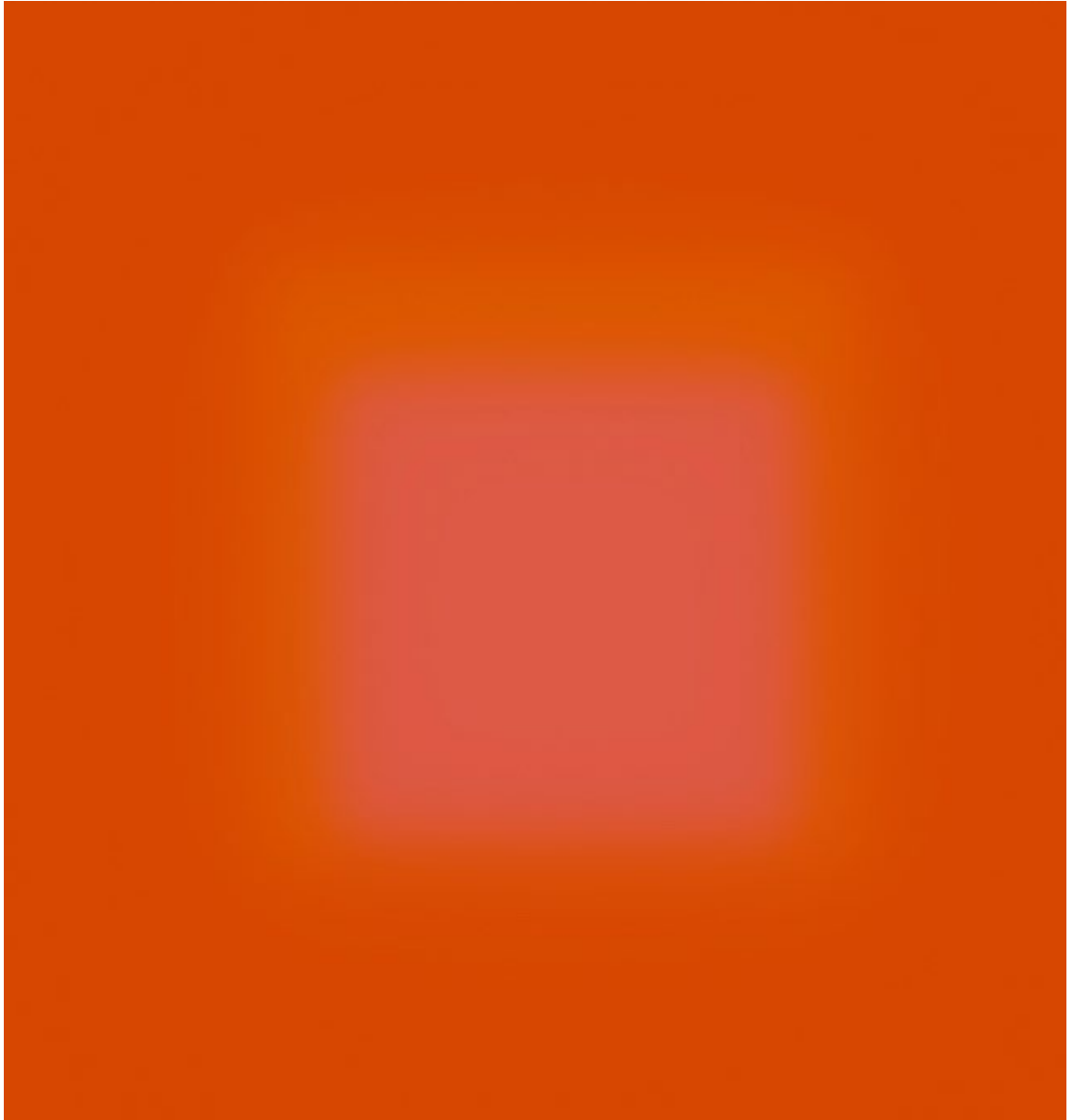
Figure 30. *XII-1* (2019)

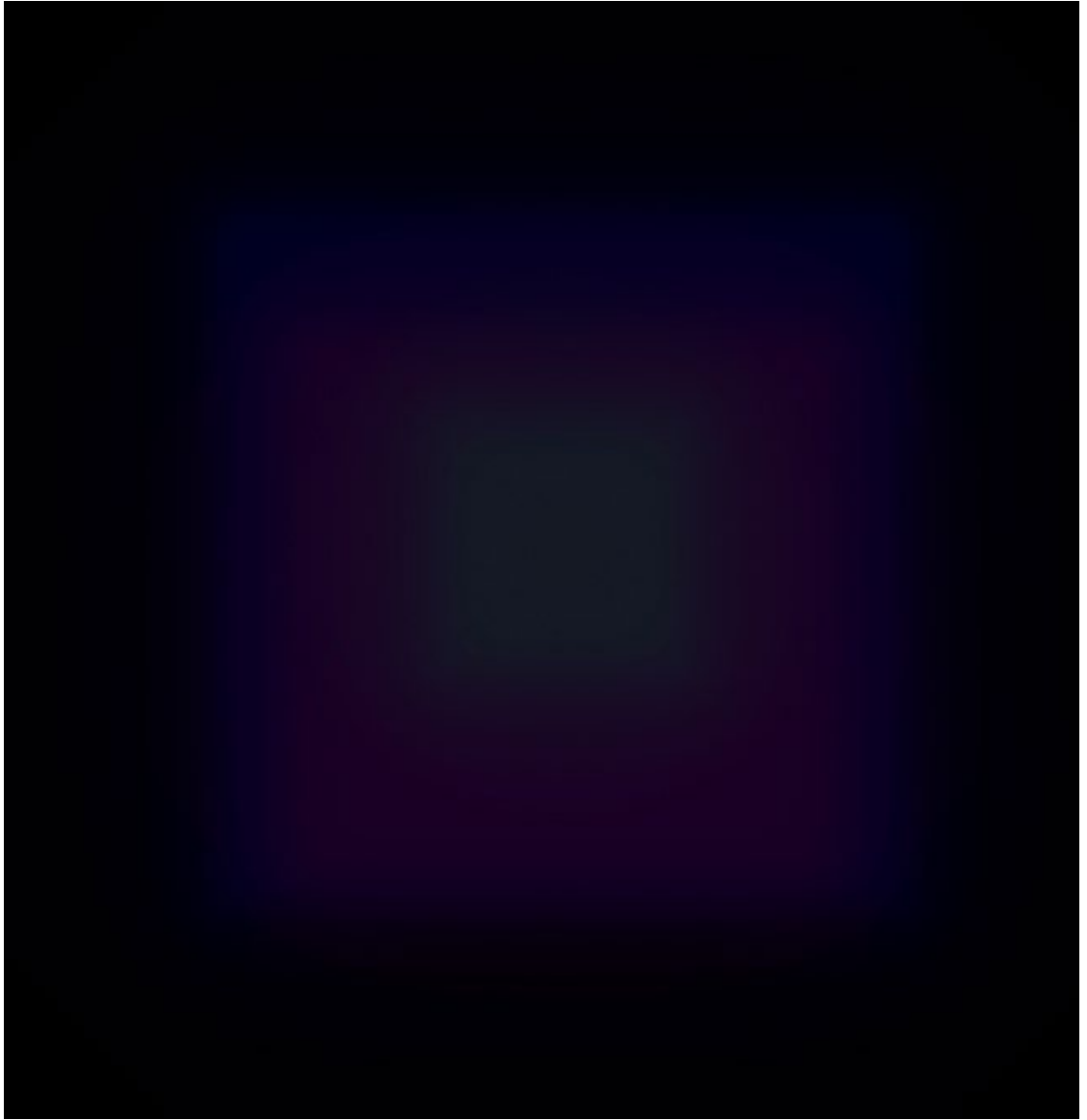Figure 31. *XII-2* (2019)

Figure 32. *XII-3* (2019)

Figure 33. *XII-4* (2019)

Figure 34. *XIII-1* (2022)
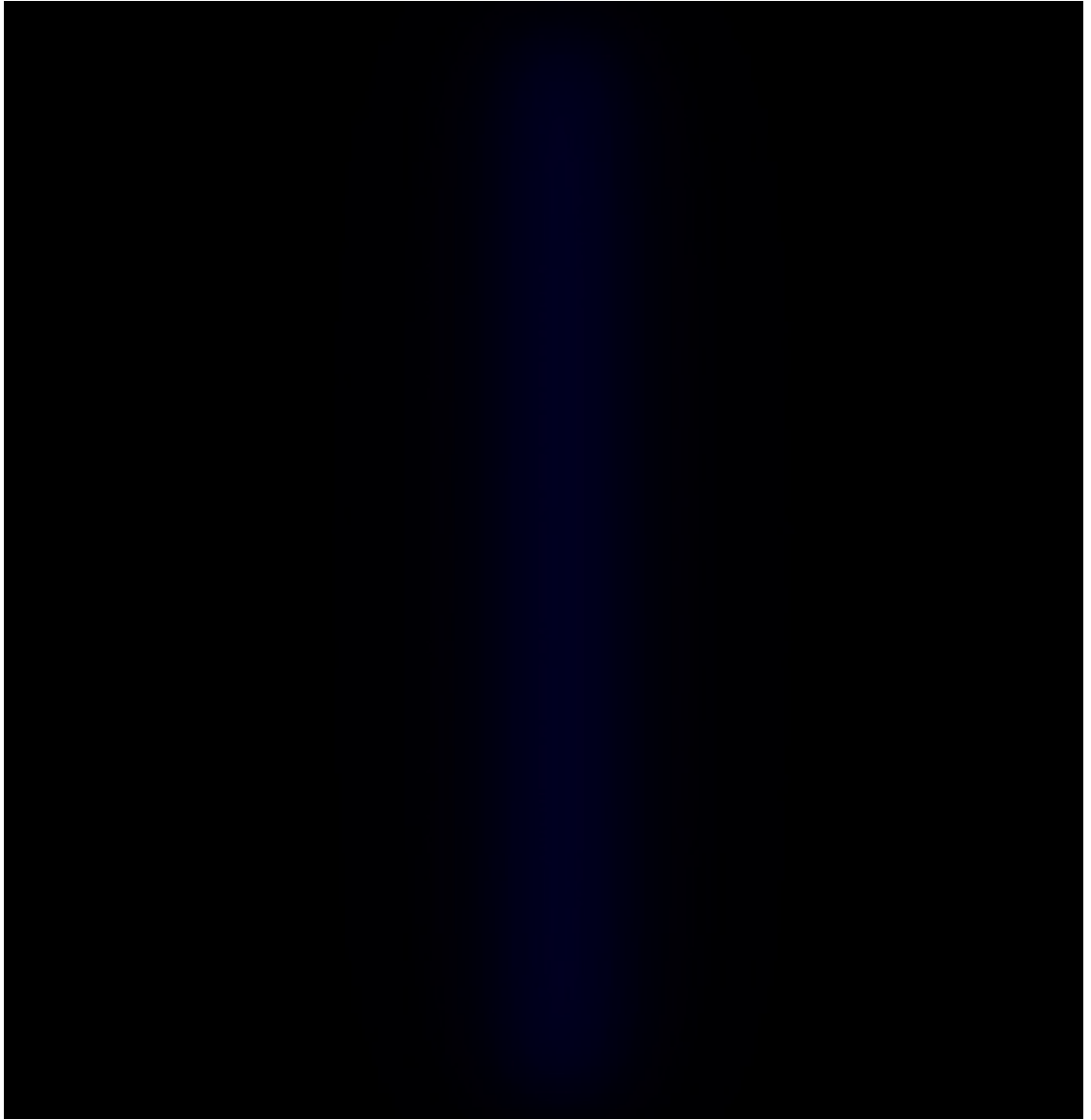
Figure 35. *XIII-2* (2022)

Figure 36. *XI-3* (2022)

The meter square images were printed as Lambda prints made on Fuji Crystal Archive photographic paper. [31] I chose the silk surface finish for all images except for *XIII-1* (2022) – Figure. 34 – where I chose the matt finish to test how it might compare to the other prints in the lighting conditions of the space.

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[31] Photographic Lambda printing is a digital printing process used to produce high-quality photographic prints. This technology allows for the direct digital exposure of light-sensitive photographic paper using three lasers (red, green, and blue) which precisely expose the paper to match the digital image. After exposure, the paper undergoes traditional photographic processing through chemical development, fixing, and washing.

