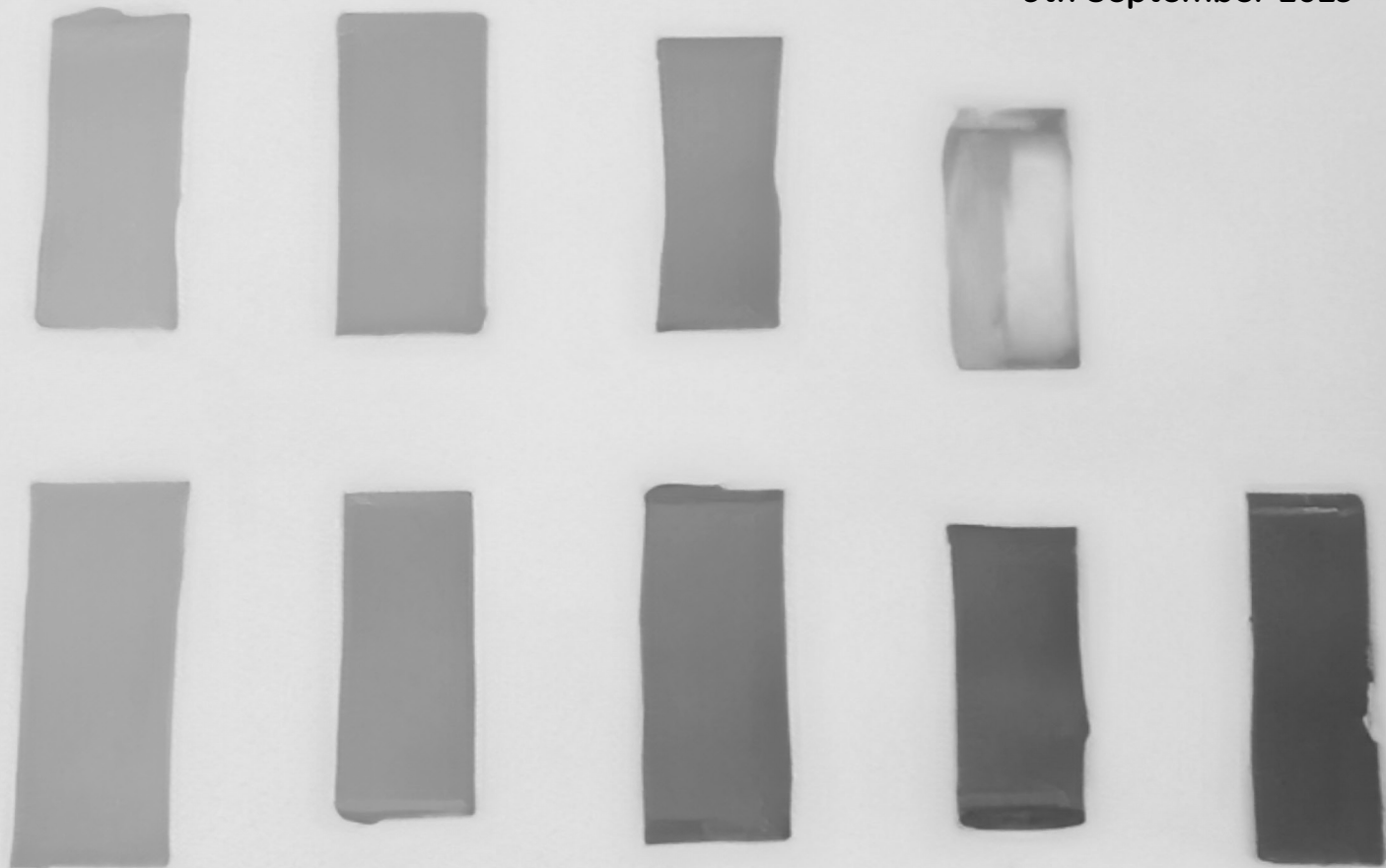


P A I N T I N G I N T H E A G E O F T E C H N O L O G I C A L R E P R O D U C I B I L I T Y :

RE-ESTABLISHING SENSUOUSNESS VIA THE
COMPLEXITY OF **THE SYSTEM OF EMERGENT TOUCH**

BE ANDR

5th September 2023



**Painting in the Age of Technological Reproducibility:
Re-establishing Sensuousness via the Complexity of System of
Emergent Touch (SET)**

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35 056 words

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for the degree of Doctor of Philosophy

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ABSTRACT

This practice-led research delves into pressing inquiries regarding the relationship between humans and algorithms and their impact on the realm of painting. In particular, this thesis focuses on the significance of tactility and touch in painting, as well as on its relevance to the advancement of artificial intelligence (AI), which necessitates a completely new approach. At its core, the thesis is centred on creating a painting system named The System of Emergent Touch (SET), which is an algorithmic digital system designed to manually convert digital photographs into oil paintings. This approach serves to bridge the gap between digital and paint, fostering a re-evaluation based on the co-working of algorithms and human, rather than an algorithmic takeover of painting. The thesis positions AI and current applied research in physical computing in relation to painting in a way that enables a practical approach to human/machine coevolution that does not privilege the machine over human as is so often the case in apocalyptic pronouncements. The primary aim of this thesis is to argue that AI and its relationship with intelligence is distributed and emergent. Notably, the resulting painting that emerges from the co-working process of SET is not a result of an algorithm doing X and the human doing Y; rather, it foregrounds the importance of human tactility in the making of art. This is the most important and original contribution of this thesis. The method employed involves the analysis of digital images and the development of a mathematical system that calculates the premix and placement of paint on the canvas. It takes a twofold approach, incorporating both discursive analysis and mathematical algorithms. The methodological approach was originally developed in Heidegger's *Identity and Difference*, exploring the concepts of "belonging" and "event" and the question of meaning and how something gets to be what it is. The discursive analysis is based on the writings of Jean-François Lyotard in *Discourse, Figure*, specifically examining the notion of the "figural." Chapter Zero explores the details of the journey leading to the project and elucidates the reasons behind the engagement in the particular type of work. Chapter One focuses on how algorithmic coding and mapping allow for a rethinking of representation in contemporary painting, introducing the idea of affective touch and a new type of touch that creates sense. Chapter Two introduces a theoretical methodology aimed at constructing a painting system that allows for unrestricted hand and brush movement, without relying on a strict point-by-point approach. The chapter elaborates on how systems establish its foundational element, known as the "ground," and how SET transitions from the abstract notion of a ground towards the concept of surface by exploring undecidability and uncertainty. Chapter Three provided an introduction to the construction and practical functioning of SET, while Chapter Four discusses the concept of distributed touch, incorporating elements of Duchamp's ready-made to challenge traditional subject-object dichotomies and explore the shaping of the emerging scenario of the artwork. This process gives rise to a novel type of artist, a "spread agency artist."

DECLARATION

This thesis represents partial submission for the degree of Doctor of Philosophy at the Royal College of Art. I confirm that the work presented here is my own. Where information has been derived from other sources, I confirm that this has been indicated in the thesis. During the period of registered study in which this thesis was prepared the author has not been registered for any other academic award or qualification. The material included in this thesis has not been submitted wholly or in part for any academic award or qualification other than that for which it is now submitted.

Signature:

A handwritten signature in black ink, appearing to read 'Be Andr.', written in a cursive style.

Date: 1st September, 2023

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Be Andr. *Painting in the Age of Technological Reproducibility: Re-establishing Sensuousness via the Complexity of the System of Emergent Touch (SET)*

Introduction: Groundless/formless: the critical importance of moving away from instrumental logics to logics of “sense” and its impact for creating a new system

Introduction: Groundless/formless: the critical importance of moving away from instrumental logics to logics of “sense” and its impact for creating a new system

*We must find new paths in order to approach new
artistic clouds and new clouds of thoughts.*

Jean-François Lyotard, *Peregrinations*¹

I. Overview

This thesis delves into the pressing inquiry surrounding the relationship between humans and algorithms and the impact this emergent relation has on the realm of painting. In today’s context, one of the most significant challenges lies in establishing a framework that perceives this relationship as a coevolution and co-working rather than a “siloeed” approach that isolating coding and artificial intelligence from the presence of the senses, free movement, and decision-making that comes with being alive in the world.² As elucidated in this thesis, even novel software like Dall-E 2, Chat Bot, and MidJourney fail to engender openness. The siloeed approach rests upon two erroneous assumptions. Firstly, it assumes that the connection between humans and machines is purely instrumental, devoid of any deeper connection. Secondly, it reproduces a closed system. More specifically, this thesis centres on the question of tactility and touch, examining their significance not only in painting but also in the realm of AI, which demands a fundamentally different and urgently required approach.

This practice-led thesis revolves around the development of a painting system, named The System of Emergent Touch (SET), which involves an algorithmic approach to manually transforming digital photos into oil paint. By incorporating AI and current applied research in physical computing, it establishes a practical framework for exploring the coevolution and co-working of humans and machines in the realm of painting, without unduly privileging machines over humans, as is often portrayed in dystopian narratives.³ The primary objective of this thesis is to demonstrate the understanding of AI and its relationship with intelligence as a distributed and emergent phenomenon. Crucially, the resulting artwork emerging through the co-working between the artist and SET is not a result of an algorithm doing X and the human doing Y; rather it foregrounds the importance of human

¹ Jean-François Lyotard (1988), *Peregrinations: Law, Form, Event* (New York: Columbia University Press), 43.

² SET explores the emergence of paintings through the inseparable co-working of the hand and algorithm, rejecting isolation or amalgamation of the digital and the manual, and emphasising the painting’s inception as a self-generating entity.

³ Martin Reinhart (2022), “Know Your Name: A Short History of Occidental Knowledge Systems since the Renaissance,” in Golding, Reinhart and Paganelli (Eds.), *Data Loam: Something Hard, Something Soft, The Future of Knowledge Systems* (Berlin: De Gruyter), 11-37.

tactility in the making of art. This is the most important and original contribution of this thesis.⁴

The following research questions have been formulated:

1. How does the transition from analogue to digital matter in reinstating agency into painting? In other words, in what way does the digital environment affect the agency of the assemblage called painting and how does this affect how art (painting) is enabled? In what way does the contemporary phenomenological approach (Heidegger, Lyotard, Golding) enable an answer to this question?
2. In what way do algorithmic coding and measurements enable a rethink of representation in contemporary painting?
3. How does a painting that brings together the human touch and the algorithmic system remain original?

By investigating these research questions, this thesis aims to shed light on the role of tactility and touch in both the traditional practice of painting and its encounter with the advances in AI. It seeks to explore innovative approaches that bridge the gap between human creativity and machine intelligence, fostering a deeper understanding of the significance and potential of tactility and touch in contemporary artistic practices.

II. Context

Previous endeavours in the realm of art and algorithms have grappled with a common challenge: a preoccupation with enclosed pixelation systems. These systems encounter similar conundrums as AI image generators such as Dall-E 2, Chat Bot and MidJourney, raising the question of how machines can paint using closed systems, where all the parameters are predetermined. Consequently, these systems produce amalgamations of the versions they have been trained to represent. It is easy to be deceived by the illusion that AI image generators create entirely new images, but their reliance on a closed training cycle leaves room for contention. The illusion that AI image generators create new images easily deceives us, but it can be easily challenged due to their complete dependence on a closed training loop.

⁴ This claim challenges Benjamin's notion of aura in relation to technological reproducibility, suggesting that aura can be redefined and partially constituted by the circulation of "code" in the context of this practice-led thesis. Walter Benjamin (2008 [1936]), *The work of Art in the Age of Its Technological Reproducibility and Other Writings on Media* (Cambridge, MA: Harvard University Press), 19-25. This point is further detailed in Ch. 2, see especially infra 89-91.

Unlike existing AI painting systems, which employ algorithms and various forms of artificial intelligence to create artworks (on the screen), SET takes a different approach. SET does not analyse extensive datasets of existing art to generate seemingly “new” artworks. Instead, SET operates without the need for any specific training; it functions as a process, a semiorganic system where humans remain a crucial part of the equation.

In light of the fact that we live in this world, my aim is to explore the possibilities of establishing an enriched relationship with the digital realm that enhances and develops human touch, tactility, and our overall connection to the digital domain. The thesis builds an argument about how sense forms the basis of artistic practice.

I have been trained in the traditional nineteenth-century approach to painting, where the connection between the hand and the eye plays a vital role in the artistic process. With the introduction of SET, this traditional relationship is still upheld, but it introduces the involvement of algorithms and machines without establishing a static hierarchical structure. While AI tends to render this relationship obsolete, my aim is to demonstrate that the fundamental connection between the hand and the eye remains significant. The change lies in the fact that algorithms can now enhance this relationship by necessitating a re-evaluation of both intelligence and painting as distributed systems. These distributed systems exhibit an emergent quality.⁵ In SET, the role of the eye is not determining sameness, or checking if something is drawn right or wrong. Instead, the algorithm empowers the eye to hyperfocus on the application and movement of paint, exploring its rhythms, the thickness of materials, and the physical act of applying paint.⁶

The rise of AI-powered algorithms and machine learning has led to their widespread application in automating various tasks, ranging from driving cars to diagnosing diseases. This thesis addresses the challenge these algorithms pose when it comes to creating a system for artistic expression on a surface. As a painter, my focus lies in the application of paint and the technical aspects of applying it to a surface. This process is open and is rooted in a bodily freedom of movement, an exchange of energy, and a departure from instrumental logic.

As an artist, my intention was never to merely replicate a photograph using paint or to represent it in a predetermined manner. I had no interest in pursuing a singular truth or establishing a rigid ground.⁷

⁵ Emergence is not merely the result of what comes out of something; it encompasses the naming of an event. It denotes the movement when the coercion happens and a shift emerges. Appendix 1: Glossary.

⁶ The notion of hyperfocus, loosely adapted from Ashinoff and Abu-Akel’s article “Hyperfocus: The Forgotten Frontier of Attention,” *Psychological Research* 2021; 85(1): 1–19, refers to the state of complete absorption in a task, to the extent that one may seemingly ignore or “tune out” everything else.

⁷ Building on Derrida’s *The Truth in Painting*, it challenges the notion that paintings directly access truth or foresee what comes next. Cf. Jacques Derrida (1987), *The Truth in Painting*, Geoff Bennington and Ian McLeod (Trans.),

Instead, I aimed to develop a painting system that would support and enable the liberating freedom of hand movements, brushstrokes, and the tangible nature of paint on a surface. This approach allowed for openness and emergence, avoiding a point-by-point process that would hinder such possibilities. With this perspective in mind, a crucial initial shift was made from the concept of a “ground” to that of a “surface.”

Chapter One, *The image’s demand, resemblance and the ghost* establishes how algorithmic coding and measurements enable a rethink of representation in contemporary painting and develop the idea of the affective touch, —touch as the groundless ground—and put forward an idea of a new type of touch that literally creates sense. By examining the binary code as the language of twenty-first-century imagery, the chapter expands the notion of touch to be distributed, emergent, and liberated through mapping while retaining agency.⁸ In this context, Chapter One challenges the prevailing belief that the resemblance derived from the digital image via its textual binary code merely serves as a substitute, a stand-in, or a representation. Instead, it articulates this resemblance through the concept of the ghost image, distinct from representative figuration, thus reimagining the relationship between image and representation.⁹

To build a painting system that enables the freedom of movement of the hand and the brush without proclaiming a point-by-point process, Chapter Two, *Mapping, how to free the mark* develops a methodology for its theoretical inception which moves from the idea of a ground to the idea of a surface. The first chapter takes on board the Heideggerian paradigm (groundless ground, event, difference, *techné*) and restages this in terms of key concepts in post-Newtonian physics, contemporary philosophy, and practice-led contemporary painting, questioning how originality can be incorporated into algorithmic-based painting.¹⁰ By emphasising the limitations of discourse and figure, it explores the critical disparity between certainty and undecidability while it rethinks the Duchampian ready-made as the algorithmic code of the digital image. The chapter advances a mathematical painting system, utilising Gödel's notion of undecidability. This concept reveals that within any mathematical (painting) system, there exists an inherent openness, an undecidability, which within SET enables the freedom of

(Chicago: University of Chicago Press), 17-147.

⁸ The term “agency” is used as a way to talk about *the capacity to act*. Laura M. Ahearn (2001), “Language and Agency,” in *Annual Review of Anthropology*, 30:109-137; Laura M. Ahearn (2000), “Agency,” in *Journal of Linguistic Anthropology* (American Anthropological Association), 9(1-2): 12-15.

⁹ Resemblance focuses on similarities between things, while representation involves symbolising or illustrating something as a substitute for another entity.

¹⁰ Johnny Golding (2010), “Fractal Philosophy, Trembling a Plane of Immanence and the Small Matter of Learning How to Listen: Attunement as the Task of Art,” in Ian Buchanan (Ed.), *Deleuze and Contemporary Art* (Edinburgh: Edinburgh University Press), 141-154; Isaac Newton (1846 [1687]), *Newton’s Principia: The Mathematical Principles of Natural Philosophy* (Daniel Adee); Martin Reinhart (2022), “Know Your Name: A Short History of Occidental Knowledge Systems Since the Renaissance,” 11-37.

the manual brushstrokes to come alive. Additionally, the system incorporates Heisenberg's uncertainty principle, which sets a fundamental limit on accuracy, measurement, and observation, pointing towards SET use of intensities rather than accuracies.¹¹ By re-evaluating Walter Benjamin's notion of aura within the framework of the circulation of the spatial binary code within the system, the chapter reinstates intimacy in painting. It accomplishes this by recontextualizing the ready-made concept through Lyotard's notion of the figural, which moves beyond representation and embraces the digital image devoid of origin.

Chapter Three, *System of emergent touch*, builds upon the groundwork laid by Chapter Two, providing an introduction to the construction and practical functioning of SET. This development goes beyond a mere point-by-point approach to form a comprehensive painting system.

Chapter Four, *Emergence via the conditions of The System of Emergent Touch and the spatial ready-made*, explores the concept of distributed touch as a means of redefining the ready-made and its significance. This chapter builds upon the essential elements of Duchamp's ready-made, offering a fresh perspective on the art object that transcends traditional notions of framing, subject-object dynamics, and the gallery's role in shaping the emergent work of art. In this context, the chapter investigates three key aspects: the conditions that facilitate the emergence of touch, the notion of code as a spatial ready-made, and a novel understanding of agency as spread. To achieve this, it examines the three conditions underlying SET: the material condition, the informational condition, and the energetic condition.

III. Research Method

The system is built on the coevolution and co-working of algorithms and humans, rather than an algorithmic taking over of painting. This co-working preserves a form of freedom and creative thinking that can only arise from this encounter. This algorithmic system is not instrumental but develops a way to think algorithm without a predetermined objective.¹² SET revolves around repetition, hand movements, mapping, and colour mixing throughout the process of applying paint to the canvas. This repetition imbues the process with stability and meticulous attention, resulting in structured and highly ordered outcomes. Repetition serves as a form of recognition, and therefore a form of completion. Similar to how an organism in biology cannot directly replicate itself but requires the self-description of DNA to achieve self-reproduction, a digital image contains a description of itself in its binary code.¹³

¹¹ David Lindsey (2007), *Uncertainty: Einstein, Heisenberg, Bohr, and the Struggle for the Soul of Science* (New York: Anchor Books), 3-4.

¹² Mastering mixing appropriate colour tones is a skill set rather than a mere objective.

¹³ G. J. Chaitin (1999), *The Unknowable* (Singapore: Springer), 57-61. The digital image arises from the discrete nature of the physical universe, represented effectively by discrete values. Edward Fredkin (2003), "An

When painting with SET, information in the form of quantified binary digital code, a dis-bodied language, is infused with vitality through bodily performance by the repetitive act of adding paint to the canvas by hand.¹⁴ Just as offspring in biology are not exact copies or representations of the parent, the emergent painting does not replicate the digital image.

The system facilitates encounters between the energy of hand movements, digital binary algorithms, and traditional oil painting media and techniques, resulting in the emergence of spatial, self-organising entities through a transduction process in which an activity gradually sets itself in motion, propagating within a given area, through a structuration of the different mapped area over which it operates.¹⁵ By directly engaging with the mathematics of the digital realm, this approach places painting at the forefront. It establishes a digital algorithmic system that translates digital photos into oil paint by hand. The method involves analysing digital images and developing a mathematical system to calculate the premixing and placement of paint on the canvas. It is situated in the space between traditional painting and algorithmic coding, offering various avenues for transitioning from representation to the figural, thus expanding the possibilities enabled by algorithmic coding.¹⁶ The thesis incorporates the Heideggerian paradigm, utilising a methodological approach derived from Heidegger's work in *Identity and Difference*. Concurrently, the discursive analysis draws upon the writings of Lyotard, particularly his book *Discourse, Figure*.¹⁷ The chosen method involves a mathematical examination of the digital image and its process of digitisation. This approach allows the thesis to bridge the digital medium and traditional painting, prompting a re-evaluation of their relationship that has not been done before. This combination of the groundless, the formless, and poetics, combined with the mathematical coding,

Introduction to Digital Philosophy," *International Journal of Theoretical Physics* 42(2): 188-189. The digital concept as a binary system reference has been recognized since Leibniz. Gottfried Wilhelm Leibniz (2010 [1669]), *De Progressione Dyadica (Le Système de numération binaire, 15 Mars 1679)*, Yves Serra (Trans.). <https://www.bibnum.education.fr/calculinformatique/calcul/de-la-nueration-binare> Accessed 1 March 2023.

¹⁴ Image processing starts with capturing the image using an acquisition system like a digital camera, followed by digitisation, where the colours are sampled and represented as a matrix. In SET, the digitisation of the image begins with the digitised binary code. Bernd Jähne (2005), *Digital Image Processing*, 6th revised and expanded edition (Heidelberg: Springer, 2005), 1-255.

¹⁵ A system can be classified as self-organising if it acquires a spatial, temporal, or functional structure without specific interference from the outside. Hermann Haken (2006 [1988]), *Information and Self-Organization: A Macroscopic Approach to Complex Systems*, 3rd enlarged edition (Springer), 11. It is the energy flow which organises the material system. Mae-Wan Ho (1998), *The Rainbow and the Worm: The Physics of Organisms*, 2nd edition (London: World Scientific Publishing), 38-39; Ilya Prigogine and Isabella Stengers (1984), *Order Out of Chaos: Man's New Dialogue With Nature* (New York: Bantam Books), 160-167; Gilbert Simondon (2020 [1964]), *Individuation in Light of Notions of Form and Information* (Minneapolis: Minnesota University Press), 1-17. Contrary to Stuart Preston's predictions during the initial exhibition of computer-generated art in 1965, SET challenges the notion that computers would render the artist's personal touch insignificant and instead emphasises the artist's active engagement and creative role in the process. Stuart Preston (1965), *Art Ex Machina*, New York Times, 18 April 1965, X23.

¹⁶ The thesis will focus on the digital aspect of quantifying numbers rather than delving into Albert Einstein's explanation of the photoelectric effect and the conversion of photons into electrons within the photodetector.

¹⁷ Jean-François Lyotard (2011), *Discourse, Figure*, A. Hudek and M. Lydon (Trans.) (Minneapolis: University of Minnesota Press).

enables an opening, a widening of the how of painting—in a way that does not take for granted how it should work. Within the thesis, a comparison is made between SET and other painting systems, specifically addressing the limitations of the static grid system employed by artists like Chuck Close, Claire Strand, and Moholy-Nagy. Further, it looks into robotic painting systems used by Liat Grayver and Rob and Nick Carter, comparing these to the problems with AI image generators such as Dall-E 2, MidJourney and Chat Bot, which all are closed systems dependent on training and representing the predetermined database.

SET does not aim to replace traditional painting methods or newer AI and robotic approaches to the medium. Instead, SET seeks to transcend the concept of digital creationism by offering an alternative that promotes coevolution, co-working and symbiosis between machines, algorithms, and human beings. As an open system, SET does not rely on AI training or a specific database, making it accessible to anyone interested in exploring emerging forms of painting on various surfaces. SET does not attempt to make a machine emulate or copy the human touch or recreate digital photographs. Instead, it is a progressive step towards allowing us to be human—touching, caring, living, and creating something in a world that is increasingly automated by algorithms. Rather than opposing the power of algorithms, SET embraces them as tools to enhance and transform what we already do as humans differently, better, and more easily, and to use algorithms as a step forward in our own development. This thesis holds significance for those examining the pervasive influence of algorithms on our daily lives and activities. The evolution of art in conjunction with technology does not diminish the role or importance of artists, nor does it diminish their agency. On the contrary, as this thesis will demonstrate, artistic agency is maintained and even amplified.



Fig. 1. Be Andr, *Untitled (Performative Waves of Embodied Matter)*, 2020, oil on canvas, 200 cm x 300 cm.



Fig. 2. Be Andr, *Untitled (I Am Too Sad to Tell You)*, 2019, oil on canvas, 200 cm x 300 cm.



Fig. 3. Be Andr, *Untitled (An Unknown Emergence)*, 2020, oil on canvas, 200 cm x 300 cm.

Chapter 0: Chronology of Development

Chapter 0 is dedicated to contextualising the technical and philosophical inquiries within the scope of the research questions. This chapter explores the details of the journey leading to the project and elucidates the reasons behind the engagement in this particular type of work. Additionally, it offers a meticulously illustrated and precise description of the System of Emergent Touch (SET) process, covering every step from its inception to completion.

Chapter 0: Chronology of Development

0.1 Chronology

Two factors influence my artistic interests and led to the development of System of Emergent Touch (SET).¹⁸ Before my interest in art and painting, I immersed myself in the world of computing from an early age, focusing on the visual aspect. This included exploring the first versions of Photoshop in the 1980s.¹⁹ My fascination with computing was sparked by my father's purchase of our first computer in 1984. I vividly recall how he was upgrading his computers and with it the evolution of screens from 2 colours to 8 colours, 16 colours and the ground-breaking leap to 256 colours—a monumental revolution that captivated me as a child. This early fascination plays a crucial role in shaping my initial ideas and the development of SET

0.1.1 Stage 1; The literal drawing

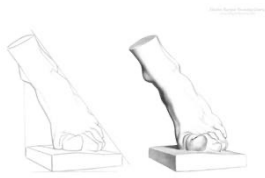


Fig. 4. Bargue drawing that shows two stages.

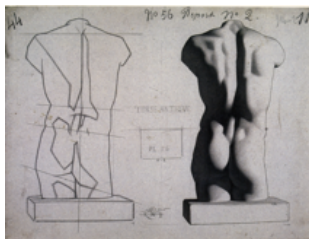


Fig. 5. Example of Bargue drawing, showcasing the initial phase dedicated to outlining the shadow's form.

In contrast, my upbringing lacked any exposure to art, and my journey into painting started much later when I was 18 years old. It was spurred by a rather inauspicious beginning; I 'got out of bed on the wrong side', studying 19th-century French academic drawing and painting techniques at the Florence Academy of Art in Florence, Italy (FAA). At FAA they taught what they would refer to as the one and only truth: the Sight-Size method.²⁰

This method enables students to copy a representation of an object onto paper or canvas by drawing them in the exact same size as one would see them, enabling measurements and checking proportions without transposing them to a smaller scale. The first year the student at the FFA copying Charles Bargue's drawings, emphasising to copying it as "perfect" as possible, then they move on to drawings of plaster cast and models before they on their second year starts the same in painting. It is a meticulous process where months can be spent on copying one 19th century drawing down to the millimetre.

By focusing on a system that was set up to copy directly and represent something else, the tutors claim the outcome, the drawing or painting would be the representation of what is representing and that would be considered 'true likeness'. The claim was the closer the image was to its origin, the better art. FFA

¹⁸ SET is the base of this thesis that will be elaborated on progressively in this chapter and all subsequent chapters.

¹⁹ This includes the earlier version called ImagePro.

²⁰ Kurt Anderson (1989), The Sight-Size Method, *The Artist Magazine*, May 1989, 56-59.

was strictly against any form of use of photography in the process and everything drawn or painted was done from models or real object. The focus was on the “perfect” drawing, and before one was allowed to paint, one would make a drawing from life, with hand to eye coordination, which was then painted to resemble the original object.²¹ The focus was the application of paint was merely a decorative flourish, giving it a rather paint-by-number look, as opposed to what I will finally develop.

0.1.2 Stage 2: Brown Sauce Painting

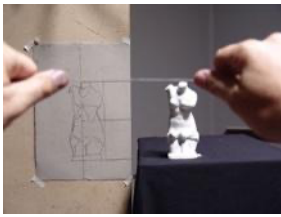


Fig. 6. Example of cast drawing using Sight Size

My frustration grew, after extensively working directly with digital photographs on the screen. I was not really interested in literal measurements and representation by hand, and the idea of ‘correctness’ that was taught—an old-fashioned philosophical focus on truth—did not resonate with me. The paintings made with this process tended to all look the same—thinly painted, with a dead-looking, representational brown colour palette. Everything became flattened out, marking what I termed my ‘brown sauce period’.

On the contrary, I was interested in the surface as something more than a ‘paint by number’ filling in. The process of making a painting, layering paint and expressive strokes, was a physical process that had already caught my attention. In this, I found an aliveness that was missing in paintings made with the Sight-size method.



Fig. 7. Example of still life

When I left FFA I made my living by painting, showing with galleries and selling to private collectors, but there was something missing, I consider this being my brown sauce moment. I aimed for a livelier form of painting because I excelled at this hand-to-eye method, but in my view it simply didn't work. In my opinion, it kept flattening out the painting, and what painting was about. I ceased to believe in the image as a way of exploring a singular truth, and over the next decade, I transitioned to creating art using machines cutting out letters and words, shaping them into forms and structures.

The text-works treat letters and words as image material, juxtaposing and overlapping them freely, using them as plastic elements. The letters become visual elements from which visual compositions emerge; words and letters are displaced, deviated, and condensed as they fluctuate into images. The rhythms of

²¹ The very notion of the hand-to-eye coordination emerged as pivotal to the argument. However, equally central was the realisation that the claimed ‘true likeness’ was not merely being copied. Rather, what was being replicated was the energetic encounter, the aura, presented as a sensuousness. A sensuous logic cannot be literally copied; it can only emerge from the expression of its encounter. A point I will return to in Chapter 3;

the lines blend the signifying letters into repetitive patterns, an image manifests as the lack of pauses between the letters create a polysemy. When passing from text to image the status of the eye changes: to see is not the same as to read. Over these years the physically act of painting, the literal eye-hand coordination, was missing.



Fig. 8. Be Andr, Untitled (I, You, Us, Them) Installation view Sundt Kvartalet Oslo, Norway, Collection of the city of Oslo, Norway.

As my practise as an artist increasingly felt lacking, I sought to reintroduce the physical touch back into my art, but from starting from the two important aspects of the textual, the binary code, and the physical realm, embodied in the act of painting. Consequently, I pursued my MA at the RCA. Between 2016 and 2018, I pursued my MA at the RCA to rekindle my passion for trying to figure out how to have this hand eye coordination that would enable an aliveness to pop, to show itself.

My questions regarding painting had shifted and grown. During those two years, I was obsessed with the question: What to paint? I began exploring the works of other artists, primarily repainting their pieces onto canvas. Once again, what baffled me was the emphasis placed by the spectator on representation. For instance, the size of the nose in the original photograph precisely matched that in the painting. Later, I encountered Lyotard's book *'What to Paint,'* where the dialogue prompted a re-evaluation of the interplay, not solely between hand and eye in painting, but also between philosophy and art.²²

The question appeared to be fixated on the correctness of the underlying drawing. In this context, the question of authenticity became very present. There seemed to be a shift in what constituted an original.²³ As I looked at the digital screen and copied it, it wasn't an original painting that I was replicating. My lack of interest in correctness and the dichotomy between right and wrong prompted me to shift my focus. In this setting, I examined how Gerhard Richter, in the 60s, started to use photos from newspapers and magazines.²⁴ In contrast, I noticed how I automatically selected and worked from images on the digital screen, giving me a sense of familiarity regarding my relationships with computers throughout my upbringing.

²² Jean-Francois Lyotard (2012 [1987]), *What to Paint?: Adami, Arakawa, Buren*, (Leuven: Leuven University Press). Infra 45.

²³ Michel Foucault (1982), *This is Not a Pipe*, James Harkness (Trans.) (Oakland: University of California Press).

²⁴ Gerhard Richter used illustrations found in widely circulated magazines like Quick, Stern, or the Bunte Illustrierte. Coosje Van Bruggen (1985), Gerhard Richter: Painting as a moral act, *Art Forum*, May 1985, 23(9).

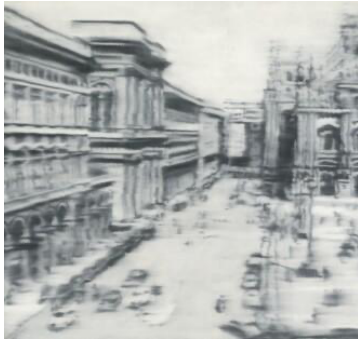


Fig. 9. Gerhard Richter, *Domplatz, Mainland*, 1968, oil on canvas, 275 cm x 290 cm

In the last year of my MA (2018), I began contemplating how to create a new system that aligned with the digital technology that intrigued me. I started using digital photos and projected them directly from the screen onto the canvas as I painted. I pre-mixed a grey scale of 16 tones and freely painted onto the projected image. I drew inspiration from Gerhard Richter's photo painting, filling in the tones and then applying his famous blur.²⁵ However, this "system" was far from good enough to execute large-scale paintings to the level I desired. It also did not address the fundamental issue of 'What to paint', and, more importantly, it was still based on a form of copying, using the eye to replicate likeness from an image on the screen.

When starting my PhD (2019), I made a conscious decision to create a system that steered clear of the 'literal' image as a starting point. For years, I had been honing my skills in copying, whether from a physical model or a photograph, or a digital image on the screen. I wanted to move away from the limitation of creating something that merely represented something else.

The question of the original, authenticity, and agency had been problematic for me since I began my journey into art. As I explored the binary code of the digital image, I realised that a different way of thinking about originality and authenticity, distinct from the 19th-century approach of copying and representing, was needed. Starting my PhD, I embraced the language of the digital image. Initially, under the guidance of my supervisor John Slyce, I delved into imagery intertwined with art history, focusing on image cropped from works of artists such as Jas Ban Ader, Picasso, and Beuys.²⁶ Gradually, I began to perceive them not merely as visual references but as raw materials, manipulating and enlarging them on a large scale. From there I moved into the poetics of imaging and started to develop a different approach to the digital following the advice by my co-supervisor Johnny Golding.²⁷ Instead of working from an image, I worked from the binary code of the cropped digital images. By looking at them as code, and not as image, I started to develop SET.

²⁵ Dietmar Elger (2011), *Gerhard Richter, Catalogue Raisonné Vol 1*, (Stuttgart: Hatje Cantz).

²⁶ John Slyce (2018), "We Have the Technology: The Conditions of Art and Its Experience in a Would-be Age of the Technological Sublime," in *More Than the Real: Art in the Digital Age*. Daniel Birnbaum and Michelle Kuo (Eds.) (Berlin: Walther König), 173-174.

²⁷ I use the notion of emergence similar to how Johnny Golding developed it in her book 'Courage to Matter.' Johnny Golding (2021), "The Courage to Matter," in *Dataloam: Something Hard, Usually Soft, The Future of Knowledge System*, Johnny Golding, Martin Reinhart, Mattia Paganelli (Eds.) (Berlin: De Gruyter).



Fig. 10. Be Andr, *Untitled (After Bas Jan Ader)*, 2017, oil on canvas, 50 cm x 60 cm



Fig. 11. Be Andr, *Untitled (Beuys)*, 2019, oil on canvas, 50 cm x 60 cm.

0.2 System of Emergent Touch (SET) – process from start to finish output

0.2.1 Why not AI image generators

At its core, the thesis is centred around the development of a painting system named The System of Emergent Touch (SET), which is an algorithmic digital system designed to manually convert digital photographs into oil paintings. This is a very different approach than AI generates such as Dall-E 2, MidJourney and Chat Bot, or approaches where digital works were foregrounded in works made by for instance Chuck Close.²⁸ In contrast to the closed-loop nature of AI image generators, my focus lies on the significance of synthetic encounters and emergent phenomena within my work. The emergent scenario breaks the feedback loop so what gets feedback is noise, in the sense that it is incomplete, rather than signal.²⁹

One should assume that when encounter the binary code of a digital image, the most apparent method to create something would involve using a digital printing system with ink or laser. I never held an interest in using ink or other printing methods on canvas or surfaces. Instead, my fascination was fuelled by the bodily movements and traditional marks on the canvas created by the brush and the hand. This approach emphasises a spatial quality with a certain volume that intertwines with the trace of human movement, a characteristic I believe ink or laser printing lacks.

0.2.2 Deep dive into SET

Detailed here is a step-by-step guide on how the system was developed. Given that the system was designed with two distinct components—one for optical grey and another for full colours—I have separated them into two comprehensive step-by-step descriptions.

0.2.2.1 Grey scale

²⁸ For clarification of the general points see pp 12-18, 18, 91 and for a more detailed comments regarding Chuck Close see pp 40-44.

²⁹ Normally, what is feed back into algorithmic coding is the signal, the clarity of the move.



Fig. 14. Photographs analysed and mapped. Each map shown in a colour code.

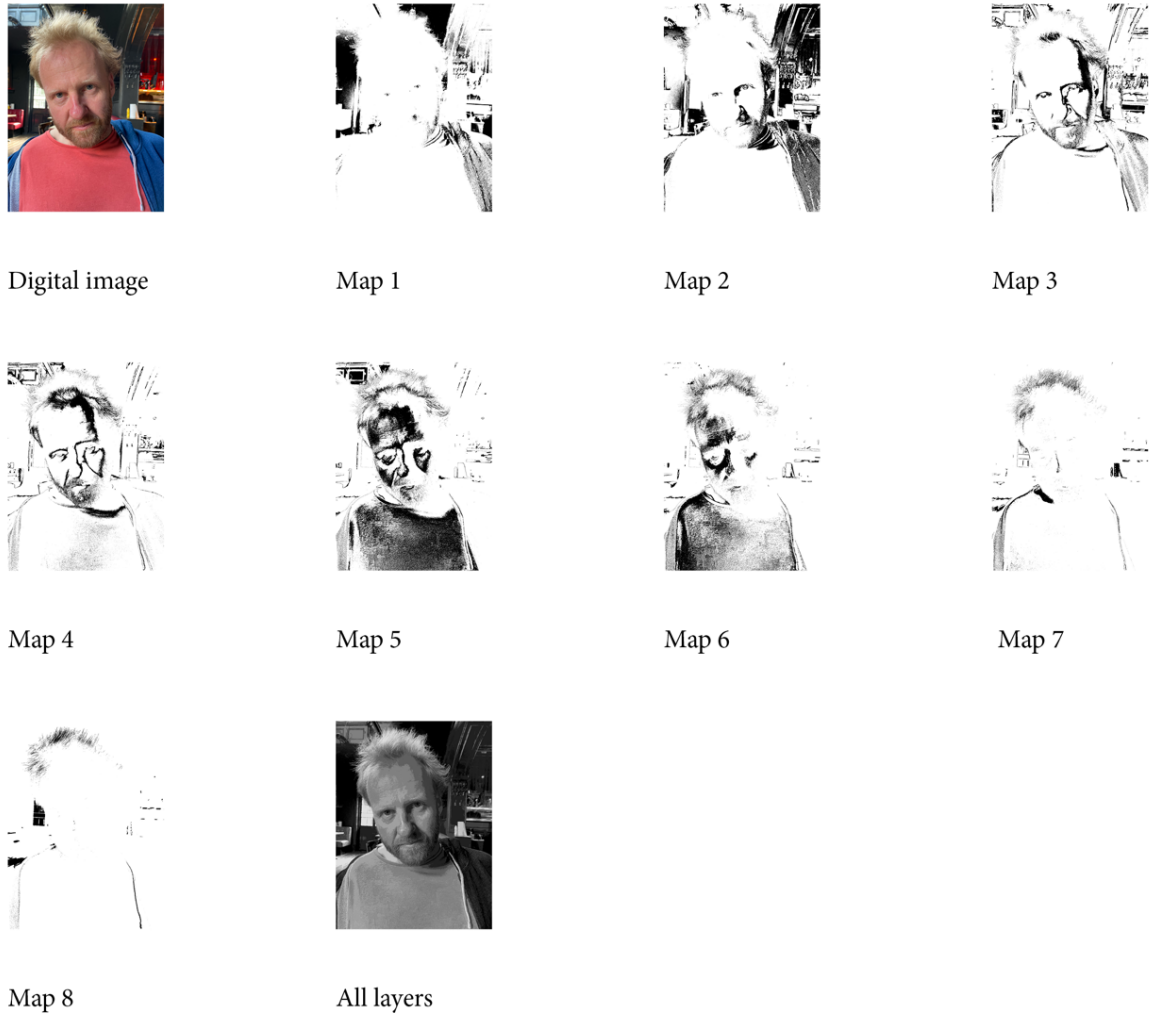


Fig. 15. The original photos shown with the 8 Maps tonal maps, and a photo where all the maps are put on top of each other.

