The Shifting Surface in Digital Photography

by

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Submitted in fulfilment of the requirements for the degree of

Doctor of Philosophy

Deakin University

September 2016
I am the author of the thesis entitled

The Shifting Surface in Digital Photography

submitted for the degree of Doctor of Philosophy

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ACKNOWLEDGEMENTS

My thanks to my supervisor Professor Kim Vincs, associate supervisors Rose Woodcock and Patrick Pound, and James McArdle who was my supervisor at the beginning of this project.

Furthermore, I appreciate the support of the Deakin Motion Lab, Deakin University Art Gallery, Ritesh Foolchand from Deakin Arts and Education Resources, and the technical support team in the SCCA Photography Media Resources Centre with specific thanks to Warren Fithie for his digital printing expertise. My thanks, also, to Kate Warren for her catalogue essay on the Shifting Skin works.

Finally, I am deeply grateful for the patience and support of my family.
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ABSTRACT

This creative practice as research project has investigated the question: *given the dematerialisation of the photographic image, to what extent can a photograph be regarded as having a surface?* Framed by the contexts of photography, materiality and surface, the creative investigation employed dialogic ‘making as thinking’ methods to generate innovation solutions within the ‘problem space’ defined by the question. This has lead to a series of creative outcomes that invite ways of thinking about and encountering surface in digital photography. The works have considered the convergence of biological and digital ‘skins’ and set up dynamic systems within which to encounter surface in digital photography as a polysemic quality. Exhibition has been integral to the investigation process and the work has toured both physically and virtually. As a result of undertaking the project, I propose that stereo-photogrammetry and reverse image search engines represent the emergence of new forms of photographic surface and that ‘mesh’ be employed as an effective metaphor for conceiving of the structural ecology for 21st century photography.
INTRODUCTION

This document is an exegesis. It will provide context for a creative investigation that was framed by the question:

*Given the dematerialisation of the photographic image, to what extent can a photograph be regarded as having a surface?*

In relation to the question, let me first acknowledge that the language of ‘dematerialisation’ is out-dated. I will be adopting Whitelaw’s term ‘transmateriality’ but have retained the word ‘dematerialisation’ in the research question as an entry point into a discussion of digital materiality. Secondly, I will employ Flusser’s term of ‘technical images’ to encompass an expanded notion of photographs and photography practice. I will also explore the term ‘expanded photography’. Thirdly, I will be unpacking ‘surface’ as a polysemic term as a means of shifting registers between senses of the concept of surface. The logic of these choices will be addressed in more detail throughout this document.

The exegesis will unpack this framing research question, outline how the investigation was approached, articulate the outcomes, and point to future directions and implications. But, like an awkward guest fumbling a joke at a dinner party, allow me to skip ahead to the punch line and prefigure some of the conclusions to the project.

The topology of the photograph and photography is becoming extruded from a two-dimensional surface to a sponge-like mesh. More than the networked architecture of the internet, computer vision has made tangible emergent surface structures between technical images, to employ Flusser’s term for photographs. This conception is important because the geometric structure of media has a profound impact on the structural
paradigms through which we think about and understand our experience. In the same way that the structure of writing creates a linear paradigm of past, present and future and the omniscient multi-presence of youtube collapses historicity, expanded photography folds and stretches around multiple dimensions and thereby offers new tools with which to interrogate and encounter ‘reality’.

Figure 1: Lyon, B 2015, The Internet 2015, The Opte Project, <http://www.opte.org/the-%20internet/>. Licensed under a Creative Commons Attribution-Noncommercial 4.0 International License

This proposition of ‘digital photograph as mesh’ is different from visualisations such as The Opte Project (figure 1) (Lyon 2015) that attempt to map the structure of the Internet as a seemingly organic network. My proposition is that the functionality of computer vision and reverse image search engines means that the structure of this sponge surface is extruded from the relationship between the images themselves, rather than the hyperlinks and web pages within which they are embedded in the distributed album. Computer vision functions to recognise formal image content, not the attached text based metadata, captions or labels. The introduction of reverse image search functions leads to emergent connections between images based on relationships between the visual data content of the images themselves.
I propose that ‘mesh’ is a rich model with which to consider and conceive the ecology of digital photographs and technical images in the early 21st century. The mesh metaphor works on several levels. The ecology and structure of technical images behaves like a mesh; this ecology is constituted as a mesh as one views the system at a macroscopic and microscopic level; and it is enmeshed - both culturally and technologically - within the fabric of transmaterial experience. Indeed, there is a meshing of biological and digital surfaces. The interplay between skin and technical image is unfolding and enmeshing. It is this visceral embodied, haptic quality of the encounter with technical images that particularly drive this investigation.

This exegesis maps the evolution of this concept of ‘digital photography as mesh,’ from my initial research question, which sought to address and interrogate the concept of surface in digital photography. The creative investigation functions as both a means of interrogation and as an outcome of the investigation in itself. The exegesis provides a context for this creative work, and for the embodied thinking the creative investigation has supported, which has enabled the formulation of speculation on the generative proliferation of surface in and of technical images.

Projecting forward, I conclude that, in addition to new forms of surface emerging between two dimensional photographs through the process of computer vision, reverse image search engines and digital photogrammetry, the emergence of light field cameras and displays represent a significant shift in the constitution of surface in technical images. Where the traditional camera captures a plane of information via the action of light, light field technology captures a field with a depth of potential image outputs. If the claims of light field display start-ups come to fruition, the surface of the screen will also be reconstituted.
This project has been a creative investigation into the presence of surface in technical images. The investigation has involved a process of considering surface as a polysemic entity - as a slippery shifting notion that coalesces and dissolves, extrudes and reforms. The examination of this layering that transitions through a series of registers is integral to both the process and outcomes of this investigation. For example, surface is both an abstract mathematical concept and a physical experience. A photograph is both a visual impression of surface - of light reflecting off surface - and is itself a surface - a two dimensional image plane represented on a flat screen, a projection onto surface, or a print.

Surface has been a guide, a tool with which to grasp and examine photographs as a material/cultural entity and photography as a practice, a medium and a techno-cultural artefact in the context of this creative practice. Conversely, surface has also been the subject of the investigation that has utilised photography as a medium of inquiry. The search for surface and the practice of photography have reflected and informed each other. They are constitutive, enmeshed on many levels. Surface and photograph merge and separate like sticky membranes. How to pull them apart? To examine the simple logic of this relationship, a photograph has surface, in a number of senses. Indeed, a photograph is a form of surface. But, obviously, surface is more than just a photograph.

Shifting register from photograph to photography, the medium and practice could also be conceived as having surface in the form of boundaries, as being defined by the limits of what it can do. Surface is a means of conceptualising the expansion of photography as a medium defined by porous boundaries. One of the implications of the transition from film to digital media is that the practical limits and boundaries around what the medium can do have shifted and are in the process of rediscovery. Examples of this include the
The convergence of still and moving images and the diffusion of photography into ubiquitous computing.

*Given the dematerialisation of the photographic image, to what extent can a photograph be regarded as having a surface?*

How did I arrive at this question? For around a decade, my work considered representations of interior spaces. Indeed, my master of fine art concluded that there is an embedded relationship between the interiority of room, skull and camera, that the spaces coexist, nested (Bennett 2009, pp. 95–97). Having exhausted this line of inquiry, it came to my attention that space is defined by surface and this would prove a fruitful meditation. Surface became a ground on which to orientate.

At a time when the enmeshing and networking of technical images has radically accelerated, it may appear impossible and pointless to attempt to describe the environment within which we are immersed. But if the present project rapidly becomes just a dated snapshot of a cascade of shifting and dissolving frames, it still serves a purpose of providing steps towards understanding the futures of a visual ecology of technical images and the ground on which it was constructed.

The research question that has guided this project was conceived at a time in which much of the discourse about the shift from analogue to digital media was couched in terms such a ‘dematerialisation’. The then dominant conception was that a digital file was ‘immaterial’. Over the course of the project, I have come to understand that this conception is faulty and out-dated, that the process of digitalisation can be more usefully conceived as a form of trans-materiality. I have retained the original wording as it offers an opportunity to consider this shift in language and thinking.
When unpacking the question, the relationship between surface and image is particularly key. An image is primarily a 2D entity. Even the representation of 3D images is essentially an illusion: both stereoscopic images and screen based 3D digital objects are 2D visual representations imbued with the illusion of three dimensions.

In terms of the creative work, this project has folded together several processes and practices in order to consider surface in and of technical images. The starting point employed scanography, skin and tattoos overlaid with augmented reality. Extruded representation of the two dimensional image created a topographical landscape representations of the image. Considering in more detail the implications of computer vision led me to the concept that images now have two audiences; people and machines. This concept led me to explore associations between images in multiple terms—spatially and topographically, as well as through data-driven paradigms. It is the intersection, perhaps synthesis, of these two approaches that underpins, for me, the structural model of the ‘image as mesh’.

This exegesis document is organised with the following structure: introduction, methodology, context, work, and wrap.

The METHODOLOGY will address the question of why the method employed was appropriate for this project. The section will consider photography as a form of inquiry and the use of framing questions to generate innovation;

The CONTEXT section will unpack the context within which the project took place. It will cover each of the three key terms of the research question - photography, materiality, surface - which maps a ‘problem space’ for the project (figure 2).
The WORK section will bring together and document the creative works completed in the process of the creative investigation. The process of making the works was literally an encounter with surface. For example, the use of scanography collapsed the space between the image capture device and the skin of the subject.

I will then WRAP up the outcomes enmeshed in the creative investigation and consider the emergence of new surfaces in the expansion of photography. Not only did the works set up performative dynamic systems between the works and the viewer, the images and ideas performed and demonstrated the networked nature of image ecology by eliciting viral online media response.
METHODOLOGY

Figure 3: Rrap, J 2015, installation view of Remaking the World, held at Ian Potter Museum of Art, Melbourne, 23 July - 15 November. Image reproduced with the permission of the artist.

In Remaking The World bodies, affects, surfaces, textures, interior and exterior spaces, images, mutating forms, and durational forces form a poetic constellation. The differences between these are not fixed. Indeed, they defy measurement, the logic of reason, and the finality of signification. There are qualitative differences that playfully combine the factuality of existence and concrete matter with the ebb and flow of dreaming and imagination. (Parr 2015, p. 36)

The gallery is stark and black with branches of screens hanging from the ceiling (figure 3). Each screen presents a video of an artist dreaming, asleep wrapped in white sheets. The images of the dreamers are hung upside down, like bats hanging together in a cave, or pod people in suspended animation from a science fiction movie. Rrap filmed thirty artists, including herself, dreaming on the proposition of ‘remaking the world’. The second room of the exhibition is a cacophony of screens and shapes, tumbling and stillness, complexity and clarity. It could be conceived as stepping inside Rrap's dreams, walking inside her mind’s eye.

In an interview on ABC Radio National’s Arts and Books program, interviewer Michael Cathcart exclaimed that he got it: these are artists at work, that the state of dreaming is a place where work takes place, where worlds are made and remade (Cathcart 2015).
This is an exhibition about how artists work and create knowledge. Dreaming is framed not as a mindless disengaged state but as a deep internal process, an act of intelligence, where meaning is formed and made. In an elegant, resolved, self-conscious proposition employing the exhibition form, Rrap positioned art making as a significant form of knowledge production.

This present PhD project proceeds from a similar premise, that creative practice can be a significant form of knowledge production. Creative practice can be a means of reframing and reassembling experience, of examining and reconfiguring paradigms. My process has been to consider photography as a knowledge creating practice, as well as a creative practice, in order to address the shifting nature of the photographic surface through an iterative, generative, making process.

Barrett and Bolt contextualise ‘creative practice as research’ with the assertion that “artistic practice be viewed as the production of knowledge or philosophy in action”, distinct from traditional empirical models of research (Barrett and Bolt 2007, p. 1). Extending the ‘active philosophy’ model proposed by Barrett and Bolt, Webb explains “the starting point is usually an idea; and the attitude is more often a concern with how humans construct the world through ideas, images, narratives and philosophies, than a generalisable ‘truth’, or understandings of cause and effect” (Webb 2008). Haseman (2010) observed that creative practice as research used the language and tropes of the medium itself to interrogate and test its paradigms, rather than translating these findings into text. Vilém Flusser simply stated, “Images are articulations of thought” (2011a). Both Haseman and Flusser’s views indicate that a full understanding of the significance of creative practice as research outcomes can only be understood by direct engagement with those creative outcomes.
Photography as Inquiry

Daniel Rubinstein’s essay What is 21st Century Photography?, commissioned by the Photographers’ Gallery in London following the 21st Century Photography conference at the University of the Arts London, positioned photography as a significant form of active philosophy, a method, a process, and a means of making sense from the swirling shifting conditions that flowed around and through us.

In short, 21st Century Photography is not the representation of the world, but the exploration of the labor practices that shape this world through mass-production, computation, self-replication and pattern recognition. Through it we come to understand that the ‘real world’ is nothing more than so much information plucked out of chaos: the randomised and chaotic conflation of bits of matter, strands of DNA, sub-atomic particles and computer code. In photography one can glimpse how the accidental meetings of these forces are capable of producing temporary, meaningful assemblages that we call ‘images’. In the 21st Century, photography is not a stale sight for sore eyes, but the inquiry into what makes something an image. As such, photography is the most essential task of art in the current time. (Rubinstein 2015)

Daniel Rubinstein’s essay has the declarative tone of a manifesto. Rubinstein contextualises photography in the nineteenth century as emerging from the scientific revolution of the Enlightenment as a tool of rationality. As a technology, it contributed to the emergence of a twentieth century modernist aesthetic by distilling the tendencies of industrial capitalism to an image plane. In his conclusion, Rubinstein argues that in the 21st century photography is subject to a new set of conditions. Where the forces of modernism produced machines that augmented functions of the body (such as ‘camera as eye’), the conditions of the information age have been co-created with machines that augment and extend mental structures (Rubinstein 2015).

In this new ecology, he argues that the emphasis is shifting from photography as spectacle, as representation of a subject, to photography as visualising and negotiating the processes of distributing information. The relationship between viewer, image and
subject is being repeatedly folded and stretched. Essentially, he contends that the
paradigms that framed 20th century photography are not adequate to account for the
conditions that mediate photography in the 21st century.

He positions photography as the primary medium of interface in a networked ecology
from which new forms of thought and agency are formed. Photography may be
conceived as a method for funnelling the chaotic flow of data, for creating structure
from the unformed multitude of orders that flow around and through us.

Rubinstein frames images as a form of assemblage in a polysemic sense. Deleuze and
Guattari (c1987) used the term ‘assemblage’ to denote entities comprised of a
multitude of disparate components and elements. The term assemblage can also refer
to Duchamp’s ready-mades and incorporates the idea that the image is made in
collaboration with materials. In Rubinstein’s use of the term, both readings are present.

A photograph is made up of a number of elements. At a basic level, a digital photograph
comprised of three elements—a digital file, the hardware that stores and displays the
file, and the software that processes the data and converts the file from 1s and 0s to a
visual representation. But a photograph also comes about and is encountered and
deployed through a range of frames - both mechanical and conceptual. The digital
photograph is contingent on a network of systems that sustain and perpetrate it.
Conversely, the frame of the photograph can function as an instrument of inquiry and
negotiation by coalescing a fleeting abstract impression long enough to allow reflection
and analysis of the conditions caught in the frame, both within and of the framing
device.
As a method of inquiry, photography is an effective means of taking a snapshot of the shifting ground, the swirling cloud of data and creating a pause on which to reflect, a sample to analyse. It is a means of distilling complex unstable conditions in an ill-structured problem space. Photography has been a method for making sense of the world, a means of grasping and analysing experience and encounter.

**Delineating the Surface of the Problem**

Psychologist Patricia Stokes contends that self-imposed creative constraints are a feature of mature artistic practice and an effective strategy for generating innovative new works. Establishing constraints is a means of escaping ‘fixedness’ – the tendency to repeat what we already know. If given a blank canvas, “composition takes place in a cul-de-sac of the customary”. Paradoxically, limited focused options generate innovation and novelty (Stokes 2007, p. 107).

A constraint can take a number of forms. For example, constraints can be couched in terms of technical process, content, style, or tone. Working within a chosen medium or genre is one such constraint, “the contents of the paint box” as Paul Klee termed it (Stokes 2007, p. 109). Artists are also working in dialogue with previous works and attempting to make a contribution to that conversation. Therefore, the territory already covered by previous practitioners becomes a constraint against which the new work must sit.

A research question may be conceived as framing a ‘problem space’. Problems can be either well-structured or ill-structured. A well-structured problem already contains a solution, such as a jigsaw puzzle that contains all the parts. Creative practice research occupies an ‘ill-structured’ problem space because the outcomes are unknowable and the
The Shifting Surface in Digital Photography

problem space does not supply all the material required to find a solution (Stokes 2007, p. 108). There is an implied relationship between an ill-structured problem space and the creation of new knowledge because it creates a situation where one is forced to come up with new solutions. The ill-structured problem by definition has an unknown outcome and there are innumerable potential solutions or resolutions to the problem.

This process of identifying and setting the constraints is a means of structuring the problem space, of defining the territory, identifying the choices and limiting the options. In order to generate new solutions, an ‘ill-structured’ problem space that does not contain a known solution is necessary.

A problem space defined by creative constraint is a means of creating focus and depth. It is a strategy for defining an area in which an investigation will take place, sometimes a form of excavation or unpacking. Working within creative constraints requires innovation as it defines a territory within which there is not an evident solution. Applying this model to the realm of computer coding, Whitaker positions ‘art thinking’ as a process of asking messy difficult questions to which there may not be answers, taking on challenges in which there is a high risk of potential for failure but also a means of reaching an innovative breakthrough to new territory (Whitaker 2013).

Thinking of creative constraints as defining a problem space aligns creative practice with the academic tradition of problematizing an issue and provides a concise means of framing creative practice as a form of research.

Returning to the question, ‘Given the dematerialisation of the photographic image, to what extent can a photograph be regarded as having a surface?’ we can begin to visualise the territory of the problem space as framed by three overlapping themes.
The problem space was the territory bounded by the themes photography, materiality and surface (figure 4).

![Venn diagram of major themes](image)

Figure 4: Venn diagram of major themes.

Deploying the question in this manner is a bit like the archaeological practice of excavation units where a square is placed on the ground to define, map and contain the site of the dig. The work that has been undertaken for this project has been contained within the territory bounded by the question. The work is not an answer as such, not a simple affirmative or measurement. The work is a materialisation, a visualisation of possible solutions within the ill-structured problem space. The creative work proposes novel ways of thinking about the emergent shape defined by the question.

**Making as thinking**

Making is a form of thinking that knits together multiple threads to create a new fabric, a materialized resolved entity. In an object or an image, it is possible to fold together and
balance a number of ideas simultaneously and demonstrate the complexity of their interconnections. Thinking-through-making offers a form of poetic simultaneity. If successful, the work will lock together these components in a form that is indivisible. The technology, materiality, subject matter and processes employed to create the works are not separate from the conceptual intentions of the work.

I am interested in works that pose questions; that engage in conversations with an audience; that are dialogical not didactic; that elucidate a dynamic interrelationship rather than isolating a single point. I love playfulness, not only in the sense of having a light touch and a sense of fun, but playful in the sense that the work is completed and extended by the engagement of the viewer.

Not only does the work set up a conversation with an audience, it is also a dialogue with materials, medium and subjects. In his book Material Thinking, Paul Carter argues that the thinking artists and craftspeople do is not detached from materials and process. Indeed, he posits creative work as “…a method of materializing ideas” (Carter 2004, p.7). The work is not a demonstration of an idea; it is a means of forming the idea.

Writing in the inaugural issue of Studies in Material Thinking, Barbara Bolt described the relationship between maker and materials as one of co-emergence rather than a relation of master and materials. Indeed, Bolt invokes Haraway (1991) with the contention that non-human actors have agency and that humans are just one of a number of actors engaged in an emergent conversation in the process of making (Bolt 2007). Indeed, the co-emergent conversation with materials and process is inseparable from the conceptual intent of the maker.
This concept of material thinking, of making as a form of dialogue, was particularly evident in the work of craft practitioners. Indeed, working as a craft curator in the 1990s I understood a resolved craftwork as an object that integrated the conceptual exploration with the affordances of the medium. In April 1996 I worked with metal-smith Karl Millard installing an exhibition of his extraordinary pepper grinders in the Craft Victoria Gallery. They were displayed resting on open plinths and visitors were encouraged to pick them up and explore the shape and movement with their hands. Millard's pepper grinders were original and perfect, a whimsical expression of his deep understanding of his materials and the potential of his technical skill. They were a playful expression of the interplay between form and function that could only fully be appreciated by engagement with the hand of the user. All these elements were resolved. The ideas were indistinguishable from the object.
This concept of material thinking may be extended to digital creative practice. Indeed, the notion that the digital is somehow separate from materiality has increasingly come into question. Nathan Jurgenson proposes that the language convention that conceives of the material and virtual as ‘real’ and ‘not real’ is an outdated cultural conception that no longer fits with the social reality. He terms this conception as ‘digital dualism’ and proposes augmented reality as a more useful conceptual model that reflects the embedded relationship between bits and atoms (Jurgenson 2012, pp. 84–85). Extending Mitchell Whitelaw’s term ‘transmateriality’ (Whitelaw 2013, p. 221), Anna Munster argues against the conception of the immaterial digital signal or algorithm. Rather, she situates code as part of a process, a flow of materialities (Munster 2014, p. 150). Indeed, the translation of photons into data within the Charged Couple Device sensor of the digital camera is a literal demonstration of this concept.

The emergence of a notion of digital craft followed from a history of artists attempting to get deep inside technologies as a medium, seeking to push and pull at them like a metal or fabric. Eleanor Kent’s experiments with colour Xerox machines in the 1970s and her wonderful machine knitted fractals from the 1980s are excellent examples of this impulse (Salomone 2014). Further examples include Margaret Wertheim’s crocheted hyperbolic structures (Tanguy 2014, pp. 39–44), the machine-knitted animations of Sam Meech (figure 6) (Sam Meech, c2016) and projects such as Krafty Knerds & Geek Girls (K2G2 n.d., p. 2). Indeed, curator Fo Wilson positions digital technology as a craft media as the central theme of her exhibition *The New Materiality: Digital Dialogues at the Boundaries of Contemporary*
Craft, shown at the Milwaukee Art Museum in 2011 (Smith 2011, p. 345; Stern 2011).

Although these artists-makers physically employ textile crafts in some of their works, the point here is not that they are examples of craft makers using computer technology. These artists have worked the digital medium using what could be described as a craft practice paradigm. They have approached the technology as a medium that embodies certain values and explored its capacity to facilitate and express thinking through making.

Figure 6: Meech, S 2014, Knitted horse in motion, stills from animated gif, GIFBITES, curated by Daniel Rourke, Dar-ol-Hokoomeh Project, Shiraz, Iran and online May 2014, <http://bitrates.gifbites.com/meech.html>. Image reproduced with the permission of the artist.

This connection between craft practice and computer technology based makers was explicit in business trend analyst John Hagel’s discussion of the maker movement.

Makers are people who get their identity and meaning from the act of creation. In the old world it was craftspeople […] but increasingly they are a set of makers who are focused on technology, or hackers who are trying to take technology and move it in different directions on their own, even bio hackers who are taking body parts [and] move them in different directions. But what is interesting is that these are not just individuals. They have come together as a maker movement. (Hagel c2016)
The name and idea of the maker movement has been traced to the founding of MIT’s *Make* magazine and the first *Maker Faire* in 2006 (Martin 2015, p. 30). Indeed, the pages of *Make* magazine do not distinguish between software and hardware, between atoms and bits, between knitting and coding. Examples include articles on embroidery techniques (Pierson-Cox 2014) and how to program an Internet connected digital alarm clock (DiCola c2014).

The maker ethic is also present in glitch, gif, generative software art and Internet art practices. This ethic values the direct contact of the maker with the medium, whether it be a widget or a gadget. The maker does not hand over a brief to a technician. It is important for the maker to 'make' it themselves in order to have intimate experiential feedback on the implications of what they have done, in the same way that a metal smith forms an object through intimate embodied knowledge of their medium built up through practice.

Whilst it may seem counter-intuitive, glitch practice may be considered within the realm of digital craft. Glitch artists are seeking a deep and virtually embodied understanding the materiality of their medium by testing its boundaries and potentials (Nunes 2011, p. 18). When they break something, make cracks in its surface and test its limits, they gain an integrated understanding of how it is put together via that direct experiential feedback. This is also one of the purposes of play, to enact and experience how things work. Far from being broken failures, successful glitch artworks are resolved expressions of process, medium and idea (Rosenthal 2014). For example, Daniel Temkin’s *Stripe Modulator* (2014a) (figure 7) presents an interactive system that pulls apart the digital colour representation system of red, green and blue channels. Temkin’s practice exemplifies this glitch craft ethic. His work is an investigation into digital systems
through the structure of play in collaboration with his medium. Cory Arcangel also stretches the limits of digital systems to extremes in order to reveal their underlying structure. His work *Colors* (2008), exhibited at ACMI as part of the exhibition *Dennis Hopper and the New Hollywood* (2010), took each pixels in every frame of the 1988 Dennis Hopper film *Colors* and extended each pixel to create a line - a reference to both slit screen technology and colour field painting (Comer 2013). Proceeding in this manner, the work takes thirty-three days to work through each line of pixels in each frame for the entire film. In the words of curator Stuart Comer, this work addresses the “precarious relationship between images, data, physical objects and digital systems” (Comer 2013).