The space for testing the 1m square images was a rather narrow mezzanine corridor, open to an atrium on one side (2.2m in width). I decided to create two groups of images, and one singular image: the single image was chosen in part by the wall space available but offered the opportunity to use a larger white space for the white image *X1-3* (2022) Figure. 36. The first group included *XII-1* (2019) Figure. 30, *XII-2* (2019) Figure 31 and *XII-3* (2019) Figure. 32. The decision to group these prints was chosen on basis of their relationships of colour and tonal qualities, with direct reference to their shadow intensities and colour saturation. The second group of prints was *XII-4* (2019), Figure. 33, *XIII-1* (2022) – Figure.34 – and *XIII-2* (2022) – Figure 35. Here the grouping was determined by the shared reference to the black ground and the low-intensity colour shadowing of the images. Finally, I chose to exhibit the image *XI-3* (2022) – Figure. 36 – within the larger white wall area towards the end of the corridor, this allowed the image print which has the lightest tonal range to sit within the large surrounding white space.

Before hanging the prints in the space, I considered a range of display options for attaching the prints to the wall. Firstly, the use of screws and magnets, secondly, command sticky pads and thirdly double-sided adhesive tape. It became apparent that the foam strips created unwanted buckling on the print surface that was worsened by the reflection of the ambient light, again detracting from the image content. Most of the prints, therefore, were displayed using double-sided adhesive tape along the top of the back surface of the print, allowing the print to fall into their own position. The lower corners of the print were tacked to the wall also using small pieces of double-sided tape, Figures 37-39.
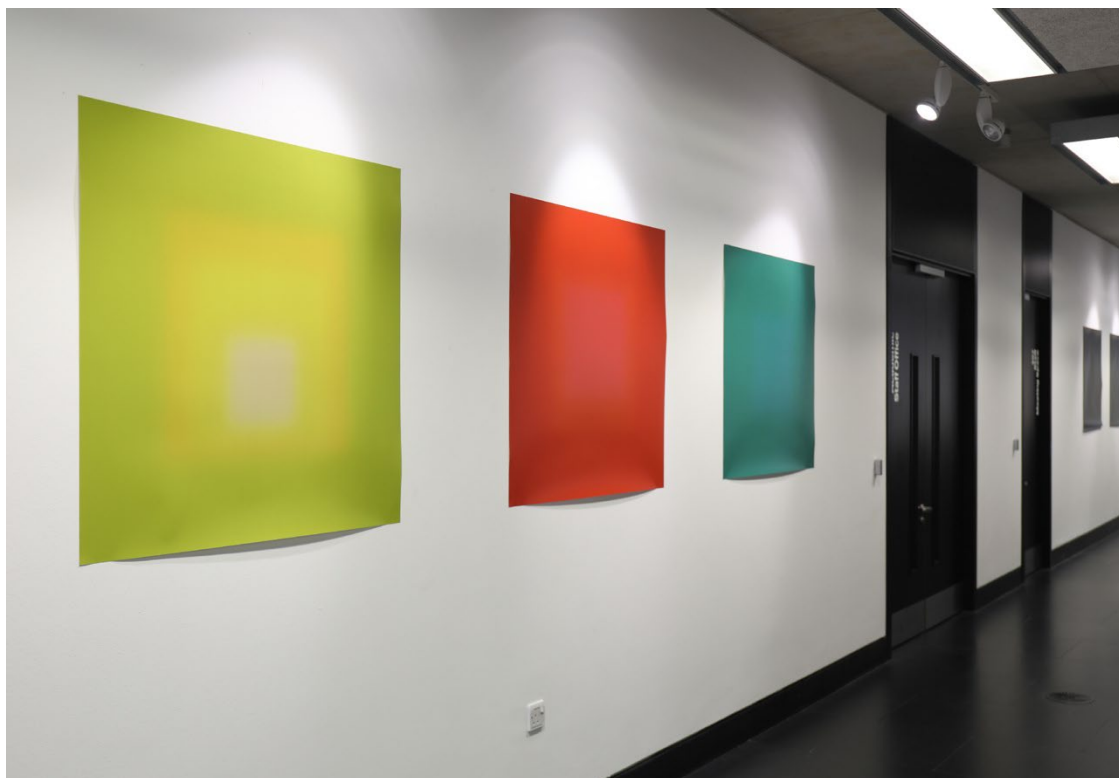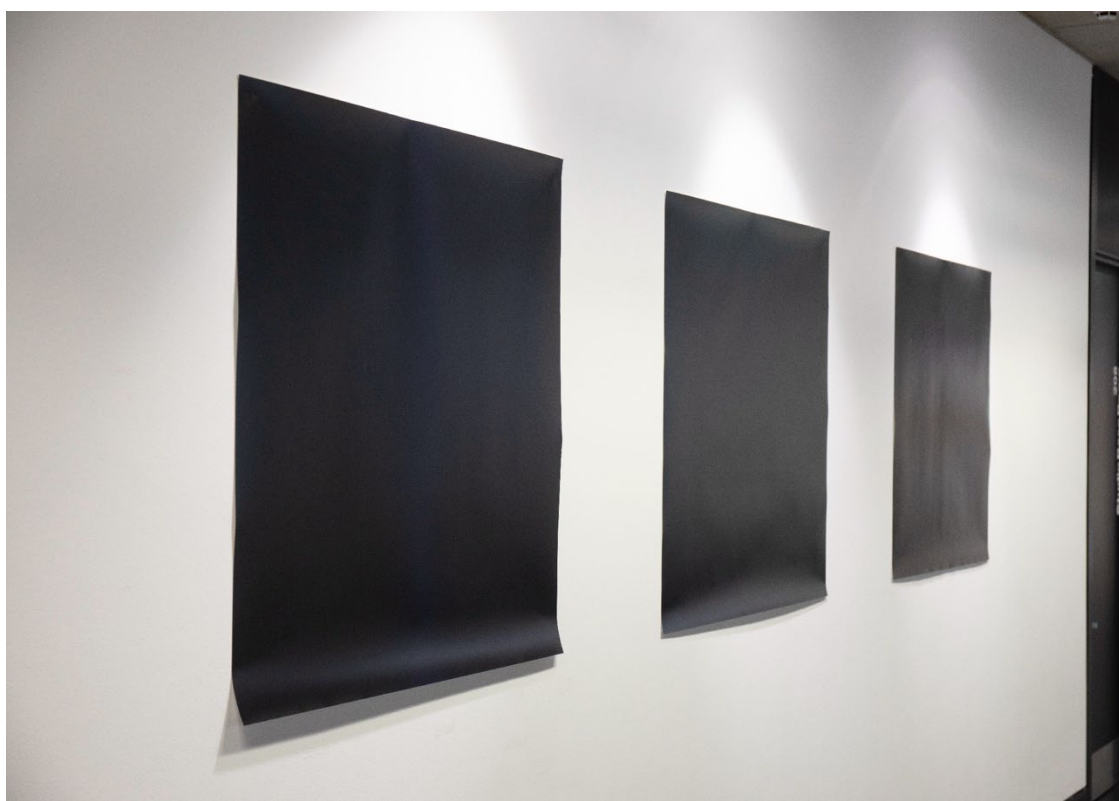
Figure 37. Print test display view (2022)

Figure 38. Print test display view (2022)

Figure 39. Print test display view (2022)

The smaller 60x60 cm test prints were displayed in a corner space that offered more possibilities for physical perspectives of the images. I used this set of four images to test prints made at a local photography print lab which offered a gloss print finish as I wanted to explore what this surface might do to the experience of the images. Three of these images were the same image files as the larger 1m square images. The images I chose for this section were *IX-1* (2017), *XIII-2* (2022), *XII-3* (2019), and *XI-3* (2022) – Figures. 40-43. The choice of print surface was informed by consideration of previous test prints, these included inkjet prints made using Hahnemühle photo rag art matt paper that have a powder-like surface finish that resulted in printed images that closely reference watercolour paintings rather than photographic images.[32] I also tested Fuji Pro Velvet photographic paper that provided a non-reflective surface. These matte

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[32] Hahnemühle Photo Rag is a high-quality, fine art matte paper widely used for inkjet printing, particularly in the creation of photographic and fine art reproductions. It's part of the range offered by Hahnemühle, a renowned German paper manufacturer. The company specializes in producing premium papers for artistic and technical applications, and its Photo Rag line is a popular choice for professionals seeking superior print quality.

print options, however, produced weak blacks in the images that resulted in prints that lacked depth. The matte surface left the print appearing less dynamic, lacking richness and depth but also emitting little as active, energised objects in the space.

All the images that result from my research and constitute the series, *Virtual-Actual*, are, as discussed in Part Two of my thesis, characterised by their subtle gradations of colour and tone. This requires that the rendered raw image files retain their wide colour space profiles which require that the images be saved as 16-bit image files for them to preserve the quality of gradation and provide maximum colour and tonal range for printing. [33] This, however, limits the range of image file compression resulting in very large digital image files. The gloss print images – Figures. 40-43 – needed to be saved at a lower image file size than the local print lab specified, resulting in images that have lost the subtle gradations that can be seen in Figure. 42. The 1m square images, however, have retained the full range of gradations having been printed at a large file and bit size that has retained their wide colour space.

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[33] In a 16-bit channel file setup, each colour channel of the image (typically Red, Green, and Blue in an RGB image) has 16 bits of data. This has a much greater colour depth allowing for the processing of 281 trillion colours.

Figure 40. *IX-1* (2017) Display View (2022)

Figure 41. *XIII-2* (2022) Display View (2002)

Figure 42. *XII-3* (2019) Display View (2022)

Figure 43. *XI-3* (2022) Display View (2002)

Figure 44. Display View 1 (2022)

Figure 45. Display View 2 (2022)

The testing of the selected prints from my research portfolio marked a transition from the digital to physical space, bringing with it a series of new challenges, aesthetic options, and technical decisions. The first and most obvious was the decision about how to group and sequence the images, this being the first time that the images were presented as a physical body of work rather than singular images that occupy the 3D digital space at any one time. As discussed, the decisions for this were based on what naturally seemed to be groupings based on the characteristics of the print images, for example, the black images, and the colour images both seeking their own identities as groupings. The sequencing selection of each grouping was more arbitrary as there was no intentional sequential imperative to the images, meaning that in a gallery situation the curator would decide the sequence and positioning of the images.

Image proximity and perception

The shift into a physical space from the 3D digital space prioritises the viewer's body as the central point of perspective. During the testing of the work this was key to the spectators' response to the prints, where different perspective reveals a different experience of the work by moving toward and away from the images to generate different perspectives and perceptions of the printed images. In the testing of the work in the space, it became evident that sufficient floor area was needed to enable these physical shifts in perspectives. Where greater viewing distance was possible (i.e., *XII-3* (2019)) I observed the impact of the physical movement towards and away from the print image by spectators, who responded to how the changing visual experience of the work shifted their physical perspectives. The spotlighting of the prints in the space significantly interfered with the printed image surface which can be seen most clearly in *XI-3* (2022) – Figure. 39 – and can be compared to the print viewed without spotlighting – Figure.46 – where the ambient light created less print surface light interference.

Figure 46. *XI-3* (2022), Display view 3, ambient light, no spotlighting (2022)

Image-body

Observations of how participants engage with the images as physical prints revealed the importance of the body acting out its role in the space, to position and reposition itself in relationship to the image in a quest to gain a 'grasp' of the image. Close and distance viewing and moving towards and away from the images produced very different experiences. Generally, the closer one is physically to the image, the more indistinct the tonal qualities appear and, conversely, the greater the distance the more distinct these differences became apparent. This necessitated a negotiation of the image – a physical activity akin to focusing – a moving in and out, that was not related to achieving sharpness or resolution (as would be the case with focusing a lens) but a differentiation of intensities, tone, and colour. It is perhaps worth mentioning here that

during the photographic documenting of the work in the space, the digital camera I was using was unable to autofocus when the camera was positioned perpendicular to the images on the wall. It continuously attempted to focus the image but could not recognise a point of focal reference within the image or any definitive point that the camera's digital algorithms could identify to focus on or optically resolve.