4. Project or print each map digitally onto the canvas/ surface. Paint each map sequentially using a pre-mixed tone that corresponds to the quantisation number. The photos below are not taken of each map painted on it in its finished stage but rather several photos throughout the process:

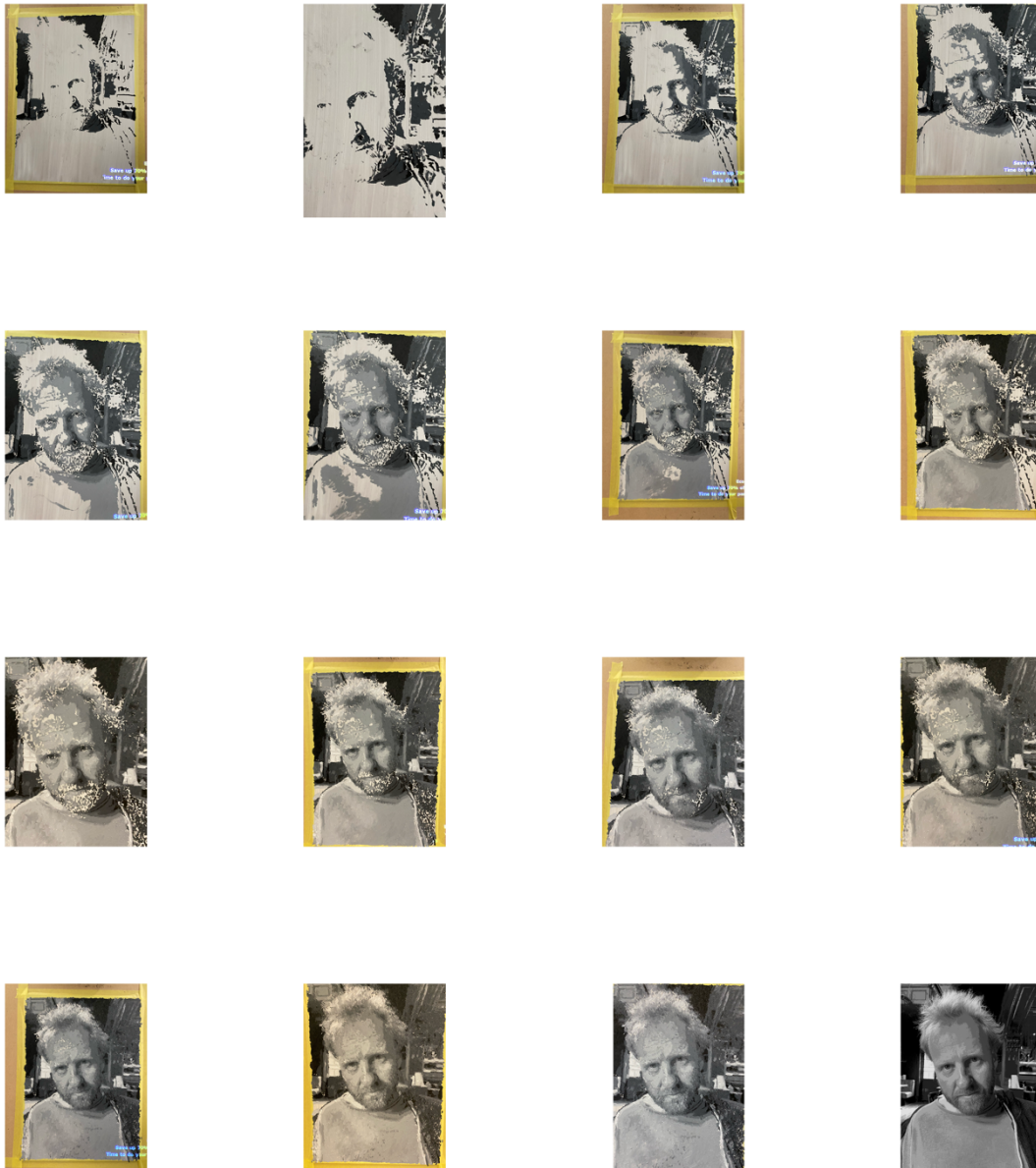


Fig. 16. Stages of painting the maps

- Optionally, modify the parameters and repeat step 4. This can be done iteratively as needed. This can be illustrated by mapping out 16 tones which then are painted onto the canvas where there are already 8 tones. This leads to encounters between the different maps (See fig. 18 page 33).

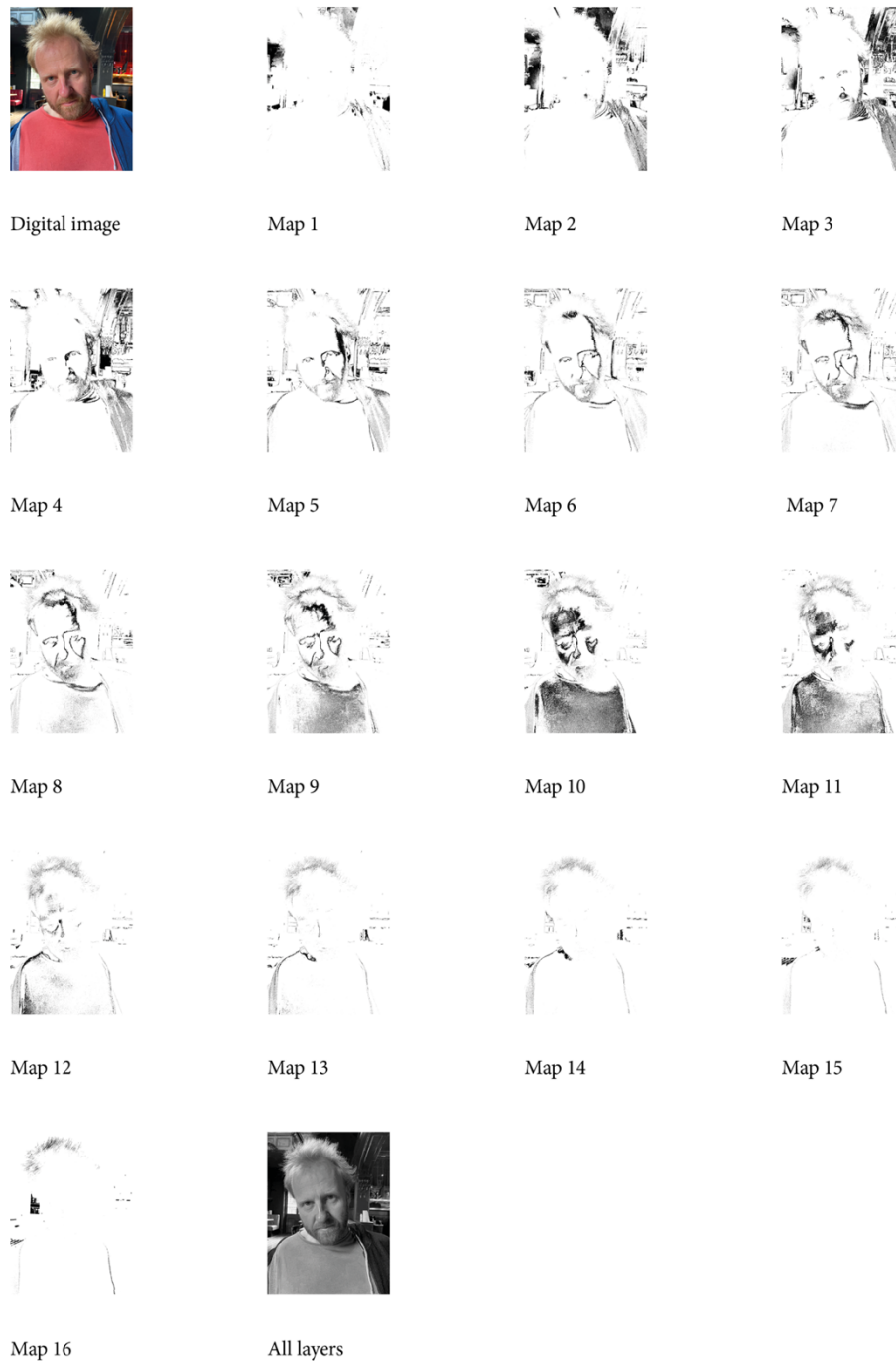


Fig. 17. Maps of 16 tones



Fig. 18. Map number 5: Left 8 tones, right 16 tones.

6. Finished painting.

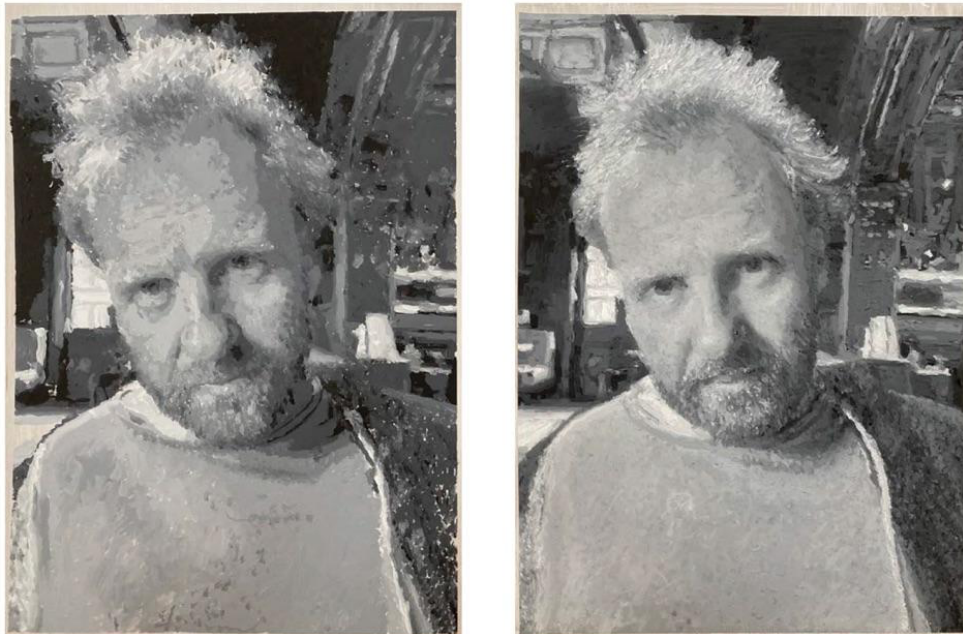


Fig. 19. Be Andr, *Untitled (Colin 8 tones)*, 2022, oil on wood, 48 cm x 30 cm; *Untitled (Colin 16 tones)*, 2022, oil on wood, 48 cm x 30 cm.

In 'Untitled (Colin 8 tones)' and 'Untitled (Colin 16 tones),' I sought to explore the hand to eye touch.

³⁰ These paintings diverge from the FFA training method due to their absence of a visual original source, a lack of relying on the replication of shapes and forms through visual observation, it used the binary code and maps.

0.2.2.2 Colour system

Considering the complexity of LAB and the vast spectrum of colours, I required a script software that integrated the LAB colour system as an inherent add-on. Python met this requirement. The entire colour system functions in a manner akin to the Processing script, but with a Python script replacing it. This system employs an algorithm that converts colours to LAB, assigning weights to each unique LAB colour utilised in the colour mixture.



Fig. 20. Digital photo



Fig. 21. Be Andr, *Untitled (Eye)*, 2023, oil on canvas, 125 cm x 99 cm.

1. Choose a digital image.

Due to the complexity involved in calibrating the LAB code with the mixing software, Match Pigment, I decided to adjust the algorithm, so it delineates large colour areas with white lines separating each tone. This helps in the process of verifying whether they are calibrated correctly. Consequently, it seemed impractical to persist with the same photography of my friend used when develop the grey system.³¹

2. Process the binary code of the image using the Python script.

3. Define quantisation parameters.

4. Project each map digitally or print them on the surface intended for painting.

5. Utilise the LAB codes that the Python scripts named for each map.

6. Input LAB code into the Match Pigment algorithm individually.

7. Utilise the best DE1 and mix each colour using a digital weight to the correlating map.

8. Paint each map separately onto the surface.

9. Optionally, modify the parameters (step 3) and repeat steps 4-8. This can be done iteratively.

10. Finished painting.

³⁰ See Fig. 19 in Chapter 0 p 33.

³¹ See Fig. in Chapter 0 12 p 28.

Chapter 1: The image's demand, resemblance and the Ghost

Every artist is a ghostly worker.

Lafcadio Hearn³²

³² Lafcadio Hearn (2017), *The Complete Works of Lafcadio Hearn*, (East Sussex: Delphi Classics), 43.

Chapter 1 explores the concept of code as a language, showing how the language of coding facilitates a distinct logic of meaning that aligns with the interconnectedness between the hand and the eye discussed in the introduction. This relationship between the hand and the eye plays a crucial role in enabling a heightened focus on the movement and application of paint. Moreover, Chapter 1 moves into the second research question: *In what way do algorithmic coding and measurements enable a rethink of representation in contemporary painting?* It further develops the notion of affective touch, a novel form of touch that literally generates sense. Touch is conceived as an additional facet of the groundless ground, expanding touch to be distributed, and also to bear agency.

1.1 The image's demand, code as the image's language

The digital era of the twenty-first century ushered in a revolutionary approach to accessing images. It marked a paradigm shift, where images ceased to communicate solely through the relationship between the figural and discourse, but instead convey sense through the way which Chapter Two developed encounters with digital technology which individuate through our encounter of its code/ demand.³³ The code, an integral part of the system, remains concealed for the human eye observing the painting. However, the code of the recorded image becomes accessible through digital means. The process of digitisation has granted us the unprecedented ability to read, for the first time in history, an image by its digits, and to totally ignore the perception of the human eye.³⁴ This is a departure from Enlightenment philosophy, which posits that sense is primarily generated through the interaction between the eye and the brain. Instead, the utilisation of SET facilitates the creation of meaning through the affective distributed touch: the coordinated involvement of eye, hand, body, and algorithmic code working in unison. The code, the demand of an image within the SET framework, enables a creation of sense through the unrestricted physical movement of the hand across the canvas. This process utilises a form of distributed intelligence, focusing on the significance of touch as it brings forth a touch that visualises.

By diving into the world of recognition, we gain the ability to listen to the needs and demands of the images, their 0s and 1s; all their secret inner life is unveiled to us through their algorithmic code. Within the context of SET, form and colours merge and undergo a process of recoding through the 0 and 1, and is rethought as a starting point of information. Through redefining the relationship between colour and form, treating them as one inseparable entity, a merge occurs, resulting in a powerful tool that generates spatially mapped vector shapes. These shapes exhibit relationships that extend to both three-dimensional and two-dimensional space simultaneously.³⁵ The code serves as the image's written voice, disconnecting colour and form from human expressiveness. Instead, the image communicates its message through the code, addressing recognition rather than the eye's interpretation of forms and colours. The code of the digital image undergoes a textual transformation into vector shapes within the matrix of 1s and 0s. When the notions of form and colour converge, they are entirely supplanted by the notion of information.³⁶

³³ The twenty-first-century image goes beyond mere representational appropriation as its representational nature does not solely arise from the technology itself but is influenced by the interpretation applied to it.

³⁴ Thomas Nail (2018), *Lucretius I.: An Ontology of Motion*, (Edinburgh: Edinburgh University Press), 150.

³⁵ Gilbert Simondon (2020 [1964]), *Individuation in Light of Notions of Form and Information* (Minneapolis: Minnesota University Press), 32, 385.

³⁶ The utilisation of the term "information" aligns with Claude Shannon's definition of "relative information." Claude E. Shannon (1948), *A Mathematical Theory of Communication*, *Bell System Technical Journal* 27: 379-423. Shannon's definition does not align with the semantic notion of information associated with meaning. His definition pertains purely in a physical sense of having information; Gilbert Simondon (2020 [1964]), *Individuation*, 16.

In this way the eye, the role of the eye changes when using SET. It no longer serves as a means for the traditional painter to assess similarity, colours, shapes, and forms. Instead, the eye's focus is directed towards the paint application and surface within each vector shape, referred to as a "map" in SET.³⁷ The hand takes on an active role, freely moving and touching, co-working with the algorithm that is already operational. Through the decoding of space, form and colours, a corporeal ghost image emerges—a simulacra, a form of radical matter that emerges from the loam of the data, which by touch enables the emergence of a self-organising image.³⁸

The binary nature of 0 and 1 is the static element within SET, comprising structures that give rise to inter-objective relations and internal coherence in the process of emergence. Within this system, every component has the ability to impact and influence every other component.³⁹ The binary code functions as data, while the static part of SET involves automated data processing, enabling the image to be read and listened to through the binary operation surpassing the capacities of human perception. But the image's demand can not be solely reduced to data processing or computation. It transcends these aspects, embodying an abundance of energy and information, and surpasses notions of unity and individuality.⁴⁰ The image's demand can not be regarded as one unity, or as an absolute truth, since what is considered a mathematical truth involves distinct physical processes that vary significantly from person to person. The ability to decipher and read the image's demand does not necessarily imply that the image possesses aesthetic quality, consciousness, or a one-sided intention. Instead, its indeterminacy points to an interpretation wherein the image manifests itself in a relational and intrinsic manner, unaffected by any arbitrary external factors.

To gain insight into how SET utilises information and code, it proves beneficial to examine how different systems employ information and code in relation to grids. An instance of a grid system is found in Moholy-Nagy's telephone paintings from 1923. Moholy-Nagy commissioned these paintings through factories by conveying orders solely over the telephone, providing informative instructions based on squares (resembling pixels) within a grid system, devoid of any visual representation. In 1944 Moholy-

³⁷ A point which is taken up in more detail in Chapter 1 pp 44-48.

³⁸ Thomas Nail (2018), *Lucretius I*, 162-163; The self-ordering of the image is reminiscent of contemporary phenomena in physics like turbulence and weather systems. These phenomena demonstrate the emergence of ordered patterns and metastable states from initially disordered or chaotic conditions. Manuel DeLanda (2002), *Intensive Science and Virtual Philosophy* (New York: Continuum).

³⁹ Unlike Jacques Ellul's emphasis on a dynamic approach, Bertrand Gille advocates for a comprehensive approach that takes into account both dynamic and static aspects when analysing a system. Bertrand Gille (1978), *Histoire des techniques: Technique et civilisations, technique et sciences* (Paris: Gallimard), 49; Bertrand Gille (1979), "La notion de "Système Technique," in *Technique et Culture I*, 8-18.

⁴⁰ Jacques Ellul (1980), *The Technological System*, Joachim Neugroschel (Trans.) (New York: Continuum), 102; Elizabeth Grosz (2017), *The Incorporeal: Ontology, Ethics, and the Limits of Materialism* (New York: Columbia University Press), 171-175; Yuk Hui (2016), *On the Existence of Digital Objects* (Minneapolis: University of Minnesota Press), 167-173; Roger Penrose (1994), *Shadows of the Mind: A Search for the Missing Science of Consciousness* (Oxford: Oxford University Press), 399-401.

Nagy explained the process:

In 1922 I ordered by telephone from a sign factory five paintings in porcelain enamel. I had the factory's colour chart before me and I sketched my paintings on graph paper. At the other end of the telephone, the factory supervisor had the same kind of paper divided into squares. He took down the dictated shapes in the correct position. It was like playing chess by correspondence.⁴¹

The three works—*EM 1*, *EM 2*, and *EM 3*—share an identical abstract and geometric composition. They were created in different sizes: *EM 1* on a large scale, *EM 2* on a medium scale, and *EM 3* on a small scale. Each painting's surface is glossy enamel and showcases a single black strip that runs vertically from top to bottom. Additionally, there are two abstract shapes formed by intersecting lines of varying thickness. Moholy-Nagy played no direct role in visually bringing forth these paintings; instead he described the paintings verbally over the phone using a coded grid system. This process highlights the changing relationship between information and form, showcasing the impact of using code as opposed to traditional methods of creation.



Fig. 22. Moholy-Nagy, M1, M2 and M3, 1923, enamel on steel.

In Clare Strand's artwork titled *The Discrete Channel with Noise: Algorithmic Painting; Destination* (Fig. 23, 24, and 25), created in 2018, a similar approach is employed. Strand's conceptual framework draws inspiration from Claude Shannon's information theory methodology. They both explore the transmission of information, as described in George H. Eckhardt's *Electronic Television* from 1936, where the process of encoding and transmitting photographs via telegraph is outlined. Strand's artwork reflects the utilisation of this information theory to convey artistic expression through painting.⁴²

⁴¹ László Moholy-Nagy (1946), *The New Vision and Abstract of an Artist* (Wittenborn: Schutz).

⁴² In this system, the original image is divided into a grid with values ranging from 1 to 10, representing different shades. During their phone conversations, the couple would exchange numbers corresponding to specific grid

Strand requested her husband's "assistance" in selecting images from her archive and applying a predetermined grid. He would then convey the sequence of numbers corresponding to the tonal code of each square on the grid. Once they had been received, Strand methodically painted the code on the matching large-scale grid she had drawn in her studio.⁴³

Another artist who employs a grid-based system is Chuck Close. He transfers the image onto the canvas, utilising a set of coordinates with numbers on one axis and letters on the other. This method allows him to create a grid based on pixels, which he gradually fills in one by one. Throughout his career, Close's painting techniques have varied and evolved. Initially, he used dots to represent pixels in his early works, but in his later lives, he has granted himself some artistic freedom within the confines of his square pixel setup, as he incorporates more expressive brushwork and geometric shapes. Nevertheless, the grid remains a prominent and influential element (see Fig. 26 and Fig. 27).

squares. <https://www.clarestrand.co.uk/works/?id=391> (accessed 4th July 2023); Shannon's theory of information is an extension of Boltzmann's statistical approach to calculating entropy in thermodynamic systems, adapted to the realm of communication. Simon Mills (2016), *Gilbert Simondon: Information, Technology and Media* (Lanham, MD: Rowman & Littlefield), 17-19.

⁴³ George H. Eckhardt (2016 [1936]), *Electronic Television* (Chicago: Palala Press); <https://www.clarestrand.co.uk/works/?id=361> (accessed 27th July 2022).

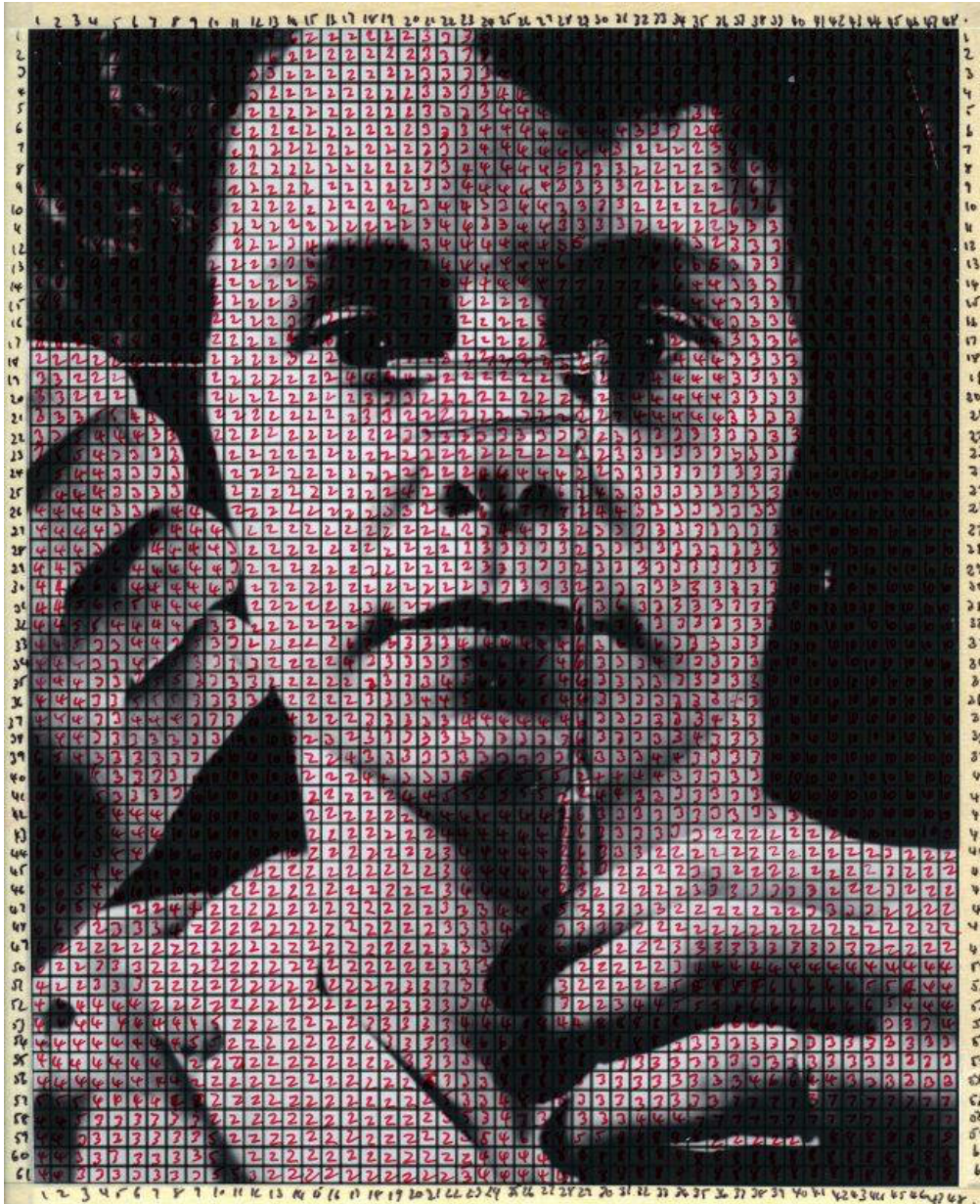


Fig. 23. Clare Strand, *The Discrete Channel with Noise: Information Source #3*.



Fig. 24. Clare Strand, *The Discrete Channel with Noise: Algorithmic Painting*. The painting made from: Information Source #3.

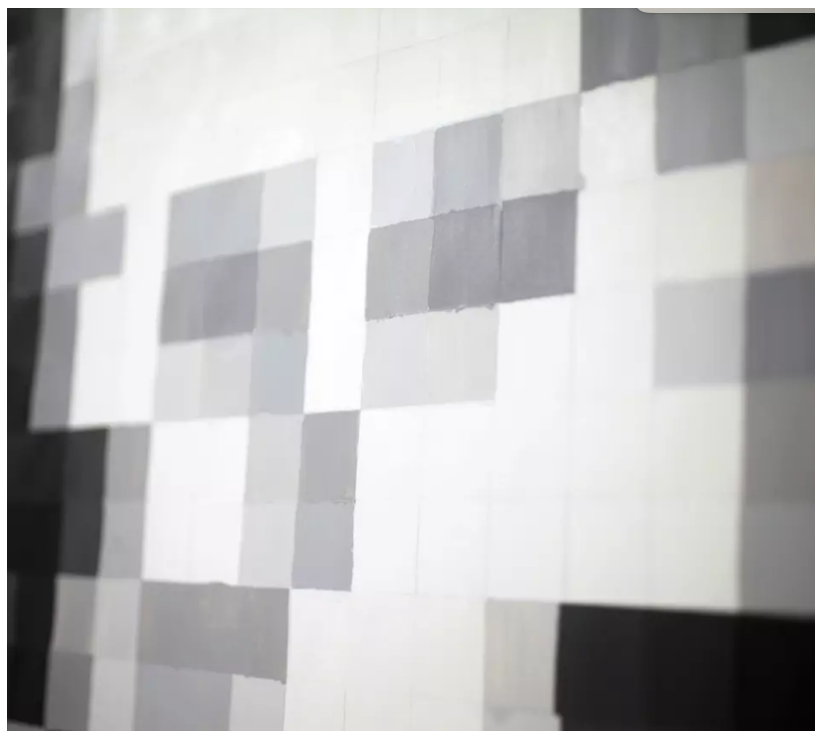


Fig. 25. Detail of Clare Strand, *The Discrete Channel with Noise: Algorithmic Painting made from Information Source #3* (Fig. 23).



Fig. 26. Chuck Close, *Kara I*, 2012, archival watercolour pigment print (90 degree) on Hahnemühle rag paper, 190.5 cm x 152.4 cm.

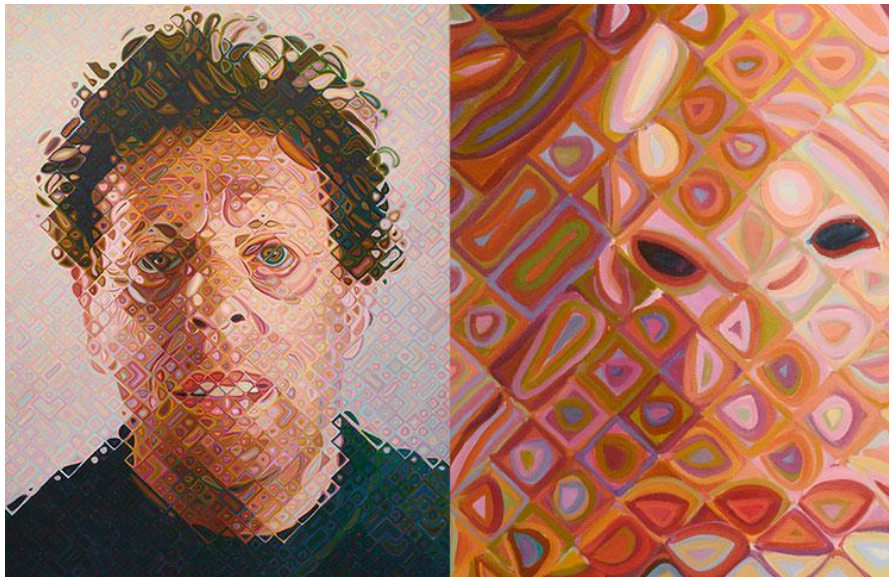


Fig. 27. Chuck Close, *Phil*, 2011, 275.9 cm x 213.4 cm with detail of nose.

In contrast to Moholy-Nagy, Strand, and Close, SET employs an open dynamic system that diverges from the traditional grid or pixel structure. Instead, it embraces mapping, the merge of form and colours.⁴⁴ Even though it follows a path similar to that of information theory, where information is reduced to bits, the binary digits 0 and 1, its mapping approach introduces a sense of openness—a realm of uninhibited choices and unrestricted movement in the process of applying paint. In this manner, SET acknowledges that information is a measure of one's freedom to choose a message and reject mere representation.⁴⁵ By utilising code, SET unlocks generative freedom through mapping of thresholds of intensities manifested within code. The code does not prescribe a point-by-point instrumental description of how paint should be applied or represent something. Instead, the code offers information by mapping the intensities, and at the same time acknowledges the uncertainty within the system—the fluidity of movement and circulation, enabling the brushstrokes to be articulated freely within each map.⁴⁶

⁴⁴ Infra Chapter 2.

⁴⁵ Klaus Mainzer (2005), *Symmetry and Complexity: The Spirit and Beauty of Nonlinear Science*, (Singapore: World Scientific), 273-277.

⁴⁶ Claude E. Shannon, Warren Weaver (1964 [1949]), *The Mathematical Theory of Communication* (Champaign, IL: University of Illinois Press), 6-24.

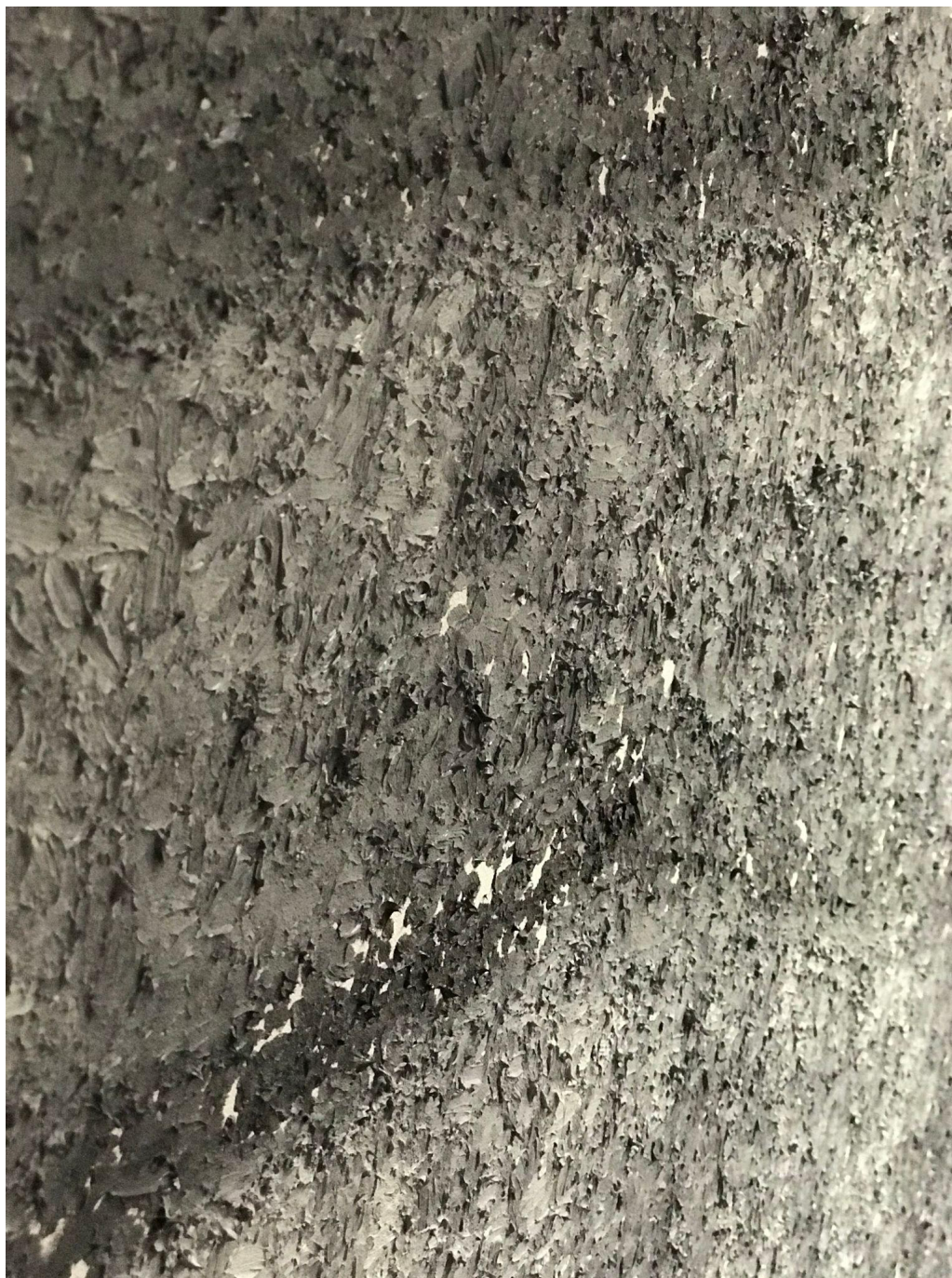
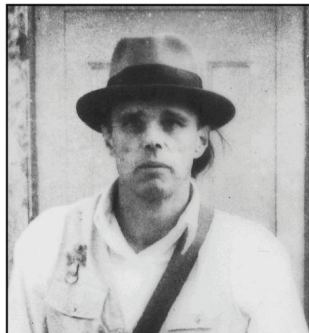


Fig. 28. Detail of brush strokes, *Untitled (Performative Waves of Embodied Matter)*, 2019, oil on canvas, 200 cm x 300 cm.



The image from which the binary code was taken.



Map 2 shows the grey tone no 2.



Map 3 shows the grey tone no 3.



Map 4 shows the grey tone no 4.



Map 5 shows the grey tone no 5.



Map 6 shows the grey tone no 6.



Map 7 shows the grey tone no 7.



Map 8 shows the grey tone no 8.



All 8 tones of grey put together to illustrate how a 8 tone painting would appear.

Fig. 28b. This is an example illustrating how the algorithms map a digital binary code into eight grey tone maps. The algorithm saves each grey tone as a separate file represented by black pixels. The layers are named based on their corresponding greyscale value. Note that the figure does not include Map 1, representing the darkest grey tone, as it was blank due to the absence of the darkest grey tone in the binary code of the specific image.

1.2 Mapping by fractals and “formless” shapes

In order to gain a deeper comprehension of the mapping employed in SET, it is necessary to begin with what is mapped: the intensity values, which is the binary translation of the textual raw data derived from the emerging patterns found in nature. These are captured by the light-sensitive sensors within a digital

camera.⁴⁷ What is mapped is the active performance of nature's own sensations of itself, something that nature does and that we do with it, which already is embedded in the binary code, its recording of space and light.⁴⁸ The resulting maps, while not constructed in terms of their physical dimensions, possess a dimensional vector that relates mathematical sets to natural objects. This allows the terms to be applied to mathematical concepts and patterns derived from reality.⁴⁹ When mapping out the colour tones of a digital image, one maps out the dynamic spatial arrangements of nature's building blocks and their interaction with light. These interactions give rise to ever-changing shapes and forms. The outcome of this process, generated by algorithms, is a collection of vector shapes that blend form and colour, resulting in intricate and unpredictable patterns, manifested as irregular patterns, monstrous shapes. Similar to natural phenomena, these mapped shapes exhibit constant motion guided by the adjustable parameters within the coding of the algorithm. They move as vectors without losing their resolution, perpetually in flux, constantly to be reconfigured by the interplay of movement and light.⁵⁰ These mapped vector shapes align with what Mandelbrot termed fractals. By utilising fractals, Mandelbrot introduced a novel geometric framework for understanding the irregular and fragmented patterns present in both mathematics and nature. These patterns which mathematicians in the past named monsters and described as irrelevant, patterns that Euclid leaves aside as being "formless," were successfully used by Mandelbrot to describe nature.⁵¹

SET works from these monstrous natural shapes, translating them into vector mappings. When examined from a mathematical perspective, these vector mappings parallel the techniques employed by computer designers when they incorporate randomised and deterministic classical fractals to reproduce nature. Designers are able to recreate nature in a remarkably authentic manner.⁵² The natural shapes captured by SET are not artificially constructed; rather, they emerge organically through the encounter of fractal patterns found in nature. These patterns operate through a construction process that incorporates random decisions, each stemming from a selection between two possible outcomes. The vector mapping's contour aligns with a random Koch curve, offering a simplified view of how randomness manifests in the natural shape utilised by SET's mapping when adjusting the binary code through its parameters.⁵³

⁴⁷ The intensity's dynamic range is determined by the bitrate of the digital image. S. Banerjee, M. K. Hassan, Sayan Mukherjee, A. Gowrisankar (2020), *Fractal Patterns in Nonlinear Dynamics and Applications* (Abingdon: CRC Press), 153-154

⁴⁸ Thomas Nail (2020), *Lucretius II*, (Edinburgh: Edinburgh University Press), 149-152.

⁴⁹ Benoit Mandelbrot (1977), *Fractals: Form, Chance, and Dimension* (New York: W.H. Freeman), 18-19.

⁵⁰ Johnny Golding (2010), *Fractal Philosophy*; Benoit Mandelbrot (1983 [1977]), *The Fractal Geometry of Nature*, (New York: W.H Freeman), 1-32; Thomas Nail (2018), *Lucretius I*, 154-168.

⁵¹ Benoit Mandelbrot (1983 [1977]), *The Fractal*, 1-6.

⁵² The SET incorporates natural fractal shapes and does not rely on artificial construction.

⁵³ Heinz-Otto Peitgen, Hartmut Jurgens, Dietmar Saupe (2004), *Chaos and Fractals: New Frontiers of Science* (New York: Springer), 425-466.

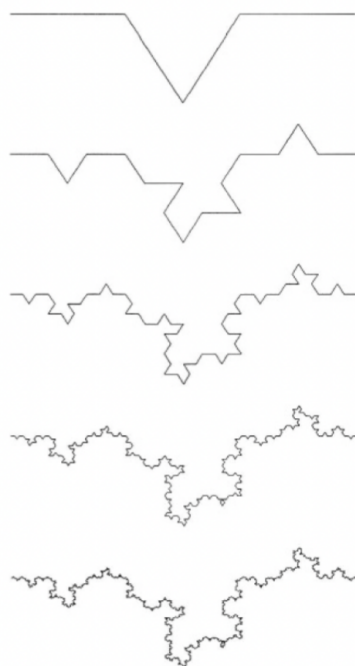


Fig. 29. Random Koch Curve.