One of the staple strategies of glitch practice exploits the interchangeability of expressions of data in digital media (Rosenthal 2014). For example, in a process that he calls sonification, Temkin reveals his process for *Glitchometry* (figure 8) as importing an image file into an audio editor. “Sound effects are added to individual color channels, as if they were sound, transforming the image” (Temkin 2014). As observed by Kittler, “[t]he general digitization of channels and information erases the differences among individual media. Sound and image, voice and text are reduced to surface effects, known to consumers as interface” (Kittler 1999, p. 1). Glitch practices that exploit this interchangeability, such as sonification, dissolved these surface effects and demonstrate an effective method of revealing the structure behind the expression of the medium.

The data embedded in the media could be edited and expressed via a range of interfaces that were designed for different modes of expression. This interchangeability reveals the underlying qualities of the media and allowed for a means of reframing the content.
Many of the ideas, values and practices raised here can be discussed under the term ‘affordances’ (Gaver 1991, pp. 79–84; Gibson 2014, pp. 119–135). The standard explanation of this concept is the example of the door handle that fits the hand and invites turning and opening. The form of the object communicates its function. The handle fits the hand. But the term also has a slightly broader meaning in that it can also refer to what it is possible to do with an object. For example, it is also possible to hang a towel off a door handle. The handle may be employed as a hook even thought it was designed and placed for the opening of doors. The term ‘affordances’ has become usefully applied within digital
practices, most notably in interface and web design. An example might be the placement of a button on an interface or the networked structure of a website. The concept of affordances encompasses not only the use and meaning implied by the design and form of the object; it also encompasses what it is possible to do with a thing.

Material thinking in digital media could be conceived as a dialogue with affordances. Bolt’s concept of making as a co-emergent dialogue between a number of actors, both human and non-human, contains echoes of Bakhtin’s term ‘dialogic’, which he developed in his works of literary analysis, such as The Dialogic Imagination (Bakhtin 1981). Adapting the concept of polyphony from music, Bakhtin uses the term dialogical to denote text that contains a number of voices. Bakhtin does not limit those voices to simply human dialogue but includes environment in the participants in the conversation. Indeed, a dialogical work respects the agency of all the voices balanced in the text (Robinson 2011).

When this question, this dialogic approach, is applied to making with digital media, we come to a more intimate encounter with the limits and possibilities of a medium. The question then shifts from “what can I make this medium do?” to “what can I make with this medium?”. The process of making is a process of discovery, of co-creation, not imposition.

**Methodology Conclusion**

Given that the research question pertained to aspects of the constitution and affordances of digital photography, creative practice as research was an effective means of testing the potential of the medium at both a technological and metaphorical level. This is because, by its very nature, creative practice incorporates multimodal iterative risky methods as a means of reaching innovative solutions. The blended multiplicity of methods was
intended to facilitate and coalesce conceptual patterns and shapes out of disparate but intersecting forces and forms.

Having set up the above discussion on material thinking and photography as a method of inquiry, I want to return to the frame of creative practice as research and, with reference to Haraway's cyborg politics, introduce Flusser's model of the geometry of media and the implications of this on forms of thinking and the constitution of knowledge.

Traditionally, academic convention held that knowledge be expressed in written form. Niedderer (2007) framed the difference between traditional text based research outcomes and knowledge that incorporated creative practice outcomes in terms of explicit or propositional knowledge and tacit knowledge. As an example of tacit knowledge, Niedderer used the example of the embodied knowledge of technique and materials held by a craft practitioner that could not be fully transmitted in written form. Tacit knowledge was transmitted experientially through engagement with material practice. “[P]art of the knowledge of practice-led disciplines is experience-based and therefore difficult to communicate through conventional language-based means of research” (Niedderer 2007).

Donna Haraway proposed that the struggle over language and forms of communication is a significant political act.

Cyborg politics is the struggle for language and the struggle against perfect communication, against the one code that translates all meaning perfectly, the central dogma of phallogocentrism. That is why Cyborg politics insist on noise and advocate pollution, rejoicing in the illegitimate fusions of animal and machine... 'We’ did not originally choose to become Cyborgs, but choice grounds a liberal politics and epistemology that imagines the reproduction of individuals before the wider replications of ‘texts. (Haraway 1991, pp. 318–319)
Creative practice investigation, working in dialogue with media and processes, offers a nuanced means of analysing complex techno-cultural systems, and a means of resisting the imperative to be explicit and transparent, to flatten and finish.

Vilem Flusser considered the implications of media on the structure of thought throughout his writing on technical images. His summary of his argument in his 1973 essay 'Line and Surface' provides an example:

“Until very recently, official Western thought has expressed itself much more in written lines than in surfaces ... Written lines impose specific structures on thought, in that they represent the world by means of a point sequence. This implies a “historical” being-in-the-world of those who write and read written lines. But, in addition, surfaces have always existed, and these also have represented the world. They impose a very different structure on thought in that they represent the world by means of static images. This implies an “unhistorical” being-in-the-world of those who make and read these surface images. Very recently, new channels for the articulation of thought have come about (e.g. films and TV), and official Western thought is taking increasing advantage of them. They impose radically different new structures on thought in that they represent the world by means of moving images. This implies a posthistorical being-in-the-world of those who make and read these moving images.” (Flusser and Ströhl 2002, pp. 25–26).

In an interview recorded in 1988 at the European Media Art Festival in Osnabruck, Flusser extended this conceptual model to consider the implications of computer technologies. He described the geometry of an emerging paradigm as ‘structural’ thinking and predicted that the implications would be as significant as the introduction of writing (Flusser 2011a).

Flusser’s model of the geometry of media builds a more nuanced insight into the significance of creative practice research outcomes than Niedderer’s concept of synthesis. Flusser points to the structure of form, material and technology as co-creative with and of different kinds of thought. That is to say, it is not only a case of synthesis and resolution of diverse elements, but also a response to the structure of writing and the ways in which that structure organises thought. Flusser argues that the technology of writing is uni-dimensional, facilitated linear thinking, and that this has created the
conditions of history. Writing and history are connected not only in terms of the documentation required to literally record history, but writing also creates a structure that requires ideas to be placed in a linear relationship that generates the notions of past, present and future. Photographs, which he termed ‘technical images’, are two-dimensional and therefore facilitate ‘scanning’ planier two-dimensional forms of thinking. Computer technologies support complex interconnected three-dimensional ‘structural’ forms of thought. Attempts to visualise the geometry of the Internet certainly reinforced this idea of computers as a medium generating complex networked structures (Meeks 2011a, 2011b).

Flusser was by no means the first or the only writer to consider the implications of technology on culture, knowledge and thought. For example, Ong’s *Orality and Literacy* considered the shift in cultural consciousness between oral culture and the impact of writing as a technology (Ong 1982). Andy Clarke, author of *Natural Born Cyborgs*, discussed extended mind theory and the ways in which technologies extend and facilitate thought (Clark 2003). Observations on the relationship between technology and thought were reiterated and extended by Rowlands (2010) through his exploration of thought as embodied, embedded, enacted, and extended. Ted Strifhas positioned the term “algorithmic culture,” as “the ways in which computers, running complex mathematical formulae, engage in what’s often considered to be the traditional work of culture: the sorting, classifying, and hierarchizing of people, places, objects, and ideas” (Granieri 2014).

If technologies impact the structure of thinking, and are in fact co-creative with specific modes of discourse, then they are also not value neutral. Technology design is influenced by the social and cultural discourses surrounding it. For example, photographic film
colour was designed around white skin as a standard based on the Shirley Card (figure 9). Complaints from wooden furniture retailers and chocolate manufacturers about poor colour results for their products in the 1960s and 1970s led to the redesign of colour film chemistry (Roth 2009, p.119-120). What is more, technologies were found to have profound impacts on consciousness, as demonstrated by a number of studies finding that people who grew up with black and white television were more likely to recall their dreams as black and white, whereas those without exposure to black and white television were more likely to recall their dreams as having colour (Murzyn 2008; Schwitzgebel 2008). These examples point to the interconnectedness between technology, culture and consciousness.

Figure 9: Kodak 1978, Shirley card. Image out of copyright.
Extending and applying Flusser’s model of the geometry of media, namely that different media support and enable different forms of thinking and therefore different forms of knowledge, to creative arts research leads to a conundrum regarding the need to translate knowledge generated and materialised via art-making in different media into language. The analogy could be like attempting to describe four-dimensional space in a two-dimensional medium - the written words are an approximate indication of the entity. Consequently, the full significance of creative practice as research outcomes remains, at least in part, embedded in the creative outcomes. The role of an exegesis in this scenario is to provide context and background to the creative works, and to map their contribution to salient debates and questions, and to point as clearly as possible to the outcomes presented in and through the work itself.

Given that the aim of this project was to implement a process of discovering and envisaging what the medium can do, it was appropriate to test the boundaries and affordances through applied practice, rather than through analysis of existing practices. Looking at what already exists does not necessarily uncover new territory. Existing practices in this exegesis function as a conceptual and practical context within which to map the process and thought development through my work. However, these analyses are not an end in and of themselves. They are therefore presented as if in dialogue and discussion with the works and contexts here, providing a disciplinary base that is, like the work itself, created from practice.

My approach could be conceived as a form of pattern recognition, of trend analysis, out of the overwhelming swirling cloud of data-points, as a means of making sense out of complexity and disorder. My own work, the work of others, and the conceptual debates that arise from both all form part of this ‘cloud’. As Grosz contended, chaos may be
conceived “not as absolute disorder but rather a plethora of orders, forms and wills – forces that cannot be distinguished or differentiated from each other, both matter and its conditions for being otherwise, both the actual and the virtual indistinguishably” (Grosz 2008, p. 18). To a certain extent, I embraced an unruly patchwork to frame a black box that ingested a multitude of sources and processes. This layering of ideas and methods was a technique for coalescing form out of large amounts of data and sources. The aim was to discern and coalesce emerging structures out of a complex unformed field, rather than to unpack a focused detail. This approach was crucial given that I aimed to investigate a geometry of ‘surface’ that is complex, and by its algorithmic nature, multi-dimensional and emergent rather than cohesive and singular. To narrow the focus of the ‘data’ would, in effect, negate the drive to uncover the structural complexity of the media.

In essence, the research question pointed to ramifications for creative practices in photography in the shift from analogue to digital. Analysing the presence and structure of surface in digital photography implies an emergent ecology and a restructuring of the framework of the medium. Rather than simply observing or examining the outcomes of shifts between analogue and digital processes in photography, this project therefore aimed to consider epistemological and material potentials through making. The boundaries of this infrastructure were explored through creative practice as a means of materialising possibilities.

The infrastructure of the medium shaped the messages that it could form. Its affordances shaped meaning, modulated emphasis and facilitated pathways. This project suggests that it is possible to materialise networks, to externalise and map connections that photography has always elicited, but which have not necessarily been as readily visualised and manipulated as is possible within digital processes, and, perhaps more
importantly, within the thinking that digital processes elicit and make possible.

Materialising these possibilities and potentials became a process of ‘creative practice as research’. Creative practice was multimodal, iterative, unfaithful, wilful, practical, material thinking, thinking through making, by working and testing what may be possible and observing how it was received, how it travelled, how it was performed and reconstructed, and how it broke. The process folded together several modes and vectors – reading, collecting, encountering, reflecting, conceiving, visualizing, twisting, stretching, showing, breaking, unpacking. This project has threaded together a combination of methods that sit under the umbrella of ‘creative practice as research’.
The purpose of this section is to outline the context for the creative work. This includes both theoretical frameworks and creative works by other creative arts practitioners. Bringing together this kind of survey was not separate from the process of making the creative works but enfolded as part of the dialogic process of making. Not only are the creative works were made in dialogue with subjects, apparatus, presentation context and audience, but also in dialogue with other works - both visual and theoretical. The contextual positioning was not conducted as a separate stand-alone phase but an ongoing part of the conversation of creative practice as a dialogic practice.

In this Context section I have arranged the survey around each of the major themes of the research question: photography, materiality and surface. I will then bring these together to consider surface in digital photography. Extending these themes, the subsequent section of the exegesis following Context will explore the emergence of forms of surface between digital photographs.

This section also serves to refine the key terms of the investigation. What does photography, materiality and surface mean in the context of this creative investigation?
PHOTOGRAPHY

MISHKA HENNER

Photography Is

moment and atmosphere of the occasion, as a naturalistic
setting and in a non-intrusive way, producing creative and
powerful images. Photography is a frustrating field. 
Photography is not life; it’s life that interests me. 
Photography is one of the most difficult to price. 
Photography is an abundant medium. Photography is a skill; a
skill is KNOWLEDGE reinforced with EXPERIENCE. 
Photography is like the question, “how do you get to
Carnegie Hall? Practice, Practice, Practice.” Photography
is a language for Bennington second, that it is a lan-
guage which is initially mixed up in the image; and third,
given Bennington’s retrospective, allegorical glance, that
language as such exists within and beyond any mean-
ingful horizon that the photographic image brings into repre-
sentation. Photography is through a retrospective glance
Photography is restricted to the use of the photographic
process to depict observations from all branches of natu-
ral history, except anthropology and archeology, in such a
fashion that a well-informed person will be able to iden-
tify the subject material and to certify as to its honest pre-
certion. Photography is a simple research method that
provides great results. Photography is a world of fantasy
Photography is used to determine how long these con-
struction sites affect the watershed. Photography is the
best research method to provide answers on this subject
Photography is used by amateurs to preserve memories of
favorite times, to capture special moments to tell stories,
to send messages and as a source of entertainment. 
Photography is the result of combining several technical
discoveries. Photography is that chemical photography
resists manipulation because it involves film and photo-
graphic paper, while digital imaging is a highly manipu-
lateive medium. Photography is often pre-eminent in pho-
tography, subjects which have little prospect of commer-
cial use or reward. Photography is probably best defined as
any photography for which the photographer is paid for
images rather than works of art. Photography is a mat-
ter that continues to be discussed regularly, especially in
artistic circles. Photography is authenticity art, and
photography in the context of art needs redefinition, such
as determining what component of a photograph makes it
beautiful to the viewer. Photography is one of the new
media forms that changes perception and changes the
structure of society. Photography is both restricted and
protected by the law in many jurisdictions. Photography
is a mistress whom one cherishes and hides, about whom
one speaks with joy but does not want others to
mention. Photography is not an art because it is pro-
duced with a mechanical device and by chemical and
physical phenomenon not by hand and inspiration. 
Photography is so similar to lithography and etching that it
would be beneficial to the arts as well. Does photography
is an art or a new form of documentation seen
by the eye instead of the mind? Photography is an expres-
sion of the photographer’s fantasy (or a combination of
the fantasies of the creative team). Photography is
regarded as one of six visual domains (the others being
film, television, arts and crafts, the built environment and
performance) which constitute a culturally conditioned
visual communication system amenable to ethographic

Figure 10: Henner, M 2010, Photography Is, screenshot of artist book on website,
In 2010 Mishka Henner published an artist’s book as a conceptual work that consisted of over three thousand statements that began with “Photography is...” stripped of their context or source (figure 10). "Mirroring the ambiguous and untrustworthy nature of photographs themselves, each phrase in the book has been torn from the context in which it originally appeared. The result is contradictory and chaotic, frustrating and insightful. In short, it is photography without photographs" (Henner 2010). The work continued as a live twitter feed that collated any tweet that contained the phrase “photography is”. I inadvertently found myself folded into this conceptual strategy that threaded together a never-ending conversation (figure 11).

Mishka Henner’s 2010 conceptual artwork Photography Is, reveals photography as a large, ambiguous and complex medium.

Figure 11: screenshot of tweet by Australian Story ABC TV 10 August 2015, <https://twitter.com/AustralianStory/status/630559233361063936>.
This small unassuming image of a gentleman inventor could support the claim of being one of the most significant images in the history of computing (figure 12). For it is indeed a digital image created in the late 1830s, encoded in 24,000 punch cards for a Jacquard loom (Essinger 2007, p. 5). It was woven by machine in an edition of at least ten, one of which took pride of place amongst the curiosities and scientific wonders collected by the gentleman scientist Charles Babbage (Batchen 2006, p. 32). The subject of the portrait is JM Jacquard, inventor of the Jacquard loom, a technology that drove much of the transformation of the industrial revolution. The significance of this image in Babbage’s collection is that Babbage intuited that Jacquard’s system of punch cards could be adapted to the purpose of mathematical calculation (Essinger 2007, p. 47) and is credited
as the conceptual leap that lead to the development of the computer (Essinger 2007, p. 48). In the context of digital photography, it is significant that a transcoded image produced by machine should be at the conceptual birth of computing.

The phrase in my question ‘[g]iven the dematerialisation of the photographic image’ might be taken to imply a recent phenomenon. Indeed, at first glance, the development of the Charged Couple Device (CCD) technology in 1969 would appear to be the break point between analogue and digital photography. The impact of this invention was acknowledged in 2009 when Boyle and Smith won the Nobel Prize for Physics in recognition of the far-reaching impact of their invention (Nobel Media 2009). Certainly, this is the device at the heart of the digital cameras that we use today, replacing the film behind the camera shutter. However, the cultural imagination of the possibilities offered by digital photography has a deeper history than the invention of the CCD in 1969. A meditation on the creative implications of digital media is not a superficial engagement, but has a connection to a deeper history of human endeavour to communicate in particular ways, to express relationships, both emotional and physical, between oneself and the world.

The technological and cultural context that engendered Babbage’s development of early computing was the same culture and time that saw the emergence of photography. In addition the machine woven portrait of Jacquard, Babbage’s collection also included early experiments of a technology that came to be known as photography, contact prints of machine woven lace by his friend Fox Talbot (figure 13) (Batchen 2006, p. 32).
Looking at Fox Talbot’s early experiments, it appears that he was also thinking in terms of sampling, as alluded to in my definition of digital and the example of the woven Jacquard portrait. At one point Fox Talbot experimented with breaking the image into sample points, like the stitches in a tapestry and now recognisable as similar to the grid...
of a pixelated image on a computer screen. Again we see the use of textiles, with Talbot employing translucent gauze to create a grid of sample points (figure 14) (Batchen 2011).

Another example of the ferment at this time around encoding and images is the work of Samuel Morse (Batchen 2006, p. 42). A successful artist in the early 1800s, Morse abandoned painting to develop and establish the telegraph system following the death of his wife. He did not receive notice of her illness in time to attend her funeral. Similar to the examples of digital thinking above, the dot and dashes of Morse Code could be viewed as an analogy of the 1 and 0 of the binary system at the heart of computer programming.

The idea of fixing an image from a camera obscura or camera lucida using light-sensitive chemical processes used in printing techniques occurred to a number of people in the early 1800s. Indeed, Morse had made some experiments in this direction in 1821 (Batchen 2006 p.42), so when Daguerre announced his process in January 1839, Morse appreciated the significance of the invention. He visited Daguerre in Paris a little over one month later to obtain a manual of the Daguerreotype technique. It was Morse who introduced photographic techniques to the USA when he established a commercial photographic studio later that year (Batchen 2006, p. 42).

I think it is significant that Morse’s interests and contributions included image making, coding, transmission and photography, demonstrating the conceptual homogeneity at the inception of these technologies. Indeed, the possibilities of the then new media technologies were imagined in ways that we now find oddly familiar. In 1878, Alexander Graham Bell speculated on the possibilities of translating images via his invention the telephone. In 1879 Punch magazine published an illustration of Edison’s concept of a
The pholoscope, an ‘electronic camera obscura’ that could transmit images as well as voice (Batchen 2006, p. 42). It looks like a steam punk imagining of Skype.

Figure 15: 1897 cartoon of Thomas Edison’s imagined Telephonscope, Punch magazine. Image out of copyright.

Figure 16: 1907, faxed image, cover, Scientific American, Vol. 96 Issue 7, February 16. Image out of copyright.
Whilst is took a few more decades, the development of the facsimile machine was driven by the desire to transmit a dematerialised image. For example, *Scientific American* (1907) (figure 16) features an image sent from a distance of nearly 1,100 miles using 'Korn's Photographic Fac-Simile Telegraphy'.

The point of this discussion is to demonstrate that digitalisation and the transmission of images has a deeper history than the invention of the CCD in 1969. Indeed, the technologies of photography, computing and telegraphy grew out of the same time and cultural context; their conception was intricately interconnected. We are not simply dealing with a radical new direction with the development of digital photography but the surfacing of potentials that were embedded at the time of their invention.

At this point I want to acknowledge the thread of textiles in this story as the connecting technology between computing and photography. As examples we have the machine woven portrait of Jacquard, whose technology inspired Babbage's difference engine, and Fox Talbot's sample prints working with machine woven lace. On a personal level, my father dedicated his PhD in computer science to his mother, a textile artist. He claims he learnt programing as a child by watching her create knitting patterns, converting the physical object of a garment into the coded specifications of knitting instructions. She also had an impact on my sensibilities; developing my ability to visualise the conversion between two-dimensional and three-dimensional structures, the dynamic relationship between surface and volume, and to visualise and manipulate in three-dimensions. She taught me this by teaching me how to sew garments. As Connor quotes of Serres,
'issue, textile and fabric provide excellent models for knowledge, excellent quasi abstract objects' (Connor 2009, p. 29). Indeed, the translation between three-dimensional space to two dimensional plane back to the perception of three dimensional space via imagination is at the core of the encounter with a photograph (Flusser 2000, p. 8).

**PHOTOGRAPHY DISCOURSES**

In his Paris Photo Platform lecture *The Slipperiness of Photography*, Heiferman (2015) reiterates the overarching point explored in his Smithsonian Institute exhibition *Click: Photography Changes Everything* (Heiferman 2012) that “there is no single or simple story” that one can tell about photography. He argues that it is, in part, photography’s unruly and slippery nature that makes it such a complex and compelling medium. Part of that slipperiness arose from the internal struggles within the medium to define photography and the claims made for its status as an art. For example, both the late nineteenth century Pictorialist movement and proponents of early twentieth century Modernist photography laid claim to the status of art but sought to promote diametrically opposed photographic values (Lovejoy 2014). In an interview with digital art curator Christiane Paul and writer Julian Stallabrass, Katrina Sluis observes that, having established its credentials and canon as a fine art medium, photography had become “completely diffused” into ubiquitous computing (Sluis et al. 2013, p. 36). Photography is not simply slippery like a slick smooth surface; it is porous like a membrane and diffuse like dust.

Kember (2008) argues that we still do not have an adequate understanding of photography because attempts to understand photography have relied on intellectual empirical understanding. She employs Bergson to argue that photography is best grasped as a form of intuitive and aesthetic understanding. Kember’s position is an invitation to
acknowledge the mystery of a medium with profound emotional power and ubiquitous penetration.

Batchen and Rubinstein propose intertwined but contradictory trajectories emerging from the digitalisation of photography, also known as the algorithmic turn in photography. Where Batchen (1997) argues that photographic desires persist despite technological change, Rubinstein (2015) asserts that the relationship between analogue and digital photography represents such a significant change in the ecology and behaviour of the medium as to render comparison superficial. Rubinstein’s position echoes Ritchen’s observation that there are significant epistemological differences between analogue and digital photography (Foam Fotografiemuseum Amsterdam 2011).

In his ‘Epitaph’ to Burning with Desire, Batchen advances that photography has experienced several fundamental reconfigurations of the technology without any break in the continuity of the practice. Indeed, technical evolutions and revolutions have accelerated the expression of the impulse to photograph, to communicate via photographic images (Batchen 1997, pp. 207–212). Batchen argues that, rather than tied to a specific technology, photography is an economy of desires to create images that express and negotiate relations. In his keynote speech at the Digital Light Symposium in Melbourne, Batchen made the observation that whenever somebody invents a new image capture technique, the first thing they do is take a photograph of their child (Batchen 2011), suggesting that the desire for photography is an emotional drive. He illustrated his point with Philippe Kahn’s 1997 photograph of his newborn child taken with a jerry-rigged mobile phone connected to a digital camera and the first digitalised photograph, a 1957 digital scan by Russell Kirsch of a photograph of his child (Ehrenberg 2010). Perhaps a similar impulse drove Fox Talbot to fix the image in the form of the calotype
c1839, spurred by the inadequacy of his honeymoon drawings despite the aid of a camera lucida (Daniel 2004). Photography is the desire to make photographs, not the specific technology employed.

In an essay commissioned by the Photographer’s Gallery in London, Rubinstein (2015) argues that the algorithmic turn, digital capture, distribution and reception, has resulted in a fundamental restructuring of the epistemological foundations of photography as a medium and the ecology within which the techno-cultural practice exists. He portrays the resemblance between analogue photography and digital photography as “superficial”. Indeed, he goes so far as to characterise the established photographic theory concepts of “Index, Punctum, Document and Representation” as “the four horsemen of the photographic apocalypse” (Rubinstein 2015). Rubinstein concludes his polemic with a vision of photography as a means of making sense out of complex chaos. If photography is a method for negotiating one’s relationship with ‘reality’, then Rubinstein points to a reality of particles. He frames photographic images as a means of temporarily coalescing the flow of multiple forces, both tangible and ephemeral.

There are some synergies between Batchen’s economy of photographic desires and Rubinstein’s conception of 21st century photography as a method for temporarily distilling fluid complex relations. Both positioned photography as an instrument of negotiation, of understanding and creating forms of knowledge.

**Posthumanism**

As we seek to come to grips with gaining a sense of photography in the 21st century, Posthumanism offers useful metaphors with which to think about photography. But
rather than being a body of theory about photography, posthumanism offers frameworks with which to think about the relationship between technology and culture within which photography is enmeshed. Stated simply, posthumanism may be summarised as the proposition that, just as tools extended our physical capacities, there are technologies that also extend our mental functions. Within this framework, photography may be conceived as a form of mental prosthesis.