The shifting of physical positioning around the image was especially noticeable with the gloss surface images. The reflective surface and contours of the print required more physical effort to view the images from different perspectives and greater mental effort to distinguish between the delineated image and the image surface. This highlighted the actualization of the images in physical space, where the digital file's content (although considered a two-dimensional printed image) acquired an additional layer – the reflected surface of the print. Thus, the printed image gained a reflective surface image.

The images as prints in the physical space revealed a need to negotiate a corporeal distance from the image: too close and the image condenses into a flat monotone, too distant and the images become static and defined. There appeared to be, what one might call, a 'sweet spot' where the image becomes dynamic and in a state of flux, oscillating in a way that reveals their ineffability. This I describe as a kind of focusing activity, a moving in and out, a focusing that is at odds with photographic camera focussing that aims to resolve an object in stasis. The images at their optimum distance created an experience of irreconcilable focus; the image-body attempting to enact its grip on the image.

Ambient light reflection

During the hanging of the work in the gallery space, there was a brief period available to receive feedback on the work displayed. Though this was limited, it did provide very valuable insights into the work from the perspective of the viewers that explored how the work functioned in the space and their experience of it. There was a consensus in the comments I received that pertain to the physicality of the print in relief from the wall. The comments I received identified that the gloss prints in particular produced richer blacks than the matt prints, but the ambient reflections from the gallery lights in

the space created a further layer of noise generated by the ambient reflections on surface of the print. This can perhaps be seen more clearly in Figure. 41, where the image is overlayed by trails of ambient lighting reflections that, though interesting as an exploration of physical surface, significantly detracted from the delineated printed image. The comments I received indicated that the most successful print surface I tested was the Crystal Archival Silk print surface, which is in effect a compromise between a surface that can retain the richness of the black areas of the image and the reduction of ambient reflections on the print surface. The black images which are in part influenced by Ad Reinhardt were at their optimum in terms of light absorption and depth when reflecting the minimum amount of ambient light, and it is interesting to note that, according to Yves-Alain Bois, (1991) Ad Reinhardt refused to gloss varnish his paintings due to 'his fear of interference of actual space caused by reflections' (though unfortunately this has inevitably contributed to the current fragility of his paintings).

Comments I received during the testing of the work also drew attention to the method of display that had the effect of accentuating the physical properties of the paper, again detracting from the surface plane of the print and therefore the image. In the future, I intend that the prints be mounted onto a flat substrate before being hung in the space to minimise the interference of ambient light reflection and any distractions to the physicality of the print.

During the testing period of the work, there was also an insightful conversation regarding the difference between the two groupings of prints. The comments I received implied that the colour image grouping more directly referenced the characteristics of painting, specifically through their exploration of form, colour, and tone, and perhaps due to the time they take to reveal their image content in time (though the latter is also true of the black images). The colour images are inspired by the work of Albers as discussed in Part Two; however, the intention is that the series *Virtual-Actual* are images that operate on their own terms and have no intentional reference to the act of painting, or any genre of painting. Comments pertaining to the black series, though influenced by Ad Reinhardt's so-called 'black paintings' were deemed as more 'photographic', again perhaps in reference to the black ground as an

indicator of light exposure on light sensitive photographic surfaces.[34] They also reference Reinhardt's paintings through their exploration of the monochromatic figure as it emerges over duration from the depth of the black surface.

Surface light reflected; surface light emitted

Exploring photographic prints within the physical space has led me to consider the degree to which the images are not just affected by, but also defined with, the ambient light in the physical space; inevitably additional reflective surfaces are produced as a result and introduce further visual complexity that manifests itself as interference. The series *Virtual-Actual* has developed over the period of the project, not through the addition of elements, but through a process of removal, or distillation. My research in the form of print requires, however, further consideration. This is based on how light reflections on the print surface take the research into considerations of the realm of physical space where, due to the almost inevitable light surface reflections, perspectival views also define the images.

The research tested as prints displayed physically in a gallery space revealed the essential shift from screen image to print. This fundamentally changed my experience of the images during their generation in the 3D digital space that were as much the result of the screen apparatus as they are of my agential activity. During the process of creating the images the screen presented itself an integral part of the process of experiencing the images. Because of the absence of ambient light reflection on the computer monitor, there is no perceptual barrier to accessing the true image. As the research developed, this provided an opportunity to explore how the images might be exhibited in spaces using screen technologies. In May 2023 I had the opportunity to test the work in a gallery space. This offered me the opportunity to show the images on large LCD monitors. For this test I selected images *XI-1* and *XI-2* as these images presented the greatest challenge to screen viewing due to the subtle differences between the tonal ranges and the figure and ground interaction.

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[34] Reinhard also referred to his black paintings as 'ultimate paintings', directly referencing this in his 'Ultimate Painting No39' (1960)

Figure 47. *XI-1 and XI-2* Gallery display on monitors, front view (2023)

Showing the images on monitors presented a range of technical challenges pertaining mainly to technical incompatibilities encountered between the image file type and the limited monitor definition. To create images that retain high resolution, technical shortcomings needed to be resolved, and equipment presented resolution issues that were eventually solved. Of interest was the way in which the monitors created a shift in image contrast and colour when viewing perspective and proximity shifted in relationship to the screens. This was a result of monitors that are unable to produce a consistently high-resolution image across the full range of the monitor. The images experienced from the front – Figure.47 – retained the intended subtle tonal differences as displayed on the computer screen monitor when used as my main reference during the making of the images. Proximity to the monitors in the space, however, significantly changed the image viewing experience. In a similar way to how the print versions behaved, when a normal viewing distance from the monitors was maintained – Figure 47 – the tonal subtleties in both images became more balanced and harmonious, as originally intended. Closer viewing revealed less distinct tonal contrasts, to the point where the tonal differences in both images began to disappear.

Figure 48. *XI-1 and XI-2* Gallery display on monitors, side view (2023)

When changing the angle of view by moving to the sides of the images, the monitors produced an increasingly different viewing experience – Figure. 48. The images took on a colour shift, where the black background of Image *VI-1* began to lose tonal subtlety and shift towards the green part of the spectrum, with red interference, whilst the white background of *VI-2* shifted towards the blue end of the spectrum. This test made it evident that a true black level is not possible to achieve with the liquid crystal display (LCD) monitors I used, as the monitor incorporates a backlight in the panel which allows a small amount of light to leak onto the screen reducing contrast and the level of true black which created image interference. To improve the black (defined as no light emitted) would require organic light emitting diode (OLED) monitors which turns off the pixels on the screen where true black is needed and therefore does not emit any light from the pixels.

The testing of the work on screens in the gallery space further confirmed the degree to which digital monitors reveal their agential role in the perception of the images. The monitors extend their role beyond the status of simply being visual display devices and

become image translators and interpreters of digital signals. They electronically convert and transfer data and images through their own technical systems, each of which are interpreted through their uniqueness and differences of technology and production. The control images when created on the computer screen are also translations, therefore it is not possible to identify one single interpretation of the images: they all fall into the wide category of data and electronic transcripts.[35]

The research outcome of the monitor tests opened the potential for investigating alternative ways to further explore and develop light emitting images in darkened spaces. The screen size dictates the size of the image shown on it and, therefore, exploring image scale is limited to the size of the screen.

The print work allowed me to test the work within the realms of light reflected images, and the monitor tests allowed an assessment of the research as light emitting images. Following these tests, I became interested in exploring the possibility of projected images which have the potential to be explored in terms of scale and where the research can occupy the space between being light reflecting and light emitting images. In my PhD final formal review in June of 2023, I took the opportunity to test and show my research in two darkened studio spaces. Each space was equipped with high-definition image projectors that allowed the images to be projected onto free standing screens within the spaces. The images I chose to test were a combination of highly saturated colour images *IX-5* (2018), *XII-1* (2019), *XII-2* (2019), *XII-3*, and low-level dark images *XIII-1* (2022), *XIII-2* (2022*), XIII-3* (2022) – Figure. 49. The dark images were projected as a sequence of three images onto 80cm x 80cm screens. The tests for these images again clearly highlighted the difficulty in attaining a true black ground for the projections. As a result, the black backgrounds were replaced by a grey projected ground where the subtle contrast between tonal forms of the image were compromised. This again reveals that true black pixels cannot be projected, only no pixel data can create a true black.

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[35] By 'control images' I am referring here to the images as created initially on the computer screen. Images that set the benchmark against which the display images can be measured.
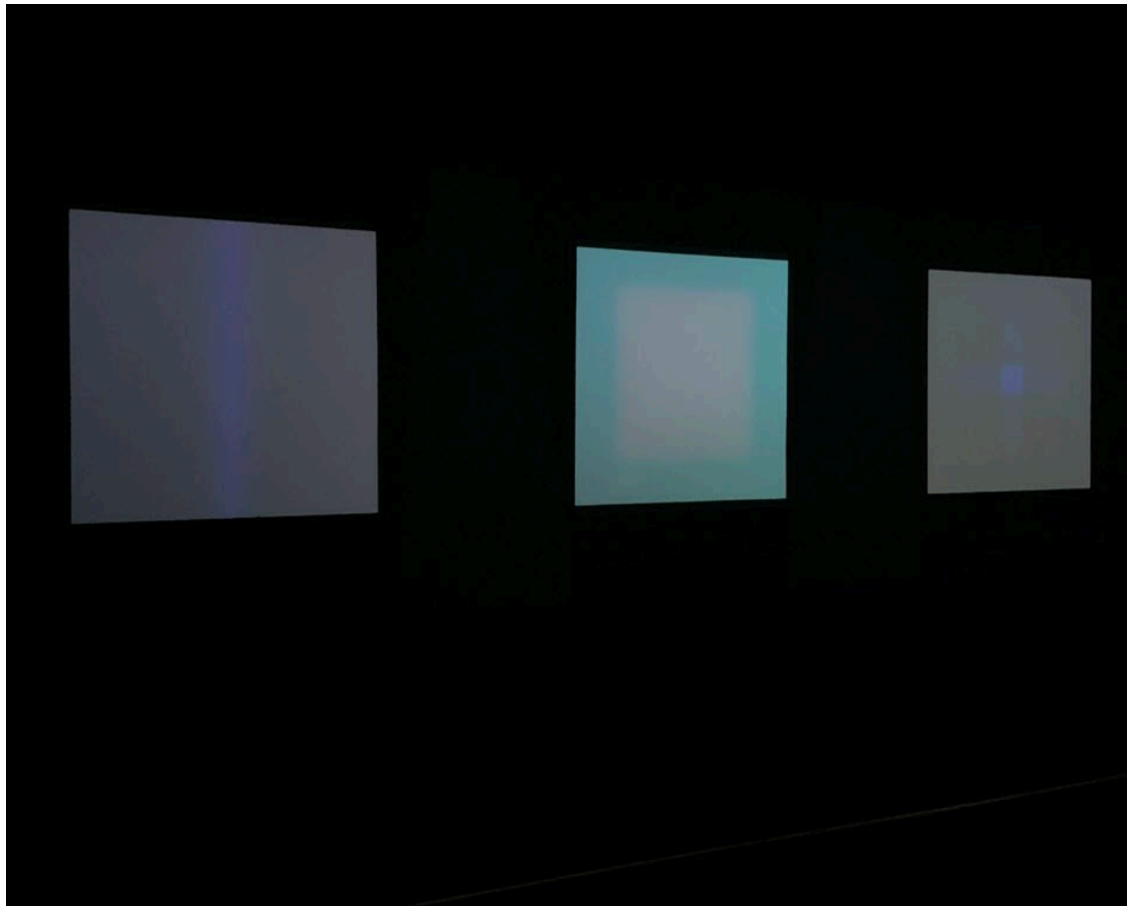
Figure 49. *XIII-1* (2022), *XIII-2* (2022*), XIII-3* (2022) test display as projections, side view (2023)