The random Koch curve is how SET records the fractal geometry of nature. As complicated shapes in nature seem to defy conventional symmetries, the Koch curve provides a means to break down the patterns and forms of nature into primitive elements using algorithmic codes to analyse the binary code describing these forms efficiently. By treating fractal geometry through the binary code as “words” [the elements are primitive transformations, and its words are primitive algorithms], SET does not take account of the detailed mathematics of fractals in relation to the digital image, but instead uses the binary numbers from sensory recordings of nature, the framework in which natural structure is recorded and digitised into fractal shapes.⁵⁴ As nature is messy and complicated—a place where nothing grows in isolation from everything else—the algorithms used in SET look for approximate patterns over a limited range of scale. When using SET, small amounts of data are needed to produce the output tonal fractal maps. Paintings can be generated without having to consider detailed mechanisms of tectonics and weathering, and emerge merely by understanding the fractal statistics of the world.⁵⁵

⁵⁴ Michele Serres (2018 [1977]), *The Birth of Physics*, David Webb and William Ross (Trans.) (Lanham, MD: Rowman & Littlefield), 8-11, 170, 176-179.

⁵⁵ For a mathematical analysis of fractals: Banerjee, Hassan, Mukherjeem, Gowrisankar (2020), *Fractal Patterns in Nonlinear Dynamics and Applications*; Benoit Mandelbrot (1998), *Multifractals and 1/f Noise: Wild Self-Affinity in Physics* (Heidelberg: Springer); Beniot Mandelbrot (1983 [1977]), *The Fractal*; Michael Frame, Amelia Urry (2016), *Fractal Worlds* (New Haven, CT: Yale University Press); Peitgen, Jurgens, Saupe (2004), *Chaos and Fractals: New Frontiers of Science*, (NYC: Springer).

Fractal geometry enables non-goal-directed gestures, the brushstrokes, to be absorbed as syntagmatic linguistic value into its sentences, the fractal shapes, and becomes a constituent of the fractal shapes itself.⁵⁶ The gestures work as an integral part of thinking in language, merging movement and spatiality, the fractal geometry of nature, enabling a dynamic dimension in which thoughts come alive.⁵⁷

1.3 Mapping and tracing, how to free the mark

The earlier, more analytic impulse was to use very rational but kind of absurd techniques or tendencies —mapping, charting, and architecture— to try and make sense of who I was in my time and space and political environment. But there's only so much truth to a theoretical understanding of something.

Julie Mehretu⁵⁸

The algorithmic mapping of the SET is not a pure intellectual invention of the human mind or a logic added to fit a system, it was a discovery.⁵⁹ The algorithmic mathematical mapping of SET encounters pre-existing elements that exist independent of the mathematician's activity, as well as the programming and working of the algorithm used. Nature operates as a mathematical process—it defracts itself into logical patterns and structures and relationships, but still there is an incomputable physical part of nature's movement that cannot be fully computed or predicted.⁶⁰ Within SET, mathematics and the incomputable physical and bodily act are intrinsically intertwined. The tonal mapping, which is a form of pattern formation, emerges from the threshold and intensities inherent in nature's own organisation and through the encounter between binary algorithmic reading of data captured by digital sensors. The employed mapping approach does not seek to artificially disentangle these elements, but rather allows

⁵⁶ Saussure refers to the value a word acquires in combination with other words as a syntagmatic linguistic value. Ferdinand de Saussure (1959), *Course in General Linguistics*, Charles Bally and Albert Sechehaye (Eds.), Wade Baskin (Trans.) (New York: The philosophical Library); Peitgen, Jurgens, Saupe (2004), *Chaos and Fractals*, 215-276; Banerjee, Hassan, Mukherjeem, Gowrisankar (2020), *Fractal Patterns in Nonlinear Dynamics and Applications*, 160-166, 215-276.

⁵⁷ David McNeill (2012), *How Language Began: Gesture and Speech in Human Evolution* (Cambridge: Cambridge University Press), 19-57.

⁵⁸ *Magazine Art 21*, Fall 2019 Issue, <https://magazine.art21.org/2009/10/01/meet-the-season-5-artist-julie-mehretu/> (accessed 17th June 2023).

⁵⁹ Robert B. Laughlin (2005), *Different Universe: Reinventing Physics from the Bottom Down* (New York: Basic Books), 116-126.

⁶⁰ Keith Devlin, (2000), *The Math Gene* (London: Weidenfeld and Nicolson), 73; Thomas Nail, *Lucretius II*, 174-175.

their encounter to naturally unfold, resulting in the emergence of the mapping itself.⁶¹

In this way, the physical act of painting and the algorithmic mapping in SET are comprehended through the fundamental lens of relations. This approach produces a new faculty, a progression, an evolution of the algorithmic system towards the organic.⁶² This evolution is facilitated by digitisation's capacity to establish inter-objective relations between different technical ensembles, thereby enabling the digital aspect of SET to transition towards becoming organic, a transition, as termed by Hui encompasses an *inorganic organicity*. The system contains the encounter and co-working of the physical and the digital, the organic and the inorganic. However, through digitisation, the mapping within the system can easily be subject to calculation, thereby awakening a sensibility that exists within all of us, enabling freedom and diversity through fluid movement and spatiality of brushstrokes, encompassing non-goal-directed gestures arising from the encounter between the hand, brush and paint.⁶³ Instead of a domination of either algorithmic technology or the bodily nature of the human act of painting, an equal co-working is in play. Yuk Hui refers to this as cosmotechnics, a state of coexistence analogous to Gilbert Simondon's concept of co-naturality.⁶⁴

SET eludes the opposition between nature and technics, and obliges us to reflect anew on the tension between system and freedom as what is discovered is a method that is using material sensation.⁶⁵ The tension between system and freedom manifests in the process, between grid and grid-free, as SET merges into a system that is not using grids or pixels. In SET, the maps are grid-free even though the algorithmic scan of the binary code is performed using a fixed grid scan.⁶⁶ The major plus of using a grid-bound algorithm scan is that it can be used as a surrogate to grid-free random processes that proved or promised to model nature.⁶⁷ A grid-bound output, on the other hand, risks looking creased or artificial when recursion subdivides each cell into the grid of equal cells.⁶⁸ The grid-free mapping of the binary

⁶¹ Michael Frame, Nathan Cohen (Eds.) (2015), *Benoit Mandelbrot: A Life in Many Dimensions*, (Singapore: World Scientific), 31-32.

⁶² Yui Hui (2016), *On the Existence of Digital*, 210-252.

⁶³ Jean-François Lyotard (1985), "Texte de la Casette-Son Remise à la presse," press release (Paris: Centre Pompidou), 9; Yuk Hui (2019), *Recursivity and Contingency* (Lanham, MA: Rowman & Littlefield), 145-150, 215-232; Jean-Francois Lyotard (1993 [1974]), *Libidinal Economy*, Iain Hamilton Grant (Trans.), (Bloomington: Indiana University Press), xii-xiv, 43-94.

⁶⁴ Yuk Hui (2017), "On Cosmotechnics: For a Renewed Relation between Technology and Nature in the Anthropocene," in *Techné: Research in Philosophy and Technology* 21:2-3, 1-23; Gilbert Simondon (2009), "Entretien sur la mécanologie," in *Revue de Synthèse*, 130, 6e(1): 111.

⁶⁵ Thomas Nail, *Lucretius I*, 136-152; Gilbert Simondon (2005), *L'Individuation à la lumière des notions de forme et d'information* (Paris: Jérôme Millon), 297; Yuk Hui (2019), *Recursivity and Contingency*, 1-2, 244-245, 270-271; Roger Penrose (1990), *The Emperor's New Mind: Concerning Computers, Minds, and the Laws of Physics* (Oxford: Oxford University Press), 120-128.

⁶⁶ Appendix 2.

⁶⁷ Nature rarely demonstrates a pattern of recursively subdivided boxes, extending infinitely. Therefore, the most precise models of nature avoid relying on grids or grid-based structures.

⁶⁸ Benoit Mandelbrot (1998), *Multifractals and 1/f Noise: Wild Self-Affinity in Physics* (Heidelberg: Springer),

code contributes to the physical geographic form of the digitised image.⁶⁹ It manifests what a purely computational system can never achieve: to directly feel, touch, and encounter the sensuous qualities: a manifestation of the present now.⁷⁰ The sensuous touch prompts us to think, not through recognition, but through a fundamental encounter. Its primary characteristic is that it can be sensed, as it is opposed to recognition.⁷¹ The emergent output from SET gives back much more than the grid-based photo-electro-optical setup constituted by the input. The grid-free libidinal perversion of the time of painting is not related to the invested capital but to bodily encounters, a feedback loop of the painter's physical body's desire and pleasure, the commutation of libidinal energy into linear, chromatic, formal inscriptions, which in their turn, in the form of emotions, will activate the libidinal organisation of the observer.⁷² As Johnny Golding states:

*We have instead discursive fields, marked by segments of encounter, which in turn establish new forms of horizons, fields, intensities. This seemingly ephemeral mattering enables different forms of agency to arise: distributed, fractal, ana-material.*⁷³

These new fields, horizons, and intensities establish fields of meaning as the painting emerges, which in turn shapeshift “depending” on other encounters, other forms of 0s and 1s. Not only does this “matter” at analytic levels, it matters at all levels. The grid-free output map is not forced into a grid, and allows for a certain aliveness and moveability, free moments of the hand, body, and paint through the brush. This aliveness further emerges as a result of the grid-free maps being fields that manifested from the geometry of space and time, a merge of the recorded colour and form, and simultaneously being nature. The tonal maps are a dense web of interactions and exist only through their interactions as a recording from nature measured by digital sensors. It is important to keep in mind that it is impossible to neatly separate the behaviour of the tonal maps from their interactions with the measuring device [or interaction with any other thing whatsoever], here the digital sensor of the digital camera and the algorithmic code, both used to define the conditions under which the mapping appears. The property of each tonal map is the way in which it acts upon other tonal maps. This correlates to Heisenberg's original intuition about electrons: to ask what the orbit of an electron is when it is not interacting with anything is an empty question. According to Heisenberg, the electron's properties are only determined through how it affects something else, and in a similar way each map is the result of its interaction with the

19-32.

⁶⁹ Benoit Mandelbrot (1983 [1977]), *The Fractal*, 116- 130

⁷⁰ Roger Penrose (1994), *Shadows of the Mind*, 399-401.

⁷¹ Gilles Deleuze (2004 [1968]), *Difference and Repetition*, Paul Patton (Trans.). New York: Continuum, 76.

⁷² Jean-François Lyotard, Jacques Monory (1998 [1984]), *The Assassination, The Assassination of Experience by Painting – Monory*, (New York: Black Dog Publishing Limited), 146-179.

⁷³ Johnny Golding (2021), *The Courage to Matter*, 484.

neighbouring maps. If the map is not interacting, there are no properties and it will have no position or velocity and therefore there will be no physical maps.⁷⁴ Everything consists solely of the way in which it affects something else. For instance, the neighbouring colours affect how we see each colour tone, and a neighbouring shape affects how the eye sees lengths, widths, and other shapes. Each mapped area constantly influences all the other areas/maps. The maps describe how every part of a recorded part of the physical world manifests itself to any other physical parts. In other words, the maps emerge from how any physical entity acts on any other physical entity. This coincides with a general idea from physics—that when a field is present, a body is taken to have an *area of influence* around it and at a distance to it.⁷⁵

A mapping in SET must have a physical reality on its own account. They are more than calculational devices describing unmediated action at a distance; they move beyond the mathematical to the physical, which is manifested in the freedom of the brushstrokes and movements within the mapped vectors.⁷⁶ The movements, mapped by the knowledge of organic nature, does not come through contemplation or interpretation but through material transformation. This move beyond the mathematical to the physical contradicts Heidegger's claim that everything counts as existing when and only when it has been securely established as a calculable object for recognition, claiming instead that the physical brushstrokes are both relational (as the laws of nature are relativistic) and at the same time freed and non-calculative.⁷⁷ The mapping used in SET is not a conventional mapping but rather a mapping that allows for matter's stochastic non-calculative self-movement.⁷⁸ SET invites its users to explore the physical world as a net of relations where the maps of the emerging painting are its nodes; where the painting's properties do not reside in a map but as bridges between maps.⁷⁹ The tonal maps are nodes where bridges meet, reflecting, mirroring of and in each other, and from these interactions a ghost image emerges on the surface.

⁷⁴ Carlo Rovelli (2021), *Helgoland: Making Sense of the Quantum Revolution*, Erica Segre and Simon Carnell (Trans.) (New York: Riverhead Books), 61-62. (PDF)

⁷⁵ Eran McMullin (2002), "The Origins of the Field Concept in Physics," in *Physics in Perspective* 4 (Basel: Birkhauser Verlag), 13-28; Lukong Cornelius Fai (2020), *Quantum Field Theory: Feynman Path Integrals and Diagrammatic Techniques in Condensed Matter* (Boca Raton, FL: CRC Press); Michael Faraday (1855), *Experimental Research of Electricity*, vol. 3 (London: Richard Taylor and William Francis), 194, 407-437.

⁷⁶ James Clerk Maxwell (2010 [1890]), *Scientific Papers of James Clerk Maxwell*, vol. 1, W. D. Niven (Ed.) (Cambridge Library Collection), 169.

⁷⁷ Martin Heidegger (1996), *The Principle of Reason*, Reginald Lilly (Trans.) (Bloomington, IN: Indiana University Press), 119.

⁷⁸ Walter Englert (1987), *Epicurus on the Swerve and Voluntary Action* (Atlanta, GE: Scholars Press), 65.

⁷⁹ Niels Bohr (1998), *The Philosophical Writings of Niels Bohr*, vol. 4 (Woodbridge, CT: Bow Press), 111; Carlo Rovelli (2021), *Helgoland*, 57-63 (PDF).

1.4 The ghost image and resemblance

SET names the image that emerges on the canvas after rewriting the mapped code a “ghost” or “corporeal ghost” image. The ghost is a result of the fact that SET works using two processes: algorithmic analysis of the binary code of digital images, that leads to mappings and manual freehand painting. These processes are intermingled in all the stages of the emerging painting and are not happening in a linear fashion, as both the mapping and the algorithmic analysis are processes that interfere with each other and can be repeated several times during the process of adding paint on the canvas.⁸⁰ The algorithms analyse and map the thresholds within the binary code. The code affects the mapped areas’ sizes and shapes, through the information hidden in the binary 0 and 1. This affects the physical painting, as to the fact that the size and form of the map enables different types of brushstrokes. The mapping generates difference by enabling different areas of free movement of the brush and it does not function to represent but instead it constructs a real that is yet to come, a new type of reality; a shift from resemblance to becoming.⁸¹ The brushstrokes applied in the process of painting are the “folding” that sets up a stable functional structure, a form of organising, and effects the passage from mixed tones to corporeal ghost image.

This corporeal ghost image cannot express itself in the binary 0 and 1, even if it is a result of an encounter between the code, matter, and touch. What emerges is the ghosting of this encounter, an expression of a demand that brings forward an emerging ghost image. The haunting image that emerges is a different way of seeing, a seeing that comes forward through the affective touch, the binary 0 and 1, and the appearance of something absent (the figural), a by-product of the shadowy basis for the production of material life.⁸² This spectral image is not a mere memory but a “re-memory”, not recalling something lost or in the past, but rather a remembrance of the now, the present. The ghostly path is haunting, a very particular way of providing perspective and knowledge of what has happened or is happening. The corporeal ghost becomes what draws us, affectively, into a structure of feeling, of a reality we come to experience, not as cold knowledge but as a transformative recognition, a diffraction, a change, a forceful move in another direction.⁸³

In SET, resemblance appears abruptly as a result of relations, a belonging between the binary code and

⁸⁰ This point has been detailed further in Chapter 1.7 pp 62-66.

⁸¹ The diagram embodies an image of a future state rather than depicting something that already exists. In this regard, SET operates akin to Deleuze and Guattari's concept of the diagram. Gilles Deleuze, Félix Guattari (1987), *A Thousand Plateaus, Capitalism and Schizophrenia*. Brian Massumi (Trans.), (Minneapolis: University of Minnesota Press), 142; Charles Peirce (1955), *Philosophical Writings of Peirce*, Justus Buchler (Ed.) (New York: Dover Publications), 99.

⁸² Avery F. Gordon (2008 [1997]), *Ghostly Matters: Haunting and the Sociological Imagination* (Minneapolis: University of Minnesota Press), 23-26, 165-166.

⁸³ Avery F. Gordon (2008 [1997]), *Ghostly Matters*, 3-8.

the free manual brushstrokes, a relation that is completely different from the digital image it is supposed to reproduce. The ghost image of the digital image emerges not through representation of the binary code but rather through the transcoded passage from code to map. The resemblance happens non-reductionistic in the sense of Simondon's general allagmatic, beyond any form of technological determinism through the rhythmic difference between the brushstrokes and the analysis of the pixels of the digital code, as a vibration constituted by freedom and chaos, manifested through the body and sensation and their interlinkage. This is an open-ended process, not measurable or mathematically definable, released through nonlinear movements of the hand that is not yet completely defined; enabling an emerging finality that is situational, what Yuk Hui calls auto-finality: the result is not yet completely defined; even the finality itself is situational.⁸⁴

The resemblance cannot be reduced to a reproduction or representation of the assemblage's separate parts, but instead creates new forms and structures. When using SET, one does not try to literally copy a likeness, but instead the resemblance appears as a result of the process, in an attempt to reconfigure painting itself as a freed and unconditioned space without an exclusive middle or a dialectical black-and-white understanding of the world. The emerging corporeal ghost image happens as a meeting of body and material in space through the exchange and movement of energy. Triggered by the tension between the passivity of adaptation to the system's mapping and the activity of freedom by the hand, a ghost image is created sensually by sensations, by non-resembling means through the analysis of the the binary code that measures the level of organisation and the contingency of the hand and the enabling of the free recursive brushstrokes when passing through SET.⁸⁵ SET does not set up a system that replicates digital photos pixel by pixel; it is not a simplistic paint-by-numbers approach. Instead, it is a system where encounters intertwine, giving rise to the present and allowing the "new" to emerge. Shape has become time through the process of the emergence; it doesn't resemble the painting it is about to become; it is not standing in for anything; it is a new generative image. The emerging painting should open the mind of the viewer for new emerging views, it is not working as a representation but instead as a trigger of a new logic that teaches us other ways of making sense. Simondon's individuation of replacing form with information has side-shifted. Form and information fluctuate while code and physical movement merge in their encounter and one can no longer come with a clear statement of what is what; the resemblance is not a representation of the binary code but an emergence of the encounter

⁸⁴ Muriel Combes (2013), *Gilbert Simondon and the Philosophy of the Transindividual*, Thomas LaMarre (Trans.) (Cambridge, MA: MIT Press), 14-16, 136; Gilles Deleuze, Félix Guattari, *A Thousand Plateaus*, 310-315; Elizabeth Grosz (2007), *Chaos, Territory, Art: Deleuze and the Framing of the Earth*, (New York: Columbia University Press), 81-84; Yuk Hui (2019), *Recursivity and Contingency*, 13-14, 136, 142, 273; Gilbert Simondon (1989), *L'individu et sa genèse physico-biologique* (Paris: Aubier), 44, 263.

⁸⁵ Deleuze and Guattari call a resemblance that comes from a difference a non-figurative, non-codified aesthetic analogy as it creates resemblance through non-resemblance means. Gilles Deleuze (2002 [1981]), *Francis Bacon: The Logic of Sensation.*, (New York: Continuum), 111-121.

between the binary code and the other parts of the system.

In the conventional perspective, resemblance and representation often intersect and overlap. SET recognises that resemblance connects with representation in a traditional painting context where the setup is to make a painting, where the eye focuses on faithfully replicating the likeness of something else. SET does not establish a system creating a painting; rather the opposite, it sets up the condition from which art emerges. The autonomy of art from the representational image is not related to any resemblance that may be found within artworks or their systematic creation. SET is a system that generates paintings that exhibit significant resemblance to the encountered digital photo. This resemblance may be mistakenly perceived as representational or photographic in nature. Upon close examination, there is no visual resemblance or likeness, but rather a noticeable distinction, a difference. This disparity resides in the distinction between the brushstrokes and the binary code's 0 and 1, as well as between a system of vectors and a system of pixels. In other words, the brushstroke does not stem from a mere replication of visual forms or the copying of likeness. Instead, it emerges from an encounter and reading of the binary 0 and 1 by a physical act, a rewriting facilitated by the movement of paint. From a distance and when photographed, the input image and the painting may appear identical. However, the manual brush marks emphasise a distinctiveness and put forward a difference that should not be overlooked. One must not be deceived by the limitations of the naked eye, as magnification and the intricate interplay between distance, sameness, and disparity add complexity to the perception of the artwork. SET is an operational process and employs information which it gets from the binary code. The information is a difference and not a sameness to the paint, which ultimately creates a distinction. The illusion of sameness in SET is merely a recurring difference manifested through the brushwork.⁸⁶

Every difference is a differing, deferring in time and differed in space, creating a new dynamic of the whole as a new creation. Every reflective brush mark leaves a trace, and every mark poses an inquiry that pertains to the movement as a complete entity. This physical act is not a symbolic detour of the code, but rather leads to a difference that is being produced sensually, though sensation. The binary code enables difference that manifests through the freedom of the hand and the movement of the brush. The ghost image is *resemblance* and at the same time *difference*. It folds, enabling matter to affect itself and produce sensations, and redefines what the code is. The resemblance between the image projected by the code onto the digital screen and the ghost image brought forth by the code onto the canvas is remarkable. This apparition is not a fusion of reality, fiction, and longing, but rather a figurative manifestation of a code that unveils the ineffable, something beyond words, something unsayable.

⁸⁶ Gregory Bateson (1987), *Steps to an Ecology of Mind*, (Lanham, MD: Jason Aronson), 276; Yuk Hui (2019), *Recursivity and Contingency*, 135-136; Gilbert Simondon (2011), *Communication et information* (Les éditions Transparence), 159.

In the previous traditional painting system, the relationship between object and the subject in the painting process was explicit. One served as the representation of the other, and the success of the painting was evaluated based on the degree of likeness, the resemblance between the object and the subject. In the technical realm of the painting process, this challenge is here referred to as the “problem of the nose.” If the painted representation of the subject’s nose on the canvas does not align with the size of the actual sitter’s nose, it is deemed an error, leading to a judgement that the painting or artwork is of lesser quality. The primary objective of such a painting is to achieve utmost accuracy in depicting the original subject. It is essential for the painted nose to faithfully represent the nose of the model with precision. In contrast, in a system where art emerges, the traditional subject-object connection is dissolved as the connection between subject and object is non-existent due to the intricate complexities that blur the distinction between the two entities. It becomes challenging to determine definitively which elements assume the role of subject and which assume the role of object. In the evolving system where art emerges, multiple entities come into play, rendering the notion of likeness between an original and a copy obsolete. The concept of a singular original and its replicated copy becomes insufficient to describe the dynamic interplay of diverse elements within the artistic process. The likeness between an original and its copy becomes irrelevant as the emphasis lies in the emergent nature of art. Instead, the artwork encompasses a broader exploration of the complexities and relationships between various entities, transcending the traditional notions of likeness and replication.

The painting, emerging as a corporeal ghost from the digital code, is a profound sensation—a spectral entity that echoes the digital image. This resonance has its origins in the Latin word *imago*, which conveys the concepts of reflection, duplication, and echo. Interestingly, these definitions stand in contrast to our conventional understanding of a mere copy.⁸⁷ SET acknowledges Thomas Nail’s assertion that matter serves as the building blocks of the image. Moreover, it recognises his definition of an image as a mobile and dynamic process in which matter contorts, folds, and mirrors itself to give rise to diverse structures of sensation and affections.⁸⁸ The utilisation of SET raises inquiries regarding intimacy and the authenticity of our senses.⁸⁹ In such circumstances, SET functions as an apparatus for emergence, wherein this emergence serves as the groundless ground of the system. The ghost manifested on the canvas relates to what Grosz states is the emergence of art as an analogical language. It is a language that transcends representation, using colours, shapes, bodily forms, and screams as its vocabulary.⁹⁰

This figural ghost defies verbal expression, rendering it unutterable and unapproachable. It cannot be

⁸⁷ Thomas Nail, *Theory of the Image*, (Oxford: Oxford University Press), 10-11.

⁸⁸ Gilles Deleuze, (2001 [1981]), *Spinoza: Practical Philosophy*, Robert Hurley (Trans.) (San Francisco: City Lights), 48, 73; Thomas Nail (2019), *Theory of the Image*, 10-11, 20.

⁸⁹ Gilles Deleuze (2003 [1981]), *Francis Bacon*, 51-52.

⁹⁰ Elizabeth Grosz (2008), *Chaos, Territory, Art*, 88-89.

talked about or talked to; it is the unsayable simulacrum that visuals haunts us. The ghost is the tangible proof of the code being rewritten—a simulacrum that generates itself through the circulation of the binary code. The ghost, or the apparition, is one form by which the code, the image's demand, makes itself known or apparent to us. As the image demand is encountered, it gives rise to the emergence of a new original painting. These artworks do not serve as mere copies or representations of the initial digital code, as the creative process remains detached from any specific information regarding the image's original intent, subjects, or the circumstances surrounding its creations.⁹¹

1.5 The loss of origin in digital images

In order to effectively dissociate the emerging paintings facilitated by SET from the notion of representation, it is beneficial to examine the two issues pertaining to representation. The first issue is the “God problem,” where representation constructs predetermined sense and meaning. The second problem is the “universal problem,” suggesting that an artist is not merely a creator, but rather someone who facilitates the occurrence of meaning by delving into the deep cut of representation. The artwork becomes a substitute, a stand-in, for something else through the processes of sublation and negation of the present.⁹² The digital puts the ‘present’ to work, not by swallowing it up (sublation) or reinstating it through the process of intuition, but rather by expressing it via an encounter.⁹³ The approach to comprehending art within the context of SET undergoes a transformation as it is perceived through algorithms. Algorithms provide a unique perspective that enables a fresh outlook on familiar issues.

In the twenty-first century, the origin of an image appears to be obscured, even lost, as there is no inherent link between binary code and its representational form, except for the fact that it exists as digital content.⁹⁴ When searching for Velázquez's *Las Meninas* on Google, one encounters an abundance of variations of the painting (Fig. 30). As one continues scrolling down, even more variations appear, all derived from the same image. However, the original point of origin, which is the Prado Museum, is no longer the focal point. The concept of representation is surpassed by the notions of multiplication and repetition. Nothing is ever the same, and what emerges is not a mere representation but rather a manifestation of difference. What becomes apparent is that they reference and highlight the distinctions among themselves. What was previously perceived as a rigid substitute, a fixed stand-in for an object in the form of representation, a profound incision that excluded the present, now exists as nothing more

⁹¹ Gilles Deleuze, Félix Guattari (1987), *A Thousand Plateaus*, 40-74.

⁹² In the realm of the digital, the present is not sublated; instead, it is the very presence itself that holds significance and meaning. Byung-Chul Han (2017), *In the Swarm: Digital Prospects*, Berik Butler (Trans.) (Cambridge, MA: MIT Press), 15-21.

⁹³ This is a complex point suggesting a different epistemological approach, one that moves away from historical materialism. It is introduced in the thesis in the Introduction pp 16-18.

⁹⁴ Tom Corby, Gavin Bailey (2006), “System Poetics and Software Refuseniks” in *Network Art: Practices and Positions*, Tom Corby (Ed.) (Abingdon: Routledge), 113.

than a textual code within an algorithmic system. The process of image creation has shifted towards a practice of writing and rewriting an algorithmic code, a code that due to its ephemerality and transient nature no longer stand in for anything, as it can be easily altered and manipulated by modifying just a single digit in its code matrix. Hence, the code can only exist as the present moment itself; ungrounded, unfixed and highly ephemeral – a constant *re-present-ing* that navigates the ever-changing now.⁹⁵ Resemblance no longer excludes the present; instead, the world becomes an embodiment of algorithmic resemblance. Within this reimagined algorithmic realm, artists create their art under new circumstances compared to the past. The significance of representation has diminished, rendering it unnecessary to say what facts an object represents as they are simply there, embedded in our reality. There is no requirement for a second image to elucidate the meaning of the initial depiction.⁹⁶ The phantom imprint, the ghost image, of SET is merely a reflection of the present moment, a simulacrum devoid of its digital image's original source. It undergoes a transformation, evolving into something detached from its representation, generating itself independently.

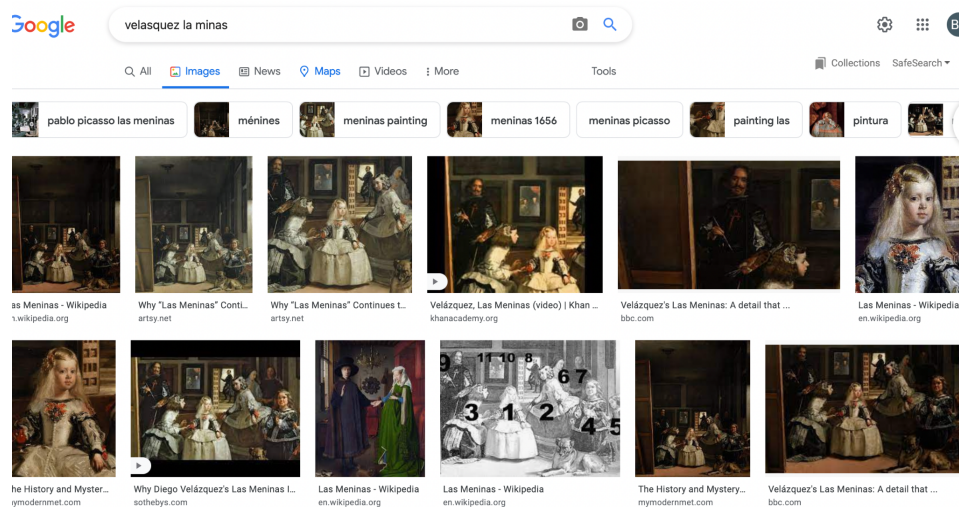


Fig. 30. Screenshot of Google search for Velázquez's *Las Meninas*.

The emergence of computational photography has enlightened us to the insight that the resemblance of an image holds little relevance to its indexical nature. Instead, it is primarily determined by the algorithmic procedures that operate on the raw data captured by the camera's light-sensitive sensors. The same data can be effortlessly be output as a text file, a sound, or a sequence of numbers or left in its unprocessed state.⁹⁷ The image emerging on the canvas is a corporeal ghost, arising from the

⁹⁵ Byung-Chul Han (2017), *In the Swarm*, 30, 54.

⁹⁶ Timothy Anderson (2020), *Quantum Wittgenstein: How Wittgenstein Might "Solve" Both Philosophy and Quantum Physics* (Aeon Essays), 5.

⁹⁷ Daniel Rubenstein, Katrina Sluis (2013), "The Digital Image in Photographic Culture: Algorithmic Photography

interplay, the encounter, of algorithmic processes and the physical act of applying paint. The use of SET aligns with Eduard Hanslick's assertion that music and art do not intrinsically represent anything and that their real subject is themselves, stripped from their original contexts, devoid of authorship—which SET argues is what the code demands. Endeavouring to translate paint into a representative image may appear futile, yet it is vital to recognise and preserve paint's expressive capabilities without undermining it.⁹⁸

1.6 The submission of the organic body to the algorithmic

Never before have images spoken more clearly to us about their ephemerality, their pedesis, and their yearning to be in motion and to be multiplied. An image no longer fits in a grid, it is no longer passive, negative or probabilistic, but performative and pedetic. In the twenty-first century, an image embodies an active process, revealing itself through relational and imminent manifestations by transmitting, encoding and decoding, moving from its initial form to something distinctly different yet unequivocally equivalent. It assumes the guise of signals, discrete symbols, within the binary code, before becoming painting through the memory of the system, as a tangible corporeal ghost.⁹⁹ The matter that emerges through the inference of the system takes on an ocular nature, while the tactile and sensuous touch, the interaction, between hand, paint, and canvas echoes Lucretius's explanation of the material conditions by which sensation is produced.¹⁰⁰ The emerging painting does not signify but makes the sensation real. Sensation is vibrations that impact the body directly, its internal forces, cells, organs, the nervous system.¹⁰¹ Sensations are not derived from the brain, representations, signs or images of *phantasia*, but are a result of how art makes the body sense in the most direct way. By treating the eye as an unfixed organ, making it mobile, placing it throughout the body as an internal hyperfocus, a wave that permeates every muscle, fibre, and cell of the body, engaging them in the encounters and application of paint.¹⁰² An image is not dependent on a sensuous condition as the image's demand is to be in movement, to become by being read and rewritten and not to be looked at. SET is designed to harness and enhance sensuousness, and was developed to treat digital numbers spatially, building on mapping the binary

and the Crisis of Representation," in *The Photographic Image in Digital Culture* (Abingdon: Routledge), 27.

⁹⁸ Eduard Hanslick (1986, [1854]), *On The Musically Beautiful*, Geoffrey Payment (Trans.) (Cambridge, MA: Hackett); Thomas Nail (2020), *Lucretius II*, 162.

⁹⁹ Christopher Neil Gamble, Thomas Nail (2020), "Black Hole Materialism," in *Rhizomes: Cultural Studies in Emerging Knowledge* 36; James C. Maxwell (1996), *A Dynamical Theory of the Electromagnetic Field*, Thomas F. Torrance (Ed.) (The Torrance Collection), 7-8; Klaus Mainzer (2005), *Symmetry and Complexity*, 273-327.

¹⁰⁰ Lucretius anchored his philosophical approach in material sensations rather than solely relying on intellectual contemplation. Walter Englert (2003), *Lucretius On the Nature of Things* (Newburyport, MA: Focus Publishing), lines 11734-41; Thomas Nail (2018), *Lucretius I*, 134, 148.

¹⁰¹ Deleuze says it explicitly: *Sensation is vibration*. Gilles Deleuze (2003), *Francis Bacon*, 39; Gilles Deleuze (2003), *Francis Bacon*, 39; Gilles Deleuze (1994 [1991]), *What is Philosophy?* Hugh Tomlinson and Graham Burchell (Trans.) (New York: Columbia University Press), 211.

¹⁰² Gilles Deleuze (2003), *Francis Bacon*, 45; Elizabeth Grosz (2008), *Chaos, Territory, Art*, 1-10, 70-81.

code of the digital photo. Vectors shape the maps, allowing the hand to experience unrestricted movements within each shape during the gradual emergence of a painting from multiple vector-based maps. The act of painting within the map is a process of lines; traditional movements of the brush, segmentation, flights, de-territorialisation (decoding) and stratification (recoding).

The mapping of the digital through the code allows for touching the canvas physically with unrestricted hand movements. By defining specific areas on the canvas, it grants complete freedom for creative and generative brush movements. This process allows for the inclusion of affective desires and emotions, reintroducing the human touch within the quantitative algorithmic system. Through the physical touch, the act of touching becomes a unique bodily expression, reaffirming an individual bodily expression of being in the world.¹⁰³ This act of privatisation of the encounter facilitates the infusion of human sensitivities and skills to enter and shape-shift meaning through a deliberate emphasis on the manual creative process of making. The algorithm is embraced as an extension of the body, projecting its functions like an organ, surpassing the utilitarian nature of the system. This liberation from the conventional rules and functions of traditional painting allows for an exploration of limitless possibilities and unleashes SET's full potential. Submitting the organic body to the algorithmic process should not be interpreted as an attempt to equate the algorithmic with the organic body, a common mistake of reductionism; rather, it serves as a precursor to integration and collaboration, a co-working based on spatial considerations, recognising the interplay between the parts and the whole, a reconciliation of the inert (matter) and the living, the inorganic and the organic, made possible by the act facilitated by mapping.¹⁰⁴ This shift fosters a distinct sense of intimacy by allowing for a multiplicity of readings, resulting in heightened intensity, which gives it its originality. In contrast, artists such as Moholy-Nagy, Strand, and Close employ grid-based systems that rely on tracing of fixed pixels in grids, reflecting an arborescent mode of thinking that emphasises the tracing of each individual pixel in isolation.

SET operates as a rhizomatic construction or machine, employing mapping and vectors instead of tracing and pixels in its process.¹⁰⁵ It directs its attention towards the organic thresholds of intensities derived from the binary code, which are translated into dynamic vector shapes. In this approach, the inherent qualities and diverse of tonalities of colours seamlessly merge with forms, creating a unified

¹⁰³ Jacques Derrida (2005), *On Touching – Jean-Luc Nancy*. Christine Irizarry (Trans.), (Redwood City, CA: Stanford University Press), 139-144, 268, 304-305.

¹⁰⁴ Alfred Espinas (1897), *Les Origines de la technologie* (Paris: Alcan); Ernest Knapp suggests viewing tools as extensions of organs, such as considering the brush as a projection of the hand. Ernst Knapp (1877), *Grundlinien der Philosophie der Technik* (Braunschweig: Westermann); Yuk Hui (2019), *Recursivity and Contingency*, 145-147, 163-167.

¹⁰⁵ The notion of a rhizome characterises a nonlinear framework that connects “any point to any other point”. Gilles Deleuze, Félix Guattari, (1987 [1980]), *A Thousand Plateaus*, 7, 21.

entity rather than static, fixed tracing points or pixels. This allows for unrestricted exploration of touch, sensations, and tactile strokes in contact with the real.¹⁰⁶

The digital algorithmic move facilitates the convergence of creativity within spatiality; spatial notations enable the movement of the brush to be liberated both from the speculation of the seeing eye and from the speculative numbers within the system (that is mapped as space). This liberation allows for instinctual organic animal-like marks. In contrast to the traditional painter's use of the eye for replicating likeness, a new role emerges—an eye that adopts a generative approach. This eye moves within the body, unravelling the motions of the touch that gives rise to meaning. The marks created establish areas that seamlessly transition to the next mapped region, forming interconnected, touching, and intertwined organic folds. The mapping leads to a resemblance of the digital code's photographic manifestation on the screen; this is not achieved through mere representation. Instead, this resemblance is a result of the co-working between the algorithm and the organic human body, involving analysing and encountering the binary code. This dynamic movement progresses the system as a cohesive entity, transitioning from the inorganic towards the organic.

1.7 Gradual growth from inorganic to organic

SET differs from a self-argumentative totalising system and acknowledges that its output maps are one-dimensional vector shapes derived from mathematical tensors, from the fusion of colours and forms captured within the recorded object's environment.¹⁰⁷ It is crucial to recognise that in SET, the maps are vectors that are mathematical calculations between two points, forming lines and shapes. As these shapes are vectors they can freely change their size in space without any loss of resolution or information, allowing them to expand infinitely large or contract infinitely small.¹⁰⁸ In contrast, a pixel is a solitary point or the tiniest individual component within a display apparatus. When you magnify a raster image, numerous minuscule squares become visible, and altering the size results in a corresponding change in resolution. Consequently, information becomes distorted and lost.

SET's vector maps possess the remarkable ability to be scaled up or down without sacrificing information or resolution in the mapping structure. However, the brushstrokes are influenced by the size of the shape, as different sizes limit their range of movement. In contrast to a pixel grid, the mapping

¹⁰⁶ Gilles Deleuze, Félix Guattari (1987), "Introduction: Rhizome," in *A Thousand Plateaus*, 12; Christopher Finch (2007), Chuck Close/ *Work* (München: Prestel Verlag), 69-111.

¹⁰⁷ In mathematics, a tensor is an algebraic object that describes a multilinear relationship between sets of algebraic objects related to a vector space; Linda G. Shapiro, George C. Stockman (2001), *Computer Vision* (Seattle, WA: Prentice Hall), 279–325.