...[T]he posthuman implies a coupling so intense and multifaceted that it is no longer possible to distinguish meaningfully between the biological organism and the information circuits in which it is enmeshed. (Hayles 1993, p. 80)

Stemming from the *Manifesto for Cyborgs* (1991) written by Donna Haraway in the early 1980s, posthumanism developed as a body of theory that describes the embeddedness of technology in the function of our extended mental lives. Haraway’s invocation of the cyborg is metaphorical and ironic. It is even a bit cheeky, humorous and playful, or, as Haraway termed it, “blasphemous” (1991, p. 149). It remains essential to distinguish posthumanism from transhumanism. Unlike the techno-utopian aspiration of transhumanist rhetoric, posthumanism does not aspire to the post-biological. The term ‘post’ does not refer to the end of the human but the end of anthropomorphism, of the privileged centrality of the category of human. Not only does Posthumanism acknowledge the reality of co-mingling of the biological with technological.

One consequence is that our sense of connection to our tools is heightened. [ ... ] Why should our bodies end at the skin, or include at best other beings encapsulated by skin? [ ... ] For us, in imagination and in other practice, machines can be prosthetic devices, intimate components, friendly selves. (Haraway 1991, p. 178)

The concept of prosthesis is fundamental to the metaphor of the posthuman. Anne Marsh explicitly positioned the camera as prosthesis in the opening paragraph of *The Darkroom*: “The camera itself is a prosthesis for the operator, one which extends and
enhances both the physical capabilities and psychological structure” (Marsh 2003, p.13). The practice and ecology of photography has become a form of extended mind; the operation of the camera resonances with the space of the skull; the photograph an extracted echo of the mind’s eye (Bennett 2009, p. 95).

Shifting the terminology to ‘technical image’, media theorist Vilém Flusser offers a departure from the term ‘photography’. Whilst his earlier writings use the term photography, he introduced the term ‘technical image’ in 1983 as a means of expanding and specifying his conception of the medium:

The technical image is one produced by an apparatus. [...] It seems as if the world signified in technical images is their cause, and as if they themselves were the last link in a causal chain connecting them without interruption to their meaning: the world reflects sunlight and other forms of light which are then captured on sensitive surfaces – thanks to optical, chemical and mechanical processes – and the result is a technical image. (Flusser 2000, p. 14)

He expanded on this term in Into the Universe of Technical Images, published in 1985 in German:

Technical images arise in an attempt to consolidate particles around us and in our consciousness on surfaces to block up the intervals between them in an attempt to make elements such as photons or electrons, on one hand, and bits of information, on the other hand, into images. This can be achieved neither with hands nor with eyes nor with fingers, for these elements are neither graspable, nor are they visible. For this reason, apparatuses must be developed that grasp the ungraspable, visualize the invisible, and conceptualize the inconceivable. And these apparatuses must be fitted with keys so that we may manipulate them. These apparatuses are essential for the production of technical images. [...] To an apparatus, particles are no more than a field of possible ways in which to function. What we find difficult to see (e.g., a magnetic field, unless we use iron filings) is, from its standpoint, just another possible function. It transforms the effects of photons on molecules of silver nitrate into photographs in just the same way: blindly. And that is what a technical image is: a blindly realized possibility, something invisible that has blindly become visible. The production of technical images occurs in a field of possibilities: in and of themselves, the particles are nothing but possibilities from which something accidentally emerges. (Flusser 2011, p. 16)

Flusser’s conception of technical images positions photography as a means of coalescing and consolidating surfaces - images - that connect and order the world of particles, the
fragmentary oscillating clouds of encounter. This conception of photography is echoed by Rubinstein in his manifesto 21st Century Photography (2015): "Through [photography] we come to understand that the ‘real world’ is nothing more than so much information plucked out of chaos: the randomised and chaotic conflation of bits of matter, strands of DNA, sub-atomic particles and computer code." Although Flusser was writing in the 1980s, his writing offers relevant frameworks for grasping digital photography as a contemporary medium. Flusser’s conception of the technical image offers useful and fruitful language with which to approach photography as an expanding medium.

**EXPANDED PHOTOGRAPHY**

Art+Com undertook some significant visualisation work in 1995 that gave shape to moving image sequences (ART+COM Studios 1995). Given that moving images are essentially a series of still images presented over time, The Invisible Shape of Things Past translates the shift from one image to the next spatially rather than sequentially. Instead of positioning the screen as an invisible immobile portal, The Invisible Shape of Things Past describes the movement of the camera image through space over time as a three dimensional form. This work demonstrates the spatial visualisation of movement over time in the relationship between each image frame. Integral to visualising form is the formation of the surface of the emergent object. The transition between each frame is interpolated and extruded to form a surface of the relationship between each image. Twenty years later a number of technologies and applications that facilitate and visualise surfaces between images, such as digital photogrammetry, have gained mainstream adoption.
This subsection will discuss the idea of expanded photography, which has formed a significant aspect of my creative investigation. Photography has expanded to occupy spaces previously corralled as other fields, such as the moving image. Photography has also expanded internally, as the application and uses of photography have multiplied. And it has expanded in terms of the sheer number of photographs being made.

Expanded photography can be thought of in terms of photographic practices and applications that sit outside the affordances of analogue photography. I am going to cover the concepts of ubiquitous photography and photography's embeddedness in ubiquitous computing. I will discuss the concept of technological affordances and consider a selection of theoretical applications of the concept of the expanded field to photography. In terms of specific practices, I will discuss scanography, computer vision, augmented reality, photogrammetry and reverse image search engines as examples of practices that may be classed as expanded photography.

Later I will argue that applications of computer vision as a processing and organising mechanism has profound implications in terms of generating new relationships, structures, geometry and new photographic surfaces.

**Ubiquitous photography**

21st century photography is more persistent and present than previous points in its short history since 1839. While Sluis observes that photography has become “diffused with ubiquitous computing” (Sluis et al. 2013), Kember simply calls it “ubiquitous photography” (Kember 2012, pp. 331–345). In her KPCB Internet Trends report of 2014, Mary Meeker estimated that in 2014 there were over 1.8 billion photographs
shared per day that year (Koziol 2014; Meeker 2014 p. 62). It is no coincidence that the growth in the number of photographs uploaded and shared has grown exponentially since 2007. That was the year Apple released the iPhone (Goggin 2012, p. 11) and created the paradigm of the ‘smart phone’ as the standard mobile device. The convergence of internet enabled screen with the digital camera brought together the ability to take, share and view photographs with a pocket electronic computing device. The smart phone has collapsed the barriers between taking, sharing and viewing digital photographs. Vernacular smartphone photography has become a form of speech communication, as seen in the ephemeral photography of Snapchat. Despite the plethora of new imaging applications, the photograph persists as the “hinge” between atoms and bits (Rubinstein and Fisher 2013, p. 8).

Figure 17: Maurisset, T 1839, La Daguerreotypomanie (Daguerreotypomania), Lithograph, 26 × 35.7 cm, Getty collection, <http://www.getty.edu/art/collection/objects/46529/theodore-maurisset-la-daguerreotypomanie-daguerreotypomania-french-december-1839/>. Image out of copyright and available courtesy of the Getty Open content Program.
The growth in the circulation of digital photographic images has been compared to the rapid penetration of photography in the 19th century following the announcement of the daguerreotype in 1839. Within months of Daguerre announcing his technique in Paris, Samuel Morse had obtained a translation of Daguerre’s manual and established a photographic studio in the USA (Batchen 2006, p. 42). There were remarkable similarities between our contemporary expanding media communications with the introduction of photography in 1839 and the growth of nineteenth century communication media – telegraphy, railroads and the postal system. The impacts of these media are familiar in terms of the contraction of time, space and knowledge wrought by digital communication media in the last two decades (Natale 2012, pp. 451–456). The figure of Samuel Morse is just one example of the entanglement of communication and imaging technologies. The rapid and profound penetration of digital photography and electronic networks in the 21st century represents a similarly manic transformation to that wrought by photography, telegraphy, trains and the postal service.

Affordances

Not only has the camera become physically embedded in computing and telecommunications, the boundaries that define the limits of photography have become increasingly porous and diffuse. The shape and categorization of what constitutes photography has shifted to occupy new expressions. There is a very real techno-determinism that shapes and limits what it is possible to do with
photography. With film-based photography, the image data was embedded in physical a stratum that determined how it can be edited and deployed. Whilst the affordances of darkroom printing offer a depth of interpretation of the image, digital processes have overlapping but different affordances. For example, the linearity of response to light is different for photographic film and digital sensors (Schewe and Fraser 2011, pp. 1–6). There was once a technical limitation that separated still and moving image, but now the same camera can capture both. File formats such as GIF occupy a space in between still and moving image. The materiality of the photographic print determines the space and locative intimacy of the encounter, whereas a digital photograph is omnipresent, broadcast via digital distribution. The boundaries that defined photography as a medium have shifted in the transition to digital medium. In many respects, the limits of what constitutes digital photography are in discovery and not yet fully articulated. Indeed, the boundaries of those limits are even hazier as photography has became enmeshed within computing.

Photography has expanded to become ubiquitous and enmeshed beyond the pre-digital limits of the medium.

**Expanding photography**

Several photography theorists have raised the concept of ‘expanded photography’. Plummer (2015), Baker (2005), and Osborne (2003) acknowledged that the notion of an expanded media is derived from Rosalind Krauss’ influential essay ‘Sculpture in the expanded field’ (1979), which discussed how the medium of sculpture expanded to incorporate landscape and architecture. Osborne and Plummer modify Krauss’ phrase to “expanding photography” in order to highlight that the expansion of photography as
a medium was not yet stabilised or resolved (Osborne 2003; Plummer 2015, p. 138).

Baker speculates that photography’s expansion be considered as a series of overlapping fields (Baker 2005, p. 124), while Batchen (Batchen 2000) addresses similar trajectories under the term ‘post-photography’.

Plummer articulates a distinction between the notion of an expanded media that becomes diffuse with other media and a media that expands internally (Plummer 2015).

Photography is expanding from within rather than simply taking on space traditionally occupied by other media. Eklund located the expansion of photography as beginning in the 1960s when “more and more photography began to seep across the well-maintained borders separating the mediums of art” (Eklund 2004). Indeed, the traditional notion of a discrete photographic may be a cultural definition rather than a technological imperative.

Baker (2005, p. 128), Osbourne (2003, p. 63) and Soutter (2013, p. 116) all touch on expanded photography as part of a shift way from Modernist medium specificity. As described by Kittler (1999, p. 1), both image and sound are recorded in digital media as 1s and 0s. There was no clear media specific boundary between photography and a range of communicative practices. The boundaries of photography, its technical limits and affordances, are expanding and becoming increasingly porous, enmeshed within ubiquitous computing and digital media.

**Scanography**

Scanography is an early example of practices that occupy a space beyond the affordances of analogue photography. Well before digital cameras were available and affordable to mainstream consumers, fax machines, photocopiers and flatbed scanners
offered a means of imaging that departed from the traditional forms offered by film photography.

Whilst not digital in the computing sense, the fax machine and the photocopier share the linear action of the scanner and, to some degree, the capacity to transmit the image. In 1907, Scientific American demonstrated the capacity of the fax machine to transmit images by publishing an image transmitted by fax from Berlin. In 1972, Brush, Sheridan and Van De Bogart exploited the networked potential of fax technology in a way that foreshadowed 21st century networked collaborations with each artist transmitting an image across a conference call phone line to a fax machine to create a composite image (Green 2011).

Ian Burn’s Xerox Book #1 (1968) held in the National Gallery of Australia collection is an artwork that employs a conceptual strategy that reveals the inherent artefacts of the photocopy process. As articulated in the work, each page is a photocopy of a photocopy repeated one hundred times. Starting with a blank page, other than the written instructions, on each subsequent copy the scratches on the glass surface of the copy bed and specs of dust become evident and amplified. The subject of the work is the surfacing of glitches and errors inherent in the technology of the medium. Eisen’s 2011 installation while (true) (figure 18) employs a similar conceptual strategy with an automated flatbed scanner that rescans itself, a process that creates a feedback loop that become the frames of an animation generated in real time (figure 19) (Eisen 2011).
Computer Vision

Integral to the expansion of photography is the development of computer vision, also known as machine vision or image recognition algorithms. The audience for digital photography has expanded to include machines (Granieri 2014). An obvious example included the pervasive presence of facial recognition algorithms such as Facebook’s Deepface (Taigman et al. 2014).

Image recognition algorithms play a key role in the execution several expanded photography practices. For example, stitched panorama software such as Photostitch panorama software, bundled with Canon digital cameras since at least 2001, uses
image recognition algorithms to align and merge a series of overlapping photographs.\(^2\)

The auto-align function in Photoshop is similar to the results achieved with Canon Photostitch but was not introduced to Photoshop until the release of CS3 in 2007 (“Photoshop CS3” 2007).

Computer vision would not be possible without the Charged Coupled Device sensor invented by Boyle and Smith in 1969 (Class for Physics of the Royal Swedish Academy of Sciences 2009, pp. 7–11; Nobel Media 2009) that allowed the image created by the physics of the camera obscura to be translated to a grid of digital sample points, a measurement of the intensity of light in each element of the picture. A digital photographic file is essentially a grid of data measurements recorded as binary RGB values. It is this pattern of translated data that facilitates what is known as computer vision. However, a computer does not ‘see’ in the cognitive sense that a human subject perceives through vision. Rather, computer vision is the function of algorithms that automate a comparative search between data in the form of a grid of measurements of intensities of light (Turek 2011). Computer vision has applications in a wide range of settings, such as factory automation and automated navigation. In the context of this investigation, I am interested in augmented reality and photogrammetry.

**Augmented reality**

Augmented reality has been blended into the expanded boundaries of photography (Uricchio 2011). As discussed earlier in relation to digital skin and augmented reality tattoos, the term ‘augmented reality’ refers to the illusion of digital content in ‘physical’ space. Whilst this perception is created on a mobile screen, the movement of
that screen enhances the perception that the digital content is located in and connected to space described by the movement of the mobile screen.

An experimental application in 1997, Azuma speculated that augmented reality might find application in the fields of medicine, engineering and entertainment (Azuma 1997). Science fiction author William Gibson’s 2007 novel Spook Country (2007) dealt with DIY hacker/artists creating “locative art” using “spatially tagged hypermedia” (Itzkoff 2007). The novel creates awareness in the reader of a present but invisible digital overlay that, in the novel, can be revealed through somewhat awkward head mounted displays. The introduction of smart phones in 2007 (Goggin 2012, p. 11) and the release of mobile augmented reality browsers in 2009 (Liao 2015, p. 311) triggered a great deal of interest in augmented reality from the advertising sector (Liao 2015, p. 315). But culture jammers also perceived the potential of augmented reality. Indeed, the ability to make an intervention in advertising whilst avoiding the criminal act of defacement is particularly attractive and subversive. Examples include Skwarek and Hocking’s 2010 augmented reality overlay for the BP logo (figure 20) (Skwarek 2014, p. 9) and The Heavy Projects AR advertising takeover of Times Square in New York City July 2011 (Moyer 2011; The Heavy Projects 2011).
This culture jamming spirit is also present in an “augmented reality art invasion” titled WeARinMoMA at the Museum of Modern Art in New York 9 October 2010, without permission from the museum. Sander Veenhof and Mark Skwarek approached the project with a DIY hacker mentality and invited artists to submit work online, which they installed as a digital overlay within the museum. They were interested in what it would mean if anyone could show their work in this prestigious art space (Veenhof c2010).
Inspired by the *Sculpture by the Sea* exhibition in Sydney and the work of artist Christopher Manzione’s *Virtual Public Art Project* (Power 2011), Warren Armstrong curated a series of augmented reality installations in a number of Australian cities between 2011 and 2015. *(Un)seen Sculpture* comprised of outdoor augmented reality installations attached to public buildings (Armstrong n.d.). Writing about *(Un)seen Sculpture* in *ArtsHub*, Mackrell (2011) compares the experience to having a “super power” to see things that were invisible to other people.

Artists have sought to resolve augmented reality as an integrated element within the resolution of the artwork. Australian artist Lynette Wallworth employed augmented reality in her exhibition *Rekindling Venus* in a way that aligned with the conceptual intentions of her work. Photographs of coral were overlaid with images of the coral phosphorescence when viewed through a mobile screen with an augmented reality application (Wallworth c2011). Relatively dull images of coral pulse and glow when viewed through an AR app on a mobile screen, revealing a hidden spectacular dimension of coral. Manzione exhibition similarly integrated and resolved application of augmented reality in an artwork with *All Surfaces Become One* at the Centre for Contemporary Art, Sacramento, in 2013. The work is comprised of large photographic
prints of surfaces with a 3D augmented reality overlay that projects into space when viewed through an augmented reality app (Lautamo 2013). At *Via Festival* in Pittsburgh 2014 and *Pulse Art + Technology Festival* at Jepson Centre for the Arts Savannah in 2015, new media artist Vince McKelvie exhibited exciting site specific augmented reality works that glimmered and pulsed, inserting internet art aesthetics into a spacial context (McKelvie 2015). His works are particularly effective at highlighting the aesthetics of digital surfaces in a material context.

![Image](image.png)


Augmented reality makes tangible the digital overlay of information attached to place. As observed by academic William Uricchio, “AR systems effectively overlay the viewer’s access to the physical world with specific (and selectable) grids of signification” (Uricchio 2011, p. 33). Gibson’s description of ‘locative art’ (2007) highlighted the site-specific quality of the experience that ran counter to the omnipresent broadcast of digital content online. Curiously, the hyped enthusiasm of the marketing sector for augmented reality advertising has not come to fruition (until the release of Pokémon Go
in July 2016). However, the ability to overlay digital and ‘physical’ content has been successfully integrated and resolved in an artistic context.

**Photogrammetry**

Digital photogrammetry was one of the notable emergent themes of the *21st Century Photography* conference (University of the Arts London 2015) with several speakers discussing work that explored the potential and implications of the technique. Examples included Ariel Caine’s point clouds (2015) and Hans Gindlesberger’s mesh works (c2014). At the same time, 3D photo booths could be found in shopping centres in London. In Melbourne, Officeworks opened a 3D centre in one of their CBD stores with a 3D photo booth and printing service offering to produce a ‘mini me’ (Officeworks, c2015). A flurry of photogrammetry based 3D scan mobile phone apps have appeared online, such as 123D Catch (Autodesk, n.d.) and Seene (Seene, n.d.). These apps utilise photogrammetric processes to build a 3D file based on a series of 2D photographs.

Digital photogrammetry is just one of a number of techniques developed to create 3D digital ‘scans’. For example, the Smithsonian Institute’s 3D digitisation program employs a combination of techniques that includes “laser scanning, structured light scanning, and DSLR photogrammetry” (Gates 2015). These three techniques are clearly seen in the documentation of the process used by the Smithsonian Institute to create the 3D printed bust of President Obama (The White House 2014).

Kyle et al. defines photogrammetry as:

... methods of image measurement and interpretation in order to derive the shape and location of an object from one or more photographs of that object. In principle, photogrammetric methods can be applied in any situation where the object to be measured
can be photographically recorded. The primary purpose of a photogrammetric measurement is the three-dimensional reconstruction of an object in digital form (coordinates and derived geometric elements) or graphical form (images, drawings, maps). (Kyle et al. 2013, p. 2)

This potential for spatial measurement within photography was acknowledged at the launch of the medium. In his 1839 announcement to the Academy of Sciences in Paris on ‘a method of capturing images with a camera’, Arago noted the implications of photography for the efficient collection of topographical data (Barger and White 2000, p. 25). Arago viewed the daguerreotype technique as a process for scientific analysis, a means of mapping and measuring (Tresch 2007, p. 446).

Equip the Egyptian Institute with two or three [examples] of Daguerre’s apparatus, and before long on several of the large tablets of the celebrated work, which had its inception in the expedition to Egypt, innumerable hieroglyphics as they are in reality will replace those which now are invented or designed by approximation. These designs will excel the works of the most accomplished painters, in fidelity of detail and true reproduction of the local atmosphere. Since the invention follows the laws of geometry, it will be possible to re-establish with the aid of a small number of given factors the exact size of the highest points of the most inaccessible structures. (Arago 1980, p. 17)

Computational photography has enabled the mechanisation of an impulse and potential to utilise photography to build three-dimensional forms. The following screenshots of work-in-progress by artist Mark Payne illustrates the basic steps involved in the photogrammetry process. Payne first photographs a series of views around the subject. Based on these photographs of the subject from different angles, the photogrammetry software Agisoft builds a point cloud by comparing the relative shifts in position between features in the photographs. The point cloud forms the basis of a surface mesh that is then overlaid with textures comprising portions, shards, of the original photographs.
Figure 23: Payne, P 2014, *untitled*, source images consisting of photographs taken around the subject. Image reproduced with the permission of the artist.

Figure 24: Payne, P 2014, *untitled*, working with Agisoft, source images generated a 3D point cloud. Screenshot shows the relative position of source image planes within the 3D space. Image reproduced with the permission of the artist.

Figure 25: Payne, M 2014, *untitled*, close up detail shows point cloud generated from photographs taken from different perspectives. Image reproduced with the permission of the artist.

Figure 26: Payne, P 2014, *untitled*, close up detail of mesh applied to point cloud to create mesh form and surface. Image reproduced with the permission of the artist.
Figure 27: Payne, P 2014, *untitled*, detail of 3D object with photographic texture applied. Image reproduced with the permission of the artist.

Figure 28: Payne, P 2014, *untitled*, texture map showing photographic fragments that are wrapped around mesh structure. Image reproduced with the permission of the artist.

A similar process can be observed in the documentation about the making of the music video Memex by Duologue. The video features a photographic 3D model of Beryl Nesbitt. Special effected company FBFX created the model using a circular array of 94 cameras around the subject that fired simultaneously (Visnjic 2014). The photographs were first processed in photogrammetry software Agisoft Photoscan before further enhancements were applied. The model is remarkable for its photographic qualities in 3D media.

Photogrammetry literally demonstrates the construction of a surface formed by the relationship between images. The process utilises the shifts in perspective generated by parallax, the relative position of the foreground and background, to build an image surface formed around a 3D shape. The algorithmic processes calculate the shifts in relative position between foreground and background in order to calculate the three-dimensional relationship between points. Like the spatial visualisation by ART + COM in 1995, it is the relationship between the images that generated the shape.

What is most striking about the resulting three-dimensional forms is the ability to rotate the shape and examine the void within the surface of the three dimensional composite image. This effect is not dependant on one particular technique or technology. Examples include Microsoft Photosynth, Adobe 123D Catch, and Agisoft Photoscan.

Figure 30: Payne, P 2014, screenshot of photogrammetry scan showing void behind the surface mesh and texture map. Image reproduced with the consent of the artist.
The impulse to draw out three-dimensional perceptions from two-dimensional images can be seen in the nineteenth century craze for stereoscopy that was immediately applied to the then new technology of photography (King 2013, p. 334). However, there is also a remarkable nineteenth century precedent to digital 3D photogrammetry in the work of François Willème, who created a steampunk equivalent to current 3D scanning and 3D printing processes. Willème’s Paris studio set-up consisted of 24 quarter-plate cameras positioned in a circle around the subject and triggered simultaneously by a cord (figure 31) (Sobieszek 1980, p. 621). Each photograph was then projected onto a screen of frosted glass and the measurements were translated into a 3D sculpture using a pantograph (figure 32) (Sobieszek 1980, p. 621). His initial process translated each silhouette to a plane of wood that was then cut in half and planed to a wedge. The forty-eight wooden wedges were then assembled into a form that was used to create a mould or prototype that was refined by hand. The second technique translated the measurements from the photographs into clay. Willème took out French patents in 1860 and 1861; and a U.S patent in 1864 (figure 33) (Sobieszek 1980, p. 618).

However, despite a great deal of media interest and royal patronage the studio was short lived, closing around 1867. Studios offering similar services were also briefly established in London and New York (Bocard 2013, p. 1497). Nadar’s series of self- portraits coincides with the height of Willème’s popularity in Paris in the mid 1860s. Indeed, the Bibliothèque Nationale de France describes this image as “Autoportraits de Félix Nadar en douze poses. Étude pour une photosculpture” (Nadar 1870). A second series of photographs in the Bibliothèque Nationale de France by Nadar is dated 1865 and the catalogue entry notes: Mention manuscrite de Paul Nadar au verso du support: “Épreuves prises pour la photosculpture au B.d des Capucines 35, par mon père Félix
Nadar, vers 1865, et représentant son ami Arosa // P. Nadar //”5 (Nadar 1865). Nadar’s experiments differ from Willème in that he captured only twelve frames compared to Willème’s twenty-four. The translation from two-dimensional photographs to three-dimensional forms using digital photogrammetry is echoed by the nineteenth practice of photoscupture.

Figure 31: Le Monde Illustre 1864, *Illustration of Willème’s round photography studio*, 31 December. Image out of copyright.

Figure 32: 1864, Illustration of Willème’s projection and pantograph technique, Gautier, Photosculpture Paris. Image out of copyright.
Whilst the fashion for photosculpture was a short-lived novelty, Willème's technique may be read as prescient and familiar when compared with digital photogrammetry processes. Willème's photosculpture technique is evidence of an alternative history that utilised photography as a tool to examine space rather than time (Fotopoulou 2012; Galloway 2012). Unlike the serial sequential image sets generated by Muybridge's 1878 *Horse in Motion* experiments that lead to cinema and the moving image (Muybridge 1878), Willème's technique utilised photography to section three-dimensional space, to generate spatial points of reference rather than a linear sequence. Willème's multi-camera technique also broke the dominant visual schema of ‘one eye’ lens perspective perpetuated by photography. Indeed, the travelling eye of the panorama was a popular visual form of the time and Willème originally trained as a painter with Philippoteaux, best remembered for his panorama painting (Sobieszek 1980, p. 618).