The colour saturated images, illustrated in Figure. 50, were projected as a series of three images onto screens sized 1.2m x 1.2m. These were more successful as, though the tonal ranges of colours are also very subtle, the images overall were much brighter and highly saturated. The images, though projections, took on the characteristics of light emitting images, resulting in the appearance of large screens or back projected images.
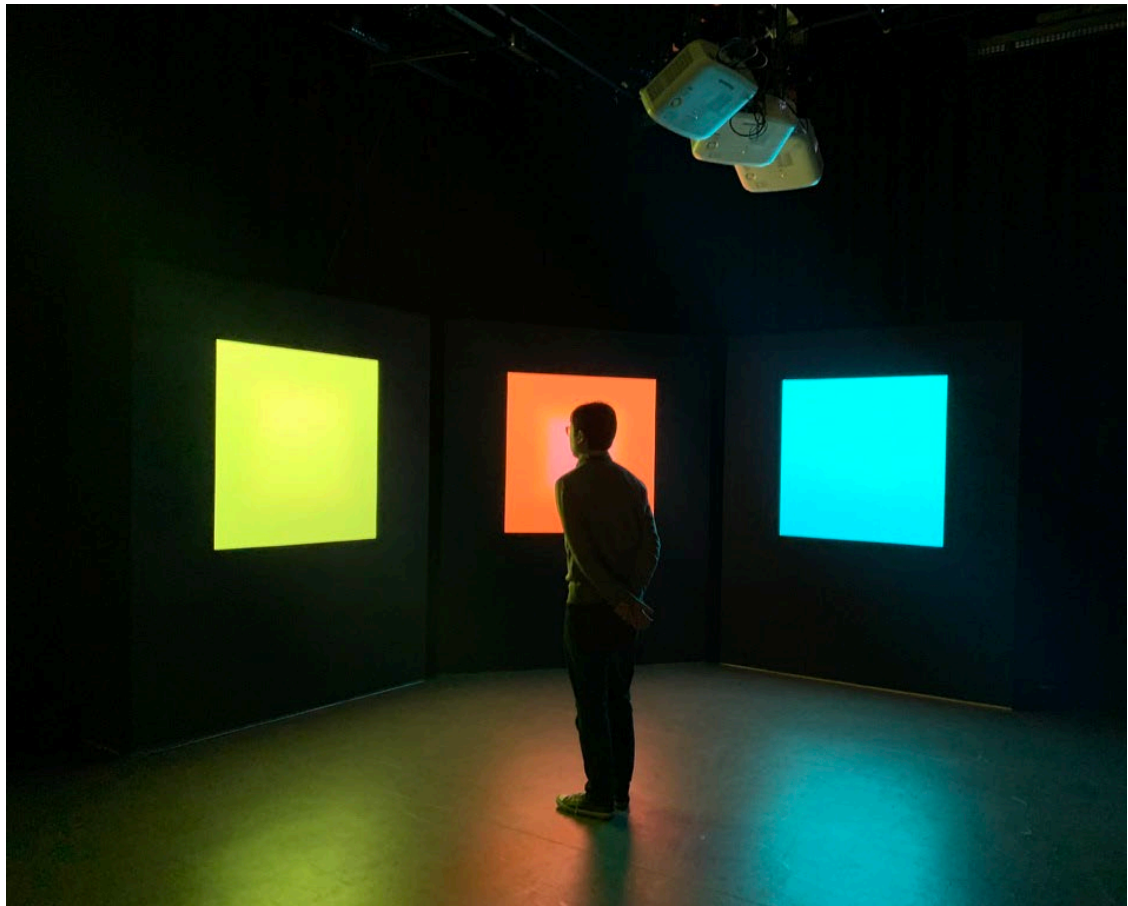
Figure 50. *XII-1* (2019), *XII-2* (2019), *XII-3)* test display as projections, side view (2023)

These projected images were sufficiently spaced to be viewed as a series of three when viewed at a distance, but they were also sufficiently separated to be viewed individually more closely. The latter creating interesting visual experiences such as the forms within the projections appearing to oscillate and disappear and reappear during prolonged viewing according to my own experience of them, which was confirmed by feedback from visitors who experienced the work. Visitors also felt the need to verify their understanding of the images through touching the screen surface or interfering with the image projection to reveal the screen. The test provided an unexpected outcome where the afterimage of one image also appeared to be projected onto the following image when viewed, creating the experience of a strange momentary hybrid image. These tests were projections onto boards anchored to the ground and painted white where the images were very accurately projected. Though this provided the sense of an isolated image, the ambient light in the space illuminated the black boards onto which the images were projected. This raised the possibility of the images being

projected instead onto suspended screens in the space. In August 2023, I was able to realise this idea in the space Figures 51-52).
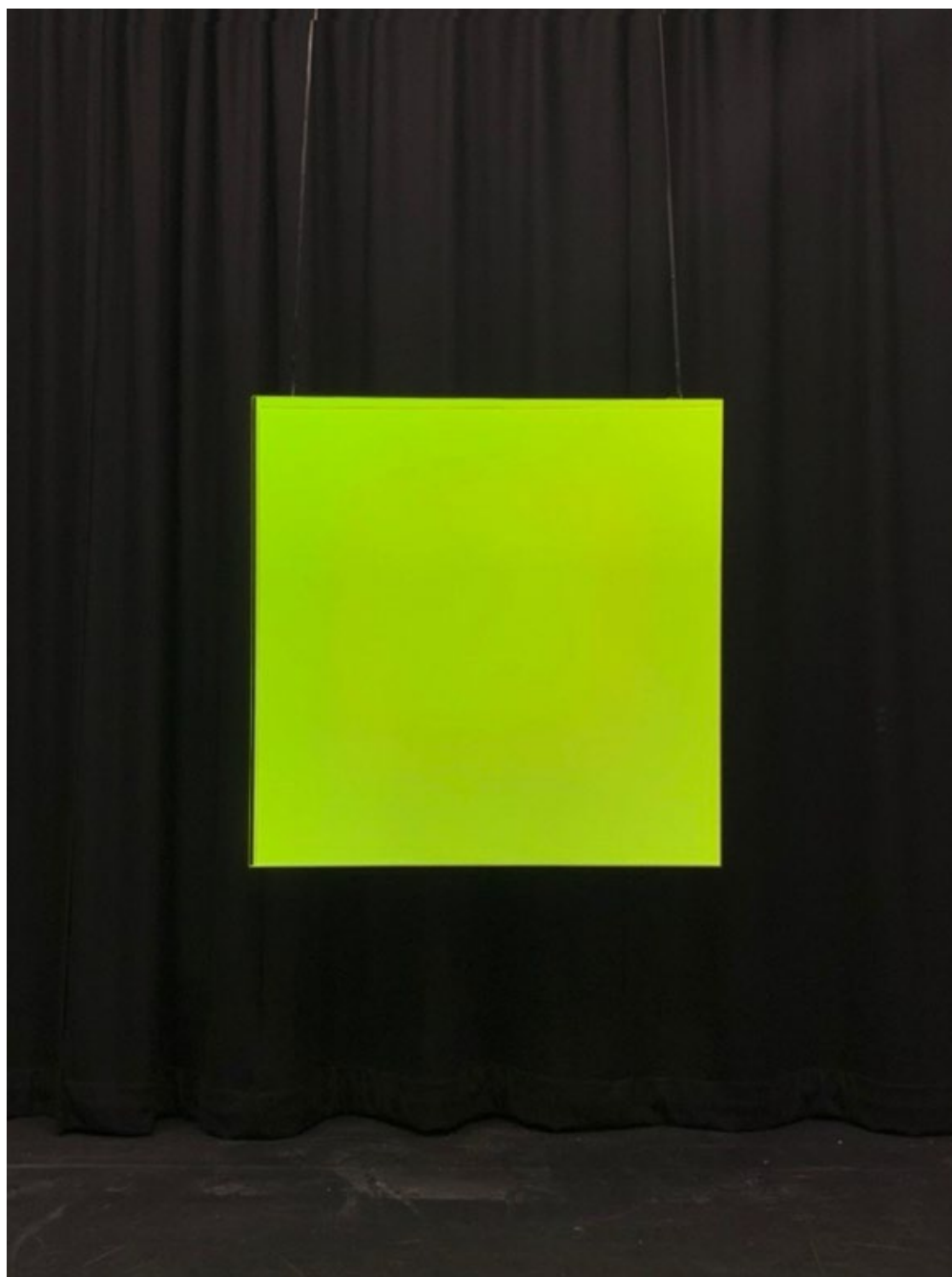
Figure 51. *XII-3* (2019), *during installing* (2023)
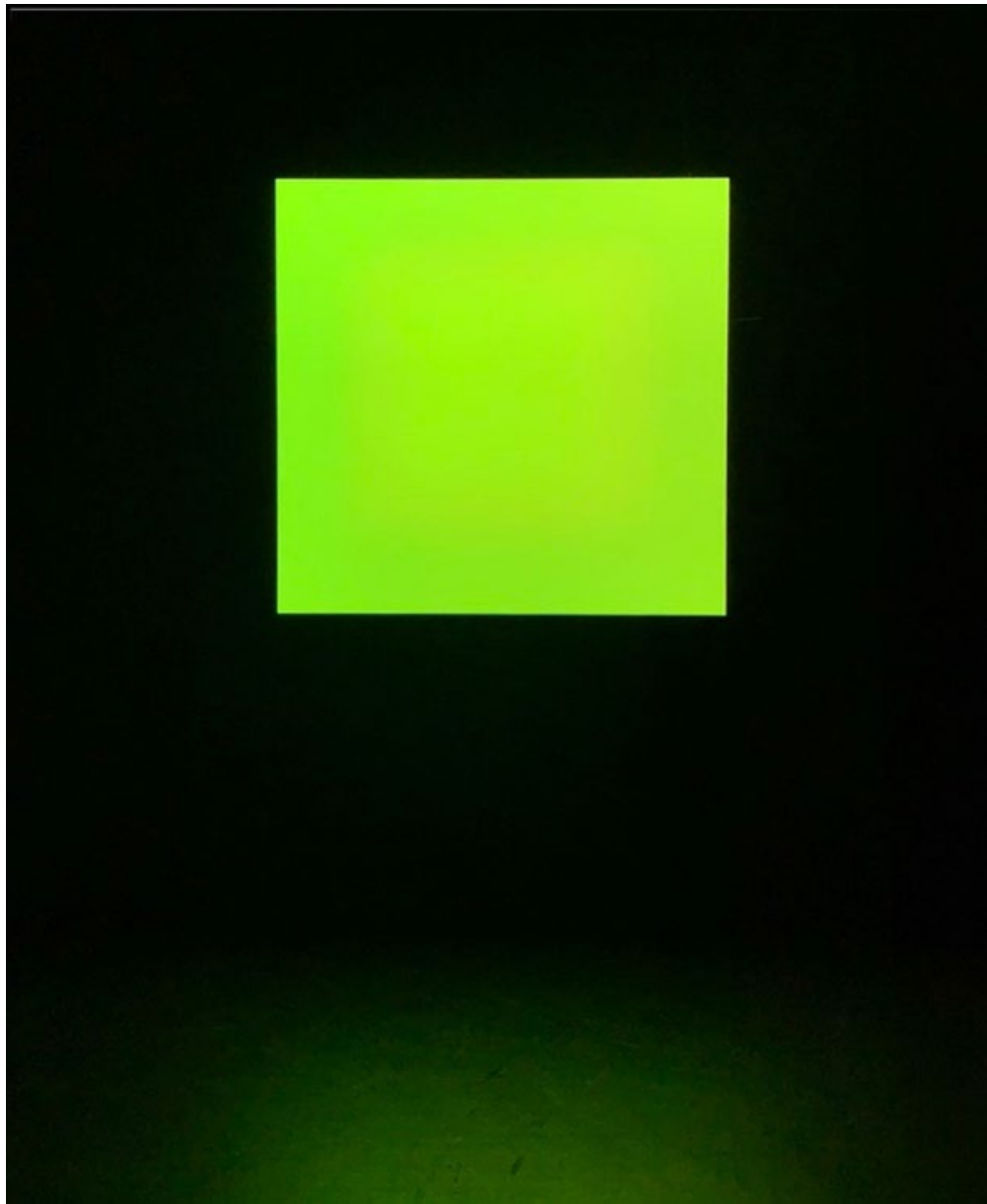
Figure 52. *XII-3* (2019), *during installing* (2023)

This required suspending a 1.2m x 1.2m board from the lighting framework and away from the wall of the studio with steel cables, then projecting the image accurately onto the board from above. The test resulted in a projection isolated from the floor of the studio, producing what appeared to be a floating image in space.