¹⁰⁸ Thomas Nail (2018), *Lucretius I*, 155-156.

structure in SET remains stable, retaining its resolution and information without any loss. The mathematical tensors that empower the vector shapes encompass a plurality, allowing them to be translated into multiple positions simultaneously by adjusting the parameters within the algorithmic coding.¹⁰⁹ The plasticity of the vector mapping arises from its nodal points, yet its shape is not rigidly predetermined due to the influence of its attractors, the dynamic movements in a three-dimensional world, and the dimensional interactions of the physical world. These factors are influenced by the inclusion of the possibilities of changing the number of bits and tones in the algorithm's parameters, contributing to the shaping process.¹¹⁰ It can be argued that abstraction, or a formlessness, shapes it as it is a discontinuous path. Its boundaries constantly reshape themselves in relation to the thresholds set by the limits of the parameters in the code. Without an outside and an inside, it emerges from encounters, moulding a sequence of movements in a manner that embraces a high degree of contingency.¹¹¹

SET utilises information derived from 3D data that has been translated into 2D. In the realm of 3D, the vectors establish connections, yet these connections are not true edges; rather, they are connectors. The 2D vector mapping in SET lacks sealed edges, as the vectors undergo changes and movements influenced by the threshold originating from the 3D space. These changes are further influenced by the changing parameters within the algorithm during the painting process. The physical implementation of tensors in SET unfolds the so-called physical structure, expanding all its surfaces beyond the sealed edges and defined boundaries.¹¹² There is no fixed original, as the form emerges from ongoing interactions with every neighbouring shape.¹¹³ Mappings in SET exhibit a dimensional organisation, being geometric in nature without possessing a distinct edge.¹¹⁴ Put simply, the inorganic non-linear algorithms employed in SET, which encounter the digital binary code, are programmed to mutate the

¹⁰⁹ Jacques Ellul (1980), *The Technological System*, 200-201; Edgar Morin (1973), *Le paradigme perdu: la nature humaine* (Paris: Éditions du Seuil).

¹¹⁰ During the process of painting, the number of tones and the parameters of the algorithms can be altered multiple times, leading to subsequent transformations in the shape of the output maps.

¹¹¹ Jean-François Lyotard (1991), *The Inhuman: Reflections on Time*, Geoffrey Bennington and Rachel Bowlby (Trans.) (Redwood City, CA: Stanford University Press), 68.

¹¹² Jean-François Lyotard (1993), *Libidinal Economy*, 1-93.

¹¹³ The encounter is named by the tensor, while the shape is what attracts (expressed by the "A=A" equation in Heidegger's philosophy). A tensor is a sign that lacks a singular designation, meaning, or a calculable sequence of such designations or meanings. When utilising SET, semiotics cannot be employed to explain how something acquires meaning. Semiotics necessitates a return to the traditional division between object and subject found in Hegelian speculative philosophy. However, reverting to the object-subject concepts fails to liberate the object or facilitate the non-goal-directed movements that occur during the encounter between the hand, brush, and paint. *Encounter* used here is how Golding develops it. See Johnny Golding (2021), *The Courage to Matter*, 482-484; Jean-François Lyotard (1993 [1974]), *Libidinal Economy*, xii-xiv, 43-94.

¹¹⁴ Nina Samuels (2012), *Islands of Benoit Mandelbrot: Fractals and the Materiality of Thinking*, (New Haven, CT: Yale University Press).

vector mappings. This mutation akin to an organic mechanism, incorporating a heredity process where meaning is acquired only in respect to its relations to the surroundings, and all the different mappings as a collected whole, a gradual growth from inorganic to organic, from performed to self-organised, from heteronomy to autonomy, facilitating the emergence of diversity.¹¹⁵

One such mutation is shown in Fig. 32. The depicted figures demonstrate how altering the input parameter in the algorithm leads to the mutation or transformation of tonal shapes. The shape itself embodies a repetition of difference rather than a repetition of the same, while the mapping is a repetition of the cohesion of all the vector maps.¹¹⁶ Fig. 31 showcases SET employing two algorithms that encounter each other. The second algorithm is programmed to mitigate the highly irregular shape of the colour tones produced by the first algorithm. It accomplishes this by selecting a radius and drawing a disc around each point off the shape. This procedure, named the Minkowski sausage, dates back to Hermann Minkowski and George Cantor.¹¹⁷ In SET, the use of the Minkowski sausage results in vector mappings that encompass large areas of uniform tone. This facilitates swift hand movements and big brushstrokes for the initial layer of paint. Consequently, it becomes possible to rapidly cover a big canvas with paint. This approach bears a resemblance to nineteenth century painting techniques, specifically the concept of *blocking in the shapes*, where the big shapes are *blocked in* in the first layer of paint before more details are added in the later stages.¹¹⁸

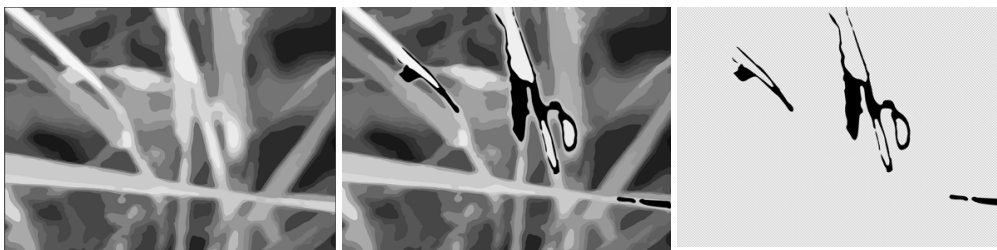


Fig. 31 a, b, c. Tone 30 simplified using the Minkowski sausage algorithm. Fig. 31 a shows the image being processed by an algorithm that simplifies and segregates the image intensity values. Fig. 31 b demonstrates the blackout of tone 30 in this specific image. Fig. 31 c displays the map of tone 30, isolated from the image. When applying paint to the canvas, the hand comes into contact solely with the map depicted in Fig. 31 c.

¹¹⁵ Yuk Hui (2019), *Recursivity and Contingency*, 3, 71-72, 215-220.

¹¹⁶ Johnny Golding (2013), "Ana-Materialism & the Pineal Eye: Becoming Mouth-Breast" in *Without Sin: Freedom and Taboo in Digital Media*, 19(4), 6-13.

¹¹⁷ Hans Lauwerier (1991), *Fractals: Endlessly Repeated Geometrical Figures*. Sophia Gill-Hoffstädt (Trans.) (Princeton, NJ: Princeton University Press), 37; Benoit Mandelbrot (1983 [1977]), *The Fractal*, 32.

¹¹⁸ Blocking in is a technique used in underpainting, allowing artists to quickly outline their artwork by applying basic shapes or "blocks" of colour.

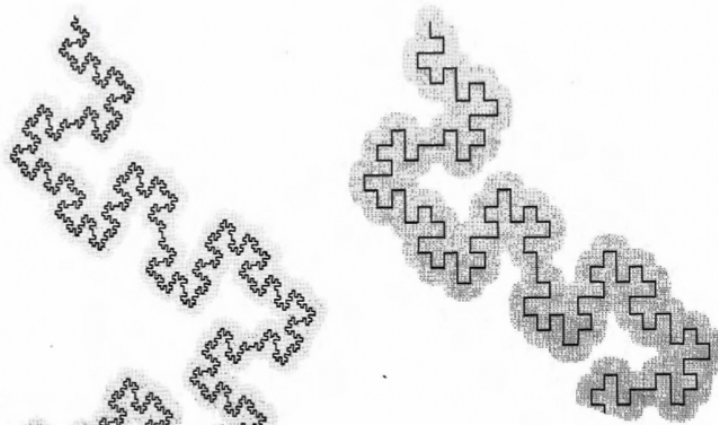


Fig. 32. Minkowski sausage.

The mutations resulting from the parameter changes and the utilisation of several algorithms in the process leads to a mapping that is not static and fixed but rather dynamic. It becomes a continuous process where information is superpositioned, reinforced, and subsequently dismissed repeatedly. In other words, the mapping operates in a recursive manner, undergoing multiple iterations, each iteration referring to and simultaneously differing from the previous one. During the painting process, each tonal map in SET undergoes a translation that establishes feedback loops, leading to their organic evolution over time. This iterative process engenders complexity, as new information emerges through the interplay and interaction within the system. While each individual mapping within SET relies on classical binary information represented by 0s and 1s, the collective interplay between these maps engenders a process that bears resemblance to quantum information and qubits. The fundamental distinction between classical information represented by the binary code and quantum information lies in the ability to form coherent superpositions between stages. In quantum information, we can combine and manipulate multiple states simultaneously, allowing for the creation of coherent superposition states that possess unique properties and capabilities not found in classical information systems.¹¹⁹ Every permutation influences the fractal shapes of the output map, consequently impacting the manner in which the free movement of the hand and the brush releases the energy that makes marks emerge on the canvas. The painting itself emerges as a superimposition of these distinct vector shapes and its final form is the outcome of spatial relational superposition. The interplay of these shapes in relation to one another contributes to the physical mark making and application of paint and the visual dynamics of the artwork.

¹¹⁹ Hermann Haken (2006 [1988]), *Information and Self-Organization*, 27-29, 216-221; recursivity goes beyond simple mechanical repetition; it embodies a looping motion that returns to itself to define its own nature. Each iteration remains susceptible to unexpected contingency, ultimately shaping its unique singularity. Yuk Hui (2019), *Recursivity and Contingency*, 3-4, 26.

SET is a flexible system that allows for the utilisation of various algorithms or multiple parameter inputs within one algorithm, to analyse the binary codes. Algorithms can be programmed to handle binary code in distinct ways, resulting in diverse versions of the output vectors as input changes during the analysis process. This enables incorporation of different fractal shapes to be used during the physical painting process, leading to a range of encounters and artistic outcomes. The adaptability of SET enables the artist to encounter the digital image with paint in a way that enables a painting to emerge from one algorithm or many algorithms without any restrictions.

The plasticity and openness of SET allow for movement, resulting in a sense of intensity that imbues the system with a form of aliveness. This dynamic nature propels the vector mapping process into the present moment, constantly in motion. In contrast, a grid-based pixel system operates in a static manner, recording the past in a linear fashion, unchanging and fixed. This static nature stands in contrast to the dynamic process of vector mapping, which aligns with Lyotard's conceptualisation of the tensor as the "is" and the "now." The tensor serves as both a container for data (distinct from what the data represent) and as an entity that performs actions, embodying both the form and function of information. A painting should not be regarded merely as a label for an object, but rather for a type of designation for a particular mode of organisation.

To comprehend painting, one should consider it through the lens of embryology, as a dynamic form that undergoes spatialisation, akin to a process of growth and continual complexification.¹²⁰ The conceptuality aspect entwines with the materiality and corporality of the process of the emerging painting, which is the nature of the inherent world itself. This is intricately woven and folded within the fabric of life and the process of becoming alive, signifying a paradigm shift that moves beyond a materialistic and scientific framework to embrace an organic materialism. In the realm of SET, the dichotomy between the algorithmic and the organic dissolves as both aspects are encompassed within the structure and operations of the system. The opposition between the two is subsumed, giving rise to a unified framework where algorithmic processes and organic expressions harmoniously coexist.¹²¹

The emergence of an "image-space," as suggested by this notion of "expanded spatiality," occurs through a dual articulation process. It begins with the probabilistic visual elements inherent in the pre-pictorial digital image, governed by the binary code. Then, it continues through the manual and

¹²⁰ Donna Haraway (2004 [1976]), *Crystals, Fabrics, and Fields: Metaphors That Shape Embryos* (Berkeley, CA: North Atlantic Books), 39-63; Joseph Needham (2015 [1936]), *Order of Life* (Cambridge: Cambridge University Press), 74; Erik Peterson (2017), *The Life Organic: The Theoretical Biology Club and the Roots of Epigenetics* (Pittsburgh, PA: University of Pittsburgh Press), 70-71.

¹²¹ Elizabeth Grosz (2017), *The Incorporeal*, 163-164; Yuk Hui (2019), *Recursivity and Contingency*, 61-63,71.

uninhibited gestures of the corporeal act of painting. While the digital image, with its binary 1s and 0s, can be measured objectively by science, the manual free mark transcends visual representation. It is non-representational in nature, solely concerned with the interaction between hand, paint, and the process of becoming pictorial. The conditions of corporeal brushstrokes in SET are influenced by the principles and logic of *techné*, the poetics of revealing. However, they function as an analogical language in the sense that they allow for immediate and unrestricted expressive possibilities, encompassing expressive movements, paralinguistic signs, breaths, and screams.¹²²

1.8 Material transformation: Form-taking via symmetry breaking

We live in a rainbow of chaos.

Cézanne¹²³

With each iteration of rewriting an image using SET, it undergoes a process of growth and transformation, ultimately giving rise to a new and distinct image that emerges from the encounter with the underlying code.¹²⁴ While the visual painting generated by SET possesses a generative and tangible nature, the underlying code remains ephemeral. In this dynamic interplay, it is the physical elements of paint and hand that carry the potential energy, which becomes, serving as the conduit for transformation and manifestation that brings forth the potential energy into tangible form.¹²⁵ In the context of emergent phenomena and the process of painting, predetermined forms do not exist. The distribution of energy is what determines the form-taking as form does not become, only matter does. Form-taking is an in-depth and intricate operation. For the system to undergo emergent phenomena, in other words, for a painting to emerge, it must be constantly supplied with ad hoc energy from the corporeal human body from which it acquires the capability to amplify fluctuations in energy and at the same time be asymptotically stable. The delicate balance between amplification and stability is what allows for the dynamic and evolving nature of the emergent painting to manifest. This process makes the system poise in the transitional space between order and disorder, enabling the capability to generate action, potential, and emergence. The process aligns closely with the complexity phenomena known as *the Edge of Chaos*, where the system's equilibrium points; the brush, the canvas, and the hand and body, are locally active though the energy released by the movement of the hand, throughout the body, but asymptotically stable

¹²² Gilles Deleuze (2003 [1981]), *Francis Bacon*, 94-95, 111-122, 154-162; Elizabeth Grosz (2008), *Chaos, Territory, Art*, 88-89; Martin Heidegger (1977), *The Question Concerning Technology and Other Essays*. William Lovitt (Trans.), London: Garland Publishing, 12-13, 34-35.

¹²³ <https://www.quotes.net/quote/11724> (accessed 17th July 2023).

¹²⁴ Hans Reichenbach (1956), *The Direction of Time* (Oakland, CA: University of California Press), 2-3, 16.

¹²⁵ Thomas Nail (2019), *The Theory of the Image*, 337-363

as a result of the mapping.¹²⁶

In this way SET embodies an open ubiquitous complex system that resides in the space between order and disorder, on the edge of chaos, which enables the process of applying paint and the emerging corporeal ghost image to be spontaneous, adaptive, and alive. The process of SET brings order and chaos into balance through an emergence of self-organisation. It is through this dynamic interplay that SET facilitates the creation of art that is both structured and unpredictable, enabling a form of aliveness to emerge. The paint is applied one tone after the other, using overlapping maps where each tone interacts with and affects the other. This process creates a dynamic interplay where the paint grows organically and organised, triggering the formation of an unpredicted painting and its ghost image to emerge through the non-linear dynamics of the complex system.¹²⁷

Complexity is the science of emergence, and the emergence—the painting—is the distinct prosperity of this complex system, a result of the fact that action of the whole is more than the sum of the parts and cannot be inferred from the parts—algorithms, binary code, paint, brushes, human decisions and movements—but instead is the result of the richness of the interactions within the agents of the system whose behaviour is emergent.¹²⁸ This is how SET achieves a delicate equilibrium, possessing the stability required to sustain itself through static mapping, while simultaneously fostering freedom, creativity, spontaneity, and aliveness, balancing on the fine line between order and disorder, striking a balance between regularity and surprise.¹²⁹ SET teeters on the edge of chaos, existing as a shifting battleground between the stagnation of the canvas's fixed tonal mapping, characterised by various forms and organisational levels via diverse algorithms, and the unrestrained disorder of manual brushwork; this is a physical encounter with information (binary code), from which fundamental localised actions within the vector maps emerge through the energy released from the hand.¹³⁰ This process generates emerging complex structures of specific spatial patterns in paint through a bodily doing that creates, or

¹²⁶ This claim is made loosely on how Mainzer and Chua define the Edge of Chaos as an uncoupled cell of a reaction-diffusion equation is said to be on the edge of chaos if one or more of its cell equilibrium points are locally active but asymptotically stable. Klaus Mainzer, Leon O. Chua (2013), *The Local Activity Principle* (London: Imperial College Press), 17; Katrina Schwartz (2014), *On the Edge of Chaos: Where Creativity Flourishes*. KQED, <https://www.kqed.org/mindshift/35462/on-the-edge-of-chaos-where-creativity-flourishes> (accessed 20th August 2023).

¹²⁷ Self-organisation emerges from irreversible processes generating entropy, where these processes act as catalysts for order to emerge in the systems. Dilip Kondepudi, Ilya Prigogine (2015), *Modern Thermodynamics: From Heat Engines to Dissipative Structures* 2nd edition (Chichester: Wiley), 117.

¹²⁸ Klaus Mainzer (1994 [2007]), *Thinking in Complexity*, 199-207.

¹²⁹ Yaneer Bar-Yam (1992), *Dynamics of Complex Systems*, (Reading, MA: Addison-Wesley), 9-14, 26-34. Francis Heylighen (2008), *Complexity and Self-Organization*, prepared for the Encyclopedia of Library and Information Sciences, Marcia J. Bates and Mary Niles Maaack (Eds.), (Abingdon: Taylor & Francis); M. Mitchell Waldrop (1992), *Complexity: The Emerging Science of at the Edge of Order and Chaos* (New York: Simon & Schuster), 1-13, 88-89, 169.

¹³⁰ Mapping in SET possesses a dual nature of being simultaneously static and in motion, akin to vector shapes. See pp 46-47, 61-62.

even stores, synergetic information in matter (paint). Order is established and new meaning has arisen to its phenotype, namely the established pattern of thick paint that serves the purpose of illuminating the nature of nature by enabling sensations, pointing to the shift from the metaphysics of the painting to material phenomena. The very notion of painting as an object or thing undergoes redefinition. It is now redefined to be emergence, an act of materialisation through the collective co-working of human and nonhuman entities coming together as an assembled one.¹³¹

Significance arises as a novel quality within the system, an act of self-creation wherein meaning is generated through the intricate flow of information. This process entails the production, transmission, reception, and subsequent transformation of information, forwarded by figural brush marks which are transformed into new forms of information through the bodily movement and the exchange of energy between human and material. As the system interacts with its environment, fused with the binary code embedded within its core, a new painting takes shape, facilitated by the interplay of human agency and material energy.¹³²

Within the context of SET, the encounter with binary code, the spontaneous gestures of the brush strokes, and the dynamic movements of paint materialise as the emergence of complex non-homogeneous patterns in the homogeneous medium of paint. These patterns signify a profound departure from homogeneity, showcasing the manifestation of complex, non-uniform arrangements. Accordingly, the concept of SET aligns with the arguments put forth by Klaus Mainzer and Leon O. Chua, suggesting that symmetry breaking of local gauge symmetries (pertaining to measurements) gives rise to the intricate complexity observed in both matter and forces.¹³³

SET employs the information extracted from the digital image, utilising the digits within it, to

¹³¹ In this context, the term “phenomenon” is used in accordance with Karen Barad’s interpretation. Phenomena should not be seen as mere appearances of things-in-themselves. Rather, they are influenced by Bohr’s concept of phenomena, highlighting their role in re-examining and interpreting issues in quantum mechanics. Karen Barad (2007), *Meeting the Universe Halfway*, 28-34, 56-66, 132-188, 247-352, 412; Hermann Haken (2006 [1988]), *Information and Self-Organization*, 23-33; Bruno Latour (2004), *Politics of Nature: How to Bring the Sciences into Democracy*, Catherine Porter (Trans.) (Cambridge, MA: Harvard University Press).

¹³² Hermann Haken (2006 [1988]), *Information and Self-Organization*, 14-29.

¹³³ Gauge symmetry is employed to illustrate how the free manual brushstrokes generate innovative variations without altering the basic structure of the mapped vector area that encompasses the amalgamation of colour and form. The evolving aspect of this process lies in the interplay and interpositioning of multiple gauge symmetries, organically disrupting each other’s symmetry. This thesis conceptually uses the terms without delving into their mathematical intricacies. Further reading: Leon O. Chua (2022), “Hodgkin–Huxley Equations implies Edge of Chaos Kernel,” in *Japan Journal of Applied Physics* 61; Leon O. Chua (2020), *The Chua Lectures: From Memristors and Cellular Nonlinear Networks to the Edge of Chaos, Volume IV. Local Activity Principle: Chua’s Riddle, Turing Machine, and Universal Computing Rule 137* (New Jersey: World Scientific); Leon O. Chua (2005), “Local Activity Is the Origin of Complexity,” in *International Journal of Bifurcation and Chaos*, 15(11):3435-3456; Klaus Mainzer and Leon O. Chua (2013), *The Local Activity Principle*; Ilya Prigogine (1989), *Exploring Complexity: An Introduction* (London: St Martin’s Press); Ilya Prigogine (1980), *From Being to Becoming: Time and Complexity in the Physical Sciences* (San Francisco: W. H. Freeman).

manipulate and transform the potential energy from the encounter of paint, hand, canvas, and movement to modulate the distribution of this energy through movements of matter via brushstrokes from which a ghost image of the digital code forms through the process of SET.¹³⁴ This ghost echoes the underlying digital structure but is chiral from the binary code as a result of its brush strokes and materiality, in other words, it is non-identical to the binary code, the symmetry of its measurements. As the gauge symmetry shatters, a profound transformation takes place, giving birth to a realm where novel shapes and forms emerge as a ghost. Louis Pasteur, the renowned French chemist, regarded the disruption of symmetry and the inherent asymmetry within living organisms as the defining characteristic of life itself. Building upon this notion, Pierre Curie expounded that it is precisely this dissymmetry that gives rise to the phenomena observed in the natural world.¹³⁵

In SET, the emergence of the ghost image on the surface/canvas encapsulates the chirality of the ghost itself—a manifestation of physical symmetry breaking and the birth of simulacra. Through the utilisation of SET, the ghost that arises relinquishes its connection to the tangible shapes and forms of the real world. Instead, it embraces a realm of references to information, engendering a simulation devoid of a fixed observer perceiving a stationary object. The resulting image becomes a conduit for expressing processes, spatial numbers, and information, rather than focusing on form or physical entities. In this context, both matter and form prove inadequate for encapsulating the transformative act of form-taking as painting is neither matter, form, or information—it is material transformation.¹³⁶

Within the framework of SET the form-taking via symmetry breaking by brushstrokes and movement of the hand requires a threshold to not just be whimsical movements of randomness. The amalgamation of colour and form are dynamic processes unfolding in the present moment, the here and now, and manifest a map that emerges from the internal resonance of the binary code. This resonance is manifested through the measurement captured by digital sensors, capturing the inherent intensities of nature itself.

In the context of SET, where gauge symmetries are continuously broken, an aspect that remains to be elucidated is the clarification of how thresholds of intensities within the merged colours and forms, as encoded in the binary code, give rise to the formation of maps. The process of mapping ensures that the application of paint does not devolve into random movement of brushstrokes (Fig. 33). The generative image of the twenty-first century transcends the confines of tracing and the restriction of a grid,

¹³⁴ Understanding form-taking is crucial as it serves as the intermediary stage between modelling and modulation. Gilbert Simondon (2020 [1964]), *Individuation in Light of Notions of Form and Information*, 21-32.

¹³⁵ Pierre Curie (1894), “On symmetry in Physical Phenomena,” in *Journal de physique* 3:393; Rene Dubos (1986), *Louis Pasteur: Free Lance of Science* (New York: Da Capo Press); Prigogine and Stengers (1984), *Order Out of Chaos*, 160-165.

¹³⁶ Thomas Nail (2020), *Lucretius II*, 155-157; Thomas Nail (2018), *Lucretius I*, 1.

recognising that matter is inherently indeterminate, generative and relational. To navigate this expansive landscape, a map becomes indispensable—a spatial realm that can be freely imposed with the freedom of choice that arises as a consequence of the chirality and thresholds embedded within the discrete information of the digital image.¹³⁷

The analysis of the binary code functions as an abstract machine—a map, a cartography—that operates blind and mute, yet enabling an emergence of a visual ghost [image] upon a surface.¹³⁸ The processes driven by algorithmic codes actualise the interplay, the push and pull, between form and matter, as well as the intricate relationship between content and expression. It seamlessly integrates the realm of information, the binary 0s and 1s, with the corporeal movement and brushstrokes, blurring any distinctions between the two, and challenges the dichotomy between representation and non-representation, embracing a fluidity where boundaries becomes less defined.¹³⁹

The distinguishing factor that sets paintings developed using SET apart lies not in its form or matter but rather in the operation through which its matter has taken a particular form within a unique system of internal resonance. SET embodies an allagmatic operation (a convergence or encounter between structure and operation, as Simondon argues: operation and structure are inseparable), encapsulating the idea of energy exchange inherent in both matter and form. It achieves this by actualising the potential energy.¹⁴⁰ This energy present within the SET system is intricately tied to the singularity of the concrete here and now; it envelops them and amplifies them. When one delves into the inner workings of SET, one is immersed in the state of the formation of a painting, the stage of becoming, the folding together of abstract relations of forces, just before they unfold into another system. This displays relations as pure function, which Deleuze names a *diagram*.¹⁴¹ SET serves as an organising force for both matter and functions, carefully arranging each tone of colour on the canvas. Through this process, it enables freedom and aliveness to emerge through the brushstrokes. Acting as a diagram, SET establishes connections between geometry, the maps and colour sensations, effectively organising matter. The corporeal ghost that emerges enables the non-representational diagram to be grasped as a becoming. SET is never an optical effect, but an unbridled manual power, which manifests itself in the movements

¹³⁷ Christopher Neil Gamble and Thomas Nail (2020), *Black Hole Materialism*.

¹³⁸ Gilles Deleuze (2006 [1986]), *Foucault*, Sean Hand (Trans.) (Minneapolis: University of Minnesota Press), 34-38; Gilles Deleuze and Félix Guattari (1987), *A Thousand Plateaus*, 91.

¹³⁹ Jakub Zdebik (2012), *Deleuze and the Diagram: Aesthetic Threads in Visual Organisation*, (London: Continuum), 1-15.

¹⁴⁰ Gilbert Simondon (2016 [1953]), *Épistémologie de la cybernétique* (Paris: Presses Universitaires de France), 189, 197, as referenced in Yuik Hui (2019), *Recursivity and Contingency*, 226-230.

¹⁴¹ Gilles Deleuze (1986), *Foucault*, 33-44, 71-107, 121-123; Gilles Deleuze (2004), *Francis Bacon*, 66, 82-83, 99-121, 137-161.

of the hand and the application of paint.¹⁴² The disparity between the visual reading of the code displayed on the screen and the ghost image of the code that emerges on the canvas may go unnoticed in practice. However, it is crucial to acknowledge the distinction between the two. One must bear in mind that while one is a representation of the code, the other embodies its transformative becoming.¹⁴³ The becoming of the ghost on the canvas points to Simondon's notion that every individual is more than themselves. It signifies the inherent capacity for individuals to embrace further growth, to explore additional layers or complexities of their being. In the same way, the ghost image on the canvas transcends a mere representation of the digital code, encompassing its own unique emergence.¹⁴⁴

¹⁴² Gilles Deleuze (2004), *Bacon*, 137.

¹⁴³ Gilles Deleuze, *Repetition and Difference*, 246. According to Simondon there is disparation when two twin sets that cannot be entirely superimposed, such as the left retinal image and the right retinal image, are grasped together as a system, allowing for the formation of a single set of a higher degree which integrates their elements thanks to a new dimension. Simondon (1989), *L'individu et sa genèse physico-biologique*, 203.

¹⁴⁴ Elizabeth Grosz (2017), *The Incorporeal*, 171-186; Gilbert Simondon (2009), "The Position of the Problem of Ontogenesis," Gregory Flanders (Trans.), in *Parrhesia* 7:9-10.

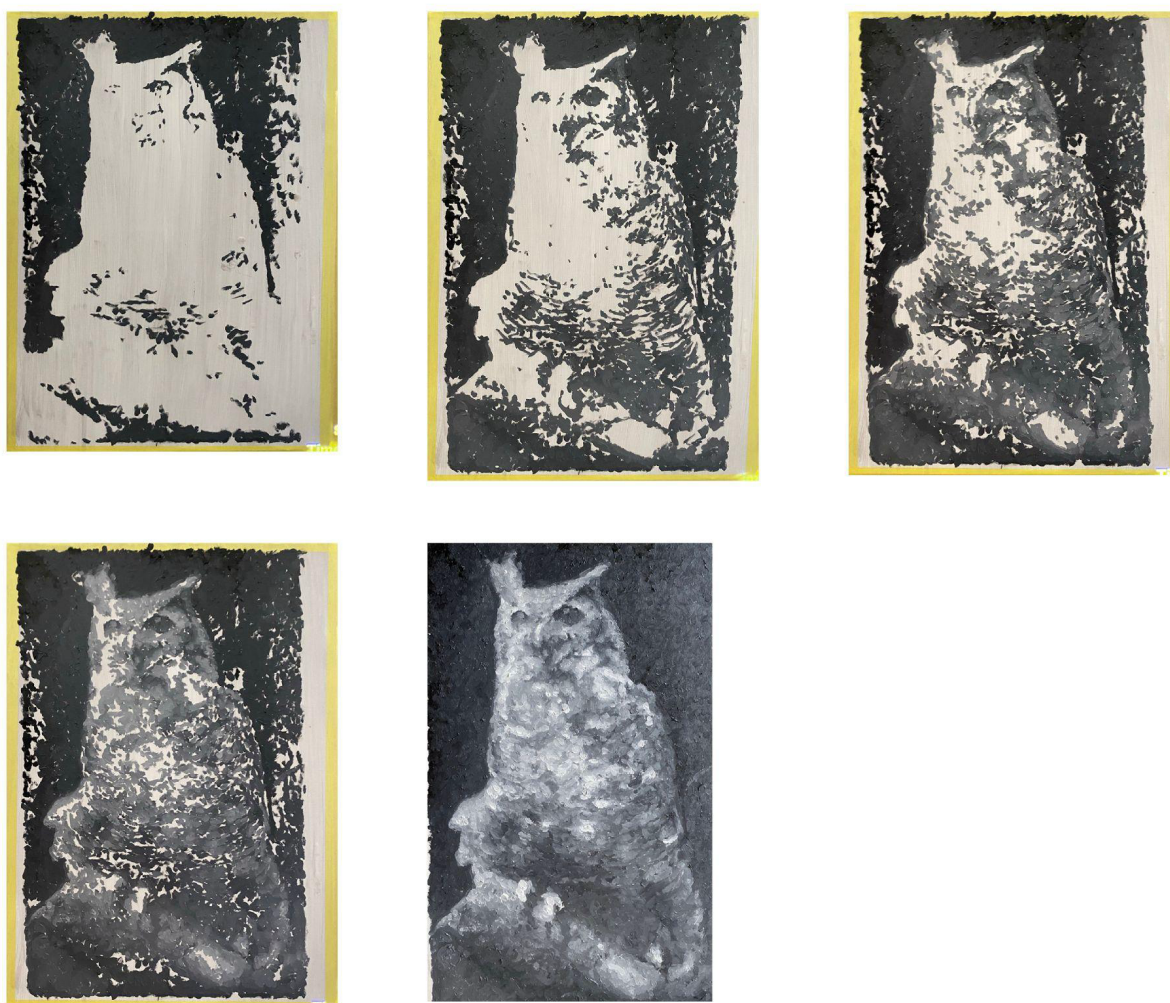


Fig. 33. Different stages in applying paint. Be Andr, Untitled (Owl), 2020, oil on wood, 50 cm x 30 cm.

Chapter 2: Mapping, how to free the mark

This chapter establishes the significance of textuality within the context of the algorithmic code employed in SET and illustrates that the textual binary code serves not as a ground but rather as a departure from representation.

Chapter 2: Mapping, how to free the mark

*In the work of art, paths are laid out for the beholder's eye,
which gropes like a grazing beast*

Paul Klee¹⁴⁵

2.1 Textuality

To make those secret patterns and rhythms within a digital image appear conscious for the eye, one must build a system that allows for the algorithm to map spatiality. For the eye to recognise that which is not described by forms but by numbers, one would need a logic, a written language. A screen has the intensity of its pixels expressed within a range between total absence, 0, meaning black and total presence, 1, meaning white. While the human visual system excels at object recognition, it is less adept at accurately measuring shades of grey, colour tones, distances, and areas. By pointing classical oil painting techniques to digital image processing it becomes possible to explore complex phenomena of density of pigments, the problem of optical illusions of lengths, and the complexity of tonal temperatures of pigments in a quantitative manner.¹⁴⁶ These aspects could not adequately be assessed using conventional measurement techniques, as they are affected by the scattering of light particles at nanometer scales (as depicted in Fig. 41) and inconsistencies in density curves (as depicted in Fig. 40).

The metrological problem of image-processing tasks correlates with the problem of the mathematical mixing of oil colours, as they are both partly measuring problems.¹⁴⁷ The fractional values between 0 and 1 encompass the entire range of grey tone.¹⁴⁸ Unlike a numerical system, the human eye cannot discern subtle differences within the greyscale of a digital photograph. However, the numerical values corresponding to each grey tone can be recorded without help from the eye. The paintings that emerge from the co-working relationship take on a certain textural attribute in their creation.

This system does not establish a foundational point from which to construct an argument for creating a painting; this foundational point can be understood as a ground. The textuality is not simply a mechanical form but rather generates a particular kind of emergence that enables the painting to start

¹⁴⁵ Jurg Spiller (1961), *Paul Klee: The Thinking Eye* (New York: George Wittenborn), 188. Klee initially describes it in this manner: "The eye like a grazing animal feels its way over the surface, not only from top to bottom but also from left to right and in any direction for which the occasion presents itself. The eye moves, grazing from the values that attract it, towards values that draw it on after the first values have been grazed bare," 78.

¹⁴⁶ The human visual system interprets context to estimate length.

¹⁴⁷ Bernd Jähne (2005), *Digital Image Processing*, 4, 18, 20-21.

¹⁴⁸ S. Banerjee, M. K. Hassan, Sayan Mukherjeem, A. Gowrisankar (2020), *Fractal Patterns*, 153-154.

coming into its own. Textuality does not serve as a starting point or as a ground in this context. Instead, it is conceived as a form of poetics initially introduced by Heidegger but subsequently evolved beyond the Heideggerian framework by Lyotard.¹⁴⁹ This reimagining of textuality reconsiders and reestablishes meaning without an origin point; the world was already in a state of “beginning.” As Heidegger puts it, textuality springs away from the ground towards belonging. In other words, the textual aspect of the code belongs to the painting and does not function as a foundational ground. The significance of textuality is critical and becomes apparent in the practice itself. There was a curious parallel in what Heidegger was speaking about in his book *Identity and Difference*, the question of meaning and how something gets to be what it is. Heidegger refers to this exploration as an event, which was further developed by Golding as an encounter.¹⁵⁰ The event of appropriation becomes critical for this system, as textuality itself is considered an event—an encounter. Within this event of textuality, its role is not to establish a ground for what follows, but rather to set a process of circulation in motion. The brush marks transition from being surface-level textual elements to a cohesive environment where they come into their own and make their distinct marks.¹⁵¹ It proclaims a groundlessness, between the image and the code, in a way that fosters belonging and denies representation.¹⁵²

2.2 Groundless and formless, a move away from representation

SET utilises a co-working between humans and algorithms, offering a distinct set of properties compared to traditional painting practices. Creating a system for painting with algorithms confronts artists with a different kind of environment that algorithms present. These environments are shaped by certain kinds of relation that coding sets in motion, logics of emergence, generating an environment where the logic of grounding does not work, a place where the surface is allowed to be itself without being grounded. The sameness of representation is not present in such an environment; instead, we find a difference in a similar way to the Heideggerian concept of plurality of identity.

Within this algorithmic space, an emergence arises through the circulation of algorithms, the binary

¹⁴⁹ Martin Heidegger (2002 [1957]), *Identity and Difference*, Joan Stambaugh (Trans.) (New York: Harper & Row), 10-16. All references to the Heideggerian formulation will be taken from this work unless otherwise cited; Jean-François Lyotard (1988), *Peregrinations*, 12.

¹⁵⁰ Johnny Golding (2021), “Courage to Matter; Johnny Golding (2010), *Fractal Philosophy*; Martin Heidegger, *Identity and Difference*.

¹⁵¹ Chapter 3 elaborates on this argument by exploring Gilbert Simondon’s concept of individuation, which highlights the transformative process through which something emerges, leaves its marks, and transitions from a surface textual environment to a cohesive unified environment.

¹⁵² The content of this thesis regarding groundless ground and its significance will be discussed in the preceding pages (27-29). However, for a deeper understanding of the importance of “groundlessness” in methodology, refer to: Lee Braver (2014), *Groundless Ground: A Study of Wittgenstein and Heidegger* (Cambridge, MA: MIT Press), 194, 229; Belonging rejects representation as it is established through an encounter that does not require an origin. In contrast, representational works depend on an original as they are copies of something; Heidegger (2002 [1957]), *Identity and Difference*, 10-11.

code—an emergence that enables the circulation of the artistic “aura.” In this system, the responsibility for tones, shapes, and paint placement is taken away from the eyes, and the act of painting is transferred into a physical act of the hand. The resulting artwork is devoid of grounding in the traditional sense—a notion Heidegger refers to as “groundless”—with its connection to the binary code being circulated. Once the textual form transforms into a painting, something entirely different and poetic emerges, disconnected from, and unrelated to, the algorithm.

Binary code in digital photos is inherently pre-pictorial, serving as a spatial map that contradicts the paint-by-numbers approach aimed at direct image representation. Instead, it enables a transition beyond literal expression, venturing into an alternate dimension. In this system, the relational bond between digital code and the physical painting exemplifies Heidegger’s plural understanding of “A=A.” It signifies a sense of equality and belonging rather than sameness. The painting does not rely on the code as its ground but exists harmoniously alongside, belonging equally together.¹⁵³ The encounter between the code and the paint engenders a groundless ground, an event of appropriation that solely emerges through this interaction. The resulting paintings are inherently linked and belong to the code, yet their relationship exhibits equality rather than sameness. The paintings themselves do not seek to visually represent the code; rather, they emerge from the encounter with the code and the touch of free brushstrokes—a touch that is inventive, a primitive biological urge in one’s desire to make a mark but also a conscious activity involving the learnt skills of the craft.¹⁵⁴ The physicality of the brushstroke, its libidinal aspect, surpasses the reach of semiotics, such as the code, allowing for the circulation. The brushstroke’s mark does not merely point to the code; its sign is liberated and detached from the code and detached from what it signifies, enabling the emergence and growth of a sensuous logic on the surface.¹⁵⁵ The key lies in the unrestricted manual brushstroke that is not directed solely by the eye’s observational prowess in the old fashion sense, where the artists used the eye to copy from real life to achieve likeness, but instead as an emergence from the libidinal, not as a random process but as an emergence of *techné*.¹⁵⁶

To break the traditional hand-eye relationship the algorithm maps out precise areas utilising thresholds of intensities where free manual marks can live their own lives independently from the algorithmic code, and lose the digital image as a ground.¹⁵⁷ The algorithm’s use of threshold, a textual numbering of

¹⁵³ Martin Heidegger (2002 [1957]), *Identity and Difference*, 36-39.

¹⁵⁴ Keguro Macharia (2019), *Frottage: Frictions of Intimacy Across the Black Diaspora* (New York: New York University Press), 53-59.

¹⁵⁵ Cf. Jacques Derrida (1987), *The Truth in Painting*, 83-119; Jean-François Lyotard (1993 [1974]), *Libidinal Economy*, 43-82.

¹⁵⁶ *Techné* includes both craftsmanship skills and expertise in intellectual arts and fine arts. *Techné* belongs to bringing forth, along with *poiēsis*. Martin Heidegger (1977), *The Question Concerning Technology*, 12-13, 34-35.

¹⁵⁷ The mapped out precise areas are not static areas per se, but areas that are in motion in relation to each other

intensities, is dependent on the co-working between the human aesthetic decisions and algorithm, and through the process of SET, these parameters can be altered multiple times.¹⁵⁸ The precise placement of each tone must be objectively determined using spatial quantitative measurements derived from the digital image. This can only be achieved by establishing a precise and stable spatial geometry through the utilisation of digital image sensors and a fixed projection of the spatial digital code onto the canvas. However, the understanding of tonality within the system is algorithmic rather than geometric, and gives precedence to formless form and groundless ground.¹⁵⁹

One must build on the reversal of the classical hierarchy in painting of form over colour that started with Cézanne.¹⁶⁰ By freeing the brushstrokes from strict geometry, precedence is placed on colour over form, with a focus on sensation rather than essence. In SET this is taken one step further as form and colour become one in the process of mapping, abandoning representation and even the capacity for thought, rejecting semiotics as the entirety of painting. Instead, it aims to conceptualise, materialise, and endure the act of becoming-x.¹⁶¹ This ungrounded difference, a total removal of the ground (synthesis) and Universal Totality, takes the surface of the painting to be itself.¹⁶² By doing so, the surface of the painting, what Golding names *the immanent-movement-structure*, will morph into many things, such as the “refrain,” an assemblage, logic of senses, simulacrum, or what this thesis refers to as a corporeal ghost [image]. This approach expands beyond Heidegger’s limited concept of groundless ground. In this new paradigm, the reading of brushstrokes becomes crucial in transcending positions that are fully formed and bounded. The stroke offers an alternative visualisation method, carrying within it the corporeal trace of reality, as Golding aptly described it.¹⁶³

and the digital code. Throughout the process of mapping and painting, each mapped area undergoes movement and alteration in relation to the entirety, the chosen number of tones, and the algorithm’s fractal-based roughness of the edges. Relying solely on measurements from a digital photographic sensor overlooks the dynamic nature and interplay of moving shapes, while SETs algorithmic coding enables openness in its encounters and the establishment of a physical theory. John Steward Bell (1990), “Against Measurements,” in A. Mill (Ed.), *Sixty-two Years of Uncertainty: Historical, Philosophical, and Physical Inquiries into the Foundation of Quantum Mechanics*, (London: Plenum), 19-20.

