‘This is a wonderful book, giving us new ways of understanding art and illustrated with well-chosen artwork. It is a story of the interplay between mind and matter, revealing the rhythmic textures of artistic creation and taking us beyond art itself into perceptual psychology, evolution and neuroscience.’
Michael Corballis, *Professor Emeritus of Psychology, University of Auckland, New Zealand, and author of* The Truth about Language

‘The author has an astonishing knowledge of great thinkers, artists, art criticism and neuroaesthetics. It is a remarkably easy read, considering its subject, and it is no-where self-indulgent or pretentious. If I were to teach any course on twentieth-century art or abstraction, I would adopt it as a textbook or required reading.’
John Onians, *Professor Emeritus of Art History, University of East Anglia, UK, and author of* Neuroarthistory: From Aristotle and Pliny to Baxandall and Zeki

‘Gregory Minissale offers an enthralling analysis of the vibrant materiality of abstract art. He brilliantly shows that to be truly open to the encounter with art one needs to embrace perceptual ambiguity and let go of rigorous cognitive control. Masterfully intertwining theories of art reception with phenomenology and recent findings in cognitive sciences, he casts light on the complexity of aesthetic relations unfolding beneath the surface of the conscious mind.’
Cristina Albu, *Associate Professor of Contemporary Art History and Theory, University of Missouri-Kansas City, USA, and author of* Mirror Affect: Seeing Self, Observing Others in Contemporary Art

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Minissale
Rhythm in Art, Psychology and New Materialism

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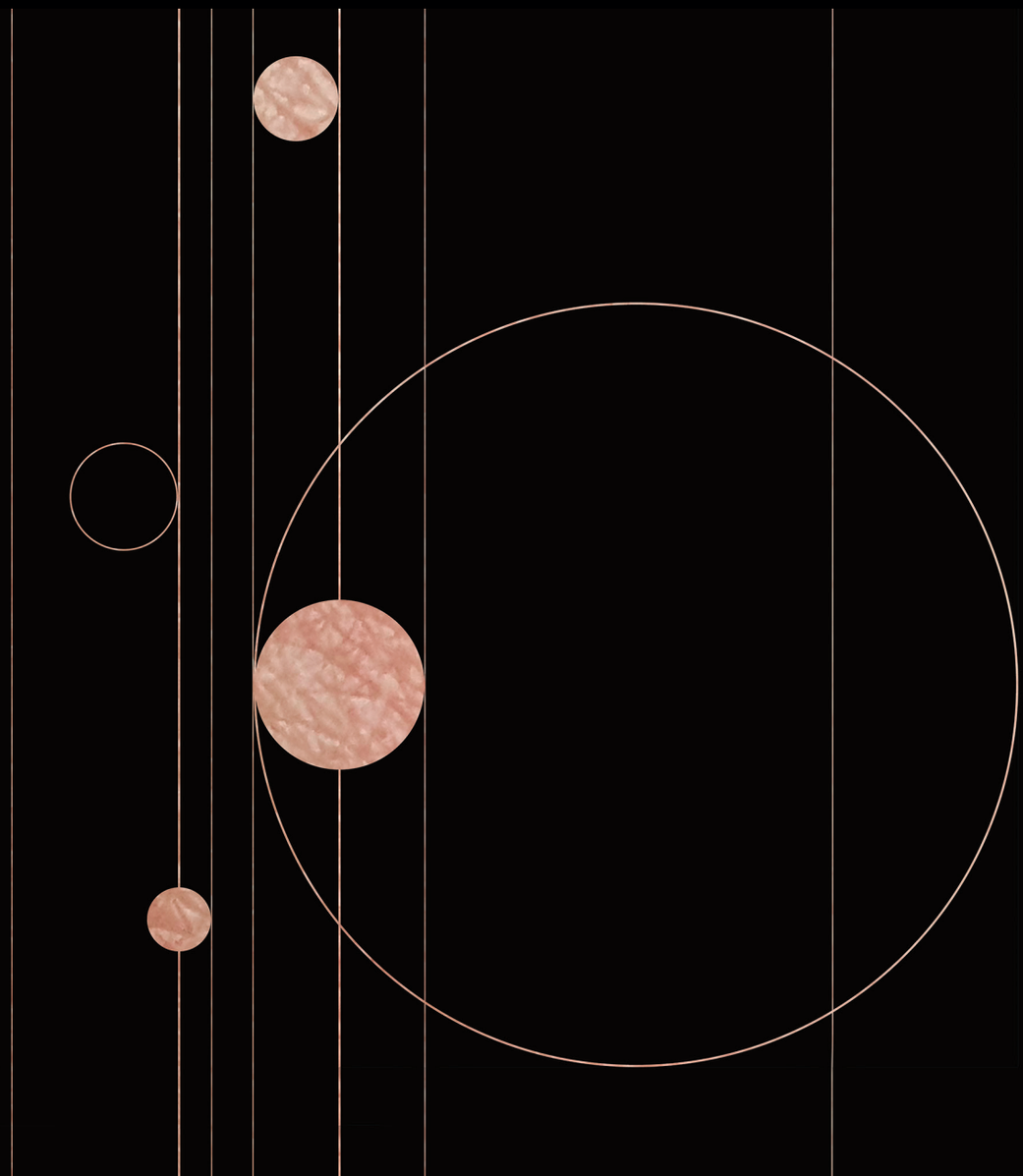
Rhythm in Art, Psychology and New Materialism