The projected images revealed the fine attention to detail needed with this mode of display. The screens on which the images are projected need to be completely smooth with no paint texture to interfere with the gradations of the images. The tests also revealed the importance of using projectors that have the highest possible resolution

to avoid the interference of pixilation of the image at closer proximity. The images projected in the darkened physical space reference the experience of the camera obscura, a projection of the world beyond the room; the work *Virtual-Actual* as projected images, however, again reference their own internal conditions, the virtualities of the apparatus expressed as images inside the black box of the gallery space (see Part One, page 35).

Images as light sources in themselves

Photographic print in most exhibition contexts will inevitably be affected by ambient reflection. The tendency is to try to ignore the reflections or look past them to attempt to see the printed image itself. My research called for a more direct experience of the image, not affected or mediated by reflected ambient light from extraneous ambient luminous sources. Moving on from the testing of print images on a wall space, the images tested as digital projections directly attribute the light to the image where the image actually 'becomes' the light source. Photographic images as prints induce an act of *looking at*. There is a relationship with a defined three-dimensional physical object that is imbued with its own kind of physical presence to which we want to attribute meaning. Light emitted images, particularly in darkened space where all other contexts and distractions are removed, provides a more tangential relationship and are, therefore, more likely to produce an *experience of*: they *are* their own meaning. The emitted light image as Gernot Böhme (1993) has noted, also belongs more naturally to the 'non-material manifestations of light' (p 198), towards 'pure light phenomena' such as the sun and stars, offering the images a certain amount of independence than when images are articulated or manifested via the physical light and space that surround them. Here, I am reminded of Gottfried Jäger's assertion that generative images are not reproductions, but productions that are themselves systems. My research as print required a processual shift from data images to material print object which involves a process that reproduces physical images from digital information. Projected images are, conversely, illuminations: they are light transmissions of electro-magnetic radiation where the blank screen is but the receiving and reflecting device. My research considers the monitor and screen as light emitting surfaces where the image is the not simply the result of an independent source of illumination, but the illumination itself.

Fuzzy Images

The photographic images emerging from *Virtual-Actual* are characterised by their inherent fuzziness and lack of sharpness. The images are, in practice, nothing other than the result of intensities of colour, light, and shadow. The results are images where the distinction between colour, tone, and edges are difficult to visually determine and therefore tend to oscillate within multistable states. Colour and tone seep into one another to create gradations that contain something of one tone and colour and something of another that it transitions to. Through the result of light and shadow, the generic fuzziness of the images makes them very un-photographic. Photographs, even photograms, are meant to be delineations or depictions determined by at least partial image sharpness. Images that do not achieve this are usually considered unsuccessful, but, as Huppauf, et al (2009) have noted, 'Blurring is an integral part of the principle of the pictorial' (p.217). Blur in the context of the photographic is fundamentally linked to camera lens optics and depth of field. Blur, created through shallow depth of field has traditionally been used to create suitable image ground upon which the figure is sharply presented. Blur, or out-of-focusness, provides the illusion of depth that is dependent on a sharp figure being present within the image. My practice research, as images of pure blur, can do nothing other than resort to a flat, albeit oscillating ground. The images emanating from my practice research are the result of the occlusion and scattering of light that creates soft shadow and gradations. It would not be accurate to suggest that this is blurring in the photographic sense as no camera is used within the space and therefore no focusing or aperture considerations. The images are fuzzy, indistinct, and indeterminate, even though they are made within a highly dynamic 3D space and are the result of high-resolution renderings. They are images about the surface, where the indeterminacy and fuzziness are the result of a merging of light and shadow, tone and colour. The surface is bathed in liquid light that dissolves into or is absorbed by the adjacent colours and tones.

The lack of definition is visually disconcerting, it pulls the perceptual rug from beneath the spectator, leading to uncertainty regarding the reliability of our senses. According to Huppauf the logic of the image is challenged:

> [Fuzziness] 'ignores the common conception of the image and transcends the world of visual representation. It loosens the bond between a picture and the thing represented […] it creates indeterminacy and ambiguity […] it appeals to imagination to complete the images, which by nature are incomplete, and it prevents this process from ever being completed' (Huppauf, 2009, p. p.231).

The series *Virtual-Actual* is devoid of narrative, the images are not symbolic or culturally codified and offer no way other than pure experience to locate the images and this further exacerbates their inherent ambiguity and ineffability. Culturally, we are conditioned to expect delineation and sharpness in images, particularly with photographs as it has become the medium's raison d'etre; unsharpness is synonymous with unsuccessful images aligned to technical failure or incompetence. The technical progress of photography can be seen at least partially as a mission to achieve clarity, precision, and sharpness. In this context, to purposefully produce photographic images that are unsharp is to miss the point of the image's functionality. Though as Huppauf has noted:

> Sharpness exists as a singular only, whereas unsharpness exists as a multitude, has degrees and shades. It exists in different varieties that can be labelled the obscure, the vague, the complex and the ambiguous (polyvalent). (2009, p. 232)

Many key cultural commentators and theorists of photography have failed to recognise fuzziness and unsharpness as a characteristic of photography, and process in general has been a side issue in photographic theory where cultural context through cultural or linguistic encoding has been the dominant interest and concern. Photographic images have come to be defined by the juxtaposition of defined form and shape. Images made

to be intentionally blurred or vague, though currently making a resurgence in photography, have been much more accepted within the modernist practices of painting where, unlike photography, there is a different ocular regime that is independent of optics. Painting, however, allows for and accepts indeterminacy and vagueness as a legitimate aesthetic value of the image. The fuzzy image requires a different approach to viewing, it requires the adoption of duration and (as I will discuss later), intuition, where the image is absorbed and experienced through an engagement with it that allows for perceptual drift or flow. Huppauf et al (2009) have noted this vague roaming of the gaze as 'non-systematic movement in space, which is imitated by the eye in front of a fuzzy image. This unsettled wandering of the eye through the haze of the image produces indeterminacy' (p233). I recognise, embrace, and celebrate vagueness, ambiguity, obscurity, and indistinctness as dimensions of unsharpness. In the context of *Virtual-Actual*, these qualities are inherent characteristics of the image, allowing for an experience of a flow into the images that adopt qualities of pulsating depth, not dissimilar to the experience of the afterimage. They are images that appeal to the imagination and cannot be comprehended or perceived within the conventional logical structures of representation. Huppauf et al, conclude that fuzziness draws us into the image and into the realm of uncertainty, capturing the gaze and fascinating it. This, they conclude, may be exactly what is needed:

> An attempt to create a school of seeing based on the
> indeterminacy of the fuzzy image could contribute to a liberation
> of the senses and a perception that emancipates itself from a
> subjection to the power of domination. Should fuzziness be
> engaged in a process of emancipation, the future may well belong
> to an aesthetics of the vague. This could become a project of the
> present leading to a new future, shaped by reborn images.
> (Huppauf, 2009, p251)

As Rubenstein (2016, p 155) has pointed out, fuzziness marks the shift from the mechanical logic of analogue photography to the fuzzy logic of the digital processing of algorithms within the system that become increasingly complex and mysterious as systems become self-learning intelligent entities. Uncertainty induced by diffusion,

fuzziness, and the indistinct appeals more naturally to the subjective realm of the imagination rather than the rational space of intellectual knowledge. The 'aesthetics of the vague' offers an opportunity for liberty from the burden of representation; ambiguity is a state more suited to the psychic state of intuition, more akin to the natural flow and continuity of inner temporal experience. As such, fuzziness is by nature non-dual: neither this nor that, here nor there, and yet both and everything in between. Fuzziness is not relative; its diffuse space defies clear measurement and is characterised by the obscure. Perceiving images that emanate from my practice research calls upon and invites durational temporality and a stillness that, though not intellectually active, is far from passive. It requires the effort to let go; to enter the image and become a sympathetic participant through the process and method of intuition.

Phenomenology of objects in space

My initial research was a practice that occupied the physical space and was informed by a phenomenological exploration of the primacy of perception (Merleau-Ponty, 2002). Merleau-Ponty's phenomenology assumes that the world is 'already there' before mental reflection begins.[36] This suggests that the visual world is fundamental, simply there for us to experience. In his seminal book, *The Phenomenology of Perception* (2002), Merleau-Ponty proposes a phenomenology of 'being in the world' that generates for us sensory perception. It is a primarily ocular-centric view of perception which privileges an eye that is separated from the body: It is the haptic eye that touches things. The world for Merleau-Ponty is spatial, stating that 'Man is in the world' (Merleau-Ponty, 2002, p xii). Merleau-Ponty's phenomenology is a model of a world 'already given', as juxtapositions of objects that change according to our physical perspectives.

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[36] See the preface of Merleau-Ponty's Phenomenology of Perception (2002, p vii).

I can clearly distinguish from myself and the world and things, since

I certainly do not exist in the way in which things exist (Ibid, xiv)

This is a dualistic approach to being in the world: there is me, and then there is the world. My research asserts, instead, Bergson's phenomenological approach which considers the body as a holistic centre of action and where emphasis is placed less on the primacy of ocular perception and more on our direct psychic experience of immediate data where the world is *in* us. In *Matter and Memory* (1988) Bergson articulates an holistic experience of the world, not things in the world but the world as an 'aggregate of images' that includes the body.

[By] "image" we mean a certain existence which is more than that

which the idealist calls a representation, but less than that which

the realist calls a thing - an existence placed halfway between the

"thing" and the "representation." (Bergson, 1988, p9)

Images are real concepts, not least because we know that we experience them. A memory that I recollect is an actualised image, it does not exist 'in the world' as such yet is somehow real to me. For Bergson everything starts from memory, memory as universal Virtual potential is there before everything, without it nothing could be actualised. Working within a digital 3D space, nothing could be generated without the virtual and potential fluctuations and charges of electrons all of which are latent until actualise as image.

Intuition and the inner time of Duration

Before considering intuition as a method for accessing my research, it is first necessary to explore the experience of psychical time that is different in kind to that of spatial time. For this, I must again refer to Henri Bergson's well-known and highly developed idea of duration, *Durée* (Bergson, 1912). To recap, there are essentially two approaches to time according to Bergson, the first is the most common understanding of clock time. This is time understood within the spatial (or physical) realm. It is relative and

measured time. Bergson argues that clock time is entirely spatial as it is a measurement between points in space that are defined through movement. Even apparent localised stillness is movement relative to other things in space such as our constantly changing distance from the sun and the wider cosmos. The clock time of technology is counted as multiple discrete units: seconds in a minute, minutes in an hour, hours in a day, and so on. This, according to Bergson, is discontinuous time, fragmented by the division of units.

> Outside of me, in space, there is never more than a single position
> of the hand and the pendulum, for nothing is left of the past
> positions. (1912, p. 108).

The units by which we measure time presuppose that time has already elapsed. Bergson argues that this tells us nothing about our experience of the passage of time. Time in this sense is a juxtaposition of localised points and is looked at and measured as quantity through the prism of space. Number is then immediately applicable to material objects as juxtaposed and made distinct in space. Spatial time is predictable and marked by quantity and division and so is therefore discontinuous, a collection of isolated spatial points.

The photographic medium has, through its development, come to be defined by this direct connection to clock time, images that are made in fractions of seconds, caught moments in time and chronological in nature. Bergson's argument then is that we count in space, not in time. This is very different from our inner psychical time, the time we experience, which he calls duration.

Duration is what Bergson refers to as the immediate data of consciousness. It is our subjective lived experience of time that is undivided and continuous. It is qualitative and cannot be measured as, unlike clock time, it is not relative: 'as soon as we start to measure it', says Bergson, 'we unwittingly replace it with space.' (TFW, p. 106). Duration, the time we experience, is the interpenetration of consciousness, a continuity of moments that permeate one another in a continuous and expanded

whole, with no moment identical and therefore constantly novel and heterogeneous. Unlike clock time, which is measured by discrete units, duration, is a continuous multiplicity:

> We shall think of all change, all movement, as being absolutely
>
> indivisible. (2007, p. 118)

If we experienced only clock time and not continuous and indivisible duration, we would live in a perpetual present and not be able to follow a musical melody, as each note would be replaced by the next and lost with no ability to retain it. Duration is the conflation of the past with the present;, it 'is the continuous progress of the past which gnaws into the future and which swells as it advances.' (2007 CE p4). Elizabeth Grosz has written extensively on Bergson's notion of temporality and in her seminal book *The Nick of Time* (2004) she points out that for Bergson:

> 'the past and the present fundamentally coexist [...] the whole of the
>
> past is contained, in a contracted form, in each moment of the
>
> present' (Grosz, 2004 p183).