¹⁵⁸ Further detail on pp 62-66.

¹⁵⁹ Gilles Deleuze (2003 [1981]), *Francis Bacon*, 156-158; Gilles Deleuze, Félix Guattari (1987), *A Thousand Plateaus*, 158-160; Benoit B. Mandelbrot (1982), *The Fractal Geometry* (New York: Times Books), 1.

¹⁶⁰ Jean-François Lyotard Lyotard (1988), *Peregrinations*, 19-20.

¹⁶¹ Infra chapter 2.1, 61-65; Gilles Deleuze (2001 [1968]), “Chapter III: The Image of Thought” in *Difference and Repetition* (New York: Continuum), 129-167

¹⁶² Gilles Deleuze and Félix Guattari (1987), *A Thousand Plateaus*, 32-35.

¹⁶³ Gilles Deleuze, (2001 [1981]), *Spinoza: Practical Philosophy*, Robert Hurley (Trans.) (San Francisco: City Lights); Johnny Golding (2020), “The Photograph of Thought,” in Daniel Rubenstein (Ed.), *Fragmentation of the Photographic Image in the Digital Age*, (Abingdon: Routledge), 210-220; Johnny Golding (2010), *Fractal Philosophy*, 141-154. Significantly, *corporeal substance*, first developed in 1664 by Spinoza and published in Baruch Spinoza, (2018 [1677]), *Ethics: Proved in Geometrical Order*, Michael Silverthorne (Trans.), Matthew J. Kisner (Ed.) (Cambridge: Cambridge University Press), 88 ff.

2.3 The limitations of discourse, figure

"You can only express in words what words are capable of expressing, what language can communicate.

Painting has nothing to do with that."

— Gerhard Richter ¹⁶⁴

One does not read or understand a painting instrumentally. The readability employed by SET is not merely an instrumental readability but rather pertains to the way one can enable the senses to come into the picture. Consequently, a painting should not be read in a strictly literal manner, as exemplified by the words of Edward Hopper:

*If you could say it in words, there would be no reason to paint.*¹⁶⁵

The “touch” of the painting slows down the eye’s judgement, forcing the mind to take position in front of the sensory.¹⁶⁶ The painting visually unveils the underlying code as both the figure matrix and visuality is in itself emergent. Visuality is an encounter and it does not actually require the eye as such as the thing called the visible is actually textuality, a distributed touch, the energy and the synergy used in SET. Learning how to see is to unlearn how to recognise; where the cogito, the understanding, is already rationalised, one needs instead to re-cognise [invent anew]. As Deleuze says:

Something in the world forces us to think. This something is an object not of recognition but of a fundamental encounter. What is encountered may be Socrates, a temple or a demon. It may be grasped in a range of affective tones: wonder, love, hatred, suffering. In whichever tone, its primary characteristic is that it can be sensed. In this sense it is opposed to recognition. In recognition, the sensible is not at all that which can only be sensed, but that which bears directly upon the senses in an object, which can be recalled, imagined or conceived . . . The object of encounter, on the other hand, really gives rise to the sensible with regard to a given sense. It is not an aisthêton [an external object of perception] but aisthêton [being of the

¹⁶⁴ Gerhard Richter *Painting*, DVD (2012), directed by Corinna Belz, <https://www.goethe.de/ins/us/en/kul/mov/ies/ygf/21333318.html#> (accessed June 16th 2023).

¹⁶⁵ The Art Story, <https://www.theartstory.org/artist/hopper-edward/> (accessed June 16th 2023).

¹⁶⁶ Jean-François Lyotard (2010), *Discourse, Figure*, 178, 205-224, 269-276.

sensible] . . . It is not a sensible being but the being of the sensible. It is not the given but that by which the given is given. It is therefore in a certain sense the imperceptible [insensible]. It is imperceptible precisely from the point of view of recognition – in other words from the point of view of an empirical exercise of the sense in which sensibility grasps only that which also could be grasped by other faculties. Sensibility, in the presence of that which can only be sensed (and is at the same time imperceptible) finds itself before its own limit, the sign, and raises itself to the level of a transcendental exercise: to the ‘nth’ power. [. . .] [T]hat which can only be sensed (the sentiendum or the being of the sensible) moves the soul, ‘perplexes’ it – in other words, forces it to pose a problem.¹⁶⁷

According to Lyotard, words and letters are not visually perceived, not seen, but rather recognised and listened to.¹⁶⁸ He challenged the notion that reading is a visual act, asserting that reading is hearing; in fact, a form of listening to the intended meaning behind the text, as conveyed by the absent voice of the author. In the context of SET, the code intertwines both the visible and invisible realms. Instead of representing recognisable figures, the code in SET generates ghost images that emerge from the graphic inscriptions of its signifiers. In this sense, the process of painting becomes a form of writing, situated within a textual space, relinquishing the role of the eye as the organ of vision and adopting the perspective of the digital code captured by a camera. SET essentially functions as a writing machine, where the strokes and tones employed in the paintings are encountered by codes and algorithms. Although they are written in textual space, they manifest as plastic lines that articulate plastic meaning, brought forth through signification and recognition rather than visual perception. These signifiers lack immediate recognition when one looks at the painting or image. The tactile nature of the hand’s plastic touch transforms the recognisable (code) within the textual space, leveraging the energy of human touch as a means in itself within the figural realm. What was initially recognised as signifying code can now only be contemplated as a figural image, once again veiling the figure matrix. The touch and the algorithmic code act as the absent speaker when observing the painting, exerting their influence indirectly through linguistic signifiers in an act of invisibility that infuses the energy of the hand into plastic meaning.¹⁶⁹ SET as a system is designed to facilitate the process of “becoming-painting” through encounters with digital algorithms, in which something new can emerge.

¹⁶⁷ Gilles Deleuze (2004 [1968]), *Difference and Repetition*, 176.

¹⁶⁸ Jean-François Lyotard (2011), *Discourse, Figure*, 205-232.

¹⁶⁹ In SET, the energy is expressed through manual brushstrokes as the hands move and encounter the binary code, resulting in the emergence of a physical map infused with energy.

2.4 The mapping of the digital, the critical difference between certainty/undecidability for coding issues

In order to accomplish the state of “becoming-painting” within the context of SET, the painting must emerge from the electrical signals through a process of digital conversion, transforming the signals into numerical sequences that can be manipulated by the computer. The concept of becoming-painting relies on an inherent incompleteness within this mathematical system, enabling these sequences of numbers to be inhibited by the free movement of the brush and paint. (see Fig. 34).

The code’s capabilities are limited to creating a mapping for manual marks, but this mapping does not confine the environment to a closed system. Gödel’s work demonstrates that any system, regardless of its simplicity or complexity, is inherently undecidable, meaning it always possesses an open aspect. The concept of undecidability inherent this openness, and SET exploits this by inserting touch as the name of the emergence of undecidability. Undecidability names the equals sign in the system of belonging ($A=A$). The equals sign cannot be closed—it is undecidable—as doing so would overlap the two As. Its significance lies in the relationship between entities rather than in the dividing line that separates them. The equals sign symbolises openness, emergence, encounter, and the groundless ground, connecting with the sensuality of touch.



Fig. 34. Detailed from Be Andr, Untitled (Performative Waves of Embodied Matter), 2020, oil on canvas, 200 cm x 300 cm.

By associating sensuality with touch through the touch that creates the marks on the canvas and the idea of undecidability, it enables sensuousness to come forward.¹⁷⁰ SET recognises and embraces the inherent openness embedded in the system which allows for a degree of uncertainty, a bit of “give,” that

¹⁷⁰ Kurt Gödel (1992), *On Formally Undecidable Propositions of Principia Mathematica and Related Systems*, B. Meltzer (Trans.) (Mineola: Dover Publication), 57-58.

comes alive because of the openness of the touch. Uncertainty implies the presence of various variables that can significantly alter the outcome, yet the system still progresses, ultimately leading to a final result. Within a system, there exists a fundamental limitation to accuracy and observation. Heisenberg's principle states that one cannot always attain desired knowledge, and that our ability to describe nature is circumscribed.¹⁷¹ The concept of undecidability permits one to get into the question of intensities at an analytical level, something that dialectical approaches cannot achieve. When the touch of the artist's hand applies paint to the surface, it deviates from the analytical closed system of dialectics, acknowledging that a system can never truly be closed. This establishes a particular type of knowledge that enables a form of material access beyond the realms of reality or the unreal (or virtuality), operating in a different register altogether. It is this domain that is employed to have an impact on the research.¹⁷²

According to Wittgenstein, certainty equates to knowledge, emphasising that the process itself forms the foundation of knowledge. This concept finds resonance in SET, where the act of painting is regarded as a form of knowledge. In his work *On Certainty*, Wittgenstein refers to Goethe to situate our knowledge in our actions rather than our thoughts. This perspective aligns with the inner structure of SET, where certainty is not attained through reasoning, but rather through the act of doing. The paintings in SET are not mere representations, but rather sensations realised through the act of doing.¹⁷³

Wittgenstein argues that objective certainty is akin to animal-like behaviour and becomes evident in our words and actions.¹⁷⁴ For Wittgenstein, practice is key, and he emphasises the importance of a practice that aligns with the logic of sense, rather than being dictated and controlled by thoughts. He suggests that we should allow for the emergence of some kind of "making sense" that is not preconceived or fully thought out. SET challenges the metaphysical underpinnings of representation by its focus on performativity, the act of painting: its doing. It shifts the focus towards physical optics and questions the notion of diffraction.¹⁷⁵ This perspective is reflected in the act of painting in SET, which encourages play and the use of free manual marks as a way of thinking without relying on rationalisation. It promotes a mode of thinking through the act of making, rather than adhering to an instrumental notion of thinking.

¹⁷¹ David Lindsey (2007), *Uncertainty*, 3-4.

¹⁷² Karen Barad posits that knowing is intricately intertwined with the materiality of the world and its ongoing processes of transformation. Karen Barad (2007), *Meeting the Universe Halfway*, 89-91.

¹⁷³ Lawrence Gowing (1978), "Cézanne: La logique des sensations organisés," in *Macula* 3/4; Éric Michaud (1979), "Les sensations de Cézanne" in *Critique* no. 390 (November 1979).

¹⁷⁴ Wittgenstein employs the terms "ur-certainty" as a shorthand to encapsulate the discussion of objective as that which encompasses only the literal, pre-historical or "instinctual" approach. Ludwig Wittgenstein (1969), *On Certainty*, D. Paul and G. E. M. Anscombe (Trans.) (Oxford: Basil Blackwell), §342, 44e; §359, 47e; 402, 51e; §510, 67e.

¹⁷⁵ Karen Barad (2003), "Post humanist Performativity: Toward an Understanding of How Matter Comes to Matter," in *Signs*, 28(3) (Chicago: University of Chicago Press), 802- 803, 822.

SET enables a freeing of the hand from the thinking of right and wrong; it removes this gap, and enables focus on the haptic dimensions of the performative act of painting, utilising what Wittgenstein refers to as “hinge belief.” Within this system, painting operates with complete certainty, a primal “ur-certainty” that precedes rationality. However, this does not imply irrationality, but rather a distinct mode of thinking. Objectivity is not static, it arises through practical-sensuous encounters. Objective certainty is both a personal, intimate and shared certainty, groundless, non-propositional, non-subjective of doubt, grammatical and foundational.¹⁷⁶ It is personal, standing firm for the individual; the world exists, but it is also complete and objective.¹⁷⁷ The mathematical framework of SET facilitates the emergence of fundamental hinge beliefs. It allows the unrestricted play of ur-certainty while accommodating the presence of digital images, with the coding reverberating as a corporeal ghost in the painting.¹⁷⁸ SET engenders a certainty that arises not from knowledge, but from direct engagement and immediate utterance through the act of doing. According to Wittgenstein, certainty “stands fast,” representing a reliable bond or encounter that one can rely on, rather than a reasoned belief. SET enables a basic coherence in sensuousness, akin to Heidegger’s notion of a thinking that gives rise to a “world” or a “world-picture.”¹⁷⁹ Wittgenstein suggests that objective certainty can be attained by transforming an empirical proposition into a norm of description, analogous to the instinctual guidance of a hand encountering paint and canvas.¹⁸⁰

In a system for painting, the first steps are pre-pictorial. To free the brush from the eye, to enable the instinctual act of the hand and the brush, it is necessary to delineate precise areas where free manual marks can live their own lives independently from their image. The placement of each tone must be objectively certain using precise spatial quantitative measurements derived from the digital image. This process relies on the establishment of a precise and stable geometric framework, facilitated by digital image sensors and the translation of spatial information from the digital realm onto the canvas utilised by a fixed projection. SET enables an ur-certainty that transcends controlled thoughts, reason, or rational knowledge. Instead, it emphasises the innate knowledge possessed by the hand, through the act of doing,

¹⁷⁶ Ludwig Wittgenstein (1969), *On Certainty*, §600, 79e; 337, 43e; §509, 66e; §150, 22e; §672, 89e; §342, 44e; §359, 47e; §510, 67e.

¹⁷⁷ Daniele Moyal-Sharrock (2004), *Understanding Wittgenstein’s On Certainty* (London: Palgrave Macmillan), 68-71.

¹⁷⁸ The notion *corporeal ghost* or *ghost image* is employed to point out the non-linearity and instinctual bodily transition from digital photo to painting on canvas. As stated by Spinoza: “*For nobody as yet knows the structure of the body so accurately as to explain all its functions*” Baruch Spinoza (2002 [1677]), *Ethics, Complete Works*. Samuel Shirley (Trans.) (Cambridge, MA: Hackett Publishing), 280.

¹⁷⁹ Martin Heidegger (1977), “The Age of the World Picture” in *The Question Concerning Technology and Other Essays*, William Lovitt (Trans.) (London: Garland Publishing), 115-154.

¹⁸⁰ Wittgenstein (1969), *On Certainty*, §115, 18e; §151, 22e, §170, §167, 24e; §279, 36e, 24e; §279, 36e, 24e, §510-511, 67e, §603, 80e.

allowing for the successful application of marks onto the surface.¹⁸¹ The transition from rational numerical codes to the instinctual certainty embedded in the act of creation is both a personal and a shared certainty. It is groundless, non-propositional, non-subjective of doubt, grammatical, and foundational.¹⁸² A painting is a substance in its intra-active becoming, it is not a “thing” if by “thing” one means an empty placeholder; it is an expression of doing.¹⁸³ While representation questions reflection (including self-reflexivity), the act of painting in its performativity shifts the focus towards physical optics, foreground overlaps, interruptions, openness, or, to use Barad’s terminology, diffraction.¹⁸⁴

2.5 The way in which undecidability connects with the problem of “touch”/tactility

SET articulates emergence, openness, and undecidability as a materialisation of sensuousness, particularly within the context of technological reproducibility, although not exclusively. It is based on a specific logic centred around sense and the question of undecidability, enabling the privileging of the intensities directly linked to human touch. Through the painting practice, SET illuminates how tactility evokes senses by departing from the logic of sense in general, by highlighting the manner in which tactility is generated in the process of painting through the work of the artist’s hand and the paintbrush.¹⁸⁵

Derrida asserts that art transcends its origins and diverges from the original. He contends that painting always contains a surplus and excess of meaning that surpasses its origin.¹⁸⁶ In SET, this surplus is engendered by the sense of touch and the question of the hand. SET refutes the notion of an original and a copy, proclaiming instead that a new image emerges through new meaning. What Derrida posits as the original is merely an acquired logical starting point, rather than a starting point per se. Derrida’s notion of surplus should not be interpreted as meaning ‘surplus and excess’ but rather as part of a new generative image that resembles this found logical starting point, the code, but is indifferent to it.¹⁸⁷

Throughout the history of painting systems, various forms of measurement have always been incorporated, such as sight size and camera obscura etc. These different systems of painting have an impact on the distribution of libidinal energies through measurements and the application of paint.

¹⁸¹ Moyal-Sharrock (2004), *Understanding Wittgenstein’s On Certainty*, 203-206.

¹⁸² Ludwig Wittgenstein (1969), *On Certainty*, §600, 79e; §337, 43e; §509, 66e; §150, 22e; §402, 51e, §672, 89e; §342, 44e; §359, §510, 67e.

¹⁸³ Karen Barad (2003), *Post humanist Performativity*, 28(3): 820- 822.

¹⁸⁴ Karen Barad (2003), *Post humanist Performativity*, 802-803.

¹⁸⁵ A logic of sense departs from the linear instrumental logic that associates each sense, in a haptic manner, with a specific function, such as the eyes for seeing and the ears for hearing.

¹⁸⁶ Jaques Derrida (1987), *The Truth in Painting*, 10, 74-75.

¹⁸⁷ Derrida (1987), *Truth in Painting*, 10, 74-75, 128-130.

Although experiments we refer to as measurements involve physical interactions, there is no inherent physical characteristic that sets them apart from other types of interactions.¹⁸⁸ According to Barad, a measurement is surely a form of touching.¹⁸⁹ In the context of SET, measurements represent the juncture where matter and meaning converge, manifesting as a spatial mapping of each colour tone utilised.¹⁹⁰ The touch of the hand is enabled by this spatial mapping, which is not dependent on the privilege of the eye, but rather on the act of the touch of the hand, as mapping and lines (Fig. 35). This freeing of the touch and the brush establishes a dimensional haptic—an algorithmic move, a mapping process that permits for the freedom of the touch which completely distinguishes it from earlier painting systems. By employing SET, we demonstrate that mental activity is intrinsically tied to material activity, challenging the notion that freedom exists exclusively within one form of matter and not others.¹⁹¹

The rethinking of the expanded field of spatiality in light of technological advancement and algorithmic coding opens up new possibilities for transforming found objects, such as digital photos, into art. Through digital algorithms, creativity can emerge by the placement of the human touch through atmospheric and spatial memory, and merge differently by the way it sets up the spatial mapping on the canvas. Touch, in this context, is not simply the function of the hand, as touch can be amalgamated with coding. Throughout history, art has always been intertwined with technology, and technology has the power to spread agency. In SET, one cannot say that the tone painted on the canvas is painted by the hand as the algorithm plays a part in both the placement of the tone and the mix of the tones.

This division of agency creates conditions for emergence, where the resulting painting arises from the co-working behaviour of the SET system, which may not be readily discernible from the individual processes at play. The interplay between the spatial mappings (see Chapter 3), and the gestural brushstrokes explores the concept of sensibility, as described by Alfred North Whitehead.¹⁹² The emergence is the painting that arises as a result of that; the collective behaviour of SET is not readily understood from the processes of the parts. The collective behaviour is dependent on the encounters, the intuitive intimacy of all of its parts, and complex behaviour arises from the way the different parts of the system affect each other.

Spatial mappings establish thresholds, merging form and colours into a unified entity, reducing

¹⁸⁸ John Stewart Bell (1990), "Against 'Measurements'."

¹⁸⁹ Karen Barad (2012), "On Touching—the Inhuman That Therefore I A," in *Differences*, 23(3): 206-209; Heisenberg Uncertainty Principle, Britannica, <https://www.britannica.com/science/uncertainty-principle> (accessed 24th February 2021.)

¹⁹⁰ Karen Barad (2007), *Meeting the Universe Halfway*, 66-70.

¹⁹¹ Jacques Derrida (2005), *On Touching*, 304-305; Christian Moraru (2006), "Touching: Proximity, Remove, and the Measure of things," in *Symptome*, 13(1-2): 306-308; Thomas Nail (2018), *Lucretius I*, 98-202.

¹⁹² Alfred North Whitehead (1948), *Science and the Modern World* (London: Pelican Mentor Books), 204.

dimensionality. Complexity and increasing entropy are balanced by the innovative variations and potential information found within the free movements of manual brushstrokes. Only when local emerging order begins to manifest as patterns, thus decreasing entropy through the exchange of matter and energy between the hand's movements and the materials used in the painting process, does the ghost image take shape.¹⁹³

In SET, the sensuous nature of subtle movements throughout the encounters between the hand and the canvas are mediated through the code, which provides spatial information without confining it to grids, specific points, pixels, or predetermined locations. The absence of precise locations and pixels aligns with Mae-Wan Ho's definition of entropy as a lack of information about the system's actual structure. This lack of specific information within each mapped area allows for a multitude of distinct structures, exemplified by the diverse range of free manual brushstrokes in SET.¹⁹⁴

Entropy, a concept also found in thermodynamics, can be seen as a measure of the randomness or disorganisation within a system. Further, the quantity which uniquely meets the natural requirements that one sets up for "information" turns out to be exactly the same as *entropy*.¹⁹⁵ In the physical sciences, the entropy associated with a situation, for instance painting, is a measure of the degree of randomness in the situation; the tendency of the system to get less and less organised relates to communication theory where information is associated with the amount of freedom of choice we have in constructing a message.¹⁹⁶ In contrast, SET does not deal with randomness or decreasing organisation, but rather focuses on the liberation of creative freedom within each mapped area. This freedom enables the circulation of energy, materials, and movements through brushstrokes. The algorithmic complexity in SET is incompressible due to its computational irreducibility, meaning that there is no finite method to predict the exact behaviour of the system without examining nearly all of its workings. As John Slyce writes about the problems of the introduction of the digital into art: the real loss is the inability to recover the story of its making.¹⁹⁷ As Slyce makes clear, the nature of the painting cannot be precisely foreseen

¹⁹³ This notion of ghost in the image is further developed in Chapter 1. See also Martin Gardner (1990 [1964]), *The New Ambidextrous Universe: Symmetry and Asymmetry from Mirror Reflections to Superstrings*, 3rd revised edition (New York: W. H. Freeman and Company), 283; Klaus Mainzer (2005), *Symmetry and Complexity*, 277-278.

¹⁹⁴ See for example "Mapping and tracing, how to free the mark"; Leon Brillouin (1962), *Science and Information Theory*, 2nd edition (New York: Academic Press); Mae-Wan Ho (1998), *The Rainbow and the Worm*, 222-228.

¹⁹⁵ The mathematical formulas for thermodynamic entropy in statistical thermodynamics, developed by Boltzmann and Gibbs in the 1870s, share similarities with the information entropy introduced by Shannon and Hartley in the 1940s. Ludwig Boltzmann (1974), *Theoretical Physics and Philosophical Problems: Selected Writings*, Brian McGuinness (Ed.) (Dordrecht: D. Reidel Publishing Company), 1, 22-53, 92-99, 170, 257; Claude E. Shannon, Warren Weaver (1964 [1949]), *The Mathematical Theory of Communication*.

¹⁹⁶ Shannon and Weaver (1964 [1949]), *The Mathematical Theory of Communication*, 11-14.

¹⁹⁷ John Slyce (2018), *We Have the Technology*, 173-174.

but emerges as a result of the complexity inherent in the system.¹⁹⁸

In contrast to the complete exclusion of the body in digital photography's production process, painting has traditionally offered a unique combination of originality, sensuousness, and communicated intimacy. When it comes to touch, painting involves active participation, while photography creates a sense of distance.¹⁹⁹ The perceived objectivity of photography, in comparison to painting, is linked to the increased effacement of the artist's body.²⁰⁰ A single dot or brushstroke in painting conveys sensations that differ from the mechanical nature of photography.

In the initial test painting with the painting system, *Untitled (Face)* (Fig. 42), the brushstrokes carry a sense of air through the thickness of the paint, providing a sensual flow of painted marks (Fig. 35c). The mapping within the system facilitates for touch that allows free exploration within its mapped space. This dimensional haptic quality arises from the undecidability present in the system. SET facilitates a shift away from questions of certainty and uncertainty towards undecidability, fostering emergence. This emergence enables the circulation of aura, an intangible quality that permeates the artwork.²⁰¹



Fig. 35. The three photos are details from the process of making the painting *Untitled (Face)*, oil on canvas, 2019, 60 cm x 50 cm. Fig. 35a displays a close-up of the digital photo; Fig. 35b exhibits a detailed portion of the black and white map with a grey tone of 10; Fig. 35c presents a specific section of the actual painting.

¹⁹⁸ Ibid. See also Taneer Bar-Yam (1997), *Dynamics of Complex Systems* (Reading, MA: Addison-Wesley), 9-14, 34; Klaus Mainzer, (1994 [2007]), *Thinking in Complexity: The Complex Dynamics of Matter, Mind, and Mankind* (Heidelberg: Springer), 224-226; Simon A. Levin (2002), "Complex Adaptive Systems: Exploring the Known, the Unknown and the Unknowable," in *Bulletin of the American Mathematical Society*, 40(1): 3-19.

¹⁹⁹ Christian, Lotz (2015), *The Art of Gerhard Richter: Hermeneutics, Images, Meaning* (London: Bloomsbury Academic), 39- 40, 48, 77-78.

²⁰⁰ Jean-Francois Lyotard, Jacques Monory (1998 [1984]), *The Assassination of Experience by Painting, Monory* (New York: Black Dog Publishing), 129-135, 152-153.

²⁰¹ The circulation of binary code in SET represents the concept of aura which was discussed previously in chapter 1 pp 52-53.

2.6 The role of “aura” as delineated by Benjamin and its relation to digital technologies

Benjamin’s concept of “aura” is that it derives from authenticity, distinguishing it from technological reproducibility. The presence of aura grants a work of art a distinct aesthetic authority, enabling it to become art. According to Benjamin, aura is a quality integral to an artwork.²⁰² He argues that it is the aura that circulates and generates value within authentic art, while reproducibility in the technological age undermines the notion of authenticity, which is based on the singular uniqueness of the object. For Benjamin, the circulation of the artwork’s aura, its uniqueness, is what defines it as art. This notion is closely intertwined with the issue of “genius” and being a one-off creation, but in the context of SET it is expressed through a shift towards the concepts of circulation and intimacy.

In the digital environment, what circulates is not the aura itself or even the image in its visual form, but rather the algorithmic codes. SET stresses a cohesive utilisation of technology and the body that does not exclude originality and authenticity in painting. The re-establishment of aura occurs through sensuous touch and the dimensional haptic, incorporating undecidability through the unconstrained brushstrokes made possible by algorithms. By employing Benjamin’s ideas and re-establishing aura through sensual touch, painting shifts away from the algorithmic system, raising inquiries about non-accidental yet non-goal-directed gestures as a means to reinstate an aliveness, something human.²⁰³

SET is not a rationalist project seeking to uphold a monotheistic concept where God is personified as the system. Instead, it revives an aliveness, which has seemingly lost its importance within the context of modernity.²⁰⁴ This aliveness is not reintroduced through figurative visual idiom or a painting wherein human attributes are imposed upon lifeless materials, as Isabella Graw suggests.²⁰⁵ Rather, it arises as a result of the “belonging together,” the dispersed agencies, and the application of paint throughout the painting process.

A novel relationship between content and expression emerges, wherein immaterial transformations find embodiment in the material realm.²⁰⁶ This transformative shift occurs throughout SET, facilitated by the fluid transition between textual code and the physical touch of the act of painting, as well as distortions within the digital code itself. As a painting emerges, the system repeatedly folds matter over itself many times. The visual digital image undergoes adjustments to enhance its dynamics before being

²⁰² Originate from: Walter Benjamin (2008 [1936]), *The Work of Art*, 22-24.

²⁰³ David McNeill (2012), *How Language Began: Gesture and Speech in Human Evolution* (Cambridge: Cambridge University Press), 3-4.

²⁰⁴ Jacques Ellul (1980), *The Technological System*, 282.

²⁰⁵ Isabella Graw (2018), *The Love of Painting* (London: Steinberg Press), 21-24.

²⁰⁶ Gilles Deleuze, Félix Guattari (1987), *A Thousand Plateaus*, 503-503.

converted into textual binary codes. These codes are then separated into multiple images, each representing the different tonalities that will be incorporated into the painting. Through algorithmic matching using a spectrophotometer to gauge density and weight, the binary images of each tone are sequentially projected onto the canvas. Between each projection, the artist's hand freely applies paint to the mapped out areas (refer to Fig. 35). This gradual emergence of an image on the canvas results from both technology and man, both equally important.

The mobility of algorithmic digital images highlights a paradigm shift where the traditional understanding of images based on representation falls short.²⁰⁷ Images are no longer distinct copies; instead, they are dynamic processes through which matter curves, bends, folds, and rebounds, echoes into various structures of sensations and affection.²⁰⁸ The echo serves as a profound poetic image of simulacra, being non-representational, transformative, creative, and responsive, encapsulating the sensation of the world itself, drawing out the forms to sensation.²⁰⁹

The fold does not consist of an original part and a copied part. It aligns with Henri Bergson's notion that an image transcends what an idealist would call a representation while falling short of what a realist would deem a thing. It exists halfway between a thing and a representation.²¹⁰ As painting is a performative act, the connection between words and things, words and images, dissolves, and instead what emerges is indifference. This indifference introduces a causal relationship between specific exclusionary practices embodied as specific material configurations of the world. My practice is both material and discursive, a diffraction of the inferences stemming from the decoding and recoding of binary code. The indifference between the digital image and the painting results in a resemblance, a manifestation of the world's extraordinary liveliness, which is nothing more than a corporeal ghost, an image.²¹¹ The performative kinetic act of painting, in its interaction with the generative algorithm of the digital image, generates new images.²¹²

²⁰⁷ Nail's definition of "image" challenges its passive and subjective connotations, highlighting its transformative, affective, and dynamic nature, particularly in the context of algorithmic digital images that reshape the generative aspect of paintings, necessitating a departure from the traditional paradigm of representation. Thomas Nail (2019), *Theory of the Image*, 3-54, 20, 53-54, 69, 87.

²⁰⁸ Thomas Nail (2019), *Theory of the Image*, 10-11; The term "image" originates from the Latin word "imago," which signifies reflection, duplication, or echo, Oxford English Dictionary (2004) (Oxford University Press).

²⁰⁹ Thomas Nail (2020), *Lucretius II*, 181-186.

²¹⁰ Henri Bergson (1988 [1896]), *Matter and Memory* (New York: Zone Books), 9.

²¹¹ Karen Barad (2007), *Meeting the Universe Halfway*, 71-94.

²¹² This argument is further developed in Chapter 2, exploring the concept of the generative image that emerges through the disruption of symmetry, creating a diffraction between the code and the ghost image. Gilles Deleuze (1988), *Spinoza*, 48, 73; Thomas Nail (2019), *Theory of the Image*, 52, 361-363.

2.7 AI training, databases and the illusion of creativity and the new

SET distinguishes itself from other algorithmic image generators through its ability to generate new images. In SET, the organic human body takes centre stage within the system, co-working with the algorithm. The AI component of SET alone cannot generate creative artworks or make a painting emerge. Unlike other systems, SET does not require training for the emergence or application of paint in the painting process. The only training involved pertains to mathematical formulas that calculate colour mixes, which are adjusted based on the measurements done by the spectrophotometer of actual oil paint. These calculations are separate from the creative aspect of the emerging painting and serve the purpose of preparing the paint for application. Even if it were possible to train the algorithm in creativity, it would still lack the fundamental inspirations behind the concept of an emerging painting.

In contrast to SET, AI image generators like MidJourney, Chat Bot, and Dall-E 2 are dependent on training and generate images that are a merging of the input data fed into the system. These AI systems are closed systems, incapable of generating anything new beyond what they have been trained and programmed with. In other words, they cannot generate anything new. It is crucial to recognise that algorithms and computations differ from living organisms and lack consciousness, creative ambition, and judgement. Algorithms do not concern themselves with the source of the electricity they utilise, nor do they observe the sun, feel the rain, or experience the warmth from a partner's CPU. They cannot draw, paint, or come up with original ideas beyond what they are trained to do. The output of an algorithm is limited by the input it receives. Algorithms lack a conscious understanding of the world and are unaware of the knowledge possessed by humans. However, in the painting process of SET, by placing the human at the core, the movements of the hand and body in SET accommodates the encounter between algorithmic computable aspects and the organic.

In this context, we can examine Simon Colton's software called The Painting Fool. Colton's objective with this software is to present it as a genuine creative artist by attempting to simulate the behaviours and techniques commonly observed in human painters.²¹³ The intention behind Colton's software seems to be to reduce painting, as well as the human consciousness and creativity, to such an extent that they can be literally replicated by imitating brushstrokes and other painterly effects using digital technology.

According to Colton, the software's success is measured by its ability to closely resemble human paintings.²¹⁴ Creativity and art is equal to a sterile algorithm that manages to make a copy of realistic-looking brushstrokes, a realistic painterly expression, copy a certain school of painting or some pre-

²¹³ Simon Colton (2012), "The Painting Fool: Stories from Building an Automated Painter," in Jon McCormac and Mark d'Inverno (Eds.) *Computers and Creativity* (London: Springer), 3-36.

²¹⁴ Simon Colton (2012), "The Painting Fool", 14-15.

defined sets of emotions digitally in a realistic way.²¹⁵ Nevertheless, this perspective contrasts with Hubert Dreyfus's critique of the Cartesian view of computation. SET, in particular, operates differently from Colton's software and other AI image generators, as it doesn't rely on inputting millions of representations of brushstrokes, painting styles, and painterly effects. Mere copying and merging of these styles and brushstrokes are deemed insufficient for The Painting Fool to be regarded as a credible artist. This inadequacy arises from the computer's inability to construct contexts or an object-milieu correlation from the millions of representations.²¹⁶

Colton's software is trained to reach its telos, which is essentially a futile endeavour that reveals its own failure by demonstrating that technology alone is only capable of resembling itself. This *resembling of itself* happens through the software's input, which Colton incorrectly interpreted as the manifestation of an independent digital artist grounded by the resembling of the human act of painting on a digital canvas.²¹⁷ In line with Margaret Boden in her book *The Creative Mind: Myths and Mechanisms*, Colton seeks to vanquish those who believe in the irreducible quality of human consciousness with the wonders of its creativity, and that there is more to art than just the calculative.²¹⁸

In contrast, SET creates an encounter between the algorithmic and the physical, asserting that creativity has nothing to do with resemblance or representation. The rewriting of an image into art through its digital code is not equivalent to mere copying because the image's demands (the code) cannot be reduced to pure computation, as there is always an excess to the visual aspect, which is expressive, singular, dynamic, and non-identical.²¹⁹

What Colton's software lacks is a presumption of *being-in-the-world* as a whole. Unlike Colton's software and AI image generators, SET does not require an ever-expanding knowledge base of representations, often referred to as "training." Instead, SET facilitates a material encounter—an

²¹⁵ The Painting Fool software incorporated emotion detection software developed by Maja Pantic and Michel Valstar, where sitters expressed six emotions in a 10-second video that served as a database for the software to determine a painting style. Michel Valstar, Maja Pantic (2006), *Biological vs. logic inspired encoding of facial actions and emotions in video*. Conference paper, IEEE international conference on multimedia and expo.

²¹⁶ Hubert Dreyfus (2007), "Why Heideggerian AI Failed and How Fixing It Would Require Making It More Heideggerian," in *Philosophical Psychology* 20(2): 247-268; Hubert Dreyfus (1992), *What Computers Still Can't Do: A Critique of Artificial Reason*, revised edition (Cambridge, MA: MIT Press), 289; Hubert Dreyfus (1972), *What Computers Can't Do: A Critique of Artificial Reason* (New York: Harper & Row), 196. A milieu is different from a context: whereas a context is always a selection of significations of the subject, a milieu is more timely, it lasts and for it to changes requires a process of (re)structuralisation. Yuk Hui (2016), *On the Existence of Digital Objects*, 158-160.

²¹⁷ Jacques Ellul (1980), *The Technological System*, 230-231.

²¹⁸ Margaret A. Boden (2004 [1990]), *The Creative Mind: Myths and Mechanisms*, 2nd edition (Abingdon: Routledge).

²¹⁹ Roger Penrose (1994), *Shadows of the Mind*, 64-66, 145-147, 399-401; Daniel Rubinstein (2023), *How Photography Changed Philosophy* (Abingdon: Routledge), 1-7.

environment in which humans and algorithms interact through material relations.²²⁰ The artist's subjective perspective, the "I" of the artist, is embedded within the system, with the artist's body serving as part of the process and forming a feedback loop. This characteristic keeps the system open and far from sterile, consisting of a certain aliveness.

2.8 The rethinking of the ready-made via the figural

The issue of digital sterility encroaching upon human life is a critical challenge facing contemporary painting in the digital era. The dichotomy between humans and machines, resulting in the loss of physicality and sensuousness in the digital realm, is a misconception that underscores a lack of intimacy. To overcome this divide and restore intimacy to painting, the concepts of Benjamin's aura and Lyotard's figural are merged. Benjamin posits that the aura of artwork withers in the face of technological reproducibility, while Lyotard's figural seeks to develop a new understanding of how an image comes to be present by going beyond illustration and figuration. According to Lyotard, the figural embodies the emotive potential of what can become something, representing desire as an "emergence" articulated and expressed in the ways in which the figural presents itself through the movement of matter. The figural is the embodiment of desire. Achieving this requires painting to extract the Figure from the figurative. Deleuze, referring to the Figure as sensation, asserts that it encompasses and puts forward the realm of the senses.²²¹ SET involves a type of mapping that frees movement, touch, and mark-making in the encounter of binary code, hand, brush, canvas, and paint. This process highlights the fact that technology can bring forth the Figure and contribute to conveying an intimacy inherent within a technological system. There exists an intimacy at the heart of algorithmic coding, which could be seen as related to a mathematical comprehension but transcends mere computation.²²²

The expanded field of spatiality within the realm of SET is profoundly influenced by technological advancements and algorithmic coding. These developments enable different forms of found objects which fundamentally repositions the role of the expanded field of spatiality. One such example is the utilisation of the "found" binary code derived from digital photos, which, when translated into art, engenders a distinct type of aura that diverges from Benjamin's concept. The introduction of digital algorithmic coding enables creativity to become present through atmospheric and spatial memory, infused with the intentional placement of the human touch, and emerges differently by the way it sets up the spatial mapping on the canvas. What circulates in this context is not the mere image itself, but rather the algorithmic code, which functions as a ready-made spatiality.

²²⁰ Yuk Hui (2016), *On the Existence of Digital Objects*, 150-154.

²²¹ Gilles Deleuze (2003 [1981]), *Francis Bacon*, 34-43.

²²² Roger Penrose (1994), *Shadows of the Mind*, 64-65, 115.

The binary code is no less than that of space itself. Rather than representing space, it serves as a map that empowers the hand's touch to make a painting emerge. Consequently, the notion of an original and a copy (reproduction/representation) becomes inadequate within this scenario. This perspective echoes Lyotard's viewpoint, asserting that presence arises through an encounter and that language invariably lags behind this emergence. Consequently, an aesthetic is impossible by the means of language. Unlike the linguistic turn, which fails to emphasise the emergent nature of painting, SET entails the encounter of multiple positionalities. The artist's manual free touch gives access to a form-less, in-built, un-referred presence wherein the spatial code operates as a map to a found object—the ready-made.²²³

²²³ Jean-François Lyotard (1993 [1974]), *The Tensor, Libidinal Economy*, 43-94; Jean-François Lyotard (2011 [1971]), "Signification and Designation," in *Discourse, Figure*, 23-129; Jean-François Lyotard (2012 [1987]), *What to Paint*, 162-167.

Chapter 3: System of emergent touch

By embracing Lyotard's figural approach rather than representation, Chapter 1 diverges from the overarching issue of uniqueness and originality, shifting its focus towards groundless ground, laying the groundwork for a painting system that goes beyond a mere point-by-point approach. Chapter 2 provided an introduction to the construction and practical functioning of SET.