There was also a pre-photography historical precedent to photogrammetry and 3D scanning in the work of 17th century sculptor Bernini (Cotter 2008). According to the UK Royal Collection catalogue entry for the triple portrait of Charles I by Anthony van Dyck, King Charles I wrote to Bernini 17 March 1636 requesting a portrait bust to be based “after the painted portrait which we shall send to you immediately” (van Dyck c1635).
The Bernini sculpture was destroyed in a fire in 1698 but several apparent copies exist. The bust of Charles I by court sculptor Jan Blommendael appears to be based on the Van Dyck painting and is perhaps a copy of the Bernini bust (Attributed to Jan Blommendael 1700). Bernini’s bust of Cardinal de Richelieu in the Louvre collection (Bernini 1640) also appears to be based on the triple portrait by Philippe de Champaigne (1642). Whilst Bernini is known to have preferred to work from life and for not requiring that his sitter hold a static pose (Petersson 2002, p. 121), both the bust of Charles I and Cardinal de Richelieu were evidence that he sometimes created sculptures based on paintings showing a range of views of the subject.

While these pre-digital examples carved from marble hold a solid materiality, the digital shells of photogrammetric processes are all surface. Even when the viewer cannot see into the interior void of the computer generated forms; there is an uncanny sense that the mass of the form was an illusion, hollow.

Artist Clement Valla undertook a deconstruction of photogrammetric scans of museum objects for his 2014 exhibition *Surface Survey* (Transfer Gallery 2014; Valla 2014). In an interview published in *Animal New York*, Valla explains that he was invited to work on a project with the Metropolitan Museum Media Lab, where he discovered their 3D models. Valla draws an analogy between the pieces of texture created from deconstructing the 3D photogrammetry files and the fragments found on an archaeological dig. He compares this with the possibilities of archaeology in the digital archive. He explores this by exhibiting the texture maps of found 3D scans – things like take away packaging - alongside unwrapped textures of the museum object scans (Galperina 2014; Pangburn 2014; Transfer Gallery 2014).
Project Mosul have utilised photogrammetry to reconstruct 3D digital models of destroyed museum artefacts and heritage sites. They employ crowd sourcing to compile and sort images of objects from a range of sources, including the footage posted by ISIS of objects as they were destroyed (Biggs 2015; N. P. R. Staff 2015). As an artist-in-residence at Autodesk, Morehshin Allahyari has also deployed photogrammetry to reconstruct artefacts destroyed by ISIS. The reconstructed objects have then been 3D printed and embedded with a flash drive containing source material and contextual information about the object (figure 34) (Allahyari 2016; Autodesk 2015).

![Figure 34: Allahyari, M 2015, Material Speculation: ISIS, Lamassu, 3D Printed Sculpture (resin, flash drive), <http://www.morehshin.com/material-speculation-isis/>. Image reproduced with the permission of the artist.](image)

Whilst Willème applied the potential of spatial thinking to the two-dimensional medium of photography in the 1860s, the emergence of digital photogrammetry in the 21st century represents a new form of photographic surface; one built from the relationship between photographs. Like Holmes’ 1859 passion for the stereoscope, digital photogrammetry is the latest iteration of the desire to extract three-dimensional forms from the surface of the photographic plane.
Reverse image search engines

Photogrammetry is a tangible example of surface formed from the relationship between images generated by computer vision algorithms. Continuing the discussion of the expanded boundaries of photography, I now want to describe how computer vision underpins reverse image search engines. However, unlike photogrammetry, in which the underlying relationships are spatial, the relationships generated by reverse image search engines are epistemological, generated by the formal composition of pixel values within the image file.

Google introduced the search by image feature in 2011 (Crum 2011). This facility differed from the established version of Google Image searches based on textual search terms. Google search by image was not the first reverse image search engine but had deeper market penetration and reach. TinEye, launched in 2008 (TinEye 2008), claimed to be “the first image search engine on the web to use image identification technology rather than keywords, metadata or watermarks” (TinEye, n.d.).

Like TinEye, the Google search by Image algorithm works effectively without meta-data or associated keywords. The match is based on the similarity of the pattern of pixels, something like the Shazam music app that matches a sample of music with known online versions of the same song. Google search by image is quite effective at finding other instances of the same image - a feature that is useful for photographers to check up on their intellectual property. The search also returns a set of ‘visually similar’ images.

Samuel Bland’s *Googlology* series (figure 35) is a visual conceptual strategy that reverse engineered and revealed something of the workings of the Google Search by image algorithm. Using his original photographs, Bland combined the first twelve ‘visually
similar’ results from a Google search by image search (Schiller 2013). The search results were layered to create a composite average that point to the workings of the computer vision algorithm.

Bland’s composites clearly illustrated that, in 2012, the function of computer vision within this algorithm did not comprehend content or representation. Whereas traditional organisational taxonomies might arrange images according to their content, by what they represent (images of birds in one group; images of cars in another group), the Google Search by image results connect and group images according to the formal arrangement of shape and line, contrast and colour. This may be somewhat like rearranging all the books in a library according to their size rather than their subject matter. Bland's work is a concrete example of the challenge to representation raised by Rubinstein (Rubinstein and Fisher 2013, p. 9). In this ‘reverse image search engine’ algorithmic environment, digital photographs are no longer sorted, organized, associated and linked according to their representational content.

![Image](<http://www.samueljbland.com/googlology/>)

Figure 35: Bland, S 2012, Googlology, merged results and original image, <http://www.samueljbland.com/googlology/>. Image reproduced with the permission of the artist.
Light Field

Projecting forward, emerging light field technologies may effect a thickening of photographic surface. The Lytro company was founded on the doctoral research of Ren Ng, completed in 2006 at Stanford University (Ng 2006). He set out to create a camera that could capture image data in such a way that it could be focused post capture. The camera that he developed captured not simply an image plane but an image field. This was achieved by placing an array of micro lenses within the lens housing of the camera. The micro lenses array enabled two effects. Firstly, the micro lenses enabled the recording of a more than a single image plane within the camera. Secondly, the micro lens array acted like a miniaturised photogrammetry array. The overlapping images taken from slightly different positions could be used to calculate depth within the image.

The introduction of light field cameras such as the Lytro, will have the effect of ‘thickening’ the photographic image. The camera does not capture a single plane at the back of the camera cavity. It captures all of the light information within the space of the camera. The resulting image data can be computationally processed to allow for post-capture focus. In the case of Lytro Immerge, their virtual reality camera, the image data can also be applied within a virtual reality environment and allow for the viewer to move within the captured light field, effectively capturing a thicker image.

Conclusions: expanded photography

Google are notoriously protective of their algorithms so creative practice research such as Bland’s provides a revealing insight into the operations and implications of these underlying processes. Like the spatial structure built by digital photogrammetry, Bland’s
Googlology built epistemological relationships between images via image recognition software. This dialogue between images facilitated by computer vision can also be seen in augmented reality. In all three instances, the action could be conceived as an extrusion and collusion between surfaces.

Digital photographs are no longer contained as stand-alone two-dimensional prints to be contemplated and considered. Whilst photographs have always been arranged and grouped, shared, touched and handled, the affordances of digital environments altered the forms of the encounter and relationships between images. Most of the billions of web-based photographs are hyperlinked to further content. The viewer is urged to click through to the next image encounter. Photographic images are experienced as a cascade of linked and interconnected image planes. The encounter is a click or stroke, flow or swipe. Where Flusser framed the keyboard and television remote as “keys” to an apparatus (Flusser 2011b, pp. 23–25), we now have the mouse, touch screen, touch pad and gestural interface.

**CONCLUSION: PHOTOGRAPHY AS CONTEXT**

Digital photography is the medium within which this creative practice as research project was grounded. Photography is both an instrument of inquiry and the context within which the inquiry took place. Photography is a means of making sense, of pausing fluid complexity. The above survey served to thicken the boundary of the research problem space. As revealed by my selection, I am interested in 21st century conceptions of photography and the spaces occupied by expanding photography, the
spaces between the affordances of analogue photography and the diffuse boundary that blurs into ubiquitous computing.

It is a somewhat fuzzy stake in the ground - slippery, diffuse, porous and expanding. It is a multiplicity of interconnected and overlapping technologies and practices. But, like Nancy Burson’s composites that aggregate types such as *Businessman (10 Businessmen from Goldman Sachs)* (1982), there is a territory and a topology. Whilst the shape of that field, or fields, is expanding, we can discern a field in which to plant a stake even though the boundaries are unclear. The discussion above points to this place, these positions and practices that frame, afford and mediate the gestures towards resolving a set of solutions within problem space, the territory that was interrogated. Despite these uncertainties, it is this porosity that makes photography a powerful and essential instrument and context with which to investigate elusive, slippery and dynamic conditions.

**Materiality (of the Digital)**

Today, as we enter the post-photographic era, we must face once again the ineradicable fragility of our ontological distinctions between the imaginary and the real, and the tragic elusiveness of the Cartesian dream. (Mitchell 1992, p. 225)

At this point, I want to focus on the term ‘dematerialisation’ in the phrase “given the dematerialisation of the photographic image”. The purpose of this section is to unpack and examine a discourse relating to the materiality of the photographic image. Whilst the primary focus of this discussion is photography, I have included elements from new media art and digital discourses where these serve to illuminate the discussion.
Until quite recently, the digital was frequently conceived as immaterial. I will first establish the scope of this trope, consider where it came from, and then propose some more useful and relevant models for thinking about digital materiality.

The ‘dematerialisation’ trope has been deeply ingrained in discourse about digital photography and digital media. Furthermore, this has been amplified by a conflation of the ‘material’ with conceptions of the ‘real’ and the ‘immaterial’ with the ‘virtual’. I will propose that this conceptualisation of the digital as immaterial is inadequate for the purpose of thinking about the ecology of digital photography. Furthermore, this model has concealed a great deal of the material impact of digitalisation and digital artefacts.

The concept of ‘material versus dematerialised’ dualism has deeper historical antecedents than late 20th century computing. For example, reflecting on the photographic stereoscope in 1859, Wendell Holmes famously declared: “Form is henceforth divorced from matter. In fact, matter as a visible object is of no great use any longer, except as the mould on which form is shaped” (Goldberg 1981, p. 112). Applying this thinking to contemporary computational processes carries the danger of imposing an out-dated conceptual model on the process of digitisation.

The roots and permutations of the dematerialisation trope are not singular or simple. Like many words and concepts in everyday use, defining the material, dematerialized and immaterial is somewhat self-referential and circular. The OED defines the ‘material’ as “concerned with matter or the physical world; […] Relating to the physical as opposed to the intellectual or spiritual aspect of things; […] materialistic.” It is also defined as “having significance or relevance”, used mostly in a legal context.
'Dematerialised' is defined as "to deprive of material character or qualities; to render immaterial." The OED goes on to define 'immaterial' as "not formed or consisting of matter; incorporeal; intangible; not material." Also "of no consequence, unimportant." Note here the parallel meanings of materiality and significance that point to the value ascribed to the material over the immaterial.

The history of the concept materiality extends back to Plato. In the context of this exegesis, I have limited the scope of investigation to materiality in photography and digital media.

**THE DEMATERIALISATION TROPE**

Before we examine the assumption that the photographic image as dematerialised, let me first establish that it has been a persistent and pervasive conceptual trope by citing some examples.

In his extended exploration of the term 'materiality', academic Bill Brown considers this claim to be significant enough to call it 'The Dematerialization Hypothesis' (Brown 2010, p. 51). His most blunt example was a quote from Colin Renfrew's 2003 book Figuring it out: what are we? : where do we come from? : the parallel visions of artists and archaeologists:

Describing the "dematerialisation of material culture," the archaeologist Colin Renfrew laments the current separation "between communication and substance," the image having become increasingly "electronic and thus no longer tangible." Because "the electronic is replacing whatever remained of the material element in the images to which we became accustomed," the "engagement with the material world where the material object was the repository of meaning is being threatened." All told, "physical, palpable material reality is disappearing, leaving nothing but the smile of the Cheshire Cat. (Brown 2010, p. 51)

Whilst Renfrew was speaking from the perspective of a discipline deeply invested in material culture, his characterisation of the electronic echoes a widespread conflation of
the digital image as without substance, as false. What is more, Renfrew positions the
digital image as a threat to materiality.

Whilst discussing a daguerreotype in *Photographs Objects Histories: On the Materiality of
Images*, art historian Joan Schwartz invoked the dematerialised digital photograph. “In
this age of electronic images and digital reproduction, when the photograph is often
circulated and viewed as a dematerialised, decontextualised image, it is all the more
difficult to imagine the excitement and wonder that the daguerreotype inspired” (2004, p.
18). Schwartz’s point is to contrast a world without photography with an environment
that is saturated with photographic images and practices. What is significant is that she
chooses to use the word ‘dematerialised’ to describe the contemporary photographic
image.

Discussing digital photography with Savedoff, photographer Sally Mann said “[t]he digital
image is like ether, like vapour that never comes to ground. It simply circulates, bodiless.
It has not material reality” (2008). Note here that Mann equates the material with the real
and significant. Mann is seeking to express her deep engagement with the physical labour
of her practice that utilises nineteenth century photographic techniques and rhetorically
sets the digital image as oppositional to this practice.

Stephen Bull also uses the term dematerialisation in his monograph *Photography.*
“Photography as a medium has gone through a process of ‘dematerialisation’. Digital files
are virtual, rather than physical objects” (2010, p. 26). This could be read as evidence that
the dematerialisation trope was still accepted and current at the time Bull was writing.

Even more recently, the exhibition *Photography: [De]materialised* held in 2015 by
graduates of the University of Roehampton London Photography program explicitly
relied on the assumption that the digital photograph is dematerialised. The exhibition description stated that “[t]his dematerialisation of the medium of photography has prompted a new generation of photographers and artists to explore the photography through the question of materiality” (“Photography: [De]materialised,” 2015).

Perhaps this tendency to equate the digital with the immaterial is not so surprising. Brown speculates that the dematerialisation hypothesis is also embedded in the historical formulation of the cybernetic paradigm. He cites Hayles, *How we became Posthuman* as the story of “how information lost its body”, that “the Cartesian mind/body distinction reappeared as the distinction between materiality and information” (Brown 2010, p. 55). Riches, Plummer and Wooldridge make a slightly more nuanced argument. “The attempts to define the ontological shifts engendered by digital technologies, and the retroactive construction of the oppositional analogue that it replaced, have rendered the photographic object increasingly immaterial” (Plummer et al. 2012). In other words, the use of dualistic terms to discuss the transition to digital has perpetuated the conceptualisation of the digital photograph as dematerialised.

Curiously, the dematerialisation trope is also present in conceptual art, most well known through Lippart and Chandler’s 1968 article ‘The Dematerialisation of Art’ that first appeared in Art International (Lippard and Chandler 1999). In the case of conceptual art, dematerialisation refers to the shift in emphasis from the aura of the precious unique object to the quality and execution of the idea under consideration.

The parallels between conceptual and digital art have been noted by Batet, who uses the term digital art and immaterial art interchangeably. “It is precisely in the midst of this change in aesthetic paradigm represented by ultra-conceptual art that conditions are
forged for the birth of new media art” (Batet n.d.). This correlation was also discussed by O’Brien and Chan in ‘Are algorithms conceptual art’s next frontier?’ (O’Brien 2015). If conceptual art practices of writing instructions rather than producing unique objects are employed to reduce the artwork to pure concept, such as Sol LeWitt’s instructional drawings (Halpern 2012), then, as O’Brien suggests, the procedural instructions of algorithmic code can also be conceived as a cultural form that can be deployed to the same ends. The cultural context in which a work of conceptual art is created is integral to appreciating the significance of the work. A good example of this point is Kernighan’s 1978 *Hello World* comprising of framed hand written instructions that elegantly traverses conceptual and algorithmic artwork.

Curiously, Bate notes that the anti-commercial impulse of the conceptual strategy is a realisation of the potential indicated in Benjamin’s 1936 ‘Work of Art in the Age of Mechanical Reproduction’ (Bate 2009, pp. 29, 140). As an entity without original, photography has the potential to elide the commercial structure built around the unique precious object.

Photography’s relationship with conceptual art goes deeper than these parallels. Photography was employed as a non-precious means of documenting and communicating conceptual artworks (Rhodes 2002). Ironically, it is these photographs that have the saleable products of conceptual art (Amalric 2014). Whilst not a dematerialised photography, this use of photography implies an assumption that photography is a means of communicating the dematerialised art object.

Christiane Paul, Adjunct Curator of New Media Arts at the Whitney Museum of American Art, also noted the relationship between digital artworks, immateriality and conceptual art.
The challenges posed by new media art are often discussed in the context of the art form's 'immateriality'—its basis in software, systems, and networks. From an art historical perspective, new media art has strong connections to the often instruction-based nature of previous movements such as Dada and Fluxus and [thus] continues the “dematerialisation” of the art object that lies at the core of conceptual art. (Paul 2007, pp. 251–252)

Connected to this discussion about materiality is the emergence of a body of discourse known as New Materialism. Sometimes positioned as a response to the dematerialisation trajectory of conceptual art, the ‘linguistic turn’ in academic theory and the perceived immateriality of digital media, New Materialism is a body of theoretical writing that engages with questions about the agency of matter, proposing the material as more than simply a receptacle for a concept (Dolphins and Tuin 2013; Schneider 2015). The field shares threads with posthumanism and phenomenology, in questioning the dualistic distinction between the living agent and the thing/object. Theorists such as Braidotti publish under both the posthuman and new materialist labels. Indeed Braidotti published her book The Posthuman (Braidotti 2013) and an extended interview as a chapter in a major book New Materialisms in the same year (Dolphins and Tuin 2013). Critics of new materialism, such as Sarah Ahmed (2008, p.35), point to the potential for fetishism and projecting anthropocentric qualities and perspective, an act counter to the new materialist project.

Materiality is of great significance to photographic discourse. In a series of articles titled ‘Photography’s New Materiality’, Riches, Plummer and Wooldridge (Plummer et al. 2012; Riches et al. 2012) discuss the implications of the medium’s techno-determinism. For example, the material limitations of the daguerreotype as a singular non-reproducible object is a material fact. The photosensitive plate is the same surface as the image one sees in the charming case. The materiality of the technique and technology meant that the image and the object are inseparable; the image cannot be transferred to
another material support. The physical labour of 19th century techniques also served to emphasise the investment in the photograph as a material outcome. Whilst Riches et al overlook Holmes’ 1859 declaration that “henceforth matter is divorced from form”, they point to the introduction of Kodak’s Box Brownie camera in the 1880s promoted by the slogan ‘you push the button and we do the rest’, which perpetuated a disinvestment in the photograph as a precious object. The disconnection from the labour of producing the photograph served to shift the emphasis to the image as an ephemeral entity. This split between the photograph as image and the photograph as object is also articulated by Barthes: “Whatever it grants to vision and whatever its manner, a photograph is always invisible: it is not it that we see” (Riches et al. 2012a). These examples point to a discourse that conceives of the image as separate from its physical infrastructure.

Riches et al propose that digitalisation is such a provocative threat to materiality as to provoke a renewed focus on the materiality of photography. Evidence of this is present in creative practice in exhibitions such as Cutting edge: 21st century photography at...
Monash Gallery of Art in 2015. Interviewed in *The Sydney Morning Herald*, curator Zagala said

"[a]rtists have been quietly rebelling against the slick finish of digital photography for a number of years now, finding ways to put photographs back in people’s hands and emphasise the materiality of the medium. The resurgence of both photo books and analogue photography over recent years has signaled this shift". (Rubelli 2015)

However, what is overlooked in the ‘material versus immaterial’ dichotomy is the observation that a digital file cannot exist without a physical substrate. Indeed, a great deal of physical resources went into creating, storing and presenting a digital photograph (Riches et al. 2012), even if the ecology of the digital photograph is transient, impermanent and omnipresent. Discussing new media art, Christian Paul makes the point that the interplay between these qualities roughly categorised as ‘material’ and ‘immaterial’ are part of what makes this field intriguing. Despite the ephemeral nature of a digital file, “it would be highly problematic to ignore the art’s material components and the hardware that makes it accessible.” Paul positions the material and ephemeral qualities of new media artworks as inseparable (Paul 2007, p.252).

Those deploying the dematerialisation trope frequently slip into using the term ‘virtual’ as an equivalent to the dematerialised. Like the term ‘material’ (which can mean both physical and significant), ‘virtual’ has had several meanings. Some of these meanings pertain to virtue and virtuousness, but the meaning of the term slides through notions of ‘quality’, as in goodness, to ‘having the quality of something’. It has come to relate mostly to similarity: virtually the same; verisimilitude. In digital culture it relates to notions of simulation (imitation of ‘real’ things) and simulacra (copies of things for which there is no original). Virtuality, the dynamic quality of being virtual, has an emergent liminal quality. It is the process of an idealised potential becoming actualised. Curiously, the virtual, the
quality of virtuality, relates to both emergence and dissolution. It relates to the things that press against the tangible, that are emergent but it also points to the dissolution of the boundary between the ephemeral ideal and that which can be perceived.

The tendency to class the virtual and the digital as not real and not of material weight (in the sense of being capable of having impact or significance) was succinctly encapsulated by sociologist Nathan Jurgenson (2012, 2011) when he coined the term ‘digital dualism’ as “the belief that the on and offline are largely separate and distinct realities. Digital dualists view digital content as part of a ‘virtual’ world separate from a ‘real’ world found in physical space” (Technopedia n.d.). This conception arose at a time where ‘logging on’ was a distinct activity that took place at a desk. That changed with the adoption of internet-enabled smart phones, accelerated in 2007 with the release of the iPhone (Goggin 2012, p. 11). However, the cultural tropes and the language used to describe these experiences are yet to be fully recalibrated.

A series of screenshots of Peter Sunde from the 2013 documentary TPB AFK: the Pirate Bay Away From Keyboard, a documentary about the prosecution of the administrators of file torrenting site The Pirate Bay, has circulated as a meme. The quote written across the screenshots, “we think the Internet is real”, was something of a revelation at the time and a statement of cultural affiliation that circulated on social media and appeared in artist statements and manifestos such as Krystal South’s Identify Yourself (2013).

Christine Paul reiterates Tiziana Terranova’s conception of immateriality as "links between materialities" (2007, p. 252). What is more, Paul presents these shifts in register between materialities as integral to the digital as a media. Mitchell Whitelaw addresses this concept with a proposition that he termed transmateriality. Rather than conceiving of the digital as immaterial, he proposes that the digital be conceived as part of a
continuum of translations between materialities (2013, pp. 223–233). Whitelaw's conception builds on an argument put forward by Krischenbaum in *Mechanisms* that argued, specifically in relation to writing, that the digital is firmly material (Baetens 2008; Kirschenbaum 2008; Whitelaw 2013). Whitelaw extends this argument to new media artworks. He points to glitch artefacts as just one form of evidence of digital materiality. The glitch appears due to a physical interruption in the recording and translation of a digital file. Whitelaw draws on the engineering term ‘transduction’ as "the conversion of energy from one form to another: a light bulb transduces voltage into light and heat […] ; in digital media it is less apparent, but no less significant. The keyboard transduces motion into voltage; the screen transforms voltage into light …" (Whitelaw 2013, p. 231). In digital photography, the flow of signal from light reflected off the surface of the subject is translated into digital measurements of intensities in the charged couple device (CCD), rather than dematerialised. If one has a working knowledge of the CCD (Boyle and Smith 1970, pp. 587–593; Class for Physic of the Royal Swedish Academy of Sciences 2009, pp. 7–14), conception shifts from a magical black box to a tangible process. Munster imbues transmaterial transduction with the shifting quality inferred by Paul and Terranova by calling on Manning: "Transduction is not translation, it is a shifting between planes that requires a simultaneous shift in process" (Munster 2014, p. 161).

If we cease to conceive of the digital as dematerialised, the digital becomes part of the physical world, less magical and ephemeral. Indeed, the spread of ubiquitous computing renders the digital commonplace. It is this shift in thinking that is at the heart of deconstructing the dematerialisation trope.
The dematerialisation trope of digital media obscures very material environmental and social impacts wrought by the pervasive infrastructure of digital media. Phrases such as 'cloud computing' are euphemisms for the reality of industrial scale data farming. Artist John Gerrard experienced the deliberate obfuscation of this reality first hand when he was denied permission to photograph the Google ‘farm’ in Oklahoma. Undeterred, he sought legal advice and photographed this very physical industrial complex from the air in a helicopter (Gerrard 2015; Kleinman 2015). Gerrard explains: “[the internet] is physical. There is a great cable running under the Atlantic Ocean from Ireland to America. There’s a new set of infrastructures which are great information railways being put into place. I became interested in asking: what does the internet look like?” (Jones 2015).

As photography becomes part of ubiquitous computing, embedded within the infrastructure that creates and distributes information, photography as a cultural practice becomes complicit in these material and social impacts. From the loss of habitat due to mining for rare earth minerals; through to the spate of suicides by Foxconn factory workers producing digital products; the digital is profoundly material. In terms of lost productivity and human suffering, engagement with digital technology has been a major cause of repetitive strain injuries and of poor health through lack of physical activity.

Along with the exponential growth in computing power come the significant impacts caused by the disposal of obsolete devices. Photographer Nyaba Leon Ouedrao describes his first visit to the ewaste dumps of Accra in Ghana as like “a ‘cemetery’ of abandoned computers that stretches for 10km. [...] My first thought was that it looked as if there had been an earthquake” (Phillips 2012).
Discussing his award-winning photograph of a worker in the ewaste dumping ground,

_The Hell of Copper_, Ouedrao says;

On one of my visits, I met this man – Yaw – but I didn’t take this shot until I returned in October the same year. Noticing that his little brother – who normally worked alongside him – wasn’t there, I asked where he was. Yaw said he had gone home one day after work and died in his sleep. He hadn’t been able to find out why because he might lose his job if he asked too many questions. (Phillips 2012)

Not only is the digital material, it is very very dirty.