The past as memory coalesces with the actual present to form perception. Memory is virtual and real but unable to act, it needs an actual perception of the present to reveal and express itself. Memory as virtual potential needs the act of perception to bring it into becoming. There is, as Deleuze (2013) notes, two sides to every image, Actual *and* Virtual (p 68).

Duration as we experience it allows the retention of the image through the interpenetration of a natural flow of infused moments. There *is* succession, but a succession devoid of a before or after. Bergson refers to duration as 'the continuous melody of our inner life [...] we have no interest in listening to the uninterrupted humming of life's depth, he says, and yet, that is where real duration is' (2007, p 125). By way of exploring the duration within things and us, Bergson introduces his now well-known analogy of the process of melting sugar in water.

If I want to mix a glass of sugar and water, I must, willy nilly, wait

until the sugar melts. This little fact is big with meaning. For here

the time I have to wait is not that mathematical time which would

apply equally well to the entire history of the material world, even

if that history were spread out instantaneously in space. It

coincides with my impatience, that is to say, with a certain portion

of my own duration, which I cannot protract or contract as I like. It

is no longer something thought, it is something lived. It is no longer

a relation, it is an absolute. (2007, p 9).

This continual and uninterrupted dissolving of interpenetrating moments is what we experience as pure duration, the inner rhythm of life that is completely devoid of spatial measurement. Duration is a non-linear experience of time, it is time in the making but which never reaches a resolution; rather, it is time as becoming. Duration as an alternative way to explore the temporality of photography liberates it from static, fixed images that are motionless fragments of time. Photography, as a means of exploring time, seem to confirm that we occupy time, but it does so by providing fragmentary evidence of it. My research explores duration as the fundamental state of time for us, though not in the sense that we reside in the container of time in the Newtonian sense, but rather that time is in us and that, far from being fragmentary, time is continuous. In other words, we *are* time, time is not just in us it is also a constituent of all the material things we experience and why Bergson refers to matter as an aggregate of images (Bergson, 1988, p 9). My research has shown that we must consider the photographic image through this lens of duration. Though the photographic image does not have memories as we do, they nonetheless occupy a particular moment in time (or more specifically, duration). The image can be opened out to its greater potential to be experienced as a dynamic whole and *Virtual-Actual* is a visual exploration of this opportunity. Rather than the photographic images being fragmented memories of the past they are, instead, to be experienced in a lived present that endures.

The conflation of memory (Virtual) with the present (Actual) makes perception and *Virtual-Actual* can be understood as an investigation of the process of the formless into form. This can be interpreted through the image rendering process where electrons form data and data form the image within the system. This is visualised through the rendering process itself that is formed of latent potential into an actualised high-resolution image as demonstrated in *Render* (Proctor, 2021). Following this process, the rendered image appears to adopt a multistable state, oscillating between the visible and non-visible, the figure and ground, when virtual memory passes into the state of an present thing and becomes 'something actually lived' (Bergson, 1988, p 139).

The crystalline image of time

In *Cinema II: the time-image*, Deleuze (2013) introduces the notion of the crystal image. This is the concept that describes how images make the transition from a virtual to actual state. This is not, however, a transition as such, rather it can be described as the interpenetration of past and present. Deleuze refers to this virtual-actual relationship as a 'circuit': an image of two sides, memory and perception, the imaginary and the real, spirit and matter. It is, as Deleuze states"

> 'the coalescence of the actual image and the virtual image, the
> image with two sides, actual and virtual at the same time […] a
> simultaneous double.' (Deleuze, 2013, p 72)

The crystalline image is in a perpetual circuit of virtual and actual states, never truly fixed in time, rather an image always becoming and fluid in duration. As an extension to Bergson's analogy of sugar melting in water through duration, Deleuze uses crystallisation as a model to understand the process of the virtual and actual circuit. It may be helpful to think of the crystalising process in terms of science experiments one might have experienced at school: a saturated solution is placed in a container in which a small object or seed is suspended to start the crystalising process. The process shows us a liquid being turned into a solid or, as Deleuze suggests, the past being turned into

the present. The crystal shows both the virtual and the actual states. The act of perception provides the seed for the process of the past being crystalised into the present, or the virtual crystalised into an actual perception. Though indiscernible, there is always something of the solution in the crystal and always the something of the crystal in the solution, it is a circuit. The crystal is time as duration where the bifurcation of past and present are unified through a process of becoming. Deleuze concludes that:

> The crystal-image is, then, the point of indiscernibility of the two
> distinct images, the actual and the virtual, while what we see in the
> crystal is time itself, a bit of time in the pure state, the very
> distinction between the two images which keeps on reconstituting
> itself. (2013, p 85).

This is a profound insight that continues to inform my research, a manifestation of the crystalline process, a shift from the virtual and unseen to the actual perceived. This is a perpetual and undivided and continuous motion. The crystal image is an image that unfolds in duration. There is always something of the virtual in the actual images that emerge from the digital space, an inherent space of potential that cannot be fully or adequately articulated.

Through this crystalising process I now want to explore how the subject/object dualism collapses and unifies. Deleuze's reading of Bergson has highlighted that it is duration itself that enables subjectivity:

> Time is not the interior in us, but just the opposite, the interiority
> in which we are, in which we move, live and change [...]
> Subjectivity is never ours, it is time, that is, the soul or the spirit,
> the virtual. (2013, p 86).

The continuous and unified experience of time as duration remains key to this unification. Duration would remain a merely passive and fixed experience if it were not for the active effort that constitutes Bergson's method of intuition to which I now want

to turn. Before this, however, I will explore the nature of the images that comprise my practice research.

Photographs without pictures

In the introduction to his book, *The Edge of Vision: The Rise of Abstraction in Photography*, Lyle Rexer (2009) present a 'book of photographs without pictures, or rather photographs that refuse to disclose full the images they contain' (p 9). Rexer valorises the early attempts at photography that represent a time 'before photographic seeing was codified', a time before expectations of what a photograph should be or should show. He insists that photography is not a looking at, or a looking through, but a looking with.' (Rexer, 2009) (p.11). As I have repeatedly said and suggested in my thesis, the research *Virtual-Actual* is not an attempt to produce representational images, these are not images that are 'taken' nor, strictly speaking, are they images that are made; instead, they are images that are the result of the intra-actions with the agential systems of the apparatus. They are emanations of the co-creation of apparatus and operator. Rexer describes the images in his book as 'abstract photography' (p 11). I try to avoid this term to describe my research, as all photographs can be considered as abstract (that is, images extracted from the visual world around us). The photographic work that comprises *Virtual-Actual* as a series of images does not intend to capture images as such, either, but produce perceptually captivating images, nonetheless. I have already discussed the practice of concrete photography (page 57) as a context in which to consider my research, and it being more closely aligned to this category of photography than any other and corresponds to concrete photography's innate characteristics of self-reflexivity and auto-dynamism. As the work shifts from print to screen, however, and from the physical to the digital, it has become less concrete, lacking fixity and less defined by its physical materiality that has come to define concrete photography. They are not, strictly speaking, 'objects made of photographic material' (Jäger, Krauss and Reese, 2005, p 15) as Jäger has defined them, but occupy a

different and more contentious material space.[37] My research images do, however, reflect the mission of concrete photography. They are photographic images that, according to Jäger:

> '[Do] not want to illustrate anything; they do not want to represent anything. They are nothing but themselves: objects referring to themselves; they are independent, authentic, autonomous, autogenic, photographs of photography.' (ibid).

They are photographic images that operate on their own terms, entirely self-referential, they do not pretend to be anything other than themselves. In terms of *Virtual-Actual* as a series of images, there is an aesthetic selection process of the images, the research, however, does not place any great importance on distinctions between experimental test images and finished image; they follow in the vein of the early attempts of what became photography, proto-photographs, where experimentation with light, light-sensitive materials and chemical processes coincide with creative investigation. Geoffrey Batchen has highlighted the importance of Fox Talbot's early photo experiments – Figures. 53-55 – where there is no discernible image, but which are nevertheless treated as photographs to form a collection of 'photographic odds and ends, bits of photograph that consist of nothing but photography.' (Batchen, 2022, p 60). Many are images that are the partially faded results of chemicals soaked into partially exposed photo-sensitive material that leave subtle beautiful colour and tonal ranges that elevate them way beyond failed experiments. According to Batchen, 'this is a photography gone wild, a photography

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[37] Coole and Frost (2010) introduce *New Materialisms* as a term aimed at questioning the traditional distinction between inorganic matter and organic matter, or animate and inanimate, at the ontological level. They suggest that materiality is always something more than 'mere' matter, it is a force, vitality, relational or difference that renders matter as active, self-creative, productive, and unpredictable. New materialists recognise that phenomena are caught in a multitude of interlocking systems that force us to consider anew the location and nature of capacities for agency. On entering the realm of sub-atomic particles, we find an even more quixotic and elusive sense of matter. Particles are theorised as vibrating strands of energy, strings that oscillate in many dimensions. The sub-atomic particles are more than tiny pieces of matter, but instead forces, charges, waves, virtual particles, and empty space that suggest an ontology that is very different from the substantialist Cartesian or mechanistic Newtonian accounts of matter.

out of the photographer's control [...] images that evade interpretation' (p 61-62). Batchen has also pointed out that this early spirit of scientific investigation which values test results is dismissed in modernist creative practice, which has tended to celebrate only the final (and intended) result.