3.1 Digitisation and quantisation

The ready-made spatial arrangement, the binary code, serves as a map for the painting, where the term “map” is the outcome of digitisation. In SET, digitisation involves utilising image segmentation and is determined by the similarity or dissimilarity of intensities in the binary code of the digital image.²²⁴ However, digitisation is not an accurate representation but it is, rather, a creative process in itself. Digitisation refers to sampling the colour values in an image at a discrete set of points, which can be represented by a grid or matrix, resulting in a loss of all information except at those grid points.²²⁵ This sampling process leads to a decrease in resolution and a loss of information. Additionally, a considerable amount of distortion occurs—for instance the moiré effect and aliasing.²²⁶ Further, the oscillating signal between the sampling distance and the aliased wavelength causes certain types of distortion, resulting in undecidable edges. As a consequence, the accuracy of the mapped areas for each tone can be either proven or disproven within the system.²²⁷ The next step involves determining how the measured irradiance at the image plane must be mapped onto a limited number of discrete values. This process, known as quantification, determines the number of tones that will be present in the painting. The algorithm is programmed to quantise the image into a specific number, q , which can be adjusted based on the desired number of tones in relation to the size of the output map.²²⁸

From this, the algorithm generates separate grid-free tonal maps for each intensity, corresponding to each q level. Typically, in a greyscale image, the data is separated into 256 shades of grey. This resolution is sufficient to create the illusion of a continuous change in grey value. However, to allow the painting to function as a painting rather than a reproduction of a photograph, one must consider how the value of q affects the size of each tone’s mapped area.

Having 256 shades of grey results in small areas where the brush cannot freely move to manifest its marks, hindering the painting’s expressive potential. Consequently, the system divides the 256 grey tones into 127, 64, 32, or 16 tones, providing each mapped area enough spatial room for expression.²²⁹

²²⁴ “Intensities” refers to the level of tonal colour intensity of the image at its specific spatial coordinates. S. Banerjee, M. K. Hassan, S. Mukherjee, A. Gowrisankar (2020), *Fractal Patterns*, 153-156.

²²⁵ Analogue images are based on electrical signals, while digital images are digitally sampled and quantised, represented by a two-dimensional discrete function $f(x; y)$ in matrix form with the coordinates mapping to rows and columns and the amplitude values assigned to matrix cells. S. Banerjee, M. K. Hassan, S. Mukherjee, A. Gowrisankar (2020), *Fractal Patterns in Nonlinear Dynamics and Application*, 152-182.

²²⁶ The moiré effect occurs when repetitive structures are overlaid or viewed together, resulting in an identifiable pattern of alternating dark and bright areas that emerges during the superposition. Isaac Amidror (2000), *The Theory of the Moiré Phenomenon* (Dordrecht: Springer), 1-10.

²²⁷ Bernd Jähne (2005), *Digital Image Processing*, 241-253.

²²⁸ The choice of a higher or lower q number determines the size of the output maps, which in turn influences the range and magnitude of hand movements, the release of energy, and the brushwork executed on the canvas.

²²⁹ Bernd Jähne (2005), *Digital Image Processing*, 37-38.

During the testing phase of the system, I started with 32 tones and gradually increased it until reaching 127 tones. The mapping of tones is crucial in revealing the freedom of brushstrokes, its *techné* and the works belonging within *poiesis*.²³⁰ Each tone is mapped out to allow for unrestricted manual marks within each area. By experimenting with painting using 127 tones in the painting *Untitled (Performative Waves of Embodied Matter)* (Fig. 1), it became apparent that 127 tones are not always necessary. Subsequently, the painting *Untitled (The Impossibility of Writing Time)* was executed using 32 tones (Fig. 59).

When it comes to quantification, one has to question the accuracy with which one can measure the grey values. From a mathematical standpoint, it is possible to calculate that the maximum quantification error is half of a quantisation level, while the mean error amounts to 0.3 times the quantification level. However, accuracy is further constrained by systematic errors, including the unevenness of quantisation levels one finds in analogue-to-digital counters, where the intervals between quantisation levels deviate systematically.²³¹ While applications like Adobe Photoshop can be utilised to separate tones, their effectiveness is limited by aliasing distortion. To overcome this limitation, I sought assistance from a coder to develop a script, using the software Processing, that meticulously analysed each pixel of the image. This script effectively separated the various tones into distinct binary, black, and white images, forming what I refer to as a “map.” As a result, significantly more precise outcomes were achieved.

Quantisation plays a crucial role in the process of image segmentation, which aims to reduce an image’s tones for easier analysis and, within SET, to generate fractal patterns that enable the encounter between hand movements, brushes, and each tonal pigment of paint.²³² Image segmentation involves taking digital binary code as input and producing tonal maps as output. Each tonal map is essentially a mask, where the analysis of the binary code denotes the class or instance to which each pixel belongs. Technically, using SET, image segmentation is the assignment of labels to pixels to identify each pixel’s intensity value before adding each intensity value into a separate map where each tone is made into a grid-free black binary image, a transition from linear pixels to non-linear fractals dimension (See Fig. 36 and Appendix 4).

²³⁰ Martin Heidegger (1977), *The Question Concerning Technology*, 14-35, 24-26.

²³¹ Bernd Jähne (2005), *Digital Image Processing*, 253-254.

²³² As discussed in Chapter 3.2 as to how fractal patterns are created and works within SET. See also Johnny Golding (2010), *Fractal Philosophy*.

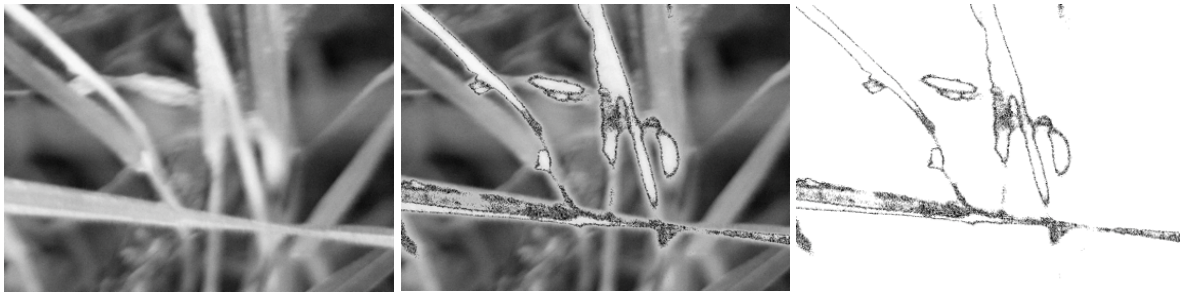


Fig. 36. Shows three photos of the mapping process for the painting. Fig. 36a. Detail of photo. Fig. 36b. Detail of photo with grey tone 30 blacked out. Fig. 36c. Map of grey tone number 30.

The amalgamation of form and colour gives rise to monstrous shapes, the "in-between" known as cohesion or emergence. It is the encounter that gets returned to create the pattern, which is closer to a camouflage. Camouflage as a pattern of self-similarity, meaning matter touching itself, is not a repetition of the exact same, whereas the repetition of coherence of certain elements and differences are repeated rather than an exact duplicate.

3.2 Colour mixing and SET

In the process of building a system for mixing precise colours it became evident that the secret of mixing colours of oil paint to an even, controlled gradient lies in the densities, as well as the warmth or coolness of each colour used in the mix. One simply cannot mix based on a simple percentage calculation of each colour, as the chemical interactions between different pigments can yield unexpected results, disrupting the linear mixing process. There is not a stable divide that can be universally applied to mix all the different tones, as this ratio changes according to the variation in the density, warmth, and coolness of each colour.

To address these challenges, I collaborated with Winsor & Newton Labs and employed a benchtop spectrophotometer, specifically the Konica Minolta CM-3600A. This device utilises diffuse illumination and measures the reflected light at an 8° angle from the normal (diffuse 8°). By analysing samples of oil colours that I provided, we obtained precise quantitative data. Using these measurements, we programmed an algorithm that followed the density curve of the mixtures, enabling us to determine the exact percentage of each colour required to achieve the desired tones of colours across a gradient of 127 variations (Fig. 37). It's important to note that while the algorithm doesn't perfectly account for wavelengths, it can be continuously improved and adjusted to align with the density curve observed in the tests.

Initially, we focused on implementing this approach with the L^* axis using black and white paint, but by incorporating density calculations, we can formulate mixtures between any numbers of colours. This

iterative process was ongoing as we further developed the system, ensuring greater accuracy and refinement.



Fig. 37. Selection of the 127 grey tones mixed.

3.3 The central black to white L* axis

*Grey is a colour—and sometimes, to me,
the most important of all.*

Gerhard Richter.²³³

Grey, also known as *grisaille* in the context of art history, represents the colour of neutrality. This makes it an ideal choice for exploring the principles of painting, contrasting with the colourlessness of white. By questioning the neutral nature of grey and examining its emotional or deliberate qualities, as well as its personal or formal attributes, one discovers more than anything that grey highlights the tone in paint.²³⁴

SET is a painting system that acknowledges the shades of grey as a central axis (L* axis); a segment, cutting through a spherical representation of all wavelengths, commonly known as colours (Fig. 44). This spherical structure possesses dimensions, spatial in all directions. This, in turn, facilitates a quantitative method for mixing each wavelength through the use of an equation. In the development of SET, the L* axis is an optical grey achieved by combining black and white. The haptic grey, resulting from the combination of green and red, automatically becomes part of the system when the dimension of hue is introduced. This integration aligns with Deleuze's concept of the diagram acting as a modulator, enabling the haptic sense of colours through manual intrusion.²³⁵

In order to test the system, the initial stage involved analysing the various levels of quantisation applied to the digital image. Fig. 38 demonstrates the adverse effects of using insufficient quantisation levels, resulting in the creation of artificial edges and the partial or complete disappearance of low-contrast

²³³ Gerhard Richter (2009), "Interview with Rolf Schön, 1972," in *Gerhard Richter Text: Writings, Interviews and Letters 1961-2007*, Dietmar Elger and Hans Ulrich Obrist (Eds.) (London: Thames & Hudson), 61.

²³⁴ Ian Chilvers (Ed.) (2004), *The Oxford Dictionary of Art*, 3rd edition (Oxford: Oxford University Press), 314.

²³⁵ Gilles Deleuze (2003), *Francis Bacon*, 138.

features. As the number of tones increases beyond 32, the image presents an illusion of continuity.

The painting titled *Untitled (Face)*, (Fig. 42), was created as a means to test the system, employing a palette of 32 shades of grey. However, the painting brought forth several issues. Firstly, the low quantisation resulted in false edges in the lighter tones. (See Fig. 38 to examine the algorithm's analysis of the tonality through different parameters). Secondly, the small dimensions of the canvas (60 cm x 40 cm) limited the capacity for broader, expressive brushstrokes, leading to a dotted appearance.

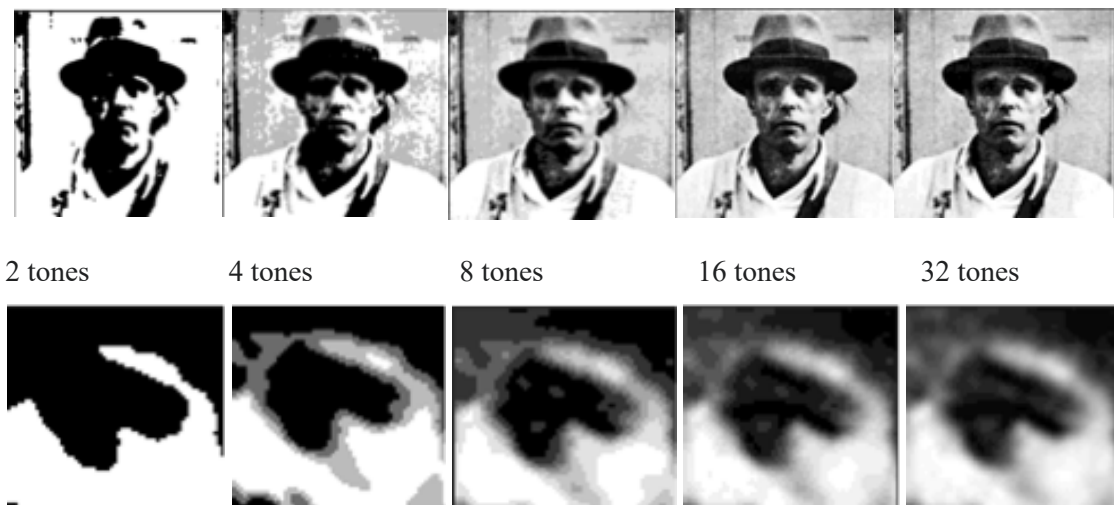


Fig. 38. Shows how a digital image can be quantized and how this affects the resolution.

In contrast, the subsequent artwork produced with the system, *Untitled (I Am Too Sad to Tell You)*, (Fig. 2), also utilises a 32-tone palette but on a considerably larger scale (200 cm x 300 cm). The expanded size of each mapped area allowed for more free brush marks, infusing the paintings with a heightened sense of aliveness. Nonetheless, this larger artwork had a drawback: the range of contrast in the darkest and lightest tones fell short of the digital source. Consequently, a gamma transformation was incorporated into the script to enhance the dynamic range for future paintings.

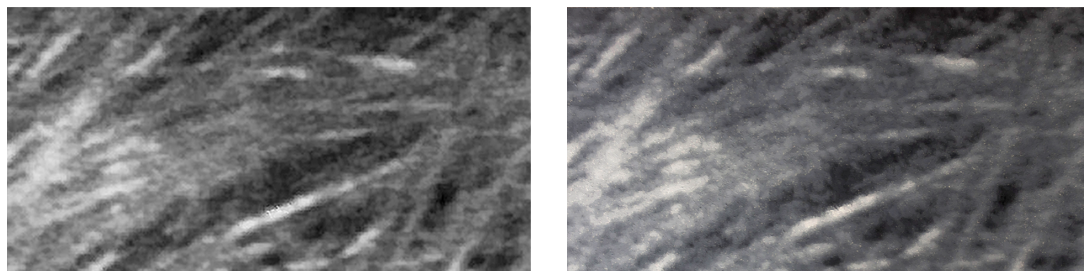


Fig. 39a. Detail of source photo encountered with the painting *Untitled (I Am Too Sad to Tell You)*.
Fig. 39b. Detail of painting *Untitled (I Am Too Sad to Tell You)*; see Fig. 2.

In order to enhance accuracy, the algorithm underwent enhancements by incorporating three separate mathematical functions tailored to three density domains. Although there is a decrease in accuracy of approximately 39% and 71.5% at the intersections of these domains, employing a single function would have significantly compromised overall accuracy. See Fig. 40 for a mathematical representation.

Weight % of Mars Black to mix with Titanium White upon chosen density:

| | |
|------------------------------------|---|
| For density between 0% and 39% | $=(0.7646 \cdot \text{density}^3) - (0.2956 \cdot \text{density}^2) + (0.0598 \cdot \text{density}) - 0.0001$ |
| For density between 39% and 71.5% | $=(11.399 \cdot \text{density}^4) - (26.177 \cdot \text{density}^3) + (23.342 \cdot \text{density}^2) - (8.9806 \cdot \text{density}) + 1.2645$ |
| For density between 71.5% and 100% | $=(166.57 \cdot \text{density}^4) - (512.6 \cdot \text{density}^3) + (589.77 \cdot \text{density}^2) - (299.26 \cdot \text{density}) + 56.488$ |

Fig. 40. Three separate mathematical functions for three domains of density.

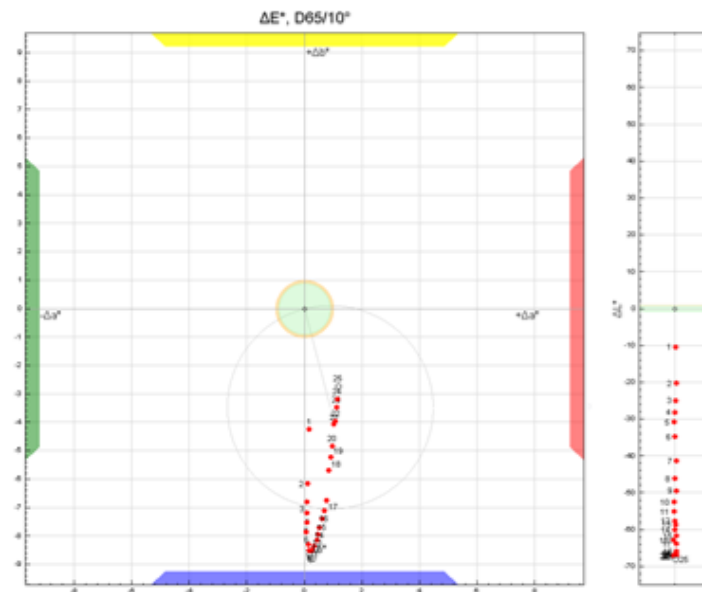


Fig. 41. The hue and saturation evolution from white to black.

From the top of the light axis, the gamut view depicted in Fig. 41 illustrates the progression of hue and saturation from white in the centre to black at the blue spectrum's end. The figure shows that instead of transitioning directly from one end to the other in hue, resulting in a neutral grey (where all points converge in the middle), the grey tones stretch significantly into the blue region before taking a U-turn towards the opposite end. This elongation of grey mixes into the blue indicates that when mixing yellowish white (Titanium White) and yellowish black (Mars Black) in specific proportions, the

resulting grey contains a noticeable blue undertone. This is attributed to the scattering of light particles at nanometer scales.²³⁶ Ideally, to correct this, small increments of yellow should be added to neutralise the grey, followed by the addition of blue after the U-turn. However, due to limited resources and minimal visual impact in the greyscale, it was decided to overlook the inconsistency in coolness and warmth among different grey mixes while developing the L*axis. On the contrary, when this occurrence takes place within the equatorial hue circle, the impact becomes exponential. To address this issue during the development of the full colour system, a mathematical equation was added to rectify the situation.

After incorporating the new density algorithm and applying the gamma transformation, the painting titled *Untitled (Performative Waves of Embodied Matter)*, (Fig. 1), was created using 127 tones. Each tone was meticulously painted one by one, covering the entire canvas simultaneously. The visual comparison between this painting and *Untitled (I Am Too Sad to Tell You)*, (Fig. 2), clearly demonstrates how these adjustments resulted in improved dynamics and more balanced tonal levels. The canvas size allowed for the creation of sufficiently large mapped areas, where free manual brushstrokes could be applied, evoking a sense of aliveness and sensuousness. However, there are some limitations in this process. Applying paint to each of the 127 tones individually results in a diminished ability to grasp the interrelationships among the tones within the mapped regions. Furthermore, using such a large number of tones makes the mapped areas too small to accommodate freely executed brushstrokes. As a consequence, *Untitled (Self-Forming Evolution)*, (Fig. 43), and *Untitled (An Unknown Emergence)*, (Fig. 3), were painted using 32 tones of grey, utilising an initial layer of 16 tones followed by an additional layer of 16 tones. This technique, although effective, lacks some of the spontaneous brushstroke qualities achieved when working wet on wet.

The next evolution of the process involved creating grids and painting each grid with all the tones wet on wet in one go. *Untitled (The Impossibility of Writing Time)*, (Fig. 59), explores the use of 32 tones of grey in such a manner. By reverting to a smaller palette while employing the grid method, all the issues observed in the previous painting regarding the relationship between the mapped areas and the paint were successfully resolved. It is worth noting that this grid is not the traditional grid employed by artists like Close, Strand, and Moholy-Nagy. Instead, it involves dividing the canvas into large squares, each of which is treated as a separate wet-on-wet painting while still utilising the mapping system.

²³⁶ When an electromagnetic wave interacts with an obstacle, the oscillation of electric charges within the obstacle results in the emission of electromagnetic energy in all directions, referred to as scattered radiation, which causes the dispersion or “breakdown” of colours. See: Craig F. Bohre, Donald R Huffman (1983), *Absorption and Scattering of Light by Small Particles*, (New York: John Wiley & Son), 3-5, 42.

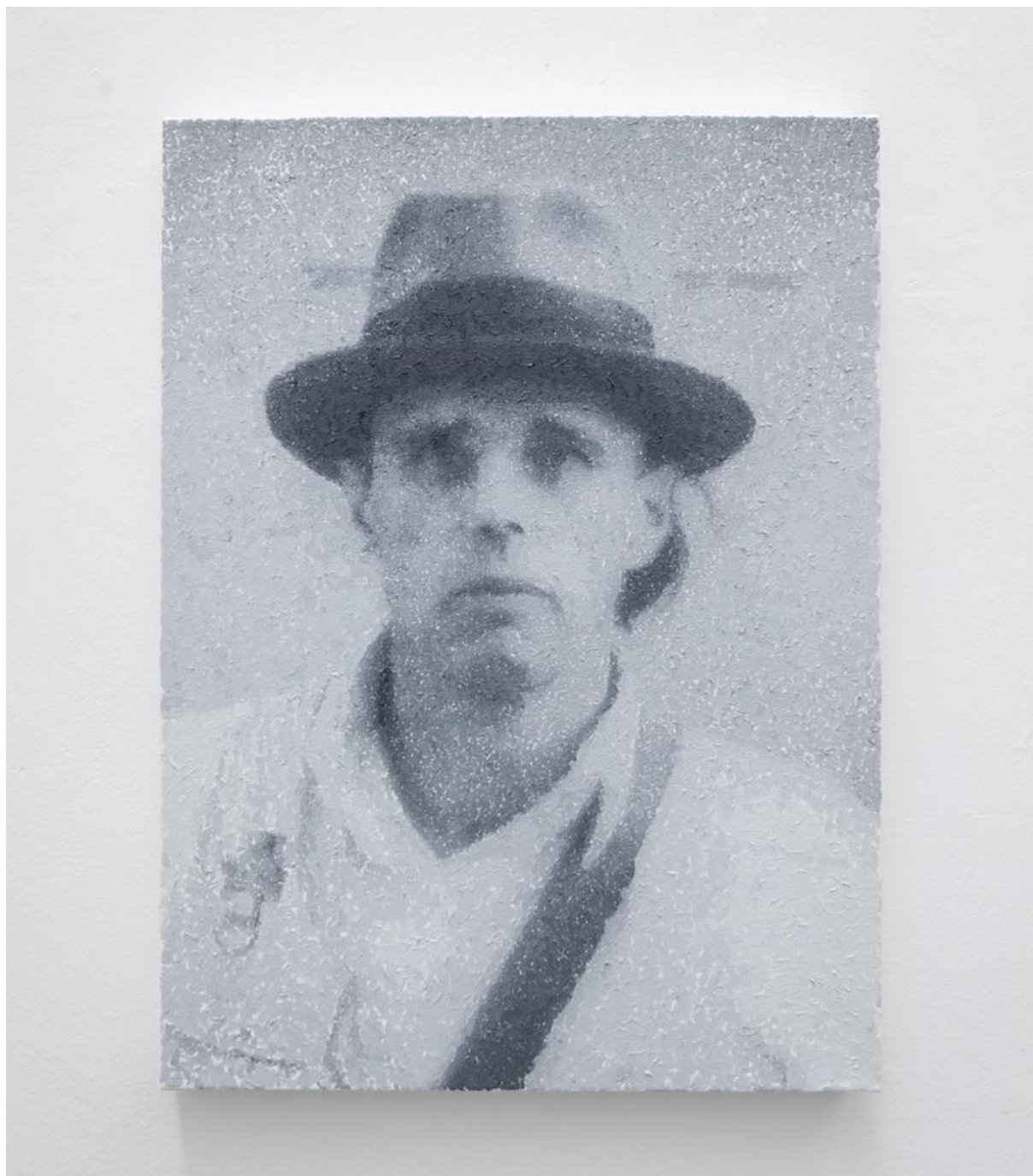


Fig. 42. Be Andr, *Untitled (Face)*, 2019, oil on canvas, 60 cm x 50 cm.



Fig. 43. Be Andr, *Untitled (Self-Forming Evolution)*, 2022, oil on canvas, 200 cm x 160 cm.

3.4 The equatorial hue circle

The initial phase involved developing a fully operational system for the central black to white L^* axis but in a project that advocates the freedom of movement of the brush and openness of thought, it is simply inconceivable to confine the medium of paint solely within the L^* axis. The unrestricted movement, the free manual brushstrokes, and the touch needs to move in all directions [axes] at once, embracing all the potential options presented by the binary code. The mapping of tones is crucial for the freedom of brushstrokes and the dimensional haptic, even though its objective is not to represent the code itself, as that would be impossible. However, the encounter between the two creates a completely new image.

Subsequently, the equatorial hue circle, the h^* polar angle, or the a^* and b^* colour axes in Cartesian coordinates were plotted as the next step. Drawing inspiration from commercial Point of Sale paint systems used in stores like B&Q, Crown, or Dulux decorator centres, a palette comprising white, black, and 10 to 14 additional colours was determined.²³⁷ It was crucial to select the appropriate palette to enable SET to calculate a vast number of possibilities within the LAB colour space. Once accomplished, the subsequent phase involves incorporating the cubic level of complexity by merging the two dimensions of colours with that of lightness, thereby achieving a comprehensive 3D space. An equation is used to estimate the quantities of black and white required to attain the desired lightness level (density), as well as the quantities of each primary colour necessary to achieve the desired hue and saturation.

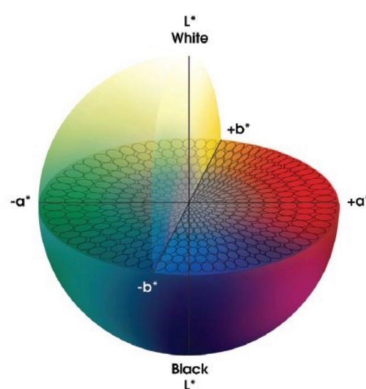


Fig. 44. The three axes of the LAB three-dimensional world of colours.

²³⁷ Commercial Point of Sale paint systems use liquid dispensers to precisely dispense different amounts of colourants into a white paint mixture, such as the Corob 200: (<https://www.eskens.com/en/eskens-producten/corob-d200/>) (accessed 16th April 2022).

Before going into the intricacies of how colour mixes are calculated in SET, it is essential to grasp the concept of colour and colour perception. The perception of colour is the result of the complex construction of the brain and mind, and there is currently no precise scientific explanation of the colour vision process. By adopting a monist perspective—that colours can be reduced to their physical properties and be measured—SET posits that the apparatus of colour vision outputs into consciousness.²³⁸ Acknowledging the incomplete scientific understanding of consciousness, SET perceives consciousness not as a static entity but as a dynamic process, wherein information continuously flows and undergoes repeated processing within various regions of the brain.²³⁹ The exact initiation and circumstances under which perception occurs in consciousness are still unknown, and critics highlight the lack of a solid foundation and the discrepancy between our knowledge of physiological processes in colour vision and the final conscious experience.²⁴⁰

Nonetheless, it is understood that colour is a phenomenon triggered by colour stimulus by the interaction between visible electromagnetic radiation (light) and the visual system. As light fleeting through the lenses of our eyes, it is absorbed by a curved, two-dimensional layer of four types of light-sensitive cells in the retina: short-wavelength cones (blue), medium-wavelength cones (green), long-wavelength cones (red), and rods. The absorption of light by these cells produces electrochemical signals, which then traverse numerous stages within the brain, ultimately giving rise to the visual world experienced by individuals with normal vision.²⁴¹ Although there are several theories, none can fully account for all aspects of colour vision.

An important aspect of colour discussion revolves around the question of where colours are located: whether they exist in the external world (colour realism) or solely within our minds (colour irrealism). Does our brain faithfully recreate the objective reality before us, or does it construct a useful but not always accurate interpretation based on the limited information provided by direct and reflected light? Andy Clark's research proposes a third perspective on colour vision, suggesting that the brain acts as a prediction machine, constantly attempting to match incoming sensory inputs with top-down expectations or predictions.²⁴²

²³⁸ SET embraces a monist approach to colour while recognising the irrealist perspective, the subjective nature of the emotional experience, allowing for subjective judgements to guide colour combinations and prioritising personal interpretation over mathematical measurements.

²³⁹ Herman Haken (2006 [1988]), *Information and Self-Organization*, 28.

²⁴⁰ Rolf G. Kuchni (2003), *Color Space and Its Division: Color Order from Antiquity to the Present* (New York: John Wiley & Sons), 1-6.

²⁴¹ Rolf G. Kuchni (2013), *Colour: An Introduction to Practise and Principles*, 3rd edition (New York: John Wiley & Sons), ix, 23-51.

²⁴² Andy Clark (2013), "Whatever Next? Predictive Brains, Situated Agents, and The Future of Cognitive Science," in *Behavioral and Brain Science* 36 (Cambridge: Cambridge University Press), 181-253.

In contrast to these theories, SET operates independently of the human visual system's processes and treats colour as part of quantum mechanics. Therefore, colours are regarded as non-local entities that do not manifest locally within any object. Instead, they are measurable waves of electromagnetic energy, varying in wavelength, a dance between light, a digital sensor, reflection, and the interaction between the dynamics of its atoms and the light that illuminates them.²⁴³ Each position in space only exists in relation to something else, and each quantitative number corresponds to a specific location within the 3D realm of colours, extending beyond the visible wavelength range of 400-700 nm.²⁴⁴

It is worth noting that SET acknowledges the significantly narrower dynamic range of a digital image compared to the human visual system. The dynamic range can be increased through gamma transformation, which enables a larger dynamic range to be perceived at the expense of resolution in brighter parts of the image.²⁴⁵ Darker regions become brighter, revealing more details. As a result, the image becomes better adapted to the logarithmic characteristics of the human visual system. When developing the Processing script for tonal separation, a gamma correction was calculated and implemented to enhance the dynamic range, resulting in visually richer paintings.²⁴⁶

In collaboration with Data Colour, an algorithm, based on their colour formulation software Match Pigment, was adjusted to calculate predicted mixtures of all LAB colours using artist oil paints.²⁴⁷ By constructing a colour library or palette comprising 12 colours, the algorithm has the capability to generate seven potential mixing options for any given LAB code added to it.²⁴⁸ Furthermore, the algorithm provides a prediction of the accuracy of each mix in relation to the LAB code. This information is reflected in the DE1 column of Fig. 45. A value closer to zero indicates a higher level of precision in matching the resulting paint mixture with the desired LAB colour.

Prior to creating the complete library, the algorithm's accuracy was tested by making a library consisting

²⁴³ Electromagnetic radiation exhibits a dual nature as both particles and waves, with light being composed of discrete energy packets called photons while also propagating as waves according to Maxwell's equations. According to Roger Penrose, photons represent particles of quantum non-locality within the framework of electromagnetic radiation. See <https://www.youtube.com/watch?v=iTMSXRruKkQ> (accessed 22 December 2022); Claudio Oleari (2016), *Standard Colorimetry: Definitions, Algorithms and Software* (Hoboken, NJ: Wiley), 54-66 (PDF); Carlo Rovelli (2021), *Helgoland*, 100.

²⁴⁴ Bernd Jähne (2005), *Digital Image Processing*, 4, 18, 20-21; Rovelli (2017), *The Order of Time*, Erica Segre and Simon Carnell (Trans.) (London: Allen Lane).

²⁴⁵ Gamma correction is a non-linear operation employed in still image systems to encode and decode luminance or tristimulus values. Charles A. Poynton (2003), *Digital Video and HDTV: Algorithms and Interfaces* (Burlington, MA: Morgan Kaufmann), 332.

²⁴⁶ Bernd Jähne (2005), *Digital Image Processing*, 265-266; The Processing Script is shown in Appendix 2.

²⁴⁷ Match Pigment is a colour management system developed for commercial paint applications. It needed specific adjustments and corrections to suit the intricate tone mixing techniques used in paintings. <https://www.datacolor.com/business-solutions/product/datacolor-match-pigment/> (accessed 28th June 2023).

²⁴⁸ The algorithm can evaluate the number of LAB values that can be matched with the existing palette, allowing for easy addition or removal of colourants within the algorithm.

of three primary colours, as well as black and white, using W&N oil paints. Six mixtures of each colour were analysed by a spectrophotometer, which enabled the algorithm to establish the colour library. To test the accuracy of these predictions, three colours were mixed using the best-predicted mixtures. In this particular case, all the predictions resulted in DE1 values that were either 0 or close to 0, indicating a high level of expected accuracy, approximately 100%. Subsequently, these mixtures were tested using a spectrophotometer to determine their level of accuracy compared to the LAB code. All the tests yielded accuracy levels ranging from 95% to 100%.

| Formula Type | Prediction 1 Brown 70 | Prediction 2 Brown 70 | Prediction 3 Brown 70 | Prediction 4 Brown 70 | Prediction 5 Brown 70 | Prediction 6 Brown 70 | Prediction 7 Brown 70 |
|--------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|
| DE1 | 0.05 | 0.07 | 15.00 | 17.35 | 27.55 | 27.78 | 27.78 |
| None | | | | | | | |
| None | | | | | | | |
| None | | | | | | | |
| White | 83.2958 | 91.9844 | 92.7850 | 94.3825 | 99.8314 | 99.8565 | |
| Black | 0.9567 | 3.3917 | 5.9404 | 2.1949 | 0.1338 | 0.1435 | |
| Lemon | 12.1599 | 3.3165 | 1.2746 | | 0.0348 | | 83.2445 |
| Rose | 3.5875 | 0.3073 | | | | | 16.5145 |
| Blue | | 0.3073 | | | | | 0.2410 |

Fig. 45. Test result of how the algorithm calculates the LAB code 70 08 16 with a 5 colour palette.

In commercial Point of Sale Systems, the selection of colourants is based on achieving the maximum possible colour gamut with the fewest number of colourants. Various suppliers offer different ranges of colourants, and the availability of colourants depends on the type of paint medium, such as solvent-based or water-based. Fig. 46 provides a list of commonly used colourants, which served as a reference for the palette used in SET. Some commercial systems may include additional colourants, increasing the total number to 16. These extra colourants could include a weaker black (iron oxide black), a phthalo blue, an orange, and a magenta. When constructing the palette for SET, I initially started with a set of 12 colours. Additional pigments can be incorporated at a later stage to address certain gaps in the colour gamut and achieve the desired colour range.

| Generic pigment | Winsor & Newton |
|--------------------------------|-------------------------------|
| White – titanium dioxide | 644 Titanium White |
| Black – carbon black | 337 Lamp Black |
| Red Oxide | 678 Venetian Red |
| Yellow Oxide | 746 Yellow Ochre Pale |
| Blue RS – red shade blue | 706 Winsor Blue (Red Shade) |
| Blue GS – green shade blue | 707 Winsor Blue (Green Shade) |
| Yellow RS – red shade yellow | 730 Winsor Yellow |
| Yellow GS – green shade yellow | 722 Winsor Lemon |
| Red BS – blue shade red | 479 Permanent Carmine |
| Red YS – yellow share red | 725 Winsor Red Deep |
| Green | 708 Winsor Emerald |
| Violet | 672 Ultramarine Violet |

Fig. 46. Comparing the generic pigment used in the commercial paint industry with artist oil pigment from Winsor & Newton.

The inclusion of such colourants can also depend on the intended use of the paint. For instance, in the case of exterior paint, the light-fastness of a pigment becomes important, which limits the choice of colourants. On the other hand, for internal applications, metamerism needs to be considered.²⁴⁹ “Metamerism” refers to the phenomenon where a pair of colour samples appear to match under one lighting environment but exhibit a difference under different lighting conditions.

Selecting the appropriate W&N colourants in conjunction with the generic pigments posed some unforeseen challenges due to the unavailability of precise information regarding the pigment percentages in each of their colours. For instance, colours like 362 Light Red, 678 Venetian Red, and 317 Indian Red are derived from various grades of red oxide. When I sought specific details from W&N,

²⁴⁹ Metamerism is a phenomenon in which two colours appear to be a match under one lighting condition but no longer appear as a match when the lighting changes.

they were unwilling to disclose the exact figures but recommended using their 678 Venetian Red instead.

In order to create a functional colour-mixing system, it is necessary to incorporate the measured data from colour samples into a database or library. This database serves as a reference for the algorithm to perform calculations when mixing colours.²⁵⁰ To build up this colour library, also known as a palette in traditional painting, the algorithm requires a minimum of 6 to 7 samples per colourant. Each colourant needs to have 5 mixtures, including mixtures with white, a masstone, and/or a mixture with black. For brighter, highly chroma colours, it is more effective to include a sample with a slight tint of black (mixture with black) rather than a masstone. Approximately 70 to 80 samples were required for measurement using a spectrophotometer. It was possible to measure 12 samples per hour (2 colourants), resulting in a total time of approximately 6 hours to measure all the samples. Once the colour database is established, it is necessary to run some predictions to check if the colour gamut needs to be expanded by adding additional pigments. Furthermore, these predictions help assess whether the data is accurate enough to achieve the desired range of LAB tones when mixing colours.

Taking the step into the full LAB colour space opened up a vast array of mixed colour tones that were previously manageable mixes of grey tones using the L* axis of LAB. Suddenly, the range expanded exponentially, encompassing the entire spectrum of human colour perception. While theoretically it is possible to mix millions of colours for each painting, striving for maximum granular continuity leaves little room for an emerging painting. The SET approach offers numerous possibilities for the emergence of a painting, without imposing limitations or constraints on the practical application of paint. The user sets the thresholds through the adjustments of the algorithmic parameters at which a painting comes to life.

To achieve free brushstrokes, the number of colour tones must be tailored to the canvas size and the mappings of each tone. Consideration must be given to the cost and time involved in using a high number of colour tones. When painting with SET, it becomes necessary to limit the number of colour tones to match the canvas size and the maps of each tone. However, using a digital algorithmic code to restrict the number of colours proves challenging. Algorithms operate in a strictly mechanical manner, devoid of creative thought, and select or exclude colours based on binary thresholds, rather than aesthetic choices.²⁵¹

²⁵⁰ This function operates similarly to the training process of AI image generators that use a database. However, in SET, the database is not used to generate or merge images but instead serves as a factual reference for numerical data obtained from physical measurements.

²⁵¹ Martin Davis (2016), *Algorithms, Equations, and Logic, The Once and Future Turing*, S. Barry Cooper and Andrew Hodges (Eds.) (Cambridge: Cambridge University Press), 4-19.

Zoomed-in fragments derived from a full image or a macro photograph, (Fig. 47), provide a more workable range of colour tones compared to using the entire code of a full photo (Fig. 48). While this perspective stems from a technical standpoint, a fragment of an image is nothing but potential to differ. The smaller registered area of a fragment inherently possesses a more constrained colour spectrum. A complete photograph, such as a portrait or a landscape, operates on the principles of representation, similarity, and identity. Consequently, it requires numerous colour tones to accurately depict what is identical—an abundance of tones in depicting a face or skin tone makes it lose its resemblance to real skin when restricted using the developed Python script (Fig. 48b and Appendix 4). Conversely, when zooming into a specific part of the face, like a detailed view of the nose, the colours are already naturally limited by the fragmented area itself (Fig. 49).



Fig. 47. A digital photo depicting a zoomed-in view of nature was processed through an algorithm that applied 32 different tones of colour.



Fig. 48a. A photograph of Jeff Koons, captured by Martin Schoeller, was processed through an algorithm without any colour tone restrictions, resulting in an output of 31,110 different colour tones. Fig. 48b. A photograph of Jeff Koons, taken by Martin Schoeller, underwent processing through the algorithm, which limited the colour tones to 30, producing an output with only those 30 tones.



Fig. 49. A close-up detail of a photograph featuring Jeff Koons, originally captured by Martin Schoeller, was processed through the algorithm with a 30-colour tone output, as depicted in Fig. 48a. In the cropped section of the nose, there are 16 distinct colour tones.

In the process of determining the optimal method for restricting the colours, two different algorithms were tested. Firstly, Adobe Illustrator's built-in algorithm, known as Image Trace. This algorithm aimed to restrict the number of colours in an image to a specific quantity. However, during testing, evidence of inaccuracies emerged, rendering the gathered information unusable as a component of an algorithm designed to map each colour accurately. Attempts were made to address these issues by reaching out to the programmers working on Adobe Illustrator. Unfortunately, the problem remained unsolved due to

the way Adobe Illustrator's algorithm is coded. Furthermore, Adobe did not provide any further details or share the actual code. Secondly, in collaboration with a coder, Dr. John Wild, a Python script was developed to separate colours based on the binary code of the digital photo.²⁵² The Python script performed admirably; however, effectively restricting the colours in a useful manner proved challenging. While the Python script exhibited superior accuracy compared to Adobe Illustrator's Image Trace, it lacked the ability to make aesthetic decisions due to its absence of aesthetic consciousness. Taking these considerations into account led to the development of the equatorial hue circle in the SET.