Through the course of this contextual mapping of materiality in digital photography and technical images, I have set out to consider ways of thinking about the materiality of digital photography. I have outlined that there was a trope that conceived of the digital photograph as dematerialised and I have unravelled a number of the cultural and historical threads that contributed to the dematerialisation hypothesis. Curiously and delightfully, the trope has several of sources that include defensive materialism, luddite tendencies, the history of cybernetics, political strategies within conceptual art practices and confluations driven by Clarke’s Third Law: “Any sufficiently advanced technology is indistinguishable from magic” (1974). I have concluded that conceiving of the digitalised photograph as dematerialised is a misconception that requires recalibration and that Whitelaw’s model of transmateriality offers a more useful means of thinking about the process of becoming within the technical image. Part of this recalibration may include a shift to a post-digital ontology where the category of digital is no longer useful in the context of ubiquitous computing.

What I have also touched upon, but have not yet resolved at this point, is a thread of discourse that conceives of the image as separate to its material support. I want to echo the question posed by Riches et al: could we consider the image and the material within which it is embedded as indivisible? (Riches et al. 2012). I am particularly interested in a
connection drawn by Plummer to surface as integral to the ambiguous interconnected relationship between photograph as image and photograph as object (Riches et al. 2012b). It is this facet of the shifting surface of the photograph that connects the conceptually separate but materially indivisible image and object.

SURFACE

This subsection of the contextual survey will consider surface. I will begin with a general definition and discussion of surface. I will then consider surface as an abstract entity and as physical skin. For the most part, these discussions will be through the lens of how artists have approached surface as an abstract form or as an embodied boundary in the form of skin.

The term surface is both a noun (a thing) and a verb (an action). As a thing, a surface could be thought about as both profoundly material and utterly abstract. For such a ubiquitous and essential entity, definitions of surface are notably self-referential. For example, “The outermost boundary (or one of the boundaries) of any material object, immediately adjacent to air, fluid, or empty space, or to another object” and the “most superficial layer or element of anything; that part or aspect which is apparent on casual consideration; outward appearance” (OED). In a mathematical context, surface is a “continuous extent having only two dimensions (length and breadth, without thickness), whether plane or curved, finite or infinite; an entity such as constitutes the boundary of a solid object” (OED). As an entity, surface is an embodied experience - a material encounter - and a purely conceptual boundary without thickness or depth.
There is a fundamental relationship between surface and depth. One defines the other; they are co-constitutive. Whether it is conceived as depth, form or space, an entity or void is bounded by its surface, the plane of transition between one thing and another. Both space and materiality are defined and, in a sense created, by their surface. Even when it defines a void, the shape is indivisible from its surface.

![Figure 37: An illustration of the iterative construction of a Menger sponge up to M3, the third iteration, Wiki commons.](image)

Surfaces are conceived as both boundaries and interfaces. Surface is the plane that bounds a space, that obscures what is beyond, that created interiority and exteriority, within and without. It is also the place of contact, where entities and states meet, where exchange, support, and communication occur. Surfaces both block and facilitate.

The action ‘to surface’ is defined as to emerge, to come to notice, to arise out of concealment (OED). Like the abstract quality of surface as boundary, this can be equated with notions of emergence and becoming. The phrase within my question “… to what extent can photography be regarded as having a surface?”

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1 As an exception that demonstrates the principle, the Menger Sponge is a theoretical anomaly that has infinite surface area but potentially zero volume, even though it takes up space. It is a structure entirely of surface. It exhibits an infinite surface area and zero volume.
implies surface as a thing, however these transitive active senses of surface are also present, echoing as possibilities within the problem space.

Surface is a rich term that facilitates the fluid shifts in registers that are integral to this creative investigation. Approaching the theme of surface in this way enables me to reveal and resolve complexity rather than reduce and fix meaning.

**SURFACE ABSTRACTIONS**

Surface has been considered, in some contexts, as an abstraction. Beginning with artists’ responses to the 19th century practice of mathematical models, abstract representation of surface was a subject of interest to modernist sculptors, surrealists, through to contemporary artists. Computing and 3D printing has, in some senses, instigated a return to the practice of mathematical models, of visualising abstract forms.

The late nineteenth century fashion for creating three-dimensional visualisations of mathematical formula as plaster models and frames strung with thread directly inspired several modernist investigations into abstraction of form. Digital technologies have facilitated a resurgence of mathematical model making and artists applying these tools to generative artworks.

I encountered these models in the Science Museum, London mid 2015, in an exhibition titled *Strange Surfaces*. The display cabinets were filled with forms from handmade plaster and frames with string that visualised the surface forms of mathematical formula. This field of maths and physics visualisation was active in the late nineteenth century (Barker and Howison 2015). For example, in 1890 German mathematician Felix Klien collaborated with Alexander von Brill to publish a catalogue of plaster and thread models
(Clements et al. 2012, p. 536). They exhibited their range at the 1893 Chicago World’s Fair and their models acquired by university mathematical departments internationally. Whilst the production and use of these surface models fell out of practice after the First World War (Barker and Howison 2015), they could be conceived as a precursor to what has come to be known as creative coding and generative algorithmic art practices. Indeed, well before the algorithmic turn these forms provoked and intrigued artists.

The abstract forms of mathematical surface models are evident in the work of several modernist artists producing work in the 1930s. Henry Moore directly cited the mathematical surface models on display at the Science Museum in London as the source for his stringed figure series of sculptures (Correia and Morgan 2015). Shapes that resonated with the forms of mathematical models were also present in the work of Moore’s friends and contemporaries Barbara Hepworth and Naum Gabo (Correia and Morgan 2015). In the mid 1930s, Man Ray photographed mathematical models held by the Institute Henri Poincaré (Tubbs 2014, p. 7) and the models themselves were included in the surrealist exhibition *Exposition surréaliste d’objets* at Galerie Ratton, Paris, in 1936 (Correia and Morgan 2015).

Echoing Man Ray’s photographic studies of mathematical models, Hiroshi Sugimoto created the series *Conceptual Forms* (2004) photographing mathematical models held at the University of Tokyo. The images continue Sugimoto’s sublime considerations of shadow and form that distinguish his images. The renowned Japanese photographer then extended his interest in these pure forms by producing machined sculptures of the equations (2006) using computer-generated forms. He reproduced the mathematical models he photographed with the intention of sculptures, as artworks generated by an algorithm. This exploration of pure surface forms extends his ongoing photographic
investigation of abstraction. Sugimoto’s investigation points to the ongoing relevance of abstract conceptions of surface to artistic investigation in seeking to represent the idea of abstract order and surface as a conceptual entity.

Computing facilitated the visualisation of increasingly complex surfaces and forms. In the nineteen eighties, chaos theory caught the public imagination with the infinite complexity of the Mandelbrot set (Challoner 2010). Images that suggested recognisable organic structures provoked particular fascination as they suggested an order and structure in nature that could be deciphered. Jon McCormack’s generative flowers (2001) and Patricia Piccinini’s Plasticology (1997) are two examples of this trajectory in computational artworks. Both these works were procedurally generated and yet mimicked forms that looked like plant-life.

Figure 38: Piccinini, P 1997, Plasticology (detail), DVD video and interactive installation, <http://www.patriciapiccinini.net/311/21>. Image reproduced with the permission of the artist.
Generative forms of surface can be found in the work of architect Zaha Hadid and designer Neri Oxman. Zaha Hadid’s redesign of the Science Museum Mathematics Gallery references the mathematical models that inspired Henry Moore. Indeed, Hadid’s body of work is an exploration of mathematically described surfaces. Her design for the Mathematics Gallery feature curved surfaces that visualised the movement of air caused by the flight of an aeroplane as structures within the gallery (Stevens 2014; Zaha Hadid Architects 2014).

Neri Oxman’s applied creative research at MIT since 2005 demonstrates the potential of algorithms to create extremely complex surfaces. Oxman’s work represents an intersection of materiality and generative processes (MIT Media Lab n.d.). Much of her conceptual and design sources are based on observations of nature, such as the structure of a silk worm’s cocoon, the complex structural surface of a sponge and the variations in the intricate mesh that forms human skin (Oxman 2015, 2007; Stinson 2014).
As seen in the examples above, abstract and mathematical conceptions of surface have been an enduring subject of creative investigation. The manifestation of abstract surface in physical form evokes the flicker and shift in registers between ephemeral and material rising from mediations on surface. Whilst surface can be conceived as an abstract conceptual entity, it can also be satisfactorily represented and expressed in material form. Surface has been approached as both an abstract entity and a material imperative. Its presence and expression shimmers between idea and encounter, making it a rich and intriguing theme for creative investigation. Surface is both material and abstract, and could be considered as simultaneously sliding between idea and a physical encounter.
When I sought to locate surface, I returned to my body, within my skin. From here I looked out, at the surfaces that surrounded me. The light reflected off the fluffy dog asleep on the frayed chair in the darkened space of this enclosed room, the insect eaten surface of the cherry tree leaves through the dirty glass of my window, the layers of paper covered in print and handmade notes across the desk, and the portal, the keyboard and screen through which I attempted to grasp, to locate this entity, to unpack the complexity of this idea, this thing to contemplate, to experience. The wet cat tickled my nose, sliding against my face, disrupting my fall into the screen, and brought me back to my skin. An exploration of surface has to begin with the skin.

I arrived at skin through architecture. At the conclusion of several photographic series looking at the interior of rooms, caves, and spaces of negotiated inhabitation, it was clear that there was a powerful resonance between interior space and the surface of the body, that the building and the body are in constant dialogue. As corroborated by Pallasmaa, "we tend to interpret a building as an analogue to our body, and vice versa" (2012, p. 38). The resonance between the surface of the body and spaces of inhabitation is integral to the process of negotiating interiority, the process of inhabiting the skin.
Embedded in the process of negotiated inhabitation (Rice 2004, pp. 40–41) is a sense of reciprocity, of extended connection and embeddedness. Cataldi invokes perception as reciprocity between observer and environment. “This elemental surface of sensibility is what Merleau-Ponty came to mean by Flesh ... Flesh incorporates our bodily being, but it is not confined to it. It is a surface to which we, as embodied perceivers, always already belong or are ‘of’, a surface from which we cannot be thought as entirely separated” (Cataldi 1993, p. 3). It is the embodied encounter with surface, the impact with flesh, that makes us known to ourselves. We are inseparable from the ecology of touch, the intercorporeality of world and flesh. All surfaces are connected, contiguous and continuous.
The interconnectedness of bodies may be summarised in the image of the handshake. As explained by Merleau-Ponty, “[t]he handshake too is reversible, I can feel myself touched as well and at the same time as touching” (1962, p. 142). Pallasmaa explicitly extends this analogy to include buildings, “[t]he door handle is the handshake of the building”, and emphasises the role of skin contact in this encounter (2012, p. 56). His invocation of intercorporeality acknowledges the integrity of the other, that which is not us. Embodiment is mediated by context, by interaction with other bodies (Weiss 2013, p. 5).
There is a subtext within much of the literature that suggests that skin has consciousness, is capable of thought (Jablonski 2006). At a biological level, the skin may be conceived as an extension of the nervous system (Montagu 1986, pp. 4–5). "In the embryo, the skin and brain are formed from the same membrane, the ectoderm: both are, in essence, surfaces" (Benthien 2002, p. 7). Addressing the notion of the thinking skin from another direction, Ahmed and Stacey seek to sidestep the dualistic thinking of the mind/body split and position the body as "the site from which thinking takes place" (2001, p. 3). Manning continues the thinking of skin as cognisant. "The surface of the body is a thinking, feeling surface. It is a gestural, linguistic, sensing skin that protects us while opening us towards and rendering us vulnerable to an other" (Manning 2006, p. 34). From these perspectives, the skin is not separate from the mind but intimately and intricately embedded within consciousness.

Figure 43: Harrison, J 2009, Table, mixed media, Hand Held, <http://www.designboom.com/art/sculpted-skin-furniture-by-jessica-harrison-12-16-2013/>. Image reproduced with the permission of the artist.
Each of the human senses is engaged, to greater or lesser extent, with surface as a means to orientate the body in space and place. The two senses most engaged with the perception and experience of surface are touch and vision. Indeed, vision is the perception of light reflected off surfaces. It is a form of remote sensing of surface. Touch comes into play when the body makes direct contact with a surface, when the space is closed. Skin is the surface through which the body encounters other. Skin is the surface through which we touch.

Mediation on skin as a subject invokes the collaboration of the senses, a synaesthesia between sight and touch (Pallasmaa 2012, p. 13), the two senses most engaged with surface. This phenomenon is encapsulated in the concept of haptics. As defined by Montagu, “[t]he term haptic is used to describe that mentally extended sense of touch which comes about through the total experience of living and acting in space. The haptic is an acquired sense in that it applies to seen objects that have been touched and acted upon” (1986, pp. 14–17). Vision and touch are mingled.
Manning discusses a similar phenomenon and points to the role of memory in informing this learnt perception in which the division between the perceptual experiences are blurred (Manning 2006, p. 166). Discussing the work of Laura Marks, Ahmed and Stacey characterise this phenomenon as "haptic visuality", "the eyes themselves function as organs of touch" (2001, p. 6). They point to the durational component of this facility, the convergence of vision, memory and touch.

Indeed, the skin may have a measure of visual perception (Pallasmaa 2012, p. 13). This potential of skin for "opticsless vision" was been noted by researchers at Tel Aviv University (Yaroslavsky 2010, p. 213) and similar project exploited brain neuroplasticity to translate visual information to the brain via touch. The BrainPort V100, with funding from Google, recently gained clearance from the FDA for distribution in the USA. The device translates visual information via a camera mounted on glasses to a sensor held against the tongue (Kendrick 2009; Tenenbaum 2016; Wicab Inc 2015).

Extending the notion of the skin that sees, there is a suggestion within phenomenological and posthuman thinking that, just as we are oriented towards an object, the object looks back (Ahmed 2006; Elkins 1996). Intercorporeality includes bodies and entities that are not flesh bodies (Haraway 1991, p. 178).

Rather than conceiving of skin as an enclosure, Connor invokes the image of skin as a plane, a milieu, a "mingling" of all that is (Connor 2009, pp. 26–29). Drawing on Serres’ philosophy of the senses, the image he creates with language is not so much one of encapsulation but of an extended plane at which the world is formed. The interface between interiority and exteriority is envisaged as a endless plane rather than an enclosure. Not only does the perception of surface in a sense create the object perceived,
but the impression of the object creates the surface of skin, provokes it into being
(Connor 2009, p. 35).

This conception of the surface of the skin as a plane can be found as a recurring image in
the work of several photographers. Examples include Tetsuaki Okuhara, Susan, 1974; June
Yong Lee Torso 2010; and Jan Smaga Skins 2007. These images are sometimes read as a
flailing metaphor, which has a strong cultural history in images such as Gerard David's
1498 The Flaying of Judge Sisamnes (The Judgment of Cambyses).

However, Connor and Serres offer a more inviting point of access to this impulse (Connor
1998, pp. 26–29). Skin as plane positions the interior and exterior, the subjective and
objective, on equal footing. Interiority and exteriority are balanced at the plane of the
skin.

![Image](http://www.juneyonglee.com/Torso-Series) Image reproduced with the permission of the artist.

The skin has been theorised as a cultural surface by writers such a Benthian, Connor,
Ahmed and Stacey. Therefore, marking skin could be conceived making the cultural
surface of the skin explicit, whether intentional or involuntary. Examples of this
phenomenon included tattoos, scars, and welts.
Sullivan translates the process of cultural inscription through tattooing with Foucault. In ‘Language, Counter-memory, Practice’, Foucault speaks of the body as ‘the inscribed surface of events ... a body totally imprinted by history’. As Foucault saw it, the inscriptive process of enculturation, of systems of power/knowledge – which are always socially and historically specific – morphologically (trans)form flesh into a body, a text, the incarnation of social fictions that can then be read as ‘truth’. It is my contention that tattooed bodies literalise such a phenomenon. (Sullivan 2001, p. 1)

Tattoos are a cultural expression of the desire to write oneself into existence, narrating through the body. In the negotiated social environment, the direct mark making has ramifications of becoming that resonate both internally and externally. It is a technocultural action that engages with both the social self and the psychic other, a technology of identity. Mark making on the skin literalises, makes explicit, skin as a culturally marked surface.

Figure 46: Jackson, S c2011, Skin, tattoo on skin, ineradicable stain, <http://ineradicablestain.com/skindex.html>.
The discourse on tattoos is remarkably polarised as either evidence of a deep-seated mental illness, part of a mortification narrative, or as healthy self-empowered self-actualisation (Sullivan 2009, p. 128; 2001 p. 4). Both positions share the conception of "the inscribed body as the external expression of an inner self" (Sullivan 2009, p.129). On one hand, for example, Lemma presents a clear example of a text that frames tattoos as evidence of mental illness. He writes from the position of a psychoanalyst who believes he can read the skin in ways that the subject cannot understand. He argues that body modification such as tattooing is driven by a number of unconscious fantasies, such as the reclaiming fantasy and the self-made fantasy (Lemma 2010, p. 5). On the other hand, Inckle challenges the mutilation reading and the view that positions the unmarked 'natural' body as normal (Inckle 2007, p. 134). Anecdotally, a recurring theme in many of my conversations with people about their tattoos is that it becomes a means why which they are able to claim ownership of their bodies and disengage from the social conventions that overlay their embodiment. My experience of getting a tattoo is that the mark-making resonated not only externally - as seen by the world - but internally. The image travelled inwards and coalesced, like the latent image revealed in the developer bath.

At the other extreme of this subject of skin as a site of mark making is the difficult subject of self-harm. In her chapter on cutting, Kilby offered a potentially useful vector by framing self-harm in terms of that which cannot be articulated, which defies speech (Kilby 2001). This echoes Scarry's earlier work Body in Pain (1987) in terms of expression that is beyond what can be framed in language. The self-cut skin is unspeakable.

Unlike notions of 'body language' or 'body talk', which ostensibly refer to non-aggressive and social gestures of the body, the 'voice' of self-cut skin is an extreme substitute for
language. Skin deliberately wounded and cut thus speaks violently of the failed promise of language to communicate trauma: it is a rupturing force that tears itself, and its significance, apart from language. (Kilby 2001, p. 126) Kilby’s observations bring into question the assumption that one can ‘read’ the body, the conception of the body as text. There is an interplay between the notion of marks on the skin as text (Sullivan 2001, p.2) and as beyond language (Kilby 2001, p.126). It is this shifting unstable focus that interests me - the inadequacy and necessity of communication, both internally and externally, and the process of negotiating one’s presence in a body constructed by social gestures (Grosz 1994). The marked skin invokes the complex dialogue of these voices.

Similarly to Kilby and Scary, Hewitt described her experience of scars as “a private landscape without words” that transformed via biological processes through time (Hewitt 1997, p. viii). The marks of surgery, accident, trauma and atrocity, the scar can also be framed as a mark of survival. For example, this framing is evident in the title of Smetana’s Dignified series of portraits of burns survivors. Anne Baylin’s portrait Kim Phuc and Thomas depicting a scarred woman holding a baby was particularly poignant as the subject is the same person from Nick Ut’s iconic 1972 photograph of a Vietnamese girl burnt by Agent Orange. Scars represent the resealing of the fissure, the gap that was, the repair, the mark, evidence of disruption to the integrous surface of the skin. Their significance is ambiguous. They can be experienced as a badge of survival or an unwelcome reminder and disfigurement.
Fig. 47: Smetana, A ©2010, Dignified #1, photograph, <http://www.smetana.net/portfolio/portrait/>. Image reproduced with the permission of the artist.

Whilst scars are relatively permanent, the surface of the skin is also the site of transient marks: bruises, welts, and acne. Artist Ariana Page Russell has a rare skin condition called dermatographia, literally ‘writing on the skin’, where light scratching on the surface of the skin produces welts that last about thirty minutes (fig. 48). Focusing on this reaction as a point of departure, her work considers the interplay between the voluntary and involuntary actions and reactions of her body. This ephemeral inscription acts as an index, marking a moment of her body's passage in time, a trace of something that happened (Frank 2014; Russell n.d.).
Reflecting on surface as skin, there is grounding in the experience of blood fed skin. Simultaneously, the experience of skin membranes extends beyond the body (Haraway 1991, p. 178; Manning 2006, p. 136); the itch of an amputated foot, the sensation of a prosthetic limb, the vitality of an encounter with an avatar. The border is unstable, uncertain (Ahmed and Stacey 2001, p. 2).

The technology is folding around the body, and the body unfolds out into the world. The skin as border loses its significance and becomes an unfolded interface to the surroundings. The body is folding into the ubiquitous techno-sphere, and new technologies are refolding embodiment. (Schick and Malmborg 2010, p. 67)
Skin extends beyond the ‘body proper’ giving us pause. Resting at the edge of our skins we cannot help but wonder what holds us together. ... Skin, our largest organ, doubles upon itself, duplicitous, touching itself as other. ... The body - even the technological body – is concerned with skin, be it skin colour or the surface of the screen, threatening to transform place into dermographics. Skinscapes abound. (Manning 2006, p. 136)

We are not isolated observers. We are provoked into being by our encounter with our environment. Engagement with objects is not a one-way affair. Being visible, existing and seen, is a political act beyond the enactment of the image. Skin is the connector between biopolitics and virtualisation (Manning 2006, p. 138).
DIGITAL SKIN

Benthien observed that the metaphor of skin is been increasingly applied to digital surfaces (2002, p. 6). Starosieski describes a cultural tendency to conflate the biological metaphor of skin with the surface of digital media, and the metaphors of the digital interface with biological skin (2007, p. 39). For example, the visual design that overlays the user-interface of software and apps was called the skin of the interface. When an app is rebranded it is called ‘reskinning’. There is been a tendency to apply the metaphors of the digital interface to conceptions of biological skin as interface, and to mechanise and technologize conceptions of the operations of the skin.

However, this trajectory is more than a metaphorical conflation. There are several examples of tentative and emerging technologies that literally combine biological and digital surfaces.

In 1997 Singer and White lodged a US patent for a “Programmable subcutaneous visible implant” (Singer and White 1997). Whilst the patent was current at the time of writing, the technology appears speculative. Levy and Cherry lodged a US patent for a “changeable tattoo system with an electrically modifiable ink” (2001), which has since
lapsed. Jim Meilke’s entry in the 2008 Greener Gadget Design Competition was a hypothetical design for a digital tattoo interface that gained viral media attention (Eaton 2008). These are examples of an apparent desire to bring together the potentials of the digital interface with the skin.

Whilst marketed as digital tattoos, there are several products that are actually more like temporary stick-on tattoos. In 2008 medical imaging company MC10 promoted a ‘digital tattoo’, also termed ‘epidermal electronics’, as a medical device (Orcutt 2013). Their product is based on research by John Rogers at the University of Illinois to create flexible electronic circuits that can tolerate the movement of the skin (Yeo et al. 2013). The MC10 product relaunched as Biostamp at the 2016 CES Innovation Awards looks a little more sturdy than the initial skin-like adhesive (Chang 2016). John Rogers has since applied the potential of his epidermal electronics as an EEG controller interface (Hodson 2015; Norton et al. 2015). Vivalnk launched an epidermal electronics product in 2014 called eskin, an ultra-thin electronic sticker that interfaces with a smartphone and may be customised for a variety of applications such as monitoring a fever or unlocking a mobile phone (Burns 2014). Artist Anthony Antonellis took this idea of dermal surface embedded with the electronic in a biohacker direction in 2013 when he had a NFC/RFID chip inserted in his hand that carried artworks that could be accessible via a smart phone (Galperina 2013).

Pursuing the idea of skin as interface, several projects have engaged the skin as a projection screen interface. Curiously, most appear to be speculative work-in-progress, but they are also examples of an urge towards the merging of biological and digital surfaces. Skinput by Harrison at Carnegie Mellon (Harrison et al. 2010) demonstrated the possibility of skin as an interactive projection screen. His prototype involves a pico-
projector strapped to the upper arm. *Skin Buttons* by Future Interfaces Group (2014), also based at the Human-Computer Interaction Institute at Carnegie Mellon University, extend the user interface of a smart watch by projecting interactive ‘buttons’ onto the user’s skin. The *Ritot* watch, a bracelet that projects the time and social media updates onto the back of the user’s hand, (Kelly 2014) raised 1.4 million on Indigogo (Ritot Watch n.d.) but the purchase section of their website is still ‘under construction’ in June 2016, which adds to doubts about the viability and legitimacy of the project (Ong 2014). The *Cicret*, also launched in 2014, promised a screen experience similar to a smartphone screen by projecting content onto the arm from a micro projector in a wristband (Robarts 2014). In an interview with Augenstein (2014) Cicret co-founder Pommier admitted that the promotional video on youtube (Cicret Bracelet 2014), with over 23 million views in June 2016, is a CGI mock up of the concept and that a working prototype is yet to be made. In June 2016, Cicret are still struggling to raise start-up funds (Cicret c2016). Both the *Ritot* and the *Cicret* concepts are much more attractive and fashionable than *Skinput* and *Skin Buttons* but the Carnegie Mellon University projects are working prototypes. Whilst not a wearable setup, Nobumichi Asai’s sophisticated projection mapping system tracks the face of the subject (Asai 2016; Landau 2016), although its limits were revealed when Lady Gaga moved a little too fast for the system to follow at the 2016 Grammy Awards. However, this is still the most impressive expression of attempts to project digital content onto the surface of human skin. Despite the unresolved limitations of these technologies, there are persistent desires to engage the skin as a digital interface.