Figure 53. William Henry Fox Talbot, 1840. Master record for Schaaf no. 4163. The Talbot Catalogue Raisonné.
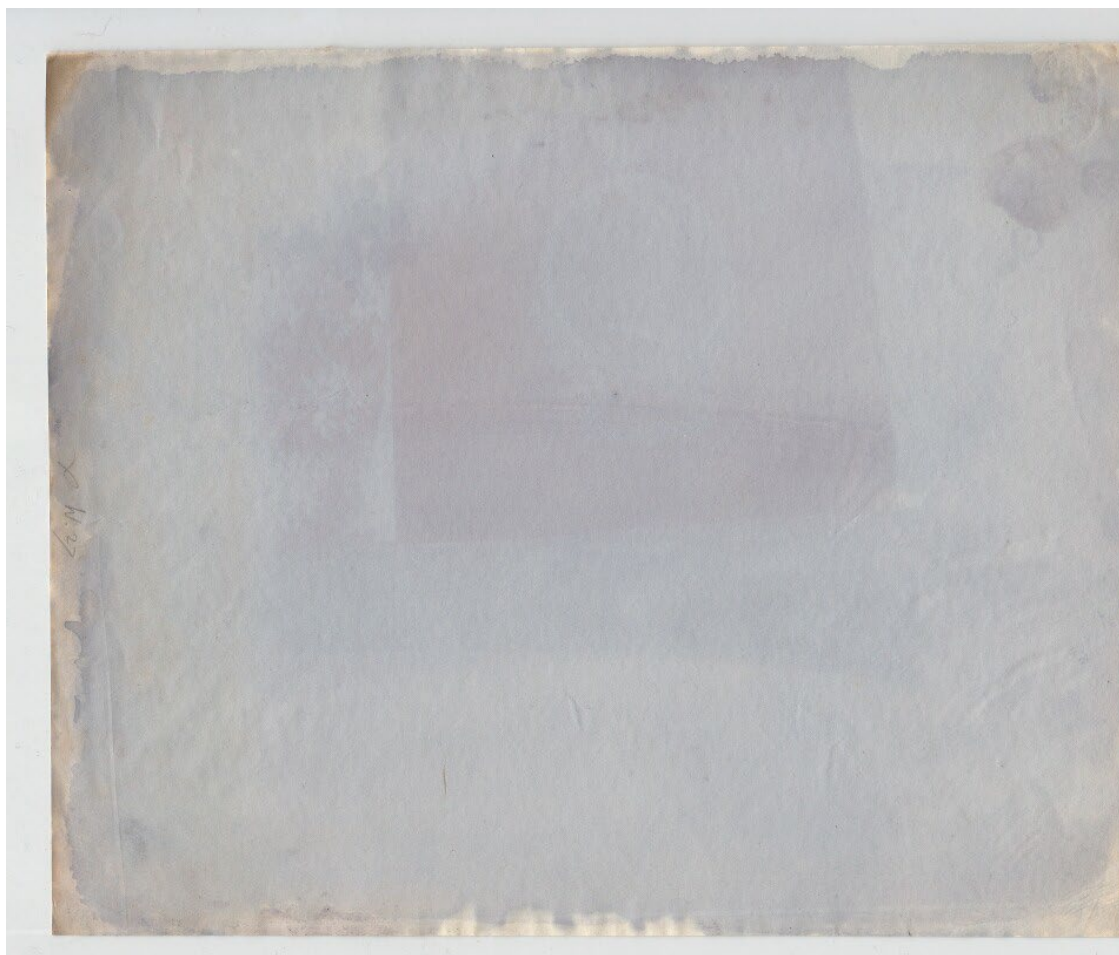
Figure 54. William Henry Fox Talbot, 1840. Master record for Schaaf no. 2356. The Talbot Catalogue Raisonné.
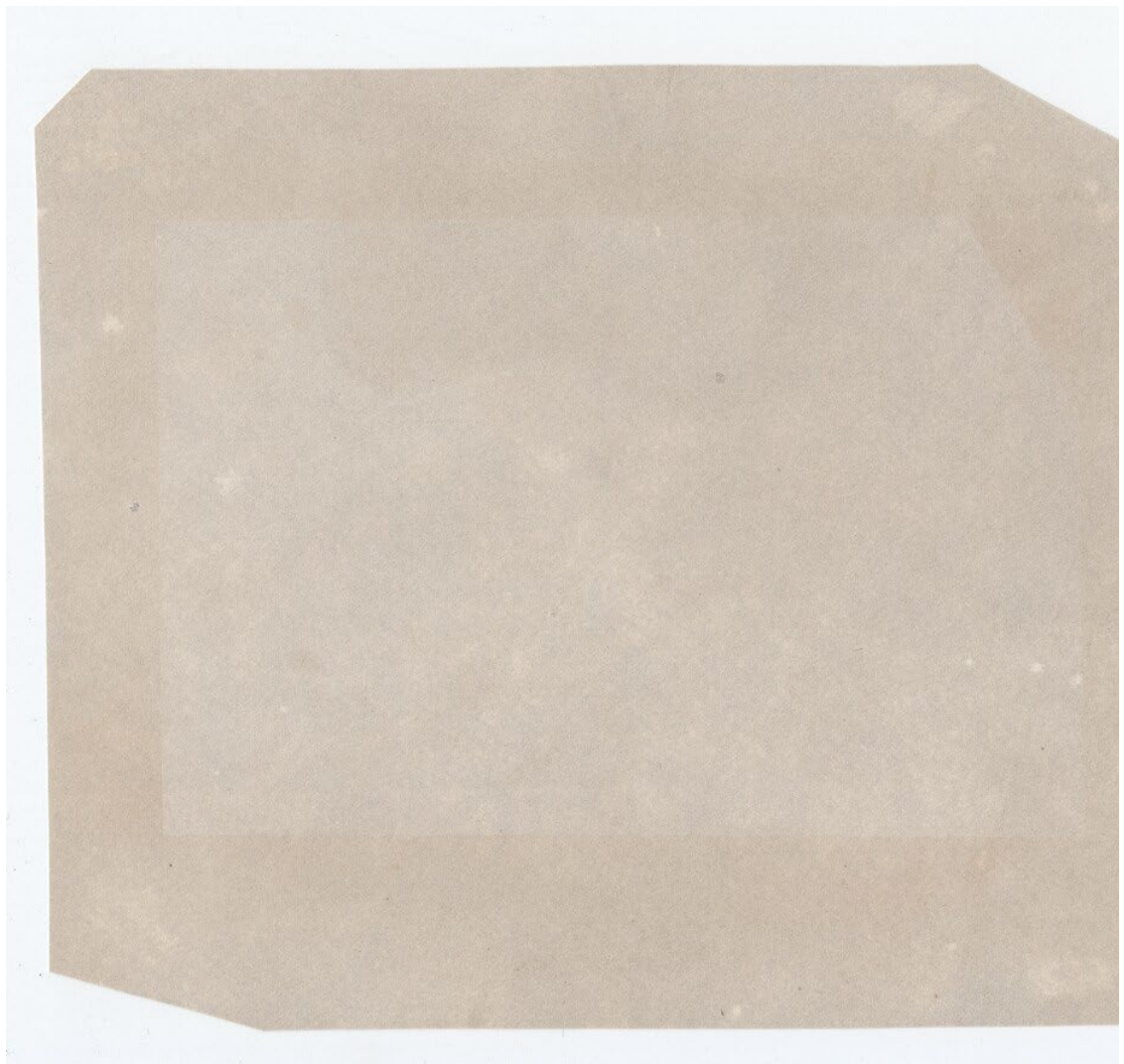
Figure 55. William Henry Fox Talbot, 1840. Master record for Schaaf no. 2419. The Talbot Catalogue Raisonné.

In his assessment of images that fall outside of the genres of established photographic practices, Rexer proposes a history of photography that comprises an archive of:

> 'experiments, intuitions, metaphoric apprehensions, eccentric,
> sometimes mad projects, apparent distortions, embraced accidents,
> and, always, contradictory impulses.' (Rexer, 2009, p 12).

I now want to investigate how the nature of the creative impetus that underpins the process of generating the series *Virtual-Actual* – which are presented as non-representational, non-codified, and self-referential images with no implicit meaning –

can be accessed. If we agree with Rexer that photography is not a looking *at*, or a looking *through*, how do I reconcile my research with the attitude of a looking *with*?

To recap briefly on Part One of my thesis: My practice research should be considered as a coalescence of multiple creative participants, which comprise both human and non-human agents. The work must be recognised as the intra-actions of the human and the apparatus, the latter exerting equal creative influence on the work. I consider the results of my practice research not as photographs taken, or photographs made, but photographic images generated through creative and systematic means.[38] I treat the process as, more accurately, a series of impulses that I will describe as an act of intuition. I am reminded here that I may be offering an insight into my working practice in dualistic terms which I need to correct: The work is made possible through the entanglement of creative and reciprocal agents that cannot be fully recognised as independent, they are indistinguishable. This entanglement enables a working practice that is as elusive as the images that are generated.

My practice research is a photographic method that is non-representational, lacks a code or a message but is not strictly abstract. What is produced are images made with a computer using light, objects, and surfaces in the digital space and often cameraless, and therefore places my research on the peripheries of what photography is.[39] Rexer draws attention again to Gottfried Jäger's manifesto for photography:

> 'In Jäger's view this uninterpretable photography is pure
> photography, occupied only with its means, not with its meanings
> or associations. "We call the sign class 'structural images'" he
> writes, "neither icon nor symbols, neither similar nor
> equivalent."(Rexer, 2009, p18)

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[38] By systematic, I do not mean ordered or necessarily structured, but images co-created by the system in which they are generated.

[39] The 3D software offers a camera through which to view the scene, however, I do not always use this apparatus. Most often I treat the camera view simply as the scene view, as no movement or depth of field is needed.

The photographic images that are the result of my practice research are characterised by their association with the process that enabled them. They are primarily photographs 'about' photography in a 3D digital space and the intra-actions that take place there. In the spirit of no representational image generation, the images are the result of impulses that are largely the result of agential creative impetus. This opens questions regarding how these images can be accessed and indeed whether it is appropriate to consider an alternative method for actively engaging with them. Rexer (2009) talks of an undisclosed photography that should be approached as 'not a looking at, or a looking though, but a *looking with*.' (p.11). I want to propose, instead, an approach to accessing my practice research that appeals to the inner experience of duration that I will explore through a method of what I will call a looking *with-in*.

Looking with-in

The photographic images emanating from my practice research, though still, are not fixed: they are dynamic. They therefore force the spectator to address the validity of their perception. The images initiate something more holistic than a looking *at*. The experience is immersive. By this, I am not referring to artistic immersive practices that are predominantly occupied with the spatial, I am instead referring to our experience of inner life that is, by nature, *truly immersive*.

In *The Creative Mind*, Bergson (2007) proposes that metaphysics is the philosophical field that provides access to experience where 'duration will be revealed as it really is, - unceasing creation, the uninterrupted up-surge of novelty' (p 7). Duration as the expression of our psychical experience of time is the foundation (ground) upon which images are manifested.[40] Duration is also the foundation of what Bergson develops as his theory of intuition, that Deleuze (Deleuze, 1988) identifies as not just a feeling or sense, but a fully developed method: 'Without intuition as method', he says, 'duration

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[40] Bergson's reference to images reaches way beyond that of representational objects. In his introduction to *Matter and Memory* (1998), 'Matter, in our view, (he says) is an aggregate of "images." And by "image" we mean a certain existence which is more than that which the idealist calls a representation, but less than that which the realist calls a thing - an existence placed halfway between the "thing" and the "representation." (p.9) Images are then in-between states.

would remain a simple psychological experience.' (Ibid, p 33). Duration is the necessary condition though which intuition can become an activity. Bergson provides a critique of science through a discussion of his metaphysics to highlight the fundamentally different empiricisms:

> 'we have on the one hand science and mechanical art, which have
> to do with pure intellect; on the other hand, metaphysics, which
> calls upon intuition.' (2007, p 62)

Scientific knowledge is dependent on symbols which metaphysics tries to dispense with. Intelligence for Bergson belongs to the spatial realm of the juxtaposition of concepts, whereas intuition is reflection (p 70). Bergson attributes a special ability of writers and artists to apply their intuitive powers and therefore, draw out latent feelings in others:

> 'As they speak, shades of emotion and thought appear to us which
> might long since have been brought out in us but which remains
> invisible; just like the photographic image which has not yet been
> plunged into the bath where it will be revealed […] Art would
> suffice then to show us that an extension of the faculties of
> perceiving is possible' (2007, p 112-113).

Bergson introduces intuition to reverse our understanding of intelligence which is scientific and analytical. Intelligence is objectified and therefore belongs to the spatial realm which is perspectival. Relative knowledge is habitual in that it synthesizes different perspectives and ideas, which is our default mechanism for functioning and organisation in the world. Intuition, however, is an internal, psychical experience that no amount of analysis can replicate. Intelligence is relative knowledge. Intuition, Bergson insists, 'is the true empiricism.' (2007, p 175):

> 'The first implies going all around it, the second entering into it.
> The first depends on the viewpoint chosen and the symbols
> employed, while the second is taken from no viewpoint and rests

151

upon no symbol. Of the first kind of knowledge, we shall say that it stops at the *relative* of the second that, wherever possible, it attains the *absolute*.' (2007, p 133)

What Bergson describes as a method of intelligence I associate with my research pertaining to test prints in a physical space, where the spectator is engaged in attaining different perspectives of the work in a quest to gain a grip of the print images beyond the ambient light reflections. The second is less dependent of viewpoint (though a viewpoint is necessary) but more concerned with the image itself, without the distractions of reflection, to provide a more direct engagement with the image where the image itself becomes the light source. The image, experienced as a direct light source, that allows for a direct entry into it, is more open to the experience of an absolute knowledge of the image; an image seen from with-in. This absolute knowledge, Bergson insists, is attributed to the inner being or, 'states of the soul':

> 'I am in harmony with these states and enter into them by an effort of imagination… and what I feel will depend neither on the point of view I adopt towards the object, since I am in the object itself, nor on the symbols by which I translate it, since I have renounced all translation in order to possess the original […] the absolute is perfect in that it is perfectly what it is. (2007 p 133-135).

Images for Bergson are not *out there* in the world in the way that phenomenologists such as Husserl and Maurice Merleau-Ponty suggest.[41] This describes taking all perspectival views of a thing and that by putting them together they can somehow be reconstituted. No matter how many perspectives we have on a thing, it will never replace our singular experience of it. It is a spatial concept where Intelligence is orientated outward into space and towards objects. Conversely, intuition is orientated inwards to occupy the mind through memory and perception; intuition is holistic. This calls for an entirely different attitude to gaining absolute knowledge that Bergson calls, *sympathy*. This involves placing oneself in the position of the other. Bergson recognises

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[41] Merleau-Ponty perceives us a 'being-in-the-world'. Mind, body, and object are separate entities.

that this also creates a need for the mind to reflect on the mind through a form of *self-sympathy*:

> There is at least one reality which we all seize from within, by
> intuition and not by simple analysis. It is our own person in its
> flowing through time, the self which endures. With no other thing
> can we sympathise intellectually, or if you like spiritually. But one
> thing is sure: we sympathise with ourselves. (2007 p 136).