The initial test paintings utilising the complete equatorial hue circle were created using the Python script. The objective of these paintings was to explore colour mapping using an algorithm that significantly limited the number of colours, followed by the construction of colour maps with a white line demarcating each colour (Fig. 50 and Fig. 51). These first colour paintings focused on zoomed-in details, similar to Fig. 49, taken from recent digitisation of the earliest colour photographs captured by Auguste and Louis Lumière between 1890 and 1905.

The algorithm employed for these colour paintings operated in a similar way to the algorithm developed for greyscale tones (Fig. 36b), treating each colour tone as a separate map. Additionally, a second algorithm adds a white line between each colour map. This was done to facilitate precise mathematical adjustment of the colour-mixing algorithm in relation to the paint, or, in other words, to establish a visual correspondence between the binary numbers and the relationship between the screen and the painting.²⁵³ Once finely tuned, the same mapping algorithm will be utilised to create subtle colour paintings of similar character to the greyscale paintings previously presented (i.e. Fig. 1).

3.5 Decomposing the code into tones of colours

What remains, when going through the practical material aspect of SET, is not a representation or signification but rather the painting's own means of production made visible. It demonstrates how embracing differences is crucial for creating a new image. Each tone is carefully mapped to allow for free manual marks to play within each area. The algorithmic ready-made binary code becomes a kinetic spatiality that *intra-acts* with all the processes, both in digital image processing, as mentioned earlier, and in the act of painting itself.²⁵⁴ The algorithmic code, as ready-made, cannot simply be inserted as it is mapped spatially; it needs to be unfolded and allowed to emerge. The algorithmic code enables a physical presence of touch that impacts the role of sensuousness within the digital environment.

²⁵² Appendix 4.

²⁵³ The precise colour mixing algorithm, developed by Datacolour for commercial paint applications, remains inaccessible in this thesis for publication due to lack of permission.

²⁵⁴ Karen Barad (2007), *Meeting the Universe Halfway*, 33, 197.

The ready-made transforms into a generative kinetic process of spatiality that introduces the sensuous into play from within the algorithmic code by employing a notion of a distributed sense of touch. This process demonstrates that sensuousness can be embedded into painting within a digital environment. The enfleshment of the sensuous is critical for any form of art to be embedded in coding. The challenge at hand is not to reinstate sensuousness, but rather the way in which sensuousness is acknowledged as a tool that is already present and further develops its potential. Essentially, it is a problem of translation. To translate using SET, one must ignore the visual aspect of the digital image and decompose the code into colour tones. What may be easily misinterpreted as the original (the digital image) holds no significance for the viewer, as the visual aspect of the digital image is irrelevant as art and is not there to instruct and inform, as Benjamin asserts:

*A translation is transparent; it doesn't cover the original.*²⁵⁵

The translation of the numerical scheme of the algorithmic code is the way in which the system enables the placement of touch, creating a repetition of the habitual spatial memory of hand movement and touch. This allows for a certain leverage of undecidability to exist. This space forms a contouring, a spatial environment marked by manual free touch—the dimensional haptic that evolves from the numeric environment inhabited by painting. This encounter, serving as a bridge between the quantitative and instinctual aspect of spatial touch, allows for sensuousness to enter.

In SET, the encounter with the found object (the spatial code of the digital image) produces a surface where the encounter literally inscribes the code in space, which deviates from Duchamp approach. While Duchamp foregrounds the encounter with his ready-made, positioning it as the foundation of modern art, SET recontextualises the encounter away from the public realm and places it on a canvas.²⁵⁶ This privatisation of the encounter introduces a sense of openness and air to enter and shape-shift meaning, focusing on the manual act of making—the touch. This shift fosters a certain intimacy, a multiplicity of readings, lending it a sort of profound intensity and originality. Through the encounter, the surface becomes a conduit for the affective, allowing desire and emotion to enter through the haptic dimension of the hand's touch. This encounter reintroduces human elements into the quantitative system of the algorithmic, ensuring that human sensuousness remains an integral part of the process.

²⁵⁵ Walter Benjamin (1996), "The Task of The Translator," in *Selected Writings Volume 1* (Cambridge, MA: Harvard University Press), 254-260.

²⁵⁶ Duchamp expresses: "There are the two poles, the artist and the onlooker. If there's no onlooker there's no art, is there?" Calvin Tomkins (2013), *Marcel Duchamp: The Afternoon Interviews* (New York: Badlands Unlimited), 56-61.



Fig. 50. Be Andr, *Untitled (Eye)*, 2023, oil on canvas, 125 cm x 99 cm.



Fig. 51. Be Andr, *Untitled (Indian Landscape)*, 2023, oil on canvas, 125 cm x 105 cm.

Chapter 4: Emergence via the conditions of The System of Emergent Touch and the spatial ready-made

The preceding chapter established how the digital code rethinks representation in contemporary art by enabling a mapping from which a ghost image and a resemblance emerge on the canvas. This chapter delves into the parallel between the twenty-first-century notion of emergence and its predecessor from the twentieth century, specifically focusing on Duchamp's ready-made as an embodiment of emergence.²⁵⁷ However, it explores a distinct form of the ready-made concept that shifts Duchamp's original idea, emphasising the encounter between the algorithmic code and tactile touch instead of the viewer and the object.²⁵⁸ This chapter investigates the dynamics that arise when the ready-made incorporates the digital algorithmic binary code and interacts with the materiality of paint and the freedom of hand movements.

Chapter Four examines how a painting can emerge on the canvas without the necessity of engaging with a visual image, prompting us to contemplate the implications of this encounter. Furthermore, Chapter Four explores the notion of distributed touch, culminating in a distributed touch that presents a new way of understanding the ready-made. It draws upon the significant features of Duchamp's ready-made, redefining an art object beyond traditional notions of framing, subject-object dynamics, and the gallery's role in shaping the emergent scenario known as the work of art.

Throughout this exploration, the chapter unfolds three key developments: the conditions under which touch can emerge, what it means to talk about code as spatial ready-made, and a new way of thinking about agency as spread. This is accomplished by examining the SET framework, which has three conditions: a material condition, an informational condition, and an energetic condition.

²⁵⁷ Appendix 1: Glossary; Sean Carroll (2019), *Something Deeply Hidden: Quantum World and the Emergence of Spacetime* (London: One World), 250-274, 323-324.

²⁵⁸ Calvin Tomkins (2013), *Marcel Duchamp*, 48-57.

Chapter 4: Emergence via the conditions of *The System of Emergent Touch* and the spatial ready-made

*Everything made since Duchamp has been
a ready-made, even when hand-painted.*

Gerhard Richter²⁵⁹

4.1 The System of Emergent Touch's conditions

SET is a system of repetition, of hand movement, colour mixing, throughout the process of adding paint to the canvas. This repetition brings stability and is a highly attentive process, resulting in structure of patterns and a high degree of order. Repetition is a form of recognition, and is therefore a form of completion. When painting with SET, one takes information, the binary algorithmic digital code, a totally dis-bodied language, and imbues it with vitality by translating it through a bodily performance by the repetition of the hand of adding paint to the canvas.²⁶⁰ Art transcends mere information, as pure data lacks the power to enchant. However, through this translation process, SET breaks the culture of the signified. It engenders a bodily connection and fosters an embodied identity through the acquisition of bodily knowledge and memory.²⁶¹ The traditional painterly challenge, reconciling the body with the Earth, the interaction between corporeal and terrestrial forces, undergoes a transformation. As a result, an intricate network of forces emerges, uniting humans and materials through the medium of information.²⁶²

The emergence of a stable state in a painting through the use of SET is a result of encountering three key conditions: a material condition, an energetic condition, and an informational condition. These conditions are states of modification that encounter each other, which enables the painting to emerge. It is crucial to note that these conditions are not linked to the identity of matter (paint, code, hand) but rather they must conform to a specific structure (the system) and exhibit a particular energetic state within the system.²⁶³ One could easily claim that the material condition is the various elements such as

²⁵⁹ Gerhard Richter (2009), *Gerhard Richter Text: Writings, Interviews and Letters*, 128.

²⁶⁰ Karen Barad (2003), "Posthumanist Performativity: Towards an Understanding of How Matter Comes to Matter" in *Signs: Journal of Women in Culture and Society*, 28(3): 802-831; Gilbert Simondon (2020 [1964]), *Individuation*, 245-250, 393

²⁶¹ Byung-Chul Han (2020), *The Disappearance of Rituals*, Daniel Steuer (Trans.) (Cambridge: Polity Press), 6-10, 60-63; Jean-François Lyotard (1998), *The Assassination*, 131-132.

²⁶² The thesis aligns with Elizabeth Grosz's view that art is an engagement with materiality that seeks to intensify and affect the way life perceives itself and the world. Elizabeth Grosz (2017), *The Incorporeal*, 258; Elizabeth Grosz (2008), *Chaos, Territory, Art*, 65-75; Anne Sauvagnargues (2016), *Artmachines: Deleuze, Guattarim Simondon*, Suzanne Verderber and Eugene W. Holland (Trans.) (Edinburgh: Edinburgh University Press), 201-205.

²⁶³ Gilbert Simondon (2020 [1964]), *Individuation*, 55-94

oil paint, the projector, the brushes, the palette, the digital weight used for mixing the colours, the mixing table, the palette knives, the paint tube, the paint medium, the paint cleaner, the paint gloves, the acrylic gesso and the canvas as the state of every single of these affects how the material encounters the other conditions. However, there is something more significant at play—a glimpse of material as matter, as a statement of what in fact matters, is at stake.

This perspective embraces the performative or pedetic approach of new materialism, which leads to a performative understanding of painting where every act of observation simultaneously transforms what is being observed.²⁶⁴ Matter is a doing, or the way it moves. When employing SET in painting, we engage in a practical investigation of how this doing is a relation of forces transformed by the embodied motions within the system.²⁶⁵ This approach introduces a spatiotemporal move that allows for fluctuation and shift from the literal materials used in the system. It departs from a dialectical comprehension of materialism, towards a quantum materialism which manifests itself through entanglement, encounter, and emergence. The focus moves from the physical materials of paint and tools to the materiality of movement, time, and space. Here, matter is expressed through rhythm and flow.

In Chapter Three, SET's algorithmic mapping depicts the interconnected fields that facilitate the release of energy through the encounter of the hand, brush, and paint.²⁶⁶ This energy, the energetic condition, forms a feedback loop—what Simondon refers to as *internal resonance*.²⁶⁷ The emergence of spatiality occurs when the hand injects specific amounts of energy into the system, realising its potential energy and causing instability that transitions the system into a new state.²⁶⁸ The actions of the hand, including its orientations, movements, and pressure on the brush, are no longer guided by the pursuit of perception or the copying of forms for likeness.²⁶⁹ Instead, the process involves a blind “stare” of machine translation and recognition through automatic algorithmic reading. The potential energy of the movement of the hand is looped with the informational condition of the digital algorithmic binary code, leading to the release of encounters from which likeness and forms emerge.²⁷⁰

²⁶⁴ Christopher N. Gamble, Joshua S. Hanan, Thomas Nail (2019), “What is New Materialism?” in *Angelaki*, 24(6): 11-134.

²⁶⁵ Karen Barad (2007), *Meeting the Universe Halfway*, 151; Barad (2003), *Posthumanist Performativity*, 802-831; Thomas Nail (2018), *Being and Motion* (Oxford: Oxford University Press).

²⁶⁶ John Archibald Wheeler (1998), *Geons, Black Holes, and Quantum Foam: A Life in Physics* (London: Norton), 163.

²⁶⁷ Gilbert Simondon (1953), “Cybernétique et philosophie,” in *Sur la philosophie*, 43,45; Gilbert Simondon (2020 [1964]), *Individuation*, 88-93.

²⁶⁸ Hermann Haken (2006 [1988]), *Information and Self-Organization*, 10-16.

²⁶⁹ What is at stake is the central perceptive process of the grasping of form; the eye's ability to see, copy and record is replaced by textual information: algorithmic numbers.

²⁷⁰ As for the eye's movement, it makes only recognition possible, threatening things as letters. Jean-François Lyotard (2011 [1971]), *Discourse, Figure*, 156.

The release of potential energy through the insisting touching between hand, canvas, paint, brush, and colours mixed in each mapped area releases an energetic sense apprehension through a range of bodily sensations, including recognition, disorientation, compassion, pity, disgust, condescension, lust, titillation, arousal, and exhaustion. Touch becomes an emotional experience encompassing both empathy and active aggression. The hand's muscle movements, the friction between the brush, paint, canvas, and palette knife, induce a transformation in the material condition. Each tone of colour shade contributes to the evolving state over time, making matter and material fold. The materials have become matter, and time and space becomes material. Its making is no longer singular and a painting has to be looked at as a place where potential energy can be actualised by the structure in accordance with material conditions.²⁷¹ In SET, touch is both risky and inventive, propelling the process of invention through the touch which is distributed throughout the system.²⁷² This transformation, facilitated by the libidinal release of energy, allows the material conditions to state something through matter about what matters, a material statement of what is important about painting.

Friction, tension, translation, pleasure, and play are at the heart of SET's mapping. Painting with SET deliberately rejects smoothness and resolution, instead emphasising discrete strokes and disjunctions. It resembles Seurat's semi-digital system, as it leaves visible traces of freely painted hand strokes in wet, thick paint, establishing a deliberate and ordered structure in the painting (Fig. 28 and Fig. 34). While Seurat's painting system relies on tangible and ever-present units of measure in the form of dots, SET liberates the use of the brush, and the brushstrokes do not depend on any measurements during the paint application process.²⁷³ Through the unrestricted manual touching and movements of paint facilitated by algorithmic digital binary codes, there is a release of human emotions through freedom and excitement.

SET unlocks new ways for us to imagine by experiencing an emergence, a new intimacy. It embraces openness and celebrates the unknown, uncontrolled emergence through the embodied experience of SET. It does not rely on exclusion but keeps the painting open for a way of thinking that enables intimacy and subtle empathy to enter. A path that unfolds something that carries a delicate aliveness through the subtleness of difference, without the extremities of the *this* or the *that*.²⁷⁴

²⁷¹ Gilbert Simondon (2020 [1964]), *Individuation*, 55-94.

²⁷² Sharon Patricia Holland (2012), *The Erotic Life of Racism* (Durham, NC: Duke University Press); Keguro Macharia (2019), *Frottage*, 4-5; Gilbert Simondon (2020 [1964]), *Individuation*, 280-283.

²⁷³ Meredith Hoy (2017), *From Point to Pixel: A Genealogy of Digital Aesthetics* (Dartmouth: Dartmouth College Press), 182-211, 59-72; Norma Broude (1974), "New Light on Seurat's 'Dot': Its Relation to Photo-Mechanical Colour Printing in France in the 1880s," in *Art Bulletin* 56(4):581-589; Meyer Schapiro (1978), "Seurat," in *Modern Art: 19th and 20th Centuries* (New York: George Braziller), 101-109.

²⁷⁴ SET declines the concept of thesis and antithesis, the excluded middle of the dialectic, and the zero-sum game. Johnny Golding (2010), *Fractal Philosophy*, 6-17; Georg Wilhelm Friedrich Hegel (2018 [1807]), *The Phenomenology of Spirit*, Terry Pinkard (Trans) (Cambridge: Cambridge University Press).



Fig. 52. Georges Seurat, 1885, *Le Bec du Hoc, Grandcamp*, oil on canvas, 64.8 cm x 81.6 cm.



Fig. 53. Be Andr, detail of *Untitled (I am Too Sad to Tell You)*, 2020, oil on canvas, 100 cm x 135 cm.

The informational condition refers to digitised data represented by a discrete, schematic, modular metric of textual algorithmic binary codes, which can convert analogue sources into numerical formats or source them from already digitised sources like digital photos. This information facilitates communication between two disparate levels: the material condition of paint and an external signal represented by algorithmic binary code. The disparity between the two implies regularity and predictability, which are essential for perception. To achieve this, the painted mark must convey two separate sets or series of signals.²⁷⁵ The paint is exposed by the code; the code then modulates the paint

²⁷⁵ Gilles Deleuze (2004), *Desert Islands and Other Texts 1953-1974*, (Los Angeles: Semiotext (e)), 86-89; Gilbert Simondon (2020 [1964]), *Individuation*, 244-249.

tone by tone. This works in a similar way to that in which a photographic film is exposed to light. The outcome is the exact textual translation of an object, image, sound, document, or signal, obtained by generating a series of numbers that describe a discrete set of points. However, the digitisation process selectively determines which values are communicatively relevant while suppressing others. This seems to be fundamentally at odds with the aims of art to make strange, to exaggerate or to defamiliarise. While the algorithm developed with the SET aims for determinacy, quantisation, and repeatability, there is a need to establish a feedback loop or relationship that creates a field of semantic possibility beyond a single intuitive thread.²⁷⁶

The informational condition of SET leads to what Golding describes as a connection between making sense (literally the production of sense—common, spiritual, cognitive, erotic, and potentially something yet to be invented) and the exponential proliferation of information and increasingly wild co-evolving forms of matter.²⁷⁷ SET builds upon Golding’s linking of sense and information, deviating from the digital depiction and the worldview that equates knowledge solely with quantisation. Instead, SET embraces density and ambiguity, incorporating them within the encounters that take place within the SET framework.²⁷⁸ By adopting an alternative logic, one that begins with the actual encounter and the resulting finished painting, rather than focusing on setting up to paint a painting, there is a shift away from solely considering the literal materials and their instrumental use value. To comprehend the painting that emerges from this approach, one must start with its manifestation—the painting itself—and then retrace its origins.²⁷⁹

Drawing a comparison to automated robot painting systems like eDavid proves insightful. Artists such as Rob and Nick Carter, as well as Liat Grayver, work with computers and painting, utilising acrylic paint or ink, but excluding direct human touch by employing industrial robot arms to execute brush strokes in their paintings. Grayver specifically utilises eDavid, a painting robot developed by the University of Konstanz, which aims to replicate the human painting process. Rob and Nick Carter use a similar robot arm from Kuka Robots. Conversely, the SET allows for a human embodiment of touch, distributed via enabling the algorithms to act as facilitators while still preserving the physical mark-making process carried out by human mark-making on the canvas.²⁸⁰

²⁷⁶ Meredith Hoy (2017), *From Point to Pixel*. 182-211.

²⁷⁷ Johnny Golding (2020), *The Courage to Matter*, 452.

²⁷⁸ Felix Guattari (1995), *Chaosmosis: An Ethico-Aesthetic Paradigm*, Paul Bains and Julian Pefans (Trans.) (Bloomington, IN: Indiana University Press), 100-101.

²⁷⁹ This is in contrast to Vilém Flusser’s phenomenological approach: Vilém Flusser (2014 [1991]), *Gestures*, Nancy Ann Roth (Trans.) (Minneapolis: University of Minnesota Press), 65.

²⁸⁰ eDavid is a painting robot designed to create artworks by analysing input images and applying brushstrokes on canvas. The project involved modifying a one-armed welding robot to perform painting tasks. Jörg Marvin Gülzow, Liat Grayver, Oliver Deussen (2018), *Self-Improving Robotic Brushstroke Replication* (Konstanz: Universität Konstanz). Online: <https://www.mdpi.com/2076-0752/7/4/84> (accessed 12th April 2022); Jason



Fig. 54. Liat Grayver, eDavid Self-portrait, 2016, acrylic on canvas, 60 cm x 80 cm.

The eDavid system utilises an input photo to generate a set of brushstrokes, which are then executed by a robot arm. Grayver's incorporation of visual feedback raises intriguing questions in the current discourse on deep learning, AI, and robotic creativity. However, the use of a robotic industrial arm in the painting process, trying to approximate the human painting process by copying the movement and touch, takes a different approach from that of SET, and seems to try to create an intimate painting by limiting the possibilities of interaction between the algorithmic process and the human body.²⁸¹

While eDavid is capable of producing painterly paintings and seems to be able to resemble a human artistic touch utilising expressive brush strokes, colour layering, and other techniques, with further advancements likely in the future, SET takes an alternative path. Instead of establishing a feedback loop between the algorithm and the machine (the robot arm), SET establishes a feedback loop between the algorithm and the human hand. This enables the release of the potential energy of the hand through informational digital code on the canvas, allowing for a co-working and entanglement between the intimate touch of the physical hand and the algorithm (the machine).²⁸²

Falconer, (2013). "eDavid the robot painter excels in numerous styles," in *Gizmag*; Mark K. Anderson (2001), "Aaron: Art From the Machine," in *Wired* 12th May 2021; <https://www.kuka.com/en-ca> (accessed 19th July 2023).

²⁸¹ Oliver Deussen, Thomas Lindemeier, Sören Pirk, Mark Tautzenberger (2012), "Feedback-guided stroke placement for a painting machine. In Proceedings of the Eighth Annual Symposium on Computational Aesthetics in Graphics, Visualization, and Imaging." in *Annecy: Eurographics Association*, 25–33.

²⁸² Sean Carroll (2019), *Something Deeply Hidden: Quantum World and the Emergence of Spacetime* (London: One World), 46- 52, 104-137, 175-304.



Fig 55. Liat Grayver, eDavid painting robot in action.

The contrast becomes even more pronounced in the use of the Kuka robot by Rob and Nick Carter, a similar type of robot arm as eDavid.²⁸³ In their series called *Dark Factory Portraits*, Rob and Nick Carter instruct their Kuka robot to create representational paintings of renowned artists. Their aim is to explore whether a machine can truly become an artist (Fig. 56).²⁸⁴ Unlike eDavid, the Carters' Kuka robot does not possess a feedback loop; instead, it operates solely to produce representational paintings based on photographs of famous artists (Fig. 57). This allows for the automated production of greyscale acrylic portraits on a mass scale. While lacking the poetic quality found in eDavid's multi-layered approach, the Carters' Kuka robot still manages to impress visually by moving beyond a focus on pixels. However, there remains a sense of low resolution, particularly in the transition between mid-range and light tones. Despite this, the robot achieves a painterly quality that vaguely resembles the work of contemporary painters like Jenny Saville (Fig. 58).

²⁸³ Kuka produces industrial robots and systems for factory automation. <https://www.kuka.com/en-ca> (accessed 12th April 2022).

²⁸⁴ <https://www.benbrownfinearts.com/exhibitions/149-rob-and-nick-carter-dark-factory-portraits/> (accessed 12th April 2022.)



Fig. 56. Rob and Nick Carter's Kuka robot arm



Fig. 57. Rob and Nick Carter, *Robot Painting of Marina Abramović*, 2020, acrylic on canvas, 122 cm x 122 cm.



Fig. 58. Jenny Saville, *Red Stare Collage*, 2007-2009, glueing on cardboard, 252 cm x 187,3 cm.

When comparing paintings created with SET (Fig. 42 and Fig. 43) to a painting executed by an industrial robot arm, one discovers a distinct subtlety in tones and the application of thick paint. The brushstrokes exhibit a varied and liberated quality that surpasses the current capabilities of the robot arm. However, it is essential to acknowledge that in the near future, algorithmic developments in robotic systems may enable the creation of similar outcomes. It would be incorrect to deem one system superior and the other inferior; the intention of SET is not to replace traditional painting methods or newer robotic approaches to artistic expression. Instead, SET seeks to abandon the principle of digital creationism, as an alternative that does not oppose the machine and algorithms against the body or being human, but advocates a coevolutionary and symbiotic relationship between machines, algorithms, and human beings.²⁸⁵ When comparing a painting produced by an industrial robot arm to one created through SET, it is crucial to recognise that the painting emerging from the SET process is the result of a co-working between the algorithm and the human touch. What is important to keep in mind when comparing the painting done by the industrial robot arm with the painting emerging from the SET process is that the painting emerging via the use of SET is the result of an encounter between the algorithm and the embodied human touch. There is an entanglement between matter, hand, and algorithm which creates a

²⁸⁵ Edward Ashford Lee (2020), *The Coevolution: The Entwined Futures of Humans and Machines* (Cambridge, MA: MIT Press), 273-301. We need a framework in which human cognition is recognised for its uniquely valuable potential, without insisting that human cognition is the whole of cognition or that it is unaffected by the technical cognisers that interpenetrate it. N. Katherine Hayles (2017), *Unthought: The Power of the Cognitive Nonconscious* (Chicago: University of Chicago Press), 136.

connection, which shapeshifts between encounter and emergence, something an industrial robot arm lacks.²⁸⁶

SET does not aim to mimic or replicate human touch or digital photographs; rather, it represents a step towards enabling us as human beings to engage, care, live, and create within an increasingly automated world dominated by algorithms. Instead of opposing the power of algorithms, SET embraces them as tools to enhance and transform what we already do as humans—different, better, easier—and to use it as a step forward in our own development. SET is not an attempt to make a machine mimic or copy a human touch or digital photographs; rather, it represents a step towards us as human beings to engage, care, live and create within a world that is getting more and more dominated by algorithms.

The focus lies in perceiving painting as an encounter; this shift generates a particular intimacy through a multiplicity of readings, thereby imbuing it with intensity, which gives it its originality.²⁸⁷ The surface of the painting allows—through the encounter— affective desire and emotion to permeate through the haptic dimension of the hand’s touch.²⁸⁸ This encounter introduces the manual touch back into the quantitative system of algorithms, not in the traditional view of the hand of the genius, but rather as a means to achieve desired outcomes.²⁸⁹

²⁸⁶ Sean Carroll (2019), *Something Deeply Hidden*, 36-52.

²⁸⁷ Johnny Golding (2013), “Ana-Materialism, 66-83.

²⁸⁸ Jacques Derrida (1987), *The Truth in Painting*, 34, 54, 96.

²⁸⁹ Steven Pinker (2002), *The Blank Slate: The Modern Denial of Human Nature* (London: Penguin Books), 215. (PDF)

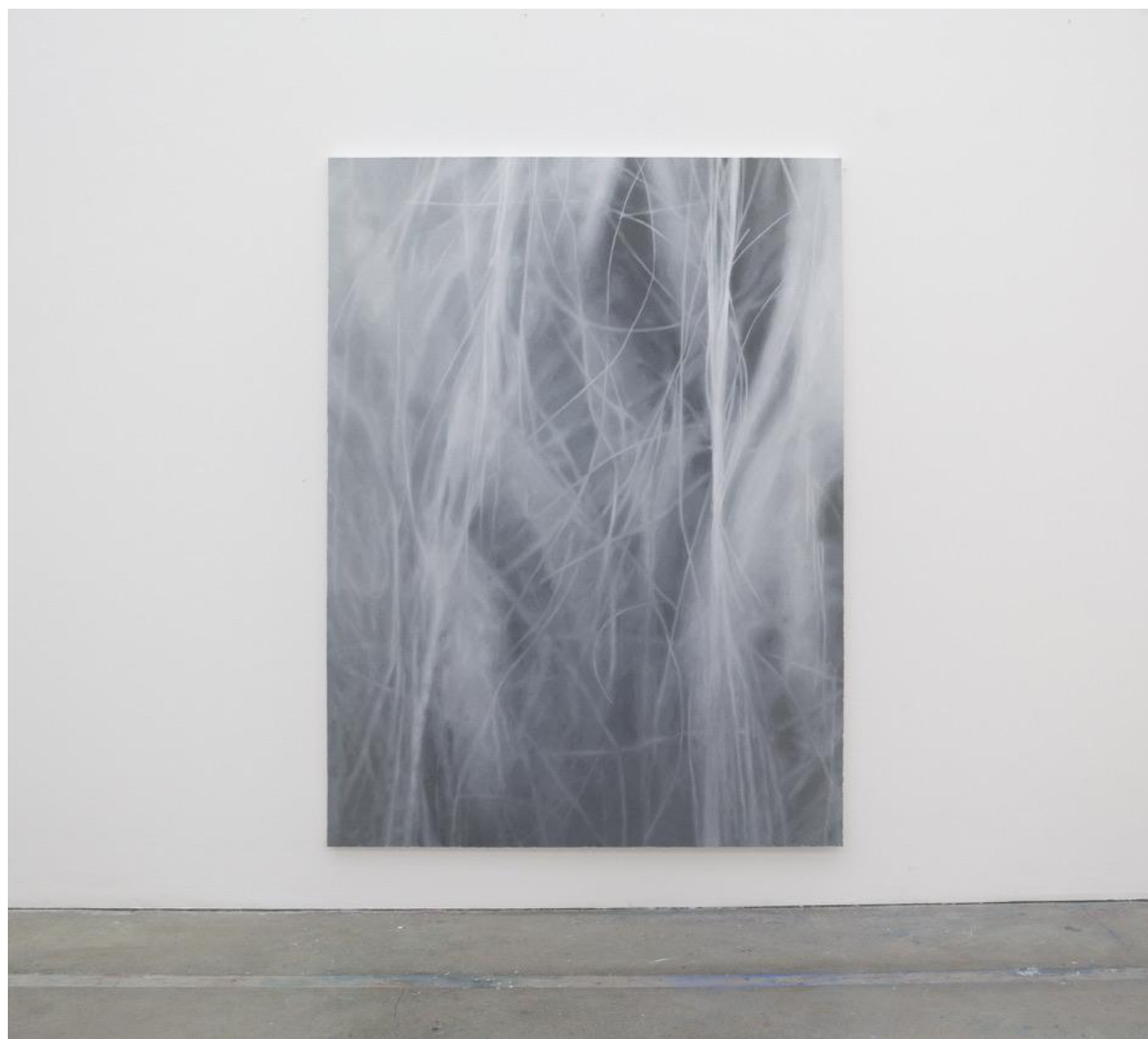


Fig. 59. Be Andr, *Untitled (The Impossibility of Writing Time)*, 2023, oil on canvas, 200 cm x 150 cm.

4.2 Code as spatial ready-made

The three conditions of SET forward a thinking of radical matter; of encounter, entanglement, and emergence. The stable stage of encounter can be experienced through the emergence, which arises from various entanglements. In the SET, the encounter involves utilising found pre-existing digital algorithmic codes derived from digital photos, pre-analysed binary textual information obtained during digitisation.

This rethinking of the concept of the ready-made, challenges Calvin Tomkins' assertion that Duchamp's real intention behind the ready-made was to reject the possibility of defining art. Instead, the primary contribution of the ready-made was to introduce the element of encounter into art. In SET, the ready-made shifts from the encounter between viewer and object to an encounter between the algorithmic code and the touch.²⁹⁰ It explores the implications when the digital binary code serves as the ready-made, encountering the materiality of paint and the movement of the hand, leading to the emergence of a painting without the need for encountering a visual image.²⁹¹

SET provides a pathway for progression, establishing a feedback loop between the hand and the digital code, fostering the development of a relationship. The binary digital code is not read by the eye but rather translated by the SET algorithm into mapped areas on the canvas. The hand moves freely, applying tones of oil paint within each designated area. Consequently, the system maps out the spatiality inherent in the ready-made algorithmic code of the digitised image, while the hand, not the eye, encounters the translated spatial binary code. This foregrounds a longing for intimacy while facilitating an emergence parallel to how the art object emerges in Duchamp's ready-made.²⁹² Duchamp's physical urinal displayed in the gallery is not the ready-made itself; rather, it is the emergence resulting from the artist's encounter; the grabbing of the urinal and the act of placing it in the gallery space, is what makes it art.²⁹³

Similarly, SET transforms Duchamp's ready-made from a viewer/subject and object encounter to an encounter between binary numeric codes found in digital images and the materiality of traditional paint. The binary code of 0s and 1s describes the image's demand through textual translation of spatiality.

²⁹⁰ Marcel Duchamp (1973), "*The Creative Act, Session on the Creative Act, Convention of the American Federation of Arts*," Houston, Texas, April 1957, in Marcel Duchamp (1989), *Salt Seller: The Writings of Marcel Duchamp*, Michael Sanouillet and Elmer Peterson (Eds.) (New York: Da Capo Press), 139; Robert Kilroy (2018), *Marcel Duchamp's Fountain: One Hundred Year Later* (London: Palgrave), 99-118; Calvin Tomkins (2013), *Marcel Duchamp*, 48-57.

²⁹¹ A preliminary discussion was raised in the introduction pp 14-15.

²⁹² The binary digital code is not merely read; instead, it is translated and transformed into mapped areas, allowing the hand to move freely and expressively within them.

²⁹³ Calvin Thompkins (2013), *Marcel Duchamp*, 17, 26, 52-60.

This spatiality undergoes changes with different coding parameters, creating a dynamic and flexible space where the resulting emergence can be adjusted accordingly.

It is crucial to acknowledge that anything that digitises our surrounding world into binary code, such as a digital camera, is not merely a passive recording device. For instance, the digital camera doesn't simply capture photos; it actively creates them. After intercepting patterns of illumination, similar to film, the algorithm takes charge, aiming to make digital pictures resemble their analogue predecessors of wet chemistry.²⁹⁴ This ready-made is a fluctuating and dynamic entity where contrast, tones, colours, and even space itself can be manipulated and easily adjusted with a few clicks on a computer.²⁹⁵ One could say that SET's ready-made is flexible and adaptable—a moving machine-made ready-made—shaping the twenty-first-century ready-made differently than its twentieth-century counterpart. To grasp the distinction in the twenty-first-century ready-made, one can examine two paintings: *Untitled (Colin 8 tones)* and *Untitled (Colin 16 tones)* (Fig. 60). Despite originating from the same code, they exhibit contrasting characteristics.

SET views digitised information as a spatial ready-made, inherent in all digital materials. The code functions as a coded space, containing information that maps the space and specifies the colour and colour mixes within each mapped area. This enables an encounter to directly create material marks on the canvas based on the mapping. The digital code is not static; it moves and changes in accordance with adjustments and programming of the parameters of the algorithmic code. SET leaves the decision of how the code is executed to the selected parameters within the code setup, which is encountered by the eye through the screen. The level of detail, the granularity level, that determines whether the perceived ghost image within each painting appears continuous or not is determined by the number of tones specified in the code. Both *Untitled (Colin 8 tones)* and *Untitled (Colin 16 tones)* encounter the same digital code, but the code has been adjusted and moved differently in the two. The first encounter and algorithm are programmed for 8 tones of grey, while the second algorithm is programmed for 16 tones.

The selected number of tones that one programs the algorithm to translate into mapping directly influences the spatiality characteristics of each painting. What is encountered is not merely seen but sensed—the eye's function becomes non-perceptive in the painting process. There is no need to visually compare or replicate shapes or forms; the sensuous touch is no longer subjective (or objective) but has become repetitive.²⁹⁶ The translation into paint is an encounter with the algorithm and the digital code

²⁹⁴ Brian Hayes (2008), "Computational Photography," in *American Scientist* (92)2: 94-99.

²⁹⁵ Bernd Jähne (2005), *Digital Image Processing*; Thomas Nail (2019), *The Theory of the Image*, 323-361; Vipin Tyagi (2018), *Understanding Digital Image Processing* (London: CRC Press).

²⁹⁶ Byung-Chul Han (2020), *The Disappearance of Rituals*, 6-10, 60-63.

from the photo allows for a controlled difference—a novel way of perceiving an emerging image through a specific number of tones determined by an algorithm.

In *Untitled (Colin 16-tone)*, SET is coded in a manner that initially encounters a low number of tones/colours before gradually adding more. This process leads to a changing and evolving image during its emergence. The painting is first created with 8 tones before an additional 8 are added. The code maps the areas, with fewer tones resulting in larger areas and greater contrast. However, the map also shifts alongside the changing number of tones. The ghost image slowly emerges from high contrast and a limited number of tones/colours, gradually progressing towards the required intensities as more tones are introduced.

SET spreads the agency between touch and algorithm, establishing a dynamic relationship between embodied painting and algorithmic coding. This process allows for diverse pathways from representation to sensation through a double articulation: decoding and recoding (not in a computational binary 0 and 1 code, but in a learning and translation scenario). It liberates perception from pre-established codes.²⁹⁷ The translation of a numerical scheme involves creating a space that enables a placement of touch by creating a repetition of a *habitual spatial memory* of the movement of the hand and its touch. This space allows a certain level of undecidability to exist, enabling contouring, the emergence of a spatial environment marked by free manual touch. This spatial environment emerges from the numeric environment inhabited by painting. The metastable system formed consists of both energy and information. This bridge between the quantitative and the instinctual spatial touch within this system leads to the entry of sensuousness through potential energy in the operation. The potential energy goes beyond mere visual perception; it possesses the capacity for genuine transformations within a system. For paint in SET, its belonging to the system defines the possibility of mutual actions with the algorithmic code. This reciprocal relationship ensures that belonging to SET is defined by a virtual reciprocity of actions between the system's components.²⁹⁸

In SET, the ready-made algorithmic code represents what Simondon refers to as “good form.” Good form, according to Simondon, transcends simple geometrical form and instead establishes a transductive order within a system of reality bearing potentials. In SET, good form—the ready-made algorithmic

²⁹⁷ Double articulation describes the process in which an object is created from other objects through coding and decoding of forms. It operates as a “difference” machine, generating new and original works rather than mere copies or replicas of sameness. Gilles Deleuze, Félix Guattari (1987), *A Thousand Plateaus*, 40-41.

²⁹⁸ A metasystem is always more than itself, for it contains not only its present capacities but also the ongoing potential for self-transformation or mutation. Elizabeth Grosz, *The Incorporeal*, 171-174; Gilbert Simondon (1992), “The Genesis of the Individual,” in *Incorporations*, Jonathan Crary and Sanford Kwinter (Eds.) (New York: Zone Books), 302; Gilbert Simondon (2005 [1989]), *Individualisation*, 47-68.

code which is the informational aspect of SET—replaces traditional forms. This structure maintains the energetic level of the system, conserving its potentials by rendering them computable. It forms the structure of compatibility and viability, inventing a dimensionality where compatibility exists without degradation. The notion of form must be replaced with that of information, which posits the existence of a system in a state of metastable equilibrium can be individuated. Unlike form, information is never a single term but the signification that emerges from a disparition.²⁹⁹

The use of digital algorithmic coding, the ready-made, enables creativity to emerge through atmospheric and spatial memory by the placement of human touch. It results in a unique merging by the way it sets up the spatial mapping on the canvas. The dynamics of this process break the symmetry of traditional equations, as touch goes beyond being solely the function of the hand. The amalgamation of touch and coding introduces an entirely different system that continues to evolve.³⁰⁰ SET does not simply trace an image; it is dynamic and focused on experimenting with the real. It liberates the brush, allowing it to move freely and create unrestricted marks.³⁰¹ The ready-made digital code encountered echoes as a ghost image through these free marks. Each artist using the system will produce different marks, yet it also enables the emergence of a signature style. Style within the SET consists of a diagram—a map—and a set of singularities that can be mapped and specified in a formulaic manner. Style evokes a signature, but it is not reliant on the artist's imagination, experience, or personal syntax. It operates in an impersonal mode, detached from symbolic or imaginary generalities. It becomes an event freed from interpretation and meaning.³⁰² To paint the conditions of becoming, where transformation becomes amenable to further transformation, acts of depersonalisation are necessary. One must become imperceptible, receding from fixed identities. To engage in painting (or thinking, writing, playing music, or scientific inquiry), one must embrace this impersonality to liberate thoughts and foster creation.³⁰³

Simondon's observations regarding the concept of metastability provide a framework for connecting becoming and individuation. In the context of SET, the process begins with the metastable state, serving as a catalyst for the emergence of the painting's individuation.³⁰⁴ The painting's emergence is characterised by the blending of matter and potential energy, constituting its existence in the present. The individualisation of a painting is not tied to the identity of its materials, but rather to a state of modification. Within SET, two fundamental dynamics are concealed: an energetic dynamic and a

²⁹⁹ Gilbert Simondon (2005 [1989]), *Individuation*, 16, 244-250, 358-359.

³⁰⁰ Isabella Stengers (2011), *Cosmopolitics II*, Robert Bononno (Trans.) (Minneapolis: University of Minnesota Press), 150-155.

³⁰¹ Gilles Deleuze, Félix Guattari (1987), *A Thousand Plateaus*, 12.

³⁰² Anne Sauvagnargues (2016), *Artmachines*, 11-17.

³⁰³ Elizabeth Grosz (2017), *The Incorporeal*, 159-168.