Augmented reality projects offer amusing and, in some senses, more resolved expressions of the desire to mingle the digital and embodied. Indeed, augmented reality
explicitly facilitates the overlay of digital content with embodied spaces. However, the mingling is still mediated and viewed via a screen. The combination of content and ‘reality’ takes place via a digital camera. The augmentation is viewed on a mobile device as a combination of digital content apparently overlaid on real time feed through the camera of the device. However, the movement of the camera and screen created the illusion that the digital content was attached to the live feed content. The content is digital but the behaviour of the content feels embodied, attached to physical space. An early example of this gesture in augmented reality tattoos was made in 2009 when a Buenos Aires based company called ThinkanApp uploaded a video to Youtube demonstrating a working augmented reality tattoo (cochi79 2009). It was based on a simple strong tattoo graphic with an animated flying dragon. Their URL has since been taken over by a cosmetic surgery company and the last tweet of their twitter account was sent in February 2010. In 2011, the Youtube account ‘I Heart Chaos’ uploaded a video by ‘Cranberryzero’, who had the augmented reality trigger design from a 3DS tattooed on his forearm (I Heart Chaos 2011). The video shows the 3DS augmented reality animations active on his arm. A few months later that year, a Paris based tattoo artist known as K.A.R.L. made a video of a client receiving a tattoo that incorporated a QR code which led to a youtube video (Strohecker 2011). This simple technical solution created the illusion that the tattoo was animated when the mobile screen was held in place against the tattoo. Jenny Lee, a textiles master degree student at Central Saint Martins University of the Arts London in 2011, extends this impetus in an augmented reality project titled *Immateriality* that creates the illusion that the wearer’s face is covered with surfaces based on mineral encrustations. Lee proposes that these posthuman inspired digital skins could ultimately be viewed through augmented reality contact lenses rather than a screen. Her proposition includes an envisaged economy of digital ornamentation
Ian Haig takes augmented bodies to a somewhat gory place by creating pulsing exposed flesh animated through an augmented reality application. Haig’s title for this 2013 installation, *Fleshify the World*, references film director Cronenberg’s ‘new flesh’ of combined bodies and screens from the 1983 horror film *Videodrome*. Whilst not augmented reality tattoos, Haig’s work invokes the convergence of screens and bodies. Coincidentally, this was around the time that I first exhibited *Shifting Skin* at Deakin University Art Gallery. More recently, Oakley Mobile marketed a range of temporary tattoos for children that came “alive” through a mobile phone app called *Magic Tatts* (Oakley Mobile 2015). The ability to augment, to extend and modify the body through digital skin make manifest cyborg desires. As noted by Strohecker (2011a; 2011b), augmented reality tattoos are a literal expression of the digital embedded with the physical.

![Image](http://www.ianhaig.net/index.php?section=project&name=install&num=6)


The convergence of digital technology and skin is also expressed in the technology of printing. In collaboration with the US Department of Defence, Wake Forest Institute for Regenerative Medicine at Wake Forest University have a method for printing skin as an
alternative to skin grafting. They developed a gel medium to suspend the living skin cells that are then directly deposited into a wound using a delivery technology usually associated with inkjet printing (Emspak, n.d.; Murphy et al. 2013; Murphy and Atala 2014). Indeed, the bioprinter incorporates an off-the-shelf print head normally used in inkjet printers (Emspak 2015). Printing technology has also been applied to make marks on the skin. In 2013, three design students taking part in a one day ‘Public Domain Remix’ event came up with the idea of re-purposing a 3D printer to make tattoos by replacing the filament head with a tattoo gun. They have since developed their invention, *Tatoue*, into a working prototype (Appropriate Audiences, n.d.).

This survey of projects that deal with the surface of skin demonstrates that the synthesis of biological surface and digital skin has pushed beyond the conceptual and metaphorical. Despite the fact that some are somewhat speculative, these projects represent the impulse to enmesh, imprint and extrude the surface of the body with digital context. If digital technologies represent a form of mental prosthesis, then, as proposed by Haraway (1991, p.178) and Manning (2006, p.136), skinscapes abound.

As an entity, surface is simultaneously a material, abstract and psychological entity. Surface is the place of contact and separation, transfer and shedding, the boundary of expansion and contraction. It is a powerful guide by which to interrogate an entity, an environment within which we are immersed. It may also be employed as an epistemological metaphor with which to visualise a shift in shape and border. It is precisely this polysemic quality that makes it a rich theme for creative investigation. The shifts in register and focus are a central structure within this project. Surface is a guide, a tool with which to grasp and examine photographs as a material cultural entity and photography as a practice, a medium and a techno-cultural artefact.
COMBINED CONTEXTS

With specific reference to the work of media theorist Flusser and photographer Bernard Voita, I want to consider some ways in which surface is present and constituent in photography.

Surface is embedded as both a subject of the medium and the nature of the medium itself. Without our surroundings surfaces, we would not be bathed in reflected light. The information that we draw from the visual perception of light is fundamentally the nature and location of surfaces. When we make a photograph, when we ‘draw with light’, we are making an impression of surface, an impression of light reflected off the face of matter, delineating the borders of space. A photograph is itself a surface, a two-dimensional plane extracted, reduced from space and time, be it a physical print or presented on a screen. Surface is fundamental to photography.

Images are significant surfaces. Images signify – mainly – something ‘out there’ in space and time that they have to make comprehensible to us as abstractions (as reductions of the four dimensions of space and time to the two surface dimensions). This specific ability to abstract surfaces out of space and time and project them back into space and time is what is known as ‘imagination’... The significance of images is on the surface. (Flusser 2000, p. 8)

As alluded to by Flusser, there is a flicker, a shift, between the sense of surfaces in photography, between the surface of the medium and the surface of the subject. This is clearly articulated in the work of photographer Bernard Voita. In the late 1980s Voita became obsessed with meticulously arranging objects at specific locations and distances within his studio in order to create the illusion of a graphic ordered polka dot pattern on

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2 Whilst the screen is sometimes conceived as a portal, even a wormhole is often visualised as a tube defined by a surface boundary. However, these visualisations of wormholes as tubes are actually a reduced abstraction of 4 dimensions as 3 dimensions. More accurately, each end of the wormhole is visualised as a ball.
the surface of the image, thereby alluding to the illusion of depth, space and volume within the two dimensional plane of the image. The optical illusion draws attention to the flicker between the two-dimensional plane of the medium and three-dimensional representation, the space, depth and surface of the subject. The viewer expands the two dimensional image back into three dimensions in their imagination, based on their learnt ability to interpret the image schema.

These images are a sophisticated and resolved statements that clearly articulate the relationship between photograph as an image of a three dimensional space and the two-dimensional surface of the photograph as object. This is a fundamental paradox of surface in photography.

There is also a trajectory within contemporary photography that seeks to unwrap objects and flatten three-dimensional spaces into two-dimensional planes. Examples include Smaga’s 2007 *Skins* and Katie Breckon’s 2014 *Set This House in Order*.

Wendt’s 2011 installation *Phantasm* demonstrates a remarkable reflection on photographic surface. The translucent fabric suspended a distance from the walls of the gallery carried the ghostly phantom image of those walls. The photographs of surface literally floated in space, superimposed over their source.

As demonstrated by the shifting, wrapping and lifting qualities of surface in each of these examples, surface may be constituted in a number of forms within photographs.

Surface is an intrinsic component of photography. As a two dimensional image, the photographic plane is a form of image. As a print or presented on a screen, the photograph is a form of surface. As a medium, a photograph records the impression of light reflected off surfaces. Expanding photography is warping, unwrapping and
extruding photographic surfaces and, in the case of photogrammetry and reverse image search engines, constructing new relationships between photographic surfaces.

**CONTEXT CONCLUSION**

The context section has been a survey and discussion of work by theorists and artists that encompassed the three themes that form the boundary the problem space: surface, materiality and photography. As explained in the methodology section, the survey is part of a dialogic approach to making. It is not a separate phase in the project but enfolded as part of the development of the work. Context is a means of thickening the boundary of the problem space and reflecting potential solutions into the unknown territory, as well as excluding already existing solutions. This exploration has expanded the possibilities for thinking about the terms of the question. To summarise, surface is both an abstract and an embodied entity. Skin is an effective and rich subject with which to consider surface. In terms of materiality, the digital must be thought about as having material substance not immaterial elusiveness. Photography is both an instrument of inquiry and a contextual medium. Considered together, this survey provides the context in which the creative investigation took place.
The constraints of the question have directed the course of the creative investigation. Through a dialogue with affordances, surface has been encountered as a multi-modal entity. If the practice of photography is a method of inquiry into the shifting concept of reality, then surface is the ground on which that negotiation takes place. Surface is a boundary, screen and interface. Surface shimmers between abstract concept and embodied encounter. It is omniscient and elusive, surface is everywhere yet difficult to pin down or isolate.

As a series of works, the creative outcomes of this creative investigation collectively deploy and resolve a combination of strategies that investigate the presence and nature of surface in technical images. These strategies are:

**Scanography** with a desktop film scanner as an image capture device held directly on the skin of the subject created a highly detailed and uncannily flattened representation of surface.

**Glitch** processes, present in both the scanography and the data inversion strategy used to create the augmented reality overlay and the touch screen content, serve to disrupt the hyperreal surface of the image and provide evidence of materiality.

**Augmented reality** superimposed as a digital three-dimensional depth-map of the image over the paper-based print of the image, sets up a dialogue about materiality by placing these entities in a tied relationship.

**Touchscreen** works mingled audience sight and touch as they engaged with the work;
I undertook the process of getting a **tattoo** in order to gain an experiential understanding of this form of mark making.

**Photogrammetry** formed three-dimensional photographic forms from the relationships between overlapping images and pointed to the emergence of photographic surfaces formed from the relationships between images.

**Virtual reality** placed the viewer within the three-dimensional forms, shifting the relationship between viewer and detached image surface.

**Exhibition** was not an end point but an element of the dialogic process of making. Exhibition was conceived as part of a conversation rather than an end point or statement.

The intention was to create works that resolved these strategies into images objects that balanced the many threads and registers fed into the problem space. Indeed, the unpacking of individual strategies was a retrospective exercise, as they were not considered as separate in the making process. Creative practice as research is a means of polysemic and polyphonic thinking. As opposed to unpacking an isolated idea, the intention was to resolve the many voices and presences into a series of works that balanced the complexity of the system. Each subsequent body of work reflected on previous works and sought to articulate and resolve the problem space as a process of iteration and extension.

Instructions on how to access the works is provided in Appendix 1. A chronological summary of exhibitions and publications arising from the body of work as a whole is included in Appendix 2. These demonstrate the impact of the research project. The work has had international exposure through media coverage, exhibitions in Ireland,
the USA, Iran and online; as well as conference presentations in the USA and UK. For examination, I drew from these series of works to create an exhibition that brought together and creatively synthesised the key elements of each series.

The largest body of work produced as part of the creative investigation was *Shifting Skin*, a series of high-resolution images of skin marked by tattoos. Larger than life giclee prints had a three-dimensional augmented reality overlay comprised of a modified depth map of each image, which generated a shape created by converting the surface values to depth values. The augmented reality overlay appeared to project directly out of the image, like an extrusion of the surface into space. This work was initially exhibited at Deakin University Art Gallery in late 2013 and has since toured nationally and internationally, including the *Theorising the Web* conference exhibition in New York 2014 and a solo exhibition at the Cork Film Centre in Ireland 2016.

Figure 54: Bennett, A 2013, Installation view of *Camera* with augmented reality overlay, *Shifting Skin*, held at Deakin University Art Gallery, 24 July – 31 August 2013, <https://alisonbennett.net/2013/07/27/shiftin-g-skin-duag/>.
Most of the works for the creative investigation were initially captured using scanography. The exceptions were the photogrammetry Mesh works that were initially captured with a digital SLR and the Wrap series that were captured with a mobile phone camera.

The title Shifting Skin refers to several events. There were two exhibitions prior to the Shifting Skin exhibition at Deakin University Art Gallery, 24 July til 31 August 2013, that were also titled Shifting Skin. The first was a series of site-specific locative augmented reality installations for Projections13, a group exhibition as part of WCCA’2013 VI World Congress on Communication & Arts at Deakin University, 4 to 7 April 2013. The second exhibition was a data-projection video work, Shifting Skin: Transforming Fabric, commissioned by White Street Projects for Cube 36 @ Frankston Arts Centre 24 May to 16 June 2013. Both these exhibitions represented development phases towards the work resolved as the Shifting Skin prints with augmented reality overlay first exhibited at Deakin University Art Gallery. The two earlier exhibitions that also incorporated the Shifting Skin title represented two strategies - augmented reality and glitch - that were subsequently integrated into the larger Shifting Skin exhibition.

Whilst the strategies employed to create the works were not conceived as discrete, I will discuss some specifics of each: scanography, glitch, augmented reality, touching the screen, tattooing, photogrammetry, virtual reality, and exhibition, to unpack how the techniques provided me with a means of sifting through the possibilities of ‘surface’.
SCANOGRAPHY

The process of scanography image capture involved holding a scanner directly against the surface of the subject’s skin and moving the flatbed of the scanner around the contours of the body as the head of the scanner moved forward. I wanted to undertake a detailed examination of the surface of the skin, to collapse the distance between the skin of the subject and the surface of the capture device.

This work with subjects was undertaken with approval from Deakin University Human Ethics Advisory Group (project number HAE-12-082; Appendix 4). As explained in the ethics application, photography practice places the practitioner within an interdependent network of subjects, clients, technicians and publishers. A photographer cannot successfully work with subjects without a reputation for ethical practice and respectful conduct. Participants were initially drawn from my extended networks, as this group was familiar with my work and methods. This ensured a high degree of informed consent. These are people who know and respect my work, are informed about creative practice as research processes. The interpersonal process of informed discussion was integral to the work, as the process required a heightened level of collaboration with the subject.

The capture required that the subject and I collaborate to develop a set of predetermined moves in order to follow the topology of the skin with the flat surface of the scanner. In her essay for the Shifting Skin exhibition catalog published by Deakin University Art Gallery in 2013, Kate Warren described this as “a performative and tactile choreography of capture” (Warren 2013, p. 6). This intimate collaboration collapsed the space between the camera and the surface of the subject, “rather than her subjects being at a remove from the apparatus, they are literally touched by it” (Warren 2013, p. 6). Instead of the
subject being observed at a distance, the capture process became an intimate touching embodied movement involving both parties.

The act of rotating the flatbed scanner around the contours of the body had the effect of ‘unwrapping’ the enclosure of the skin into a flat image, echoing Serres and Connor’s conception of the skin as a extended plane (Connor 2009 pp. 26 - 29). What is more, the flat lighting of the light source within the scanner erased the contours of the body and highlighted the mesh, pores and follicles of the skin surface. The mechanics of the flatbed scanner removes the lens perspective of the camera and creates an even plane for the travelling eye. The image has an extremely narrow depth of field with virtually no space in the image plane. The scanography image scans surface, creating an analogy of surface that functions like a photogenic drawing, a contact print.

The choice of tattooed skin complicates and amplifies skin as cultural site. Speaking at the Bodily Matters: Human Biomatter in Art conference at University College London, Karly Etz observed that whilst

… Bennett’s flatbed scanner exemplifies the flatness of the resulting photograph and the body’s inability to conform to that form of representation; the tattoo actively transcends these two and three dimensional boundaries through its connections to societal interaction and the liminal qualities of the skin itself. Like a “moebius band”, tattooed skin is simultaneously internal and external, sign and signified, protective and penetrable. Utilizing this model, it is impossible to distance the sign from the body it is inherently connected to, no way of extracting that essential source of the body’s signifying power. Bennett’s description of her pieces as “skin extensions” latches onto this idea, relying on the skin’s Moebius structure in her representation of tattooed skin in order to signify not only the body’s self-hood, but also its social and cultural position within a postmodern world and the world of postmodern abstraction. (Etz 2016, pp. 7–8)
Figure 55: scanning workshop at Wyndham Arts Centre 25 October 2014. Photo by Megan Evans.

Figure 56: Bennett, A 2014, Day of the Triffids, animated gifs online, <http://goo.gl/huvZ3U>.
Glitch artefacts and processes were present in the work in two capacities. The act of scanning involved lifting the scanner off the desk and moving it about, which caused glitches. As the scanner was tilted on one side and sometime upside-down, gears would slip and crunch as the scanner head traversed behind the flat glass bed, sometimes making noises that alarmed the subject. These slippages revealed the actions and underlying architecture of the capture process - the individual colour channels of red, green and blue would break apart and extrude into streaks, echoing the linear action of
the scanner head. For example, as seen the detail of *Camera*, the glitch artefacts in the black ink of the tattoo revealed the colours in each channel that create the image surface. What is more, in order to re-engage the slipped gears, we sometimes had to reposition and lift the scanner away from the body in order to re-engage the gears of the scanner midway through a capture. This created breaks and valleys in the apparent flatness of the image, further disrupting the hermetic seal of the hyper-real surface. Part of the collaborative capture process involved showing these effects to the subject and designing movements that would both avoid and enhance these effects. Glitch was employed as a direct method of interrogating the surface. Because glitches point to the materiality of the digital, these artefacts stitch the image and the capture process to the shifting register of materiality within the research problem space.

Figure 58: Bennett, A 2013, *Temptation*, giclee print 110 x 145 cm with augmented reality overlay, *Shifting Skin*.
A glitch strategy was also employed to create the three dimensional shapes used in the augmented reality overlays in *Shifting Skin*, as well as the three dimensional shapes in works such as the *Wrap* series, *Bio Bruise*, *Spikey Monkey*, *Orb* and *Skin Room*. Focusing on the co-constitutive relationship between surface and depth, the three dimensional objects that appeared in these augmented reality and touch screen works were created by expressing the surface data - the light and dark pixel values - as depth values. The light parts of the image became peaks and the dark became valleys, like a three dimensional histogram. In the same way that a histogram allows an interrogation of the image, these depth maps created an alternative form through which to consider the surface of the image. The transformation served to bring into focus the presence of surface that was an otherwise invisible quality of the image. This is a similar strategy to that described by Temkin as ‘sonification’ (2014b). Not only does this inversion of values point to the expressive translatability of digital data, this action draws on and emphasises the co-constitutive relationship between surface and depth.

Glitch was employed as an integral strategy within the creative project. The furrows, disruptions and bulges, the breaks in the surface of the image, were a means of extracting surface in a way that brought its presence and constitution forward and allowed it to be grasped, examined and interrogated.
Figure 59: Bennett, A 2013, *Birds and Butterflies*, screenshot of augmented reality overlay, *Shifting Skin*.

Figure 60: Bennett, A 2014, *Skin Room*, animated gif online, <https://goo.gl/XJKo1b>. 
Augmented reality was employed as a means of setting up a dialogue between the physical prints and the overlaid ‘virtual’ content. This has been a significant and timely conversation within the development of the work.

Augmented reality superimposed the depth map forms directly over the physical prints. The print was not simply a trigger for the screen to load content. When viewed through the camera of a mobile screen, the forms appeared to arise directly out of the flat print image, like the mobile screen was revealing an alternate reality. The augmented overlay had a direct relationship with the trigger image, both in terms of remaining positioned over the flat surface of the image and in terms of content. The augmented reality content was a direct extrusion of the flat image and set up a dialogue between surface and depth, digital and material.

What is more, the encounter with the augmented reality works provoked an embodied response in the viewer. Visitors to the exhibition would move in an arc before the prints, holding up a mobile screen to reveal the shape of the augmented work projecting out of
The delightful aspect of the augmented reality overlay was the physical engagement of the viewer. Given that the augmented reality was not stereoscopic, in order to explore the three dimensional qualities of the augmented reality overlays on a two dimensional screen, the viewer had to move to reveal the shape of the image. The movement of the image on the screen created the illusion of a three dimensional shape. The positioning of the digital entity in physical space reveal by a screen portal reinforced the perception of a three dimensional form. Some viewers literally rolled around on the floor in an attempt to see under the overlay! These movements echoed the choreography of capture; the movements of viewer with the screen were not dissimilar to my movements with the flatbed scanner. This physical engagement of the viewer to reveal and complete the work reinforced the materiality of the embodied experience.

TOUCHING THE SCREEN

This physical engagement was also present in the online interactive works. For example, Orb and the Wrap series were best viewed on a mobile device. Touching the screen rotated the orb, a two finger pinch created zoom. The encounter with an image object becomes a haptic experience, emphasising the mingling of skin and screen, the conflation of vision and touch.

Figure 63: Bennett, A 2015, Orb, screenshot of online interactive, Australia Post Art Prize, held at 69 Smith Street Gallery, 22 January - 6 February 2016, <https://goo.gl/MUHj9G>.
Figure 64: Bennett, A 2015, Skin Wrap, photographic print & online interactive, Still in Progress …, held at Deakin University Art Gallery, 13 April – 27 May 2016, <http://goo.gl/OBTN9w>.
TATTOO

Having worked with so many subjects to make scans of their tattoos, it was important to undertake this form of mark making on the surface of my skin directly. The pattern of my grandmother’s carpet served to fold together many of the themes of the creative investigation as an embodied action. This carpet was the ground on which I learnt to think through making, to develop my capacity to think visually in three dimensions, to turn objects around and inside out in my mind, to examine how they were constructed and formed through holding a mental image. This was achieved by my grandmother teaching me the soft engineering of sewing, as well as the applied mathematics and coding language of knitting.

The floral pattern of the carpet was made up of individual thread ends, like pixel picture elements. The tuffs of wool and the pricked skin of the tattoo ink were two examples of the use of sample points to create an image surface.

The experience of receiving a tattoo resonated internally, a prolonged meditation on my relationship with my grandmother and a form of embodied encounter with the boundary between life and death. The pricking and healing of the skin represented an encounter with the convergence of skin and image.
Figure 65: Bennett, J 1979, photo of Alison and James Bennett sitting on the floor of their grandmother’s lounge room.

Figure 66: Bennett, A 2015, Carpet, video data-projection, Transduction, curated by Renata Lemos Morais for Pause Festival, held at Tech_Bar Beer Deluxe, 10 February 2015, <https://alisonbennett.net/2014/12/11/pause/>.
PHOTOGRAMMETRY

Photogrammetry was employed for both Carpet Skin (figure 67) and Mesh (figure 68), the work that wrapped the photographic surface of the gallery space around the viewer in a virtual reality headset. Digital photogrammetry was an extension of stitched panoramas, a technique I explored in my master of fine art research (Bennett 2009). However, unlike stitched panoramas that aligned overlapping images to create an unwrapped image plane, digital photogrammetry used the shift in parallax between each image to calculate the depth of the space and objects depicted. The resulting mesh was overlaid with a composite photographic image. Digital photogrammetry constitutes a form of expanded photography, a three-dimensional photography technique that has become increasingly significant in the early 21st century.
Photogrammetry results in an image object that is a form of surface generated by the relationships between images. As revealed in *Carpet Skin* and *Mesh*, the photographic texture is comprised of shards from the source images overlaid on a mesh structure. However, as clearly seen in *Mesh*, the actions of the photogrammetry software, in this case 123D Catch, is by no means ‘accurate’. The image surface bulges and folds with large gaps that reveal the uncertainty of the process. Whilst photogrammetry reconstitutes the photographic surface as a three-dimensional object, it represents an estimate rather than a replication. In the case of *Mesh*, it is as though the surface of the room has been peeled off, floating warped and crumpled.

When framed as a three dimensional forms, the image as surface becomes explicit.

*Figure 68: Bennett, A 2015, Mesh, photogrammetry and virtual reality, Tinning Street Gallery, 16 - 26 July 2015, <https://goo.gl/g0PPQo>.*
VIRTUAL REALITY

Virtual reality may be thought about as an extension of the stitched panorama (Grau 2003, p. 6) but, rather than unwrapping the space as a flattened image, the image is wrapped around the viewer. The photogrammetry reproduction of the Tinning Street gallery space and the Media Lab Melbourne exhibition space wrapped the viewer within an image surface of the space within which they were standing. This deceptively simple action highlighted the shift between physical and virtual space and the effect of image mediation. The stereographic representation of the photogrammetric form reinforced the illusion that the space in some way mapped directly onto the physical room. However, the glitches in the photogrammetric process warped and folded the image surface, bringing attention to the folds and glitches in mediation.

Figure 69: Bennett, A 2015, Mesh, screenshot of stereoscopic view, Tinning Street Gallery, 16-26 July 2015 <https://skfb.ly/FD9R>.

Figure 70: Bennett, A 2015, Mesh, screenshot from video documentation, Tinning Street Gallery, 16-26 July 2015, <https://vimeo.com/133953961>.
Figure 71: Bennett, A 2015, *Orb*, screenshot of online interactive in stereoscopic mode, Australia Post Art Prize, held at 69 Smith Street Gallery, 22 January - 6 February 2016, <https://goo.gl/MUHj9G >.
EXHIBITION

Exhibition has been an integral method within this creative investigation. The reception of the work fed back into the ongoing iterative process. More than just the physical engagement that the works provoked in the audience, exhibition was the launch point for the work to travel through media networks in the form of viral distribution. For example, stemming from a tweet by science fiction author William Gibson, the Shifting Skin work was covered by media such as Mashable and the Huffington Post. The images appeared on hundreds of websites and dozens of languages. This distribution was a direct exploration of the networked ecology for photography in the 21st century.