As Grosz has observed, 'intuition is a method, a way of knowing, that bypasses the divisive impulses of intelligence.' (Grosz, 2004, p 235). It offers a direct pathway to knowledge, and this is what defines the absolute, but intuition is momentary and fleeting. And although (according to Bergson) intuition is a simple act, it takes effort and is limited in term of one's ability to sustain it, before reverting to the default position of attending to the familiarity surrounding the practicalities of the actual world. We need to seek out new means of apprehension:

> This is partly why, even with the effort of attention, intuition always
> begins with indeterminacy and vagueness and is shadowy in its
> origin. The objects to which it is directed cannot be readily
> comprehended, for intellect decomposes the new and the mobile
> into the already known and the immobile. Grosz (2004, p. 236)

Intuition pertains to the virtual. It is not virtual but requires an appropriate attitude to it that places experience at the exact point of perception where memory and the present coalesce. Bergson talks of entering into the object, to *sympathise* with ourselves and with the image, this being the only method through which we can, 'coincide with what there is unique and consequently inexpressible in it' (2007, CM p. 135).

Part three conclusions

Generally speaking, art-based photographic work has tended to be exhibited in print form, particularly for analogue photograms that are not reproductions and therefore have the aura of unique objects. Traditional photograms, and some more recent digital photograms, tend to be images that are more immune to ambient reflection and therefore easier to look *at*. This also applies to concrete photographic practice where images are often defined through their geometry and sometimes displayed as sculptural prints, in the form of objects assemblages and installations, or so-called 'photomaterial works' (Jäger, 2011). All traditional photograms, including concrete photographic images, are images that are born of matter and their materiality: their processes, chemical, and paper are integral to them as objects. This is not the case with my practice research. The images that have emerged are born of a different material, that of electromagnetic fields, voltages, data, and rendering algorithms. They are not printed but generated. At the beginning of this final part of my thesis, I discussed my work as prints in a physical space and the difficulties that ambient reflections created to the way there were accessed. This is important as the printed image in the space adopted layers of ambient light reflection that disrupted or obliterated the 'pure' image. The decision to show the images on monitors not only avoids the issues of unwanted reflections but, more importantly, is sympathetic to the innate and dynamic intangibility of digitally generated images. The shift from light reflected images, to light emitted images in a space also directly illuminates the body surface of the spectator who (as discussed), emits their own inner light back, creating a reciprocal exchange within the space.

Ambiguity and indeterminacy remain central to my practice research. The lack of definition and sharp edges allows the images to operate more on the level of intensities of colour, tone, and brightness. Figure and ground become more reciprocal and, in some images, begin to merge or oscillate between these two defined states, becoming multistable. A common thread through much of the writing I have referenced is the tendency to use music and sound as an analogy for such images, where harmony, dissonance and melody are used as a method to understand continuity and our ability to hold resonance through the interpenetration of past into the present. Fuzziness in images is not crucial for this experience, but it does

contribute to creating an attitude of drift and flow that is necessary to fully enter the images.

Henri Bergson's method of intuition provides a helpful insight into how the images resulting from my research can be accessed in a way that does not require prior intellectual knowledge. By this I mean no effort is needed for meaning-making, cultural decoding, or interpretation, all that is required is simply an effort to enter the image and experience it from with-in. The images that have emerged from *Virtual-Actual* are therefore open to all sighted spectators irrespective of age or cultural knowledge. The images are a gateway to internal duration which is a uniquely human capacity. We always already live duration which we mistake for spatial time. We see time in the images, crystallisations of virtual-actual states, images that are a 'simultaneous double' (Deleuze, 2013, p 72). These images provide a temporal opportunity for full immersion in duration that provides access to intuition.

Research Conclusions

My research is an investigation of a non-dual approach to photographic practice through the perception and experience of photographic images generated within a 3D digital space, and the realisation of high-resolution rendered image projections in a physical space. The research is an investigative process which is articulated through the three key parts of the thesis. This charts the development of the work from traditional studio practice to an image making process within a 3D digital space. The research has revealed important insights into the deep nature of the Virtual and the Actual through a confluence of thinking and making processes which have provided insights into how we can reevaluate how photographic images can be experienced. In each part of the thesis, notions of the Virtual and Actual have been brought together: firstly, through investigations of the non-dualistic coalescence of human-machine, secondly through a connected process of light-shadow-surface, and finally of non-spatial-space.

Virtual-Actual as research that investigates the effects of light on surface has been marked by key turning points, each of which are articulated in the three parts of thesis. The first turning point of the research was marked by a shift in my working method from operating in a traditional photographic studio environment to adopting the very different, but no-less creatively lucrative, digital space of 3D imaging software. The shift to working in an entirely digital space was pivotal as it introduced me to new ways of exploring the intersections of light, shadow and surface within an entirely different dimension. This workspace both emulates and conflates the two traditionally separate functions of the studio and the darkroom. This has enabled me to investigate a new approach to making photographic images. The algorithmic space of 3D software provides dynamic environment in which to explore the intra-actions of light, shadow and surface; this has facilitated new possibilities of merging materials, suspending objects and working with infinite scaling.[42] Exploring light, shadow and surface in a 3D digital space offers a new ontology of the photographic image, one that presents an alternative structural framework for the image, accessed through an interface that

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[42] See Barad, K. M. (2007) *Meeting the universe halfway : quantum physics and the entanglement of matter and meaning.* Durham, N.C.: Duke University Press ; Chesham : Combined Academic [distributor].

represents the creative capacity of the machine whilst concealing its inner workings, a new interpretation of the camera obscura where the black box that Flusser (1984) alludes to represents the opacity of technology.

The second turning point in the research was marked by the discovery that digital objects and light sources placed in the scene of the computer interface, can be hidden from view prior to the rendering of the final image. This revealed the capacity for the software to mimic the process of the photogram, a process where the object that occluded the light on the surface is no longer present in the image but instead leaves its trace only as shadow. This discovery enabled viewpoints of the surface to be seen through the objects and light sources placed in the path of the illumination. This I liken to cutting through the opacity of the physical materials by means of making them transparent, whilst simultaneously manipulating objects that affect the illuminated surface, something akin to having the capacity of X-ray vision.

The result of this method of working enabled a square-on perspective of the surface where the proximity of objects of occlusion to the illuminated surface could be explored resulting in the exploration of the blurring of the boundaries between light and shadow. Through the manipulation of the intensities of light and the subsequent softening and fuzziness of illumination, a nebulous image was revealed where surface, light and shadow oscillate from appearance to non-appearance and from colour to pure tone.

My research was inspired by an initial investigation into *Trompe l'oeil* painting. This is a sub-genre of still life paintings that has historically been overlooked or classed as novelty images based on their capacity for trickery, deception and illusion resulting in mere errors of perceptual judgement.[43] The research *Virtual-Actual* can be described as contemporary *Trompe l'oeil* images that, rather than being classed as mere visual trickery, can be treated as images that appeal to immediate conscious experience and are in this interpretation not illusory but rather dynamic and elusive, not illusion but

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[43] See Norman Bryson assessment of Trompe L'oeil painting in Bryson, N. (1990) *Looking at the overlooked : four essays on still life painting.* Cambridge, Mass.: Harvard University Press.

elusion, images that are less the result of an act of deception, but images that exist in the indeterminate and indefinable realms of the elusive, ethereal and ineffable.

The thesis *Virtual-Actual* has also generated an investigation of spatial and no-spatial realms. This has allowed an investigation of the tendency to prioritise spatial time which is intrinsically linked to the photographic act. The research has allowed me to reconfigure and directly rearticulate time in terms of our direct experience, our individual rhythms of duration. This allows the images to be accessed and experienced through a method of intuition that offers the potential of experiencing the images from within, requiring a certain sympathy with the image based of our own time and making. According to both Bergson and Deleuze, the present is never truly fixed, it is in a constant state of flux and reinvention, articulated through the act of becoming. My research *Virtual-Actual* explores this temporal dimension, and in so doing provides an alternative understanding of the photographic image, not as a fixed image but rather, as fluid and dynamic in its internal and external interactions.

This leads me to highlight the third turning point of the research. This has been marked by the shift from traditional printed photographic images to projected images. The screen becomes the surface, but one that is imperceptible, leaving only the light of the image to create the field of perception. In the darkened space of the gallery, access to the images have been maximised and ambient reflections removed. In this context light becomes the key source of the image, more specifically light *is* the image and its fundamental essence in the space reflects on one's own body image.

Henri Bergson's contribution and inspiration has been central throughout the thesis. It has brought to my research new thinking about a transcendent understanding of matter and materiality, revealing that images are our only true experience of the present. The thesis *Virtual-Actual*, uses methodologies framework that enables the exploration of light, shadow and surface to be framed within the intangible and impalpable nature of the perception of images. The concept of the Virtual has enabled an opening of potentiality that is has brought new insights into the importance of recognising and articulating the creative process as an assemblage of agents, revealing the often-unrecognised multiplicity of creative forces that contribute to the generation

of images. Through an interpretation of the Virtual, the research has brought new meaning to the potential nature of latency, not as something that is merely inevitable in the creative process, but instead infinite underlying multiplicities from which only some will be actualised as image. The research has also enabled an approach to image making that is not a predetermined process. Both Bergson and Albers make musical analogies to perception that demonstrate harmony or the persistence of memory. I add to this a consideration of the creative act as an activity comparable to an improvisation with the apparatus where there a basic pattern or structure is virtually present, but creative leave a crucial space where decisions are made in the moment and in full co-operation with the apparatus.

Virtual-Actual has provided an exploration of the over-emphasis of the dualism of subject and object that has placed barriers between the viewer and the image, human and non-human agency and the qualitative and quantitative interpretations. Bergson's contribution again has helped to deconstruct these dualisms into not differences in kind, but rather differences in degree. The decentring of the artist as the sole creator has allowed the recognition and acceptance of other influences and forces to impact the research through coalescence and auto-actualisation.

My research journey has challenged my thinking and preconceptions of photography, revealing a much more complex understanding of the medium as a process that has the capacity to operate at a much deeper level that transcends mere human physical interactions with tools. The recognition of a multiplicity of agents in the process has instigated a reconsideration of creative intention that places the artist in the position of co-director of the process. This is perhaps an area of the research that might be challenged: the photographer is after all perceived as the central and key reference point, the maker and owner of images. My research has taken a generative approach to image making that has revealed a non-dualistic understanding of interactions of human and non-human agency.

The series *Virtual-Actual* has initiated a process of thinking and practice that has blurred boundaries between perceived realities of a visual world made of objects, and the virtual nature of the image as the fundamental source of perception. The research

has contributed to the much-needed re-evaluation of the field of photography and photographic practices within the context of the digital arts, a new ontology that recognises the need to expand on current interpretations of photographic temporality, the physical and material nature of the photographic process, and the photographer's intrinsic and reciprocal relationship with the digital apparatus.

The research within the 3D digital space has enabled me to recognise the ever-present state of the Virtual as the potential force to manifest the actual. To this end the potential of my thesis has always been in the making through the multiplicity of assemblages. The Virtual is a kind of plane, or metaphysical surface, upon which time, memory, thinking and practice and all other assemblages occur. It is the perfect reciprocity: the Actual is the Virtual and the Virtual the Actual.

The latter stages of the research witnessed an exponential increase of text to image large language models (LLMs) that has enabled the use of artificial intelligence (AI) through the interpretation and response to language and verbal text prompts. Debate regarding AI has tended to focus on the relationship between human and artificial intelligence. This relationship is based on human with image-based AI tools, a model that responds to input prompts to create images. My research has shown a different partnership with the machine, one where the relationship forms a reciprocal creative interaction in the generation of images. This has formed deeper interactions through co-constitutional, entangled agents where the image is formed through an intricate process of intra-action, rather than a linear question/answer interaction that is based on communication between two separate entities. The relationship between human and AI is evolving and this dualism may become less prominent as the technology becomes more embedded in our lives. The development of this technology will, I believe highlight the degree to which intuition as a method is a unique human faculty, one that relies on our capacity to experience duration that extends beyond the pattern recognition processes of LLMs. Intuition is a process born out of duration, it offers a distinctly human aptitude that enables an inner state of accessing images.

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