³⁰⁴ Gilbert Simondon (2005 [1989]), *Individuation*, 11; Gilles Deleuze (2004), *Desert Islands*, 86-89.

structural dynamic. SET operates in a metastable state, encompassing potential conditions for its structuring. These conditions involve both energetic and material aspects, as well as an informational component. It is the encounter of these three conditions that enables the painting to reach a stable state and emerge fully.³⁰⁵ According to Simondon, true knowledge is attained when it aligns with the most stable conditions within the subject-object relationship. Consequently, SET generates knowledge through the process of emergence, rather than relying solely on the connection between the eye and the brain.³⁰⁶

The initial stage of individualising a painting involves an event within a metastable state of the system. SET operates as a metastable system where form, matter, and energy coexist, yet not alone is sufficient for form taking. In a hylomorphic situation, there is a lack of communication between form and matter, as they function in two separate realities. SET establishes this communication through the emergence of a singularity, which can be referred to as information. However, in reality, this information is nothing more than the demand of the image itself—a ready-made—represented by the digital algorithmic code. The image's demand initiates the process of individualisation.³⁰⁷ The veritable principle of individuation is mediation, and the relationship between matter and form, represented by the paint and the ghost image, does not occur between inert matter and an external form. Instead, there is an allagmatic operation that exists on the same level of existence between matter and form, realised through the actualisation of potential energy.³⁰⁸ This energy, specific to the system, depends on the singularity or singularities of the concrete here and now, enveloping and amplifying them. It is a force that arises from the momentary encounter between matter, touch, and the algorithmic code, replacing the notion of form with that of information from the ready-made. This shift in structure within the physical system occurs through the exchange of energy, manifested by the emergence of a ghost image in the paint. Potential energy goes beyond mere perception and corresponds to the capacity for actual transformations within a system. It demonstrates the need for a theory that combines both structural and energetic perspectives, surpassing the traditional notion of elements. Information, unlike form, is never a singular entity but rather the significance that emerges from disparition.

³⁰⁵ The emergence of the individual, here, the emerging painting, causes the metastable state to dissipate as it reduces the tension within the system. The painting transforms into a static and non-evolving spatial structure, lacking motion. This contrasts with the individual as a living being, where metastability is sustained. Gilbert Simondon (2005 [1989]), *Individuation*, 261-262.

³⁰⁶ Michel Foucault (2011), *The Courage of Truth: The Government of Self and Others II, Lectures at the Collège de France 1983-1984*, Graham Burchell (Trans.) (Basingstoke: Palgrave Macmillan); Johnny Golding (2021), *The Courage to Matter*, 484-485; Gilbert Simondon (2005 [1989]), *Individuation*, 68-76.

³⁰⁷ Gilbert Simondon (2005 [1989]), *Individuation*, 74-75.

³⁰⁸ Gilbert Simondon (2005 [1989]), *Individuation*, 54-60, 257-264; Simondon employs the concept of the allagmatic to investigate the ontological relationship between structure and operation. Gilbert Simondon (1964), *L'individu et sa genèse physico-biologique*, 263 (PDF).

In the context of paint[ing] within SET, its belongingness to the system allows for mutual actions with the machine-made algorithmic code, the ready-made. This mutual interaction ensures that the paint's belongingness to SET is defined by a virtual reciprocity of actions between the system's components.³⁰⁹ It is the orientation of the living being in a polarised world, where the allure of the ready-made algorithmic code influences the artist's hand without sacrificing its freedom within the defined areas on the canvas. The construction of the painting does not abstractly rely on sensation alone but rather problematically on the initial unity of tropism and sensation. Sensation acts as an expectation of tropism, a signal guiding the direction, rather than a mere grasp of an object.³¹⁰

The process of painting using SET is a transductive. The term “transduction” primarily refers to the process of individualising the real itself. Transduction is defined as a gradual propagation of an activity within a specific domain, relying on a structured progression from one region to the next, encompassing physical, biological, mental, and social operations. In the context of painting, each structural region on the canvas, mapped out from the tones of colour, acts as a guiding principle and model for constituting the subsequent region. Through this structured operation, modifications gradually spread throughout the painting. A crystal provides a simple image of the transductive operation, as it grows and expands in all directions from a tiny nucleus in its supersaturated liquor. Each previously formed molecular layer serves as the basis for structuring the layer in the process of formation, resulting in an amplifying reticular structure. Similarly, in painting, the process starts with small areas and expands in all directions based on the ready-made. The transductive operation is an ongoing process of individualisation, integrating disparate elements into a meaningful system—a painting. Transduction, like dialectics, conserves and integrates opposing aspects but does not assume the existence of a preliminary framework. The resulting system is made concrete by the algorithmic code, and the transductive order preserves the algorithmic code through the emergence of a ghost image.³¹¹

In summary, transduction in the process of painting with SET involves a gradual propagation of activity, utilising a structured progression from one region to the next. It is a process of individualisation that incorporates multiple dimensions and structures, preserving information and integrating opposed aspects. Time is not a preliminary framework but emerges as a dimension within the discovered system. Paintings that emerge through SET exist within a complex regimen, posed between the phase transition between order and chaos, defying a simplistic hylomorphic interpretation. While one can acknowledge that a painting is the result of intentional application of paint, its purpose and evolution remain surprising in its elegant coevolution.³¹² It is astonishing to discover that SET, a system governed by straightforward

³⁰⁹ Gilbert Simondon (1992), *Incorporations*, 302; Gilbert Simondon (2005 [1989]), *Individualisation*, 47-68.

³¹⁰ Gilbert Simondon (2005 [1989]), *Individuation*, 1-17, 26-32, 61-68, 285-291.

³¹¹ Gilbert Simondon (2005 [1989]), *Individuation*, 15-16, 100-125, 162-264, 272-311, 328-380.

³¹² Elizabeth Grosz, *The Incorporeal*, 262.

rules, which forward a liberation of the brush and artistic expression, gives rise to complex dynamics that defy prediction.³¹³ The painting "sculpts" itself, and the local order of complex structures emerges through self-organisation. This process is spontaneous, self-organised, self-ordered, unpredictable, and beyond the influence of any external agents. It establishes a permeable difference between the various unfoldings of the bifurcation that emerges between energy and information, as form emerges from matter.³¹⁴ The act of painting, in conjunction with SET, becomes a spontaneous self-organisation and self-ordering entity, whose transductive emergence enables the logic of sensuousness to enter.

³¹³ Klaus Mainzer, Leon Chua (2012), *The Universe as Automaton: From Simplicity and Symmetry to Complexity* (Heidelberg: Springer), 17-29.

³¹⁴ Thomas Nail (2018), *Lucretius I*, 46, 55.



Fig. 60. Be Andr, *Untitled (Colin 8 tones)*, 2022, oil on wood, 48 cm x 30 cm; *Untitled (Colin 16 tones)*, 2022, oil on wood, 48 cm x 30 cm.

4.3 Order from disorder

*A painting is a living organism
which grabs what it needs.*

Neo Rauch, David Zwirner, 2023³¹⁵

It takes energy to create improbable configurations from disordered ones, and to understand painting as spontaneous self-organisation, one must explore emergent phenomena that exist separately from SET.³¹⁶ First, the composition of paint itself involves a mixture of different pigments combined with specific amounts of oil tailored to each pigment's unique qualities. Even small discrepancies in the mixing process, particularly when adding the pigment mix, can alter tonal variations, which play a significant role in the emergence of an image. SET fails to consider anything beyond the weight of each oil painting colourant. Secondly, the role of the hand in painting is often mistakenly viewed as the sole mark maker that encounters the tonal paint by its movements, and is dependent on the subtle pressure and *techné* of the hand that moves the brush. These interactions, the transmission of energies, exist independently of SET's calculations of placement and tone. The exchange of energy between the terrestrial forces, represented by pigments, and the corporeal forces embodied by the hand and the resistance of the canvas, establishes a particular order from disorder.

Yet, this corporeal ghost image remains a continuum where the complexities introduced by SET come in with its complexities and co-working and ordering the movements of both the mix of tones and the moment of the hand in an encounter of the energy transmitted between hand, canvas, and calculation. The resulting image on the canvas, emerging from chaos through complexity, defies straightforward transparency regarding authorship, as it uncovers what was previously concealed.³¹⁷ Thus, the infusion of energy enables the spontaneous development of self-organisation, creating a flexible, adaptable system with great plasticity and emergent phenomena through the encounter between technology and the hand. Human thinking and bodily production extend beyond what computation alone can achieve. Unlike conscious beings that can directly experience sensations, purely computational systems lack awareness and seem to be unable to process the sensual qualities and are not actually capable of *feeling* anything. Bergson suggests that existence for a conscious being entails continuous change, maturation, and endless self-recreation, which curiously aligns with the nature of the binary code used in

³¹⁵ David Zwirner Instagram—<https://www.instagram.com/p/CrLsFDWMCWo/> (accessed 17th June 2023).

³¹⁶ Ilya Prigogine, Isabella Stengers (1984), *Order Out of Chaos*, XV, 69-70, 73, 103, 129, 251.

³¹⁷ Elizabeth Grosz (2017), *The Incorporeal*, 171-181; Prigogine and Stengers (1984), *Order out of Chaos*; Jean-François Lyotard (2004), "Anamnesis of the Visible," in *Theory, Culture & Society* 21: 107-119.

computational systems. Art transcends formal arguments and computable procedures; it emerges through encounters. This uncomputable aspect, referred to by Lyotard as the sublime, eludes regulation by taste and allows for the faculties of material comprehension and sensitivity to intertwine with the mathematical underpinnings of the universe.³¹⁸ In this encounter, information undergoes transformation and emerges physically through the release of kinetic energy. It becomes a lived experience, no longer confined to thoughts or calculations but lived through the creation of form—a continuous exploration of the inventive and generative, giving rise to the new.³¹⁹

4.4 Dimensional agency and the spread agency artist

In SET, every element contributes to the technological framework: the movement of hand, the brush, the paint, the canvas, the body, AI, and technology itself empower a distributed and spread agency.³²⁰ Unlike artists like Avery Singer and many contemporaries who aim to remove the trace of the artist's hand from the creative process and move towards a purely computational system, SET does not advocate for such an approach. Instead of dividing humans and technology, SET establishes conditions that distribute and spread agency between algorithms and touch.³²¹ To simplify, the traditional notion of technology involves a goal-means relationship, where humans formulate goals and create technologies to achieve them. In contrast, SET's relationship with technology is much more complex, and labelling humans as active and algorithms as passive would be misleading.

While it may appear that SET delegates the analysis of binary code and the definition of outcomes through the mapping solely to algorithms, the reality is that both processes involve the co-working and encounter between algorithms and human tactility. It's a two-way communication and information exchange.³²² Drawing a dichotomous distinction between human agents and technological artefacts is problematic, even without the pre-emptive and active nature of algorithms.³²³ Throughout history,

³¹⁸ Jean-François Lyotard (1991), "After the Sublime, the State of Aesthetics," in *The Inhuman*, 125; Roger Penrose, *Shadows of the Mind*, 64-66, 399-401, 418-419.

³¹⁹ Henri Bergson (2002), "Creative Evolution", in *Key Writings* (New York: Continuum), 174-178.

³²⁰ In this context, the term "agency" refers to the ability or capacity to act.

³²¹ Singer utilises large printers that replicate the look of oil colours, in order to eradicate the artist's personal touch from her images transferred onto canvas.

<https://www.vip-hauserwirth.com/gallery-exhibitions/avery-singer-reality-ender/> (accessed 17th June 2023).

³²² Jos de Mul (2009), "Moral Machines: ICTs as Mediators of Human Agency," in *Techné: Research in Philosophy and Technology*, 14(3): 226-236.

³²³ "Preemption" is a term that is used to describe the delegation of decisions-making to algorithms; Yuk Hui (2016), *On the Existence of Digital*, 210-252; Bruno Latour (1992), "Where We are the Missing Masses? The Sociology of a Few Mundane Artefacts", in Wiebe E. Bijker and W. E. John Law (Eds.), *Shaping Technology / Building Society: Studies in Sociotechnical Change* (Cambridge, MA: MIT Press); Bruno Latour (1993), *We Have Never Been Modern* (Cambridge, MA: Harvard University Press); Bruno Latour (1999), *Pandora's Hope: Essays on the Reality of Science Studies* (Cambridge, MA: Harvard University Press); Bruno Latour (2002), "Morality And Technology: The End of the Means," in *Theory, Culture & Society*, 5-6: 247-60.

humans and artefacts have consistently established interconnected networks, relying on each other. According to Jos de Mul, humans have effectively functioned as cyborgs since the inception of tool usage, embodying a combination of organic, technological, and cultural elements:

*Man has been a cyborg ever since the moment he [sic] started using tools, partially an organism, partially technology and culture.*³²⁴

In Plato's *Phaedrus*, it is argued that assigning human abilities to technological artefacts diminishes human agency.³²⁵ The analysis of binary code in SET is an open, ongoing process where humans constantly adjust and interact with algorithms by modifying parameters and the number of tonal/colours of the resulting artwork. This process emerges from the need for aesthetics in painting and the fact that AI lacks conscious aesthetic choices. AI relies on humans' visual and aesthetic decisions to articulate and circulate matter through humans' ability to utilise and sense tactility in the making of art. Therefore, in SET, the algorithm facilitates the development of novel forms of creativity and creations, without diminishing human autonomy. On the contrary, it activates human agency through performativity, serving as a physical reminder of what it means to be human. This, in turn, enhances human autonomy and expands creative possibilities. The more agency SET possesses, the more it potentially enhances human autonomy by inviting new means to be used.³²⁶

Through divided agency, SET enables the conditions for emergence. The spatiality that emerges from the spread and distributed agencies depends on both the system's algorithms and the mixture of oil and pigment, as well as on the logic of *techné* within the brushstrokes enabled by the algorithm. The emergence, which in this case refers to the paintings, is not solely the result of touch and the hand alone but rather a consequence of the spread agency, the co-working process between touch and algorithm.³²⁷ The spread agency transforms the possibilities of creation by reconfiguring material-discursive apparatuses of bodily production, altering, contributing to, and challenging what matters in the

³²⁴ Jos de Mul (2003), "Digitally Mediated (Dis) Embodied. Plessner's Concept of Eccentric Positionality Explained for Cyborgs", in *Information, Communication & Society* 6 (2): 247-266.

³²⁵ Plato (1925), "Phaedrus," in *Plato in Twelve Volumes, Vol. 9*, Harold N. Fowler (Trans.) (Cambridge, MA: Harvard University Press), *Phaedrus* 275A, as found online: <http://www.perseus.tufts.edu/hopper/text?doc=Perseus%3Atext%3A1999.01.0174%3Atext%3DPhaedrus%3Asection%3D275a> (accessed 11th July 2023).

³²⁶ Jos de Mul, Bibi van den Berg (2011), "Remote Control: Human Autonomy In The Age of Computer-Mediated Agency," in *Law, Human Agency and Autonomic Computing: The Philosophy of Law Meets the Philosophy of Technology*, Mireille Hildebrandt and Antoinette Rouvroy (Eds.) (Abingdon: Routledge), 46-63.

³²⁷ Emergent phenomena, stemming from the collaboration of dissimilar elements, exhibit distinctions from their individual components, as they cannot be simplified or measured solely based on the sum or difference of these elements. George Henry Lewes (1875), *Problems of Life and Mind, First Series: The Foundations of a Creed* (Boston, MA: Osgood), 369; David Blitz (1992), *Emergent Evolution: Qualitative Novelty and the Levels of Reality* (Dordrecht: Kluwer Academic).

differential mattering of the world. Agency is not an inherent attribute but an ongoing process of reconfiguring the world, a dynamic in which the primary semantic units are not limited to “words” but encompass material-discursive practices that constitute boundaries. The hand with no encounter with AI cannot make the same image emerge. The distributed and spread agency of SET enables the formation and evolution of a spatial technology. This re-evaluation of pixels, utilising maps as a condition that enables the spread of agency, fosters a process of becoming—an apparent living growth of colours and tones across the maps, an intensity, a material reconfiguration, a serene patience, *letting things come to you*, allows things to unfold. Through enabling deep contemplative attention and hyperfocus, SET creates a seemingly timeless moment that makes the painting come alive.

In the framework of SET, matter is not static. The paint, canvas and algorithms are produced and productive, generated and generative, agentic factors in its iterative materialisation. The space of agency is not restricted to the possibilities for human action but instead is an iterative reconfiguring of the materiality of human and nonhuman AI. Agency is a “doing,” an enactment of iterative reconfiguration. The act of painting with SET is an act of becoming, a transition from improbable to probable configurations of molecules. It serves as the nucleus of the flow of time and a physical reconstruction of what is possible and what is impossible. However, becoming in SET is not a linear progression in time or a confined occurrence in space. Instead, it is an ongoing and open-ended process that defies determinism. It is an open-ended, non-deterministic, and sedimentary process—an exhausting dynamism of the enfolding of mattering. It encompasses the dynamics through which temporality and spatiality are produced and iteratively reconfigured in the materialisation of phenomena and the reconfiguration of material-discursive boundaries.³²⁸

SET posits that what makes matter matter is realised through its engagement with the amalgamation facilitated by SET, rather than relying solely on the hand or the algorithm. An aliveness emerges through the present, where the ghost image in the paint defies representation and materialises as an emergent manifestation of the present. This ghost image arises from the unfolding of the painting, transcending its status as a mere painting. Instead, it becomes an emergence that involves not just the artist or the algorithm alone, but a co-working system in which a new kind of artist—an assemblage of the person applying paint and the algorithmic system—emerges.

This process gives rise to a novel type of artist, a “spread agency artist.” An artist that makes its works in the entanglement between the human and the machine, expressing a *poiesis* of the being-together

³²⁸ Karen Barad (2007), *Meeting the Universe Halfway*, 134-141, 175-182, 234-236, 439; Hans Reichenbach (1971 [1956]), *The Direction of Time*, 1-17, 55.

between humans, nature, and algorithms.³²⁹ By doing so, the antagonism between humans and machines can be resolved, and a sense of co-naturality emerges.³³⁰ The traditional understanding of causality and agency undergoes reformulation, continuously reconfiguring both reality and potentiality. The gesture involved in this process is non-goal-directed and not solely determined by a conscious human subject. Instead, it emerges through multiple encounters and the complex condition of spread agencies.³³¹ It is what Heidegger called an *Ereignis*— an event—in which the subject giving birth to it lacks knowledge, analysis, and control.³³² A shift occurs from an organised inorganic state to an organising inorganic state, where the algorithmic system ceases to be a mere tool and instead becomes an integral part of an organic whole. This marks the transcendence of the human-AI opposition.³³³ However, agency remains intertwined with issues of accountability, determining what is significant and what is excluded from the realm of importance. Matter actively participates and constitutes the substance of becoming, congealing agency, but it is not a fixed essence.

The true value of the encounter between AI and human artistry lies in the potential for symbiosis, co-working, coevolution, collaboration, innovation, and the liberation of freedom of movement and expression. The emerging painting is not solely the creation of either the human or the algorithm, but rather the result of their encounter. The act of painting transforms the artist's relationship with the system, shifting from the singularity of a person creating artwork to a process where the human exists within a system that produces the artwork. In this perspective, the concept of "artist" extends beyond the individual human, encompassing the entire system, pointing in the direction of understanding the very construction of the system anthropomorphic on the basis of the structure and function of a living system or, said differently, an organism.³³⁴

³²⁹ This concept of entangled poesis was developed in the *Entanglement Seminar, September 2019-21, led by Professor Johnny Golding*. Here, entanglement can be understood as an encounter that, when it "works" creates a "sticky cohesion" without recourse to an external system. In this thesis, "entanglement" names the very relations that weave reality: the manifestation of one object to another, in the course of an encounter, in which the properties of the objects become actual. See also Carlo Rovelli (2021), *Helgoland*, 68-74. (PDF)

³³⁰ Gilbert Simondon (2009), *Entretien sur la mécanologie*, 103-32.

³³¹ A gesture, generated within the process of speaking, is a visibly expressive action that embodies imagery, not limited to the hands or hands alone. David McNeil (2012), *How Language Began*, 3-4.

³³² Martin Heidegger (1969 [1957]), "The principal of identity," in *Identity and difference*, (23-41), 39.

³³³ Donna Haraway (2016), "A Cyborg Manifesto," in *Manifestly Haraway* (Minneapolis: University of Minnesota Press), 59-61; Yuk Hui (2019), *Recursivity and Contingency*, 28.

³³⁴ Georges Canguilhem (2008 [1965]), *Knowledge of Life*, Stefanos Geroulanos and Daniela Ginsburg (Trans.) (New York: Fordham University Press), 75-97.

Conclusion

Conclusion

The thesis sought a way to articulate a painting practice that combines human creativity with algorithms and AI, establishing a collaborative and symbiotic relationship between the two. The aim was to identify the potential of an open painting system that can continuously evolve and adapt to the demands of the image, the binary code, and advancements in technology like AI. The algorithms utilised in this practice are flexible, adaptable, and can be employed in various ways. The co-working between AI and the human body, which I term “spread agency artist,” spreads and distributes agency between the human and the machine, offering limitless possibilities for future developments in painting.

Throughout this thesis, it became evident that SET is not a static entity confined to a specific time or space, nor is it a characteristic of a particular material or structure, or a point-by-point expression of a model. Instead, SET is characterised as an open dissipative system residing within complexity, encompassing dynamic flows of matter and energy. Placing the human artist as a feedback loop within this system infuses the emerging painting with energy, making it alive, enabling spontaneous self-organisation that make it grow and develop and emerge as a painting.³³⁵

Commencing with the initial research question of the thesis, which probes the significance of the transition from analogue to digital in reinstating agency to painting, the response to question 1 permeates the entire thesis but receives specific attention in Chapter 0. Briefly, by "agency," I refer to a sense of aliveness, vitality or vibrancy that imbues a painting with subtleties or uniqueness, qualities that may be lost in a straightforward translation. In Chapter 0, it becomes evident that the FAA training set me on my trajectory. However, this thesis aims to establish a sense of aliveness, moving away from the "brown sauce moment" associated with the sight-size method.

The transition from analogue to digital redefines the agency and enablement of art by incorporating Heideggerian notion of belonging and event, further developed by Golding into the notion of encounter. The encounter between the structure, represented by digital binary code, and the operation, the bodily act of painting, leads to the emergence of the painting. The circulation of the binary code enables mapping, perceived as a recontextualising and merging of Benjamin's aura and Lyotard's notion of the figural.

³³⁵ A dissipative system is characterised by its openness to interactively exchanging energy and matter with its environments. A prime illustration of a dissipative system is a living organism. By placing the human body as an integral component and a feedback loop within SET, the functioning of SET resembles that of a dissipative system. Dilip Kondepudi, Ilya Prigogine (2015), *Modern Thermodynamics*, 8-9, 71-72, 117; Klaus Mainzer (2005), *Symmetry and Complexity*, 190.

The merging of aura with Lyotard's figural shifts the focus to emphasise the artist's touch, enabling expressive brushstrokes that infuse the emerging painting with authenticity and vitality. Overall, this transition revitalises painting by redefining agency, highlighting liberated brushstroke movements within the digital codes. The collaboration between algorithms and human touch in SET reinstates the agency of the artist, infusing vitality and redefining the art of painting.³³⁶

The second research question asks how algorithmic coding and measurements prompt a re-evaluation of representation in contemporary painting. This shift surpasses traditional depictions, embracing digital imagery stripped of its original source and signalling a departure from conventional representation. Simultaneously, it moves beyond abstract or expressive painting; it heralds a new form of artistic expression. I belong to a cohort of artists exploring coding structures, engaging in a practice distinct from both faithful representation and abstract expressionism like Rothko's. This figural approach facilitates a unique mode of interpretation, no longer tethered to strict fidelity to real-life resemblance.

The transition to the digital medium rethinks the Duchampian ready-made concept as the algorithmic code of the digital image. Within my art, this transformation of the ready-made bestows upon the status of art, igniting a vibrant quality and fostering the emergence of the poetic. The representation of the image facilitates the emergence of aliveness within it. This vitality is not a precise replica—often, when people consider algorithmic coding, it's perceived as a means of duplication. However, it embodies a form of representation that embraces multiplicities. What is repeated embodies a peculiar form of pattern—it generates synthetic patterns that, despite being based on precise measurements, are inherently imprecise. What sets them apart is that the feedback loop generates noise rather than a clear signal, fostering openness instead of the typical closed-loop feedback system found in conventional generative environments (zero sum feedback loops).

By situating SET within the generative capacity of painting, the focus shifts away from representation, truth/falsehood, likeness, and copying. By rethinking aura as a circulation of binary code, rather than as a ground, SET aims to explore the present rather than create paintings that reference past images. This paradigm shift would not have been achievable without AI mapping and the liberation of manual brush strokes. This liberation allows for both an aliveness and a resemblance without relying on point-by-point representation.

³³⁶ Jeanine Griffin (2022), *Aura in the post-digital: a diffraction of the curatorial archive*, (Sheffield Hallam University); Christina Mullan, *Mechanical Reproduction and Techno-Science: Walter Benjamin and Jean François Lyotard* see <https://christinamullan.weebly.com/mechanical-consideration-walter-benjamin-and-jean-franccedilois-lyotard.html>.

The third and final research question inquiries about how a painting can retain its originality while integrating both human touch and algorithmic system. In traditional approaches to art, the debate on the originality of an artwork holds significant weight. The notion of originality, central to art discourse, often grapples with the reproducibility of art objects. Photography, for instance, sparked contentious discussions as it inherently involves copying. Benjamin's concept of aura addressed this dilemma, framing the perception of art's originality within the context of its aura.³³⁷ To the degree to which one wants to see art as original, and therefore as part of the art world that one is in.

One must get a sense of what it is that one is claiming as originality. For Benjamin, the originality lies in the question of the aura, whereas I emphasise the aliveness as the source of its originality – enabling a certain style and signature to emerge, providing the work with a kind of truth. This truth isn't about mimicking reality; rather, it's about the work's ability to assert itself in any form it chooses. Merely replicating a subject isn't the aim. The notion of originality can be misleading, suggesting that faithful reproduction equates to superior art – which isn't necessarily true.

When examining my paintings, the focus isn't on meticulously rendering hair or a forehead. Instead, I strive to capture the dynamic interplay of time, movement, and contemplation. Consider '*Untitled (Performative Waves of Embodied Matter)*': it offers a distinctive commentary on how the flow of time manifests itself.

The endeavour to integrate touch into the synthetic interaction between algorithm and the artist's hand has proven to be a complex journey. When unsuccessful, the paintings appeared flat, reminiscent of paint-by-number images. For instance, this can be seen when comparing images in Fig 19. In the pursuit of aliveness within the painting, the challenge lay in finding the right approach. It required a process of trial and error. Adjustments were necessary, such as adapting the quantification to the brush size and calibrating the application of paint to each mapped area's dimensions. The project aimed to seamlessly integrate technology, particularly AI and digital processes, into the painting process, fostering a collaborative dynamic between algorithms and human touch. This integration, exemplified by the development of SET, successfully bridges the gap between digital and traditional painting, allowing painting to emerge as a collaboration between algorithmic code and the human body. Evidence from various chapters, notably Chapter 1, supports this collaborative behaviour, illustrating how the artist's body functions as a feedback loop within SET. This collaboration enables a physical presence of touch that significantly impacts the role of sensuousness within the digital environment.³³⁸

³³⁷ Walter Benjamin (2008 [1936]), *The work of Art*; as discussed pp 86-88.

³³⁸ Referring to pages 43, 67-68, 87, 123, and 137 for discussions on the gap between digital and traditional

The painting practice uses a coordinated involvement of eye, hand, body, and algorithmic code working in unison. The hand encounters the mapping emerged through the binary code, infusing energy and aliveness into the painting with brushstrokes enabled by the algorithmic mapping. The concept of "the emergent touch" involves an affective and distributed touch.³³⁹ This distributed touch transforms the spatial code of the digital image into a transformative ghost image on the canvas, as evidenced in Chapters 2 and 3.³⁴⁰ The concept of "the emergent touch" involves an affective and distributed touch. Further, the thesis adeptly reassesses Benjamin's notion of aura, particularly highlighted in Chapter 1, where the circulation of binary code triggers a re-evaluation of aura. Walter Benjamin's conception of aura undergoes transformation through the encounters of painting, body, and algorithms. This re-evaluation merges aura with Lyotard's notion of the figural, enabling authenticity and originality to re-enter through free manual brushstrokes.³⁴¹

Furthermore, the project challenges traditional subject-object dichotomies, emphasising spread agency and co-working processes. SET is not a goal-oriented system where humans set objectives and develop technology as means to achieve those goals. Instead, the thesis focuses on the encounters among SET's components, devoid of hierarchical structures, fostering emergence through equality among system elements. This approach dismantles subject-object dichotomies, highlighting a collaborative partnership between humans and SET rather than a hierarchical relationship. Chapter 4 adeptly investigates spread agency, disrupting traditional dichotomies and accentuating a process of reconfiguring that transcends human capabilities.³⁴²

In reflection, challenges were encountered with colour mixing and full-colour mapping and separation. Disparities between the colour system on the screen and mixable pigments led to differences in visual appearance, while issues with the Python script used for full-colour code analysis resulted in unnecessary details and an excess of maps. Despite these challenges, the project underscores the ongoing process of refinement and adaptation inherent in artistic exploration.

The contribution to existing knowledge lies in the proposal that the aliveness of painting emerges from the foregrounding of human tactility in the artistic process. Unlike a grid-based system, this approach

painting.

³³⁹ To explore the development of "the emergent touch," please refer to pages 67, 73, 89, 96, 114, 117, and 121, particularly.

³⁴⁰ To explore the development of "the emergent touch," please refer to pages 67, 73, 89, 96, 114, 117, and 121, particularly.

³⁴¹ Referring to pages 42-45 for a discussion on the re-evaluation of Benjamin's concept of aura.

³⁴² For insight into how this project challenges traditional subject-object dichotomies, emphasising spread agency and co-working processes see pp 72, 132-134.

remains open to the environment and organises itself by unfolding to the external environment by its potential transformation into dynamically stable forms. It can be viewed as a continuum between the living and the non-living, where energy flows through the body's role as a feedback loop, orchestrating the material system. It is a process of intensities, not of accuracy, making sensations by giving an autonomous life to expressive qualities and material forms and through them affecting and being affected by life.³⁴³

By situating SET within the generative capacity of painting, the focus shifts away from representation, truth/falsehood, likeness, and copying. By rethinking aura as a circulation of binary code, rather than as a ground, the SET process aims to explore the present rather than create paintings that reference past images. This paradigm shift would not have been achievable without AI mapping and the liberation of manual brush strokes. This liberation allows for both an aliveness and a resemblance without relying on point-by-point representation.

It is my hope that the development of SET will not merely introduce a new painting system but, through dismantling binary structures and conventional thinking, raise new questions and identify new challenges in the relationship between AI, technology, human creativity, and painting. The generative materiality achieved through a distributed touch is evident throughout the development and utilisation of SET, suggesting that painting is nothing other than a process of material transformation. In the context of SET, painting operates as an ever-‘present’ anamnestic entity that keeps asking us to listen through the sensuousness of the distributed and emergent touch.³⁴⁴ This configuration is not an arbitrary construct of our choosing or the outcome of deterministic structures, but rather an ethical matter of an ongoing reconfiguration of the world.³⁴⁵

³⁴³ Elizabeth Grosz (2008), *Chaos, Territory, Art*, 101-103; Mae-Wan Ho (1998), *The Rainbow and the Worm*, 3-6, 37-59; Mae-Wan Ho (1988), “How Rational Can Rational Morphology Be?,” in *Rivista di Biologia* 81:11-55, 232-238; Alfred North Whitehead (1948), *Science and the Modern World*.

³⁴⁴ An anamnestic entity explores the meanings of a given “present”, of an expression of the here and now, without immediate concern for referential reality. Jean-François Lyotard (2004), *Anamnesis: Of the Visible*, 107-119

³⁴⁵ Karen Barad (2007), *Meeting the Universe Halfway*, 179-185.

APPENDIX 1: GLOSSARY

Algorithm/AI is a field that combines computer science and extensive datasets to aid problem-solving using predefined rules or procedures. Algorithms, as a form of artificial intelligence (AI), are used interchangeably with AI.

Allagmatic represents the encounter between structure and operation, drawing inspiration from Gilbert Simondon's usage of the term.

Assemblage is employed in a manner that derives its meaning from the French word *agencement*, which pertains to arranging, laying out, and piecing together. This differs from its conventional English usage, which relates to the unity achieved by joining two things together.

Aura For Walter Benjamin, what makes an artwork is the circulation of the work's aura, its uniqueness.³⁴⁶ However, this thesis argues that the circulation of the binary code, rather than the aura, takes precedence.

Belonging denies representation as it is established through encounters that do not require an origin. In contrast, representation necessitates an original as it involves copying something.

Complexity is the science of emergence, and in the context of painting, emergence refers to the unique outcome of a complex system. It arises because the actions of the entire system exceed the sum of its individual parts.

Corporeal ghost is used to point out the non-linearity and instinctual bodily process from digital photo to painting on canvas.

Distributed touch is used to describe how touch is distributed through a material condition, an energetic condition, and an informational condition.

Emergence is understood as something that arises as a result of the collective behaviour of the system is not readily understood from the behaviour of the parts.³⁴⁷

³⁴⁶ Walter Benjamin (2008 [1936]), *The Work of Art*, 22-24.

³⁴⁷ Sean Carroll (2019), *Something Deeply Hidden*, 250-274, 323-324 ; Taneer Bar-Yam (1997), *Dynamics of Complex Systems*, 9-14, 34.

Entanglement names the very relations that weave reality: the manifestation of one object to another, in the course of an encounter, in which the properties of the objects become actual.

Figural encompasses non-discursive and pre-linguistic elements that disrupt linear, logical, and rational structures. In SET, the figural denotes the translation of binary code into expressive brushstrokes on canvas, providing a tangible manifestation to this concept.

Fractal is a type of mathematical set that exhibits intricate and complex patterns. Fractal patterns are used in the process of mapping when using SET and enable encounters between the hand movements, the brush, and each tonal pigment of paint.³⁴⁸

Groundless ground stands in contrast to the old-fashioned ground as a way of giving meaning to truth. A groundless ground means there is no root to something, no way to situate it; it is self creating meaning, a topological surface that gives meaning and allows cohesion and the next step.

Individuation stems from Simondon's concept, which describes the process through which an entity, here a painting, becomes separate and distinct from its surrounding environment.

Mapping is a process performed by algorithms, analysing the binary code pixel by pixel, and dividing the corresponding tone codes into distinct graphic maps. In SET, form and colour merge into one entity. This mapping is highly adaptable and undergoes numerous permutations as it transitions from binary code to the emerging painting.

Ready-made This thesis deals with a distinct form of the ready-made that deviates from Duchamp's ready-made, shifting the focus from viewer-object encounter to an encounter between the algorithmic code and the touch.³⁴⁹ In this context, the found ready-made is the binary code of the digital image.

Re-present-ing, in contrast to representation, is a term used to describe an image that is not as a stand-in for something but fully an image in itself, as the now.³⁵⁰

Resemblance and representation Resemblance refers to the observed similarity or likeness between things, indicating shared qualities or features. Representation, on the other hand, involves the act of symbolising or depicting something, creating a substitute that stands for another entity.

³⁴⁸ Linda G. Shapiro, George C. Stockman (2001), *Computer Vision*, 279–325.

³⁴⁹ Calvin Tomkins (2013), *Marcel Duchamp: The Afternoon Interview*, 48-57.

³⁵⁰ Anne Sauvagnargues (2016), *Art Machines*, 51-52.

Sensation This thesis argues that there is no distinction between the physical and mental realms; sensation is both physical and mental.³⁵¹

Simulacra refers to the resemblance observed in the ghost image that arises from the binary code and its projection of the digital image. It eliminates the original point of origin, disconnecting it from its representation and transforming it into a self-generated entity that deviates from its original form.

Transduction involves the sequential propagation of activity within a specific domain, as structured elements extend from one region to another. In the context of SET, transduction can be seen as the gradual process of painting the maps.

The uncertainty principle was formulated by Werner Heisenberg in 1927 and states that *position* and *momentum* cannot both be precisely determined simultaneously.

Undecidable is a term used in reference to Kurt Gödel's proof, which shows that every system, regardless of its simplicity or complexity, inherently possesses an unresolved aspect and openness. This thesis utilises the concept of undecidability, referring to it as "touch" to symbolise the emergence of this inherent openness.

³⁵¹ Erik C. Banks (2014), *The Realistic Empiricism of Mach, James and Russell: Neutral Monism Reconceived* (Cambridge: Cambridge University Press); Bertrand Russell (1921), *The Analysis of the Mind* (London: Allen & Unwin/ Macmillan), 10; Carlo Rovelli (2021), *Helgoland*, 84-107 (PDF).

APPENDIX 2: Greyscale mapping algorithm

Converts any PNG input into 8, 16, 32, 64, 128, or 256 tones of grey:



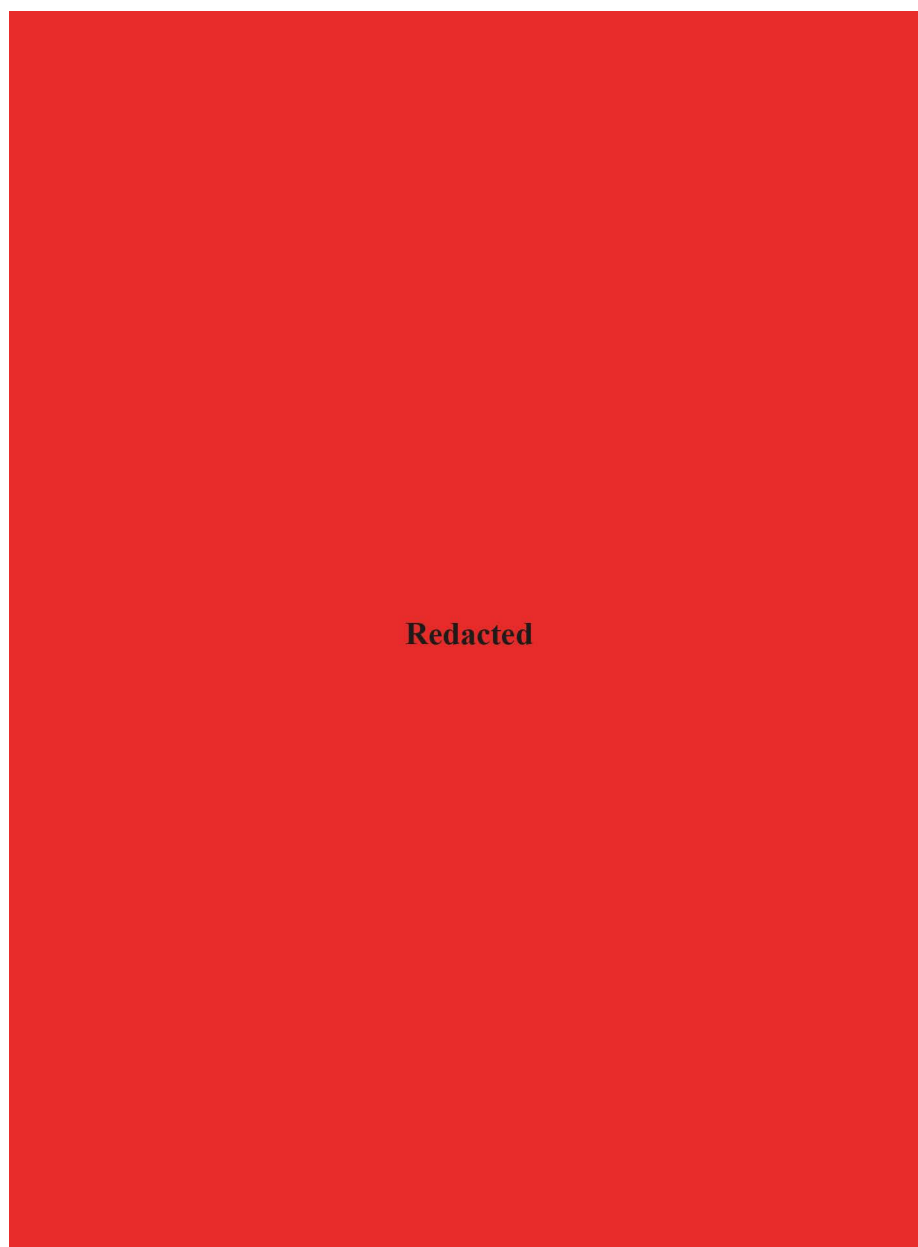
APPENDIX 3: Black and white ratio algorithm

The black and white ratio algorithm determines the mix ratio between black and white, as shown below for an 8-shade and 16-shade grey painting.



APPENDIX 4: Colour mapping algorithm

This code separates each colour in an input PNG image into layers by saving each colour pixel as a separate file:



Redacted

Redacted

APPENDIX 5: Ethics approval

←  **RCA Ethics**
To: Be Cc: John >

17/04/2019

Dear Be,

Many thanks for providing the additional information. This has been reviewed by the Ethics Committee and we are pleased to inform you that, based upon the information supplied, your ethics application has been approved and you can progress with your research.

Please note that should you make any changes to this research project or methodology, you may need to apply for further ethics approval.

Good luck with your future research.

Kind regards,

Student Research Ethics Team

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