Figure 72: installation view of Shifting Skin works installed at Theorizing the Web, New York City, 15-16 April 2014. Photo by Aaron Thompson

3 Website documenting media coverage of Shifting Skin, <https://shiftingskinonline.wordpress.com/>.
SUMMARY OF DISCUSSION OF WORKS

The *Mesh* exhibition at Tinning Street 16 til 26 July 2015 comprised of three components.

A metal projector stand in the centre of the gallery space held a Google Cardboard virtual reality headset (figure 73). The headset contained a photogrammetry render of the Tinning Street space itself, prior to installation. The virtual reality presentation mapped the three-dimensional representation of the room over the actual space; the photogrammetry process rendered the surface with bulges and blank spaces, revealing the gaps in the representation. Because the source images for the photogrammetry were made when the gallery was empty, it created the momentary illusion that the other artworks and people in the gallery disappeared. Visitors experienced a shift and momentary confusion as they transitioned between the nested physical and mediated space. The three-dimensional image surface within the space, brought attention to the slippage of mediation.

Figure 73: Bennett, A 2015, still from video documentation showing visitor looking at photogrammetry work in virtual reality headset, *Mesh*, Tinning Street, 16-25 July 2016, <https://vimeo.com/133813696>.
Adjacent to the virtual reality work were two small photographs attached to the gallery wall. These photographs from the late 1970s show my brother and I at our grandmother’s house, sitting on her floral carpet (figure 76). This carpet became a central metaphor throughout this creative investigation. The reference to this surface drew together the contiguous active extended relationship between skin and ground, image and internal action.
Four cardboard panels attached to one wall were covered with a patchwork of images and text (figure 78). Structured in a similar way to this exegesis, the images and text reflected the research and context for the creative works; and documented the exhibitions that lead up to the Tinning Street installation. Rather than presenting the works as appearing fully resolved without labour or context, this component of the installation demonstrated the
fragmented complexity of the sources that fed into the resolved works. Rather than didactic panels, this competent of the exhibition was informed by dialogic processes.

A large framed print with augmented reality overlay, *Camera*, was hung at the back of the gallery (figure 79). This image from the *Shifting Skin* series represents a resolved statement of the problem space as a counterpoint to the dialogic panels.
I have sought to create works that integrated the themes and methods into resolved polysemic entities that balanced a number of voices, which shifted between registers.
NEW SURFACES

As a result of undertaking the creative investigation within the problem space bounded by photography, materiality and surface, I propose that the field of investigation can be usefully visualised as comprising of forms of mesh and that digital images be conceived as ‘enmeshed’ rather than the dominant posthuman metaphor of ‘embedded’.

I argue that this shift in metaphor opens up more useful vectors for conceiving of the presence of image as surface. Specifically, emergent forms of mesh can be observed in two operations: photogrammetry and reverse image search engines. Both of these operations are functions of the algorithmic turn and are driven by computer vision; also known as image recognition algorithms. With reference to Flusser’s proposition that the structure of thought is mediated by the geometry of media (Flusser and Ströhl 2002, pp. 25–26), I speculate that these emergent surface structures may have significant epistemological implications.

 Whilst it can be argued that images have always been in dialogue with and connected to other images, this has been amplified and made more tangible by digital media and the algorithmic turn. Image recognition algorithms have played a significant role in the reconstitution of digital photographic surfaces and structures. Two examples of this process are:

1. Photogrammetry - the algorithmic building of three dimensional surfaces and forms from sets of overlapping two dimensional images taken from different perspectives.
2. Reverse Image Search Engines – image recognition search algorithms such as Google Search by image.

Both these applications draw out relationships between images that have both surface and depth. Photogrammetry builds form and surface from the relationship between overlapping photographic images, whereas Reverse Image Search Engines draw complex networked relationships between images that may be visualised as a three dimensional mesh.

Given the emergence of sorting algorithms for images that do not rely on representational content, we find ourselves at a moment where the taxonomy of image mediated knowledge and culture has been shifted in a profound way – from representational content to formal visual elements.

If we extend Flusser’s contention that technologies impose shape and structure on thought and knowledge to consider the implications of computer vision mediated search by image engines, how might we begin to conceive of how the organising of images via computer vision structures and facilitates ways of knowing and perceiving?

The technology we use facilitates the form of knowledge, the geometry of thought possible. It shapes and facilitates the structural paradigm though with we comprehend our world. If digital photographs are a dominant form of online communication, the “hinge” as Rubinstein and Fisher termed it, between the material and virtual (Rubinstein and Fisher 2013, p. 8); and if that form of communication and thought is grouped, shaped and arranged according to formal patterns of intensities of light rather than content and
representation, then the algorithmic turn of the image marks another breakpoint with the photograph’s historical tie to representation.

This may be a passing phase given the emergence of deep learning AI capable of associating language with image content (Vinyals et al. 2014), but it does offer a moment of insight into the implications of the shift towards a semantic web. Given the connection with emotional desires met by smartphones and social media, we may not notice as we pass through the wormhole.

PROPOSITION

What if we were to expand Bland’s merged search by image results with the spatial thinking that informed Art + Com’s 3D visualisation? Drawing on the ideas embedded in photogrammetry - that the relationships between images can be conceived spatially rather than serially and that the organisational algorithms that utilise computer vision have structural implications - I speculate that the epistemological structure generated by organisational algorithms such as Google’s Search by image may be conceived as a mesh structure like a sponge or a 3D Voronoi mesh.

In running this thought experiment, this systemic structure may be conceived as a generative structure that morphs and bifurcates with enormous complexity. Unlike the linear sequence visualised by Art+Com, the relationships generated between images by reverse image search engines are exponential - each generation branches potentially infinitely, like a tree or a mandelbrot set.
How does one map the surface of a sponge? Rather than creating a merged composite, spatial values could be assigned to the shifts in colour and shape within the succeeding generation of images. Where *The Invisible Shape of Things Past* created space and surface between images based on camera movement over time, we could visualise a structure based on the shifts, the differences in colour and shape between successive generations of images sourced via a search by images.

Whilst there are numerous examples of visualisations that map the geometry of the internet and demonstrate the web-like networked structure of internet sites based on hyperlinks between web pages, a visualisation of fractal like generative relationships between images wrought by the application of computer vision on technical images demonstrates an emerging structure of the relationship between images. This structure has implications in terms of how we access information and how we think about that information.

The conception of this model has arisen through the process of creative practice, of handling the artefacts generated in dialogue with the apparatus, fertilised by research and reading.

**EMERGENT PHOTOGRAPHIC SURFACES CONCLUSION**

If photographs are a form of surface, then there is a stretching and a reaching within those planes, they are displaced, depth-mapped. As they are displaced and stretched, they begin to contact and merge with other images through organisational structures that are not related to the representational content of the technical image. Computer vision mediates new relationships between technical images.
The geometric spatial structure of mediating technologies has a profound impact on the potentials of conceptual paradigms. This section has described a shape bounded and described by surface. But it is not a fixed static shape or surface. It is a structural system generated by a set of conditions. These conditions have arisen through the emergence of computer vision as an organisational tool. And the present description is nothing more than a snapshot of a given moment that is already receding. This is an attempt to create a plane for reflection in order to be oriented within the click and flow of emerging algorithmic environments for images as a form of thinking.
WRAP

To recap, throughout this exegesis I have articulated a process of dialogic making that aligns with posthuman precepts. Making is a dialogue with affordances, materials, media, processes, subjects, audience and previous works that seeks to enact a form of thinking in and through these complex domains.

Through a process of creative investigation, of direct engagement with the medium, these bodies of work have activated layered coexisting registers of surface in photography as a digital medium. Ways in which this was achieved included the use of high-resolution scans of skin that occupied the ambiguous space between biological and digital surfaces. The inextricable relationship between surface and depth was made tangible through the deployment of depth mapping as a conceptual strategy.

The Shifting Skin series of augmented reality works thus set up a dynamic relationship between photographic surface as physical print and photographic surface as a digital entity on a screen.

The exploration of photogrammetry in works such as Mesh extended this slippery shimmer between physical surface and the lifted image by exhibiting the photogrammetry model within the space that it represented. Presentation via a virtual reality head mounted display wrapped the surface of the image around the viewer, bringing attention to the gap between the space and the image of the space.

Later works such as Bruise worked in an online interactive context where the surface of the image of skin literally responded to touch on the screen or via the prosthetic reach of a
mouse. This activated an embodied experience of the convergence of biological skin with
digital surface, the co-mingling of touch and vision.

Returning to the question, ‘given the dematerialisation of the photographic image, to what
extent can a photograph be regarded as having a surface?’, the answer is not simply one of
extent. Surface is fundamental to photography and is folded throughout the medium.
Surface is an effective conceptual guide with which to investigate photography, but it is not
a simple analogy. Surface can slip between registers in a way that mirrors the porous
slipperiness of photography. Surface is a verb and a noun, an abstract concept and a
material imperative. Surface is a polyvalent entity that is elusive and flexible in similar
ways to photography as a medium and a practice. It is a useful model with which to
conceptualize this ubiquitous medium. There are several forms in which surface is present
in digital photographs. A photograph may be conceived as an impression of surface - of
light reflected off surface. A photograph is itself a surface, a two-dimensional plane
extracted, reduced from space and time, be it a physical print or presented on a screen.

Photography as a medium is expanding, thickening, and extruding. Whilst the panorama
and stereoscope predate photography, the impulses and desires embedded in these
trajectories is extending through 21st century photography to include immersive
presentations that wrap around the viewer in the form of photogrammetry, augmented
reality and virtual reality. The desire for photogrammetry was present at the birth of
photography, however the current digital proliferation represents the emergence of new
forms of composite photographic surface that is formed over the 3D mesh generated by
the shifts between each overlapping image. Extending Flusser, expanded photography
means that the epistemological shape and structure of the media has changed. Examples
include reverse image search engines that generate algorithmic structures that connect the distributed album like a conceptual sponge or mesh.

Projecting forward, the implications of light field photography shift the photograph from an image as plane to image as field. The photographic surface is thickening.

I want to leave the reader with the image of the delicate complex mesh of the skin that was captured by direct contact with the apparatus. Not only is the skin a complex cultural plane that reflects the complex mingling of self and world but the surface of the skin has depth that captures light within its translucent surface. Its reflection has a complex diffuse depth.

Figure 80: Bennett, A 2013, Mesh scar, detail, giclee print 110 x 145cm and online, Shifting Skin, <http://goo.gl/Y8Reqj>.
Figure 81: Bennett, A 2013, Mesh scar, giclee print 110 x 145cm and online, Shifting Skin, <http://goo.gl/Y8Reqj>.
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APPENDIX 1: INSTRUCTIONS FOR ACCESSING WORKS"

The following appendix of works includes augmented reality, virtual reality, moving image and screen based content that may be accessed by a mobile device. This will be indicated in figure captions with the use of hash tags.

#AR: augmented reality

#QR: quick response tag web and based content

#TOUCHSCREEN: best experienced via a touch screen

#VR: virtual reality
INSTRUCTIONS: AUGMENTED REALITY

Images with augmented reality overlay are tagged #AR in the associated caption. The augmented reality content utilised the Aurasma app that can be downloaded to a mobile device from iTunes or Googleplay. You do not need to create an account to use the app.

The Aurasma interface has the following options at the bottom of the screen.

In order to activate and access the augmented reality content for this project,

1. within the app interface, touch the Aurasma icon to open the menu,

2. navigate to the search function and search for the ‘Shifting Skin’ channel.
‘Follow’ the channel to make the device receptive to the content.

3. Return to the viewing screen by touching the frame icon and point your device's camera at the trigger image. When the augmented reality content loads you can move the screen around the 3D content projecting out of the physical print. You will need to keep the trigger image within the view of the camera.
INSTRUCTIONS: ONLINE & INTERACTIVE CONTENT

Web links and QR codes link to online screen content. In addition to a QR code located just below the figure caption, the images with online components will be tagged #QR as part of the figure caption. Interactive content can also be manipulated on a desktop with a mouse but is particularly effective when viewed on a smart phone. The content may be rotated by stroking the mobile screen and zoom is operated with a two finger pinch.
INSTRUCTIONS: VIRTUAL REALITY

Virtual Reality content can also be accessed online. Three dimensional objects hosted on Sketchfab can be viewed in stereo on a smart phone by touching the Google Cardboard symbol in the lower right hand side of the screen and placed in a virtual reality head mounted display such as Google Cardboard. The object will rotate with the movement of the smart phone. Works that can be viewed in stereo will be tagged #VR. It is not absolutely necessary to see these works in stereo mode with a head mounted display but it does add a different form of encounter to the experience.

Figure 82: Screenshot of Sketchfab interface host 3D content. Note Google Cardboard symbol in lower right hand corner of the image.

Figure 83: Screenshot of 3D object hosted on Sketchfab viewed in stereo mode.

Figure 84: Phone placed in head mounted display.
APPENDIX 2: CREATIVE WORKS

Following is a chronological summary of exhibitions and publications that demonstrate the impact of the research project. The work has had international exposure through media coverage, exhibitions in Ireland, the USA, Iran and online; as well as conference presentations in the USA and UK.

Figure 85: screenshot of Projections13 website, <https://projections13.wordpress.com/2013/03/23/alison-bennett-shifting-skin/>.
This work consisted of site-specific locative augmented reality artworks. A number of virtual objects were installed around the WCCA venue buildings at Deakin Waterfront Campus; these works were revealed when viewed with a mobile screen through an augmented reality app. The distorted surface of the building appeared to project out of the wall.

Figure 86: locations of *Shifting Skin* augmented reality installations as part of Projections13.

Figure 87: location of one of the *Shifting Skin* augmented reality installations. This image can also act as a trigger image for the augmented reality content. #AR

Figure 88: invitation to Bennett, A 2013, *Shifting Skin: Transforming Fabric*, video data-projection, commissioned by White Street Project with the support of Arts Victoria, held at Cube 37 at Frankston Arts Centre, 24 May – 16 June 2013, <http://alisonbennett.net/2013/05/24/Cube37>.
Figure 89: still from installation documentation of Bennett, A 2013, *Shifting Skin: Transforming Fabric*, video data-projection, commissioned by White Street Project with the support of Arts Victoria, held at Cube 37 at Frankston Arts Centre, 24 May – 16 June 2013, <http://alisonbennett.net/2013/05/24/Cube37>.

Figure 90: installation view of Bennett, A 2013, Camera, giclee print 110 x 132cm with augmented reality overlay, Shifting Skin.

Figure 91: installation view of Bennett, A 2013, Shifting Skin, giclee prints with augmented reality overlay, held at Deakin University Art Gallery, 24 July – 31 August 2013, <https://alisonbennett.net/2013/07/27/shifting-skin-duag/>.
Media highlights:


Bennett, A 2013, Shifting Skin, giclee prints with augmented reality overlay, Sydney Gay and Lesbian Mardi Gras visual arts program with financial assistance from LINC, held at 10x8 Gallery, 25 February – 9 March 2014, <https://alisonbennett.net/2014/02/25/10x8gallery/>.

Figure 92: installation view of Bennett, A 2013, Shifting Skin, giclee prints with augmented reality overlay, Sydney Gay and Lesbian Mardi Gras visual arts program with financial assistance from LINC, held at 10x8 Gallery, 25 February – 9 March 2014, <https://alisonbennett.net/2014/02/25/10x8gallery/>.

Media highlights:


**Figure 94**: installation view of Bennett, A 2013, *Shifting Skin*, giclee prints with augmented reality overlay, exhibited at *Theorizing the Web* conference exhibition, New York City, 15-16 April 2014, <https://alisonbennett.net/2014/04/27/ttw/>.

*Figure 95*: installation view of Bennett, A 2013, *Shifting Skin*, giclee prints with augmented reality overlay, exhibited at *Theorizing the Web* conference exhibition, New York City, 15-16 April 2014, <https://alisonbennett.net/2014/04/27/ttw/>.

Figure 96: installation view of Bennett, A 2013, Shifting Skin, giclee prints with augmented reality overlay, held at Swan Hill Regional Art Gallery, 18 July – 24 August 2014, a Deakin University Art Gallery touring exhibition, <http://alisonbennett.net/2014/07/04/swanhill>.

Media highlights:

- Evening news report, WIN TV News coverage, July 2014
- Interview, ABC Local Radio: Mildura – Swan Hill, July 2014
Bennett, A 2013, *Shifting Skin*, giclee prints with augmented reality overlay, held at Wyndham Cultural Centre, 2 September – 3 November 2014, a Deakin University Art Gallery touring exhibition, <https://alisonbennett.net/2014/07/06/wyndham/>.

Figure 97: installation view of Bennett, A 2013, *Shifting Skin*, giclee prints with augmented reality overlay, held at Wyndham Cultural Centre, 2 September – 3 November 2014, a Deakin University Art Gallery touring exhibition, <https://alisonbennett.net/2014/07/06/wyndham/>.

Figure 98: invitation to Bennett, A 2013, *Shifting Skin*, held at Wyndham Cultural Centre, 2 September – 3 November 2014, a Deakin University Art Gallery touring exhibition, <https://alisonbennett.net/2014/07/06/wyndham/>.
Media highlights:


Figure 99: Screenshot of Facebook post by Cork Film Centre about Shifting Skin.
A SELECTION OF SHIFTING SKIN WORKS:

Figure 100: Bennett, A 2013, Camera, giclee print 110 x 132cm with augmented reality overlay, Shifting Skin. #AR
Figure 101: Bennett, A 2013, *Birds and Butterflies*, giclee print 110 x 145cm with augmented reality overlay, Shifting Skin. #AR
Figure 102: Bennett, A 2013, Zombie Nurse, giclee print 110 x 145cm and augmented reality overlay, Shifting Skin. #AR
Figure 103: Bennett, A 2013, Dragon Girl, giclee print 145 x 110cm with augmented reality overlay, Shifting Skin. #AR
Figure 104: Bennett, A 2013, Duchamp, giclee print 110 x 145cm with augmented reality overlay, Shifting Skin. #AR
Figure 105: Bennett, A 2013, *Zombie Nurse*, giclee print 110 x 145cm with augmented reality overlay, *Shifting Skin*. #AR
Figure 106: Bennett, A 2013, *Mother*, giclee print 165 x 110cm with augmented reality overlay, *Shifting Skin*. #AR
Figure 107: Bennett, A 2013, *Mesh scar*, giclee print 110 x 145cm and online, Shifting Skin, <http://goo.gl/Y8Reqj>. #QR #ZOOM
Figure 108: Bennett, A 2013, Ankh, giclee print 110 x 145cm, Shifting Skin, <http://goo.gl/Zqzmo8>. #QR #ZOOM


Media Highlights:


Bennett, A 2014, *Light Lines*, video, screened on Federation Square big screen as part of the *Light in Winter Festival*, <https://alisonbennett.net/2014/06/03/lightlines/>.

Figure 110: still from Bennett, A 2014, *Light Lines*, video, screened on Federation Square big screen as part of the Light in Winter Festival, <https://alisonbennett.net/2014/06/03/lightlines/>.

Figure 111: installation view of Bennett, A 2014, *Light Lines*, video, screened on Federation Square big screen as part of the Light in Winter Festival, <https://alisonbennett.net/2014/06/03/lightlines/>.

Figure 112: Bennett, A 2014, *Day of the Triffids*, animated gifs online, <http://newhive.com/alleykat2/triffids>.

Figure 113: Bennett, A 2014, *Day of the Triffids*, animated gifs online, <http://newhive.com/alleykat2/triffids>.
Figure 114: Bennett, A 2014, *Day of the Triffids*, animated gifs online, <http://goo.gl/huvZ3U>. #GIF #QR

Figure 115: Bennett, A 2014, Persona, print and augmented reality overlay, Quo Vadis: the last drawing show, curated by David McNeill, held at UNSW Galleries, National Institute for Experimental Arts, College of Fine Arts UNSW, 20 September – 11 October 2014, <https://alisonbennett.net/2014/07/07/quovadis/>.

#AR

Figure 116: stills from Bennett, A 2014, *Skin Room*, animated gif, held at Widget Art Gallery [online], 16 October - 16 November 2014, <https://alisonbennett.net/2014/07/23/widget-art-gallery/>.
Figure 117: still from Bennett, A 2014, *Skin Room*, animated gif online, <https://goo.gl/XJKo1b>. #GIF #QR
Figure 118: still from Bennett, A 2015, Carpet, video data-projection, Transduction, curated by Renata Lemos Morais for Pause Festival, held at Tech_Bar Beer Deluxe, 10 February 2015, <https://alisonbennett.net/2014/12/11/pause/>.

Figure 119: still from Bennett, A 2015, Carpet, video data-projection, Transduction, curated by Renata Lemos Morais for Pause Festival, held at Tech_Bar Beer Deluxe, 10 February 2015, <https://alisonbennett.net/2014/12/11/pause/>.
**Bennett, A 2015, Mesh, held at Tinning Street Gallery, 16-26 July 2015, <https://alisonbennett.net/2015/04/26/tinning/>.**

Figure 120: Bennett, A 2015, Mesh, photogrammetry virtual reality, <https://goo.gl/JwBTLC>. #QR #TOUCHSCREEN#VR

Figure 121: Bennett, A 2015, Mesh, stereoscopic mode, photogrammetry virtual reality, <https://goo.gl/JwBTLC>. #QR #TOUCHSCREEN#VR
Figure 122: Bennett, A 2015, installation view showing virtual reality headset and photograph attached to the gallery wall, *Mesh*, Tinning Street, 16-26 July 2015.

Figure 123: Bennett, J c1979, photo of Alison and James Bennett sitting on the floor.

Figure 124: Bennett, A 2015, *Carpet Skin*, photogrammetry animated gif, <https://goo.gl/sy8B74>. #QR #GIF
Figure 125: installation view of Bennett, A 2015, *Mesh*, Tinning Street, 16-26 July, <https://alisonbennett.net/2015/04/26/tinning/>.

Figure 126: Bennett, A 2015, installation view of *Camera*, Mesh, held at Tinning Street, 16-25 July 2015.

Figure 127: still from Bennett A 2015, Mesh 2, virtual reality, ImMEDIATE, held at Media Lab Melbourne, 18-20 December 2015, <https://alisonbennett.net/2015/09/16/immediate/>.

Figure 128: installation view of Bennett A 2015, *Mesh 2, virtual reality, ImMEDIATE, held at Media Lab Melbourne, 18-20 December 2015*, <https://alisonbennett.net/2015/09/16/immediate/>.
Bennett, A 2016, Orb, virtual reality and online, Australia Post Art Prize, held at 69 Smith Street Gallery, 22 January - 6 February 2015, <https://alisonbennett.net/2015/09/16/australia-post/>.

Figure 129: Bennett, A 2015, Orb, screenshot of online interactive, Australia Post Art Prize, held at 69 Smith Street Gallery, 22 January - 6 February 2016, <https://goo.gl/MUHj9G> #QR #VR #TOUCHSCREEN
Bennett, A 2015, Wrap, three photographic prints and online interactive, Still in Progress ..., held at Deakin University Art Gallery, 13 April – 27 May 2016, <https://alisonbennett.net/2016/03/27/wrap/>.

Figure 130: Bennett, A 2015, Skin Wrap, print 33 × 33 cm and online interactive, <http://goo.gl/OBTN9w>. #QR #TOUCHSCREEN
Figure 131: Bennett, A 2015, *Rust Wrap*, giclée print 33×33 cm and online interactive, <http://goo.gl/g6gHDe>. #QR #TOUCHSCREEN
Figure 132: Bennett A 2015, *Cloud Wrap*, print 33 × 33 cm and online interactive, <http://goo.gl/SyXVTG>. #QR
#TOUCHSCREEN
Bennett A 2016, Six online interactive artworks, #NFCDAB Wrocław Biennale of Digital and Internet Art, Wrocław, Poland, June 2016, <https://alisonbennett.net/2016/05/24/nfcdab/>.

Figure 133: Installation view of #NFCDAB Wrocław Biennale of Digital and Internet Art, Wrocław, Poland, June 2016, <https://www.facebook.com/groups/1nfcdabiennale/>.

Figure 135: still from Bennett, A 2015, *Bio Bruise*, screen and online interactive, <http://goo.gl/dKa8VC>. #QR #TOUCHSCREEN
APPENDIX 3: PUBLICATIONS AND PRESENTATIONS

Summary of publications and presentations:

- Bennett, A 2013, 'Shifting Skin', AR[t], no.4, pp.26-31, <http://www.arlab.nl/media/art-magazine-issue-4-online>

- Bennett, A 2014, artist talk presented at OpenLAB, Media Lab Melbourne, held at The Dock, 5 October 2014, <https://alisonbennett.net/2014/09/28/openlab/>


APPENDIX 4: ETHICS APPROVAL

Project number HAE-12-082
DEAKIN UNIVERSITY HUMAN ETHICS ADVISORY GROUP (HEAG)
LOW RISK APPLICATION FORM

**Project Title:** The shifting surface in digital photography

**Proposed Start Date:** September 2012  
**Proposed end date:** 12 March 2016

**Principal Investigator/s:** James McArdle

**Student Researcher/s (if applicable):** Alison Bennett

**Degree/s for which student/s enrolled:** PhD / A900

**School:** Communication & Creative Arts  
**Faculty:** Arts & Education

**Contact Telephone No:** 924 68234

**Email:** james.mcardle@deakin.edu.au

**Other researchers involved in the project:**

<table>
<thead>
<tr>
<th>Name</th>
<th>Role</th>
<th>Contact email address</th>
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<tbody>
<tr>
<td>Kim Vincs</td>
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</tr>
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Please note: As of 2 April 2012, all first time applicants are required to complete compulsory human research ethics training prior to submitting their first ethics application to DUHREC or a Faculty HEAG. Details can be found on the [human research ethics website](#).
PART A: Excluded Categories (See National Statement 5.1.6)

1 Does your project focus on any of the following? NO

- Aboriginal or Torres Strait Islander Peoples or issues;
- Research involving pregnant women or the human foetus;
- People highly dependent on medical care who may be unable to give consent;
- People with a cognitive impairment, an intellectual disability, or mental illness;
- People who may be involved in illegal activities;
- Interventions and therapies, including clinical and non-clinical trials and innovations;
- Human genetics;
- Human stem cells;
- Projects involving ionizing radiation;
- People in countries that are politically unstable, where human rights are restricted; and/or where the research involves economically disadvantaged, exploited or marginalized participants from such countries;
- Projects involving active concealment or planned deception of participants.
- Collection of identifiable personal information, without permission from the person identified
- Risk of harm to participants (more serious than discomfort, National Statement 2.1.6)

If your project focuses on ANY of these elements, it is not eligible for low risk review. You should complete the Full Ethical Review Application for DUHREC.

2 Does your project involve ethical review by another organisation? NO

If yes, your project is not eligible for review by HEAG. You should consult the Human Research Ethics Manual regarding the Prior Approval processes.

3 Does your project involve ONLY use of existing collections of non-identifiable data? NO
(Data are non-identifiable when they do not identify the people to whom the information relates – identifiers should never have been collected, or should have been permanently removed from the data set before you received it.)

If yes, you should complete the application form for Exemption from Ethical Review.
PART B: Checklist

This checklist will help you decide whether your research may be submitted for Expedited Review. Research is eligible for Expedited Review if it is low risk (the foreseeable risk level is no more than discomfort).

If you answer 'YES' to any items on the checklist your project is not eligible for expedited review unless you can explain how this potential risk will be managed or minimised to ensure that the project remains low risk. This should be explained in the special case assessment section (section 6) below.

It is your responsibility to assess the level of risk associated with your project. If your project is not considered low risk by the HEAG, you will be required to complete the application for DUHREC approval.

1 Are any of the following topics to be covered in part or in whole?

<table>
<thead>
<tr>
<th>Topic</th>
<th>YES</th>
<th>NO</th>
</tr>
</thead>
<tbody>
<tr>
<td>Parenting</td>
<td>☑</td>
<td></td>
</tr>
<tr>
<td>Sensitive personal issues</td>
<td>☑</td>
<td></td>
</tr>
<tr>
<td>Sensitive cultural issues</td>
<td>☑</td>
<td></td>
</tr>
<tr>
<td>Grief, death or serious/traumatic loss</td>
<td>☑</td>
<td></td>
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<tr>
<td>Gambling</td>
<td>☑</td>
<td></td>
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<tr>
<td>Eating disorders</td>
<td>☑</td>
<td></td>
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<tr>
<td>Illicit drug taking</td>
<td>☑</td>
<td></td>
</tr>
<tr>
<td>Substance abuse</td>
<td>☑</td>
<td></td>
</tr>
<tr>
<td>Self report of criminal behaviour</td>
<td>☑</td>
<td></td>
</tr>
<tr>
<td>Any psychological disorder, depression, mood states and/or anxiety</td>
<td>☑</td>
<td></td>
</tr>
<tr>
<td>Suicide</td>
<td>☑</td>
<td></td>
</tr>
<tr>
<td>Sexuality, sexual behaviour or gender identity</td>
<td>☑</td>
<td></td>
</tr>
<tr>
<td>Race or ethnic identity</td>
<td>☑</td>
<td></td>
</tr>
<tr>
<td>Any disease or health problem</td>
<td>☑</td>
<td></td>
</tr>
<tr>
<td>Fertility</td>
<td>☑</td>
<td></td>
</tr>
<tr>
<td>Termination of pregnancy</td>
<td>☑</td>
<td></td>
</tr>
</tbody>
</table>

2 Are any of the following procedures to be employed?
<table>
<thead>
<tr>
<th>Activity</th>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td>Use of personal data obtained from Commonwealth or State Government</td>
<td></td>
<td></td>
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<tr>
<td>Department/Agency</td>
<td></td>
<td></td>
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<tr>
<td>Concealing the purposes of the research</td>
<td></td>
<td></td>
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<tr>
<td>Covert observation</td>
<td></td>
<td></td>
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<tr>
<td>Audio or visual recording without consent</td>
<td></td>
<td></td>
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<tr>
<td>Recruitment via a third party or agency</td>
<td></td>
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<tr>
<td>Withholding from one group specific treatments or methods of learning,</td>
<td></td>
<td></td>
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<tr>
<td>from which they may ‘benefit’ (eg in medicine or teaching)</td>
<td></td>
<td></td>
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<tr>
<td>Psychological interventions or treatments</td>
<td></td>
<td></td>
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<tr>
<td>Administration of physical stimulation</td>
<td></td>
<td></td>
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<tr>
<td>Invasive physical procedures</td>
<td></td>
<td></td>
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<tr>
<td>Infliction of pain</td>
<td></td>
<td></td>
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<tr>
<td>Administration of drugs or placebos</td>
<td></td>
<td></td>
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<tr>
<td>Administration of other substances</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Use of medical records where participants can be identified or linked</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
3 PARTICIPANT VULNERABILITY ASSESSMENT

Does the research specifically target participants from any of the following groups?

<table>
<thead>
<tr>
<th>Category</th>
<th>YES</th>
<th>NO</th>
</tr>
</thead>
<tbody>
<tr>
<td>Children or young people under 18 years</td>
<td></td>
<td></td>
</tr>
<tr>
<td>People with a physical disability or vulnerability</td>
<td></td>
<td></td>
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<tr>
<td>People whose ability to give consent is impaired</td>
<td></td>
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<tr>
<td>Residents of a custodial institution</td>
<td></td>
<td></td>
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<tr>
<td>People unable to give free informed consent because of difficulties in understanding the Plain Language Statement or Information Sheet (e.g. language difficulties)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Members of a socially identifiable group with special cultural or religious needs or political vulnerabilities</td>
<td></td>
<td></td>
</tr>
<tr>
<td>People in dependent or unequal relationship with the researchers (e.g. lecturer/student, doctor/patient, teacher/pupil, professional/client)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>People with existing relationships with the researcher (e.g. relative, friend, co-worker)</td>
<td></td>
<td></td>
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<tr>
<td>People in a workplace setting with the potential for coercion or problems of confidentiality (e.g. employer/employee)</td>
<td></td>
<td></td>
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<tr>
<td>Participants able to be identified in any final report when specific consent for this has not been given</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Persons not usually considered vulnerable but would be thought so in the context of the project</td>
<td></td>
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</tbody>
</table>

4. RESEARCH IN OVERSEAS SETTINGS ASSESSMENT

Does the research involve any of the following:

<table>
<thead>
<tr>
<th>Category</th>
<th>YES</th>
<th>NO</th>
</tr>
</thead>
<tbody>
<tr>
<td>Research being undertaken in a politically unstable area</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Research involving sensitive cultural issues</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Research in countries where criticism of government and institutions might put participants and/or researchers at risk</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

5. OTHER RISKS

Are there any risks to the researcher, (e.g. research undertaken in unsafe environments or trouble spots)? | YES | NO |
6. **SPECIAL CASE ASSESSMENT**

If you have answered ‘YES’ to an item in the checklist but you still believe that because of the particular nature of the project and the participants your project may still be eligible for expedited review. Please provide details below, or attach an additional sheet.

**SPECIAL CASE DETAILS:**

Some scans of skin may include features such as scars that may be associated with sensitive issues for some people. However, as outlined in the following application, the project will only involve participants who are engaged by the project and who actively want to participate. In case of an unexpected instance where a participant was to find that the process triggers uncomfortable feelings, we will have the contact details of Deakin counselling service on hand.

The participants are either known to me, or part of my extended networks. The process of networking and negotiation is integral to the project and the quality of the outcomes. The participatory process of informing and consent is integral to the integrity of the outcome. Participants drawn from my extended networks will ensure a higher level of informed consent.

My students will be excluded from participating.

**PART C: PROJECT**

1 **Aims of the project**

‘God made volume but surface is the devil’s work’ – Wolfgang Pauli

Given the dematerialisation of the photographic image, to what extent can a photograph be regarded as having a surface?

This creative practice research project will examine the shifting surface in digital photography.

The project will produce a body of studio work, supported by an exegesis, which interrogates and extends modes of representation of digital images. This will contribute to the ongoing broader dialogue, both visual and written, that is seeking to articulate the implications and possibilities of the dematerialisation of the photographic image.

Now, ‘for the first time in history ... the image is a dynamic system.’ (Rush, M 2005, p. 181) The photograph is no longer a physical object but a collection of numbers translated at recall. The dominant mode of encounter with photographs has become the screen. This encounter could be characterised as a cascade, a flow, rather than a fixed image or print. We are urged to click through to the next encounter, one no longer contemplates a fixed image (2005, p.220). The image-skin has become dematerialised and fluid.
The shift from physical print to a screen based digital ecology has created a new paradigm for photography. Whilst this was heralded as the death of photography and characterized as the post-photography debate in the 1990s (Koop 1995, MCA 1996), the outcome could be characterised more as hyper-photography with the photographic environment proliferating at an inconceivable rate. For example, Facebook was recently estimated to host over 140 billion images (Yarrow, J 2011).

Furthermore, the phenomenology of photography, the experience of encountering a photograph, has shifted from a fixed plane to part of a dynamic, interconnected network. This shift was anticipated by Flusser in 1988 when he described the shift in models of thinking from linear writing, to the imaginative surface of the photograph through to the complex structural thinking facilitated by the computerised image. Uricchio (2012) has characterized the ‘changing implications of the image’ as ‘the algorithmic turn’, pointing to the shift in the viewer position effected by photographic applications such as Photosynth, which creates a dynamic three dimensional virtual space out of a set of images and radically disrupts our traditional relationship to the photographic image. Applications such as the recently introduced facility within Google Image Search to search via image files, as opposed to text, radically shifts photographs from a standalone plane or surface, to part of an interconnected network of image membranes (Media Watch 2012).

This research builds on my MFA research, which dealt with experimental representations of space via digital stitched photographic panoramas (Bennett 2009). The exegesis included consideration of surface as membrane and the enfolding of interior and exterior.

Pauli uses the terms ‘surface’ and ‘volume’ interchangeably, suggesting that space is indivisible from surface (Pauli, W 1956 p.30). Pringle argues that comprehension of space is a function of embodiment. ‘We know space through our knowledge of our bodies, but since that knowledge is itself uncertain, space too is uncertain, subjective, and contingent’ (Pringle, P 2004), therefore strengthening the potential to draw a relationship between the digital image skin and the physical encounter. Indeed, in 2004 Benthien suggests that touch will be the ‘guiding sense for new media’. The question of embodiment in digital aesthetics has been examined further by Munster (2006), White (2009) and Sullivan (c2009).

Surface may be considered as a form of skin (Hauser, J 2008; Benthien, C 2004; Ahmed, S 2001), a porous membrane that functions as an interface between the internal and external. Starosielski initiates an examination of the metaphorical interplay of skin as a biological/cultural entity and skin as the surface of digital media. ‘Just as this metaphor of skin is used to understand the interface, we increasingly use the metaphors of the digital media interface to make sense of our own skin.’(2007 pp.39)

Skin is a primary surface; it is the ultimate boundary and the site of subjectivity. It is the surface by which we perceive the other, all that are not us.

Given the metaphorical and theoretical analogies between surface and skin, it is proposed that a component of this creative practice research project include images of skin that examine questions of embodiment in relation to the encounter with the digital image. The aim is to test the metaphorical and poetic potential of skin as a subject.

2 Research design and methods
Give a concise and simple description of the proposed research design and the methods to be used. Please include all data collection procedures and all groups of participants.

In order to investigate the nature of surface in digital photography, I will develop creative works that engage with consideration of the surface in photography in terms of content, formal presentation and technical implications.

Photographic surface will be considered from a number of perspectives. The project will not deal simply with the representation of surface – the reflection of light off physical objects – but consider the shifting surface of the medium itself, its dematerialisation and reconstitution.

This is a creative practice as research project in the field of digital photography. Given there is some fluidity between the terms ‘practice-based’ and ‘practice-led’, I generally use the term ‘creative practice as research’.

Creative practice as research is the dominant mode of inquiry within the creative arts. In the 2010 Excellence in Research for Australia to the Commonwealth Government, the Australian Research Council reported that 71.5% of outputs within the FoR19 (studies in the creative arts and writing) were non-traditional outputs, the majority of which were creative outputs. (ARC 2010 p.182)

Deakin University has been a leading exponent in the consolidation of creative practice as research. One of the most oft cited texts within this field, Practice as research: approaches to creative arts enquiry, (Barrett & Bolt 2010) was co-edited by Deakin academic Estelle Barrett. The book features chapters by six Deakin academics, including the internationally esteemed Paul Carter.

Barrett and Bolt contextualize these contributions with the assertion that “… artistic practice be viewed as the production of knowledge or philosophy in action… practice-led research is a new species of research, generative enquiry that draws on subjective, interdisciplinary and emergent methodologies that have the potential to extend the frontiers of research.” (2010, p.1.) This conforms to the ARC definition of research as ‘… the creation of new knowledge and/or the use of existing knowledge in a new and creative way so as to generate new concepts, methodologies and understandings. This could include synthesis and analysis of previous research to the extent that it is new and creative.’ (ARC 2012, p.12)

Creative practice as research is distinct from traditional empirical models of research. Further to the ‘philosophy in action’ concept proposed by Barrett and Bolt, Webb (2008) explains that ‘… the starting point is usually an idea; and the attitude is more often a concern with how humans construct the world through ideas, images, narratives and philosophies, than a generalisable ‘truth’, or understandings of cause and effect.’ Haseman (2010) explains that practice as research uses the language and tropes of the medium itself to interrogate and test the paradigms constructed by the use of the medium, rather than translating these findings into text. Indeed, as Vilem Flusser stated in 1988, ‘images are articulations of thought’. A full understanding of the significance and context of the claims of a creative practice as research outcome can only be understood by direct reference to those creative outcomes. (Candy 2006)

Data Collection Procedures
It is envisaged that the images of skin will be created using a flat-bed scanner and a hand held scanner. The scanners employed are repurposed home office text scanners that have been set to capture full colour image files, such as when one makes a digital copy of a photograph. The procedure of placing the scanner on the skin and undertaking an image capture requires the consent and cooperation of the subject.

The raw material of images captured by this process will be edited and developed for an exhibition of creative works.

The images will be based on a group of 20 participants, recruited via the process described below in Section 9.

3 **Use of existing stored data**

Please list any existing stored data that you plan to use as part of the project eg health or employment records used for recruitment, or comparison. Please include in your answer:

- The type and number of records being accessed
- Whether the records identify individual people
- How you will obtain permission to use them (consent from individuals or permission from custodians of non-identifiable data).

N/A

4 **Risks and benefits**

**Give a summary of the expected benefits of this project**

This may include benefits to the broader community, the participants, people with whom the participants identify or the researcher (See National Statement on benefits).

This research project will produce a body of studio work, supported by an exegesis, which interrogates and extends modes of representation of digital images. This will contribute to the ongoing broader dialogue, both visual and written, that is seeking to articulate the implications of the dematerialisation of the photographic image. This may include extensions of new modes of presentation such a projection and augmented reality and/or technical, conceptual, and aesthetic examination of the changing implications of the image.

**Give a summary of the expected risks of this project and how they will be managed**

This should include any risks to participants, researchers, to the environment or to Deakin or other organisations. (See National Statement on assessment of risk.)

The main issue connected with this process is the issue of identification of participants. This is not a simple process as we anticipate that there will be some participants who wish to remain anonymous, whilst there will also be some participants who will insist on being identified and acknowledged.

We propose to respect both wishes and ask participants to formally indicate their preference via the Consent form.
The proposed images are abstract close up details of skin and do not include facial details.

The images will be identified within storage and publications by date of creation.

In some instances, an image may include the work of a third party such as a tattoo artist. In such instances, the normal copyright laws and processes will be applied and the artists’ permission will also be sought.

5 Monitoring

As the researcher, how will you monitor the progress of the research? (See National Statement 5.5.3)

The student researcher is being supervised by Associate Professor James Mc Ardle.

Alison Bennett has experience in creative practice as research, having completed a research master in fine arts at Monash University in 2009. Furthermore, Bennett is an experienced practitioner well versed in establishing and maintaining the trust and confidence of her subjects.

Any adverse events or variations from the proposal contained within this application will be reported to the HEAG.

6 Resources

Please explain how the project is funded (sponsorship, tender, grant etc.). If there are specific resources required for the project how will they be provided?

Student researcher in receipt of an APA scholarship

7 Conflict of interest

Do any of the researchers or others involved in this project have any conflict of interest in relation to it? If so, please explain how this will be managed.

No.

PARTICIPANTS

8 Describe your participant group/s

Please include the following information for each participant group.

How many participants do you plan to recruit?

What are the inclusion and exclusion criteria?

There will be 20 participants.

As an initial point, I am interested in making images of skin that has been marked by scars and/or tattoos.

Participants will understand that not all images will be included in the final published works and consent to participate on this basis.
Inclusion is based on the recruitment process described below. Recruitment will cease when the required number of participants have been reached.

9 Explain your recruitment process

Please include the following information for each participant group.

How will you locate the participants that you plan to recruit? If through existing records or contact lists, please explain how this will be done in a way that does not infringe privacy requirements.

How will initial contact be made?
If you plan to use a document or spoken statement eg flyer, letter, advertisement, phone call, please attach a copy of the document or script to this application.

Will the participants be screened?
If there is a screening tool, please attach a copy.

Photography practice places the practitioner within an interdependent network of subjects, clients, technicians and publishers. These relationships are established and maintained through an ongoing process of trust and earned confidence. A photographer cannot gain access to subjects without a reputation for ethical practice and respectful conduct.

Participants will initially be drawn from my extended networks as this group is familiar with my work and methods and ensures a higher degree of informed consent. These are people who know and respect my work, are informed about creative practice as research processes, and are interested in being involved with my creative projects. ‘Cold calling’ would be inappropriate for this project as a certain level of established credibility is required.

I do not make direct approaches to potential subjects but regularly engage in general conversation about my projects and investigations. A typical conversation might start by being asked “what are you working on?” or “how are you going with your research?” In some instances, a potential subject will express an interest in being involved as a subject. When a potential subject expresses an interest, there is then a process of discussion and negotiation. I explain my motivations, aims and intentions and explore the motivations and expectations of the participant. The technical/physical process of creating the images is discussed, as well as the potential outcomes for the images in terms of image processing, development and publication.

Participants understand that not all images will be included in the final published works and consent to participate on this basis. Participants are provided with digital copies of their raw capture images.

For this project, the process of negotiation and consent will be formalised by the Plain Language Statement and Consent Form.

The interpersonal process of informed discussion is integral to my working method as it produces more resolved and integrious results.

CONSENT

10 Describe the consent process
There are a variety of ways in which consent can be established, most commonly by giving participants a Plain Language Statement and Consent Form (PLSC) or by return of survey. You may wish to consult the Human Research Ethics Manual for more information.

As described above, briefing and consent will be formalised via a Plain Language Statement and Consent Form (attached).

As described above, the interpersonal process of informed discussion is integral to my working method as it produces more resolved and integrious results.

When a potential subject expresses an interest, there is then a process of discussion and negotiation. I explain my motivations, aims and intentions and explore the motivations and expectations of the participant. The technical/physical process of creating the images is discussed, as well as the potential outcomes for the images in terms of image processing, development and publication.

Participants understand that not all images will be included in the final published works and consent to participate on this basis. Participants are provided with digital copies of their raw capture images.

For this project, the process of negotiation and consent will be formalised by the Plain Language Statement and Consent Form.

Subjects understand that not all images will be included in the final published works and consent to participate on this basis. Participants are provided with digital copies of their images. Selection and refinement of images to complete the final works is part of the practice as research process.

Is a subject chooses to withdraw from the project before publication; the files in which they are a subject will be deleted.

The informed recruitment and consent process may be summarized as follows:

General discussion about project without direct approach

Participant expression of interest

Informed discussion

Formal consent

Image capture, copy of images to participant

Images development

Copy of images to participant

Participants informed of outcomes
11 Will there be reimbursement of expenses or incentives to participate?

See Human Research ethics Manual section 8 for more information.

No.

12 Pre-existing or unequal relationships

Do any of the proposed participants have existing relationships either with the researchers or each other? Please explain the relationship/s, and how you will make sure that participants don’t feel pressured to take part.

The participants are either known to me, or part of my extended networks. The process of gentle networking and negotiation is integral to my practice model. The participatory process of informing and consent is essential to the integrity of the outcome.

Indeed, given that this group is generally informed about the creative practice as research process and is interested in my work, there is less danger of misunderstanding.

My students will be specifically excluded from participating in this project.

13 Does your project include children or young people under 18 years?

If your project involves people under the age of 18, please answer the following questions. For further information, consult National Statement chapter 4.2.

What age group is involved?

Will parental/guardian consent be obtained? If the young people will consent on their own behalf, how their capacity to do this will be judged?

Is it necessary to involve people under 18? Could your projects be undertaken with adult participants?

Is the methodology appropriate for children/young people?

Is there any reason to consider that participation in the research is not in the best interests of the children/young people?

No.

14 Language and communication issues

Will your project involve people who cannot communicate easily in English? (ie people who are not confident English speakers, or who have a disability, such as a hearing impairment that requires special arrangements for participation). If so, please explain how translation/interpretation issues will be managed. For further information consult the Human Research Ethics Manual on Language and communication.

No.
15 People in other countries

If you are planning to undertake research in other countries, please answer the following questions. For further information consult the Human Research Ethics Manual on Research in other countries.

What are the legal and ethical requirements for conducting research in the designated country?

What arrangements will be in place for a local, readily accessible contact to receive responses, questions and complaints about the research (National Statement 4.8.16).

How will the research be monitored on site?

Are there cultural sensitivities relating to the research? How will these be managed?

If the research is to be conducted in a language other than English, please ensure that you have covered all relevant language issues under question 14.

No.

CONFIDENTIALITY / PRIVACY

16 Will you be collecting data in identified form?

Data are generally divided into:

Identifiable (also called personal): the person to whom the data relates can be established from the data – either because they are named, or information that identifies them is included (eg position in an organisation at the time)

Re-identifiable (also called coded): the identifiers have been removed from the information and replaced with a code.

Non-identifiable: the data were collected anonymously, or all identifiers have been permanently removed.

Please explain the form in which the data will be collected. If you plan to collect it in identified form and later remove the identifiers, please explain how and when.

The proposed images are abstract and close up details of skin and do not include facial details. Where the participant prefers, privacy will be protected by not publishing identity information. The images will be identified by date of creation.

17 Storage of data

Data storage should meet the requirements of the Authorship and Data Management Procedure. In most cases data should be stored securely at Deakin, for a period of at least 5 years after the final publication of the research outcomes. If the data will be stored in another location, please explain this, and how data security will be maintained. You should include:

Whether the data will be identified/re-identifiable/non-identifiable

How security will be maintained (locked storage, secure server, etc)

How long the data will be stored
If and when the data will be disposed of and how security will be maintained.

Image files will be stored on a secure server for a period of five years. The files will be identified by date of creation and will not include the identity of the subject.

The data for the final work will not be destroyed.

18 Publication of results

How will you notify participants of the outcome of the research?

Participants/subjects of photographs will be notified of outcomes via email.

How will your research be reported/published?

The research will be published via exhibitions, journals and project blog.

How will you manage participant confidentiality?

Images will not be captioned with the identity of the subject unless this is the wish of the participant, as indicated in the Consent Form.
REFERENCES


Barrett, E & Bolt, B 2010, Practice as research; approaches to creative arts enquiry, IB Tauris, London, UK.


Haseman, B 2010, 'Rupture and Recognition: identifying the performative research paradigm’ in Barrett, E & Bolt, B 2010, Practice as research; approaches to creative arts enquiry, IB Tauris, London, UK.

Hauser, J 2008, sk-interfaces, Liverpool University Press, Liverpool, UK.


Museum of Contemporary Art 1996, Photography is dead! Long live photography!, Museum of Contemporary Art, Sydney NSW.


Pringle, P 2004. ‘Seeing impossible bodies: Fascination as a Spatial Experience’, SCAN journal vol. 1 no. 2 8p, retrieved 17 October 2011


PART D: Declarations

1 I/We, the undersigned declare that the information supplied in this application is true and accurate to the best of my/our knowledge.

I / We the undersigned have read the National Statement on Ethical Conduct in Human Research and accept responsibility for the conduct of the project detailed in this application in accordance with the principles contained in the Statement and any other conditions laid down by Deakin University or the Human Ethics Advisory Group.

Signatures:

Principal Investigator/s Date:
Date:

Student Investigator/s Date:
Date:
Date:
Date:

2 ACKNOWLEDGMENT OF HEAD OF SCHOOL /DIRECTOR OF RESEARCH

I the undersigned acknowledge that the Faculty has considered and approved the academic worth of the project described in this application.

Name:

Signature: Date:

Part E

Please attach:

☑ A copy of the email confirming successful completion of the online human ethics quiz (for first time applicants only)

☐ A copy of any advertisements/flyers or other recruitment materials

☑ A copy of the Plain Language Statement and Consent Form (PLSC) or other consent materials to be used in the project

☐ A copy of any survey, list of questions/topics for interviews, or other materials to be used in this project

☐ Any other documents to be supplied to the participants or used in the conduct of the project
If you are proposing to recruit participants through organisation/s, a letter of support from the organisation/s involved if an organisational PLSC has not been provided

Please submit all documents to the secretary of your Faculty HEAG.

HEAG and inquiry contacts are available on the Human Ethics Contacts page or on your faculty website.