Gregory Minissale



Rhythm in Art, Psychology and New Materialism

This book examines the psychology involved in handling, and responding to, materials in artistic practice, such as oils, charcoal, brushes, canvas, earth and sand. Artists often work with intuitive, tactile sensations and rhythms that connect them to these materials. Rhythm connects the brain and body to the world, and the world of abstract art. The book features new readings of artworks by Matisse, Pollock, Dubuffet, Tàpies, Benglis, Len Lye, Star Gossage, Shannon Novak, Simon Ingram, Lee Mingwei, L. N. Tallur and many others. Such art challenges centuries of philosophical and aesthetic order that has elevated the substance of mind over the substance of matter. This is a multidisciplinary study of different metastable patterns and rhythms: in art, the body and the brain. This focus on the propagation of rhythm across domains represents a fresh art historical approach and provides important opportunities for art and science to cooperate.

Gregory Minissale is Associate Professor of Modern and Contemporary Art at the University of Auckland, New Zealand. He specialises in philosophical and psychological approaches to art, and is the author of *The Psychology of Contemporary Art* (Cambridge University Press, 2013).

Rhythm in Art, Psychology and New Materialism

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Contents

Color plates are to be found between pp. 137 and 138

Figures

Introduction: A Rhythmanalysis of Art

We overlook the hairline fractures in the sheen of an oil painting in order to exchange glances with a long-deceased personage. Inconvenient truths are barely registered: a ridge of impasto collects dust, an uncertain light on the surface moves as we move, briefly exposing the warp and weft of the canvas. To focus on humble materials would only remind us that the silk, hair and flesh, the mind and soul depicted, are bits of stuff slowly decaying. Several centuries of practice have turned this habit of overlooking matter into a fine art: the image prevails over its worthless material substrate.

Why do we overlook matter in this way and what happens when we don't? This is one of the key questions I pursue in this book. An answer to the first part of this question is that for many centuries it seemed a natural function of art to express eternal ideals – the divine, the soul, the mind, order and harmony, and other immutable truths. Making art has long been an exercise, implicit or explicit, in manipulating inanimate matter and controlling the chaos and contingency that undermine these ideals. Yet artists literally hold matter in their hands, replaying these kinds of conflicts at the back of their minds. In contrast, and to answer the second part of the question, in modern abstract art, wild and rude amounts of matter seem to be all there is to look at. Without order, matter comes forth to produce a direct encounter with its rhythms, textures and viscosities, offering no narrative, meaning or form in which to find comfort.

This book studies the kind of engagement that is involved in sifting through the matter in abstract art, an experience that rhythmically switches from order to disorder and back again. In many of the artworks I examine, matter appears unmodelled and in a raw state. Such work offers the tantalising notion that, however much it presents visions of rhythmic strata, dappled shadows and swarming masses, abstract art is simply pigment, oil, sand and dust – a zone, or more particularly a piece of material, left dangling, free of artistic manipulation. When the artist relaxes control of matter, and the viewer follows this relinquishment of control, there may arise a feeling of passive receptivity to the agitated

patterns of matter in the work that seem to gather and disperse of their own accord. How this kind of spontaneous, involuntary and rhythmic connection arises is the stuff of this book.

Involuntary yet structured rhythms in the artist's brain and body arise in the handling of materials in this kind of artistic practice. These internal rhythms are at the same time externalised in abstract art and may be felt as rhythm by the viewer. Rhythm is an essential way in which the brain and body are connected to the world, and this is particularly so in the world of abstract art. The kind of artistic practice that enables these connections resists centuries of philosophical and aesthetic order that has elevated the substance of mind over the substance of matter. But, as I will argue here, such art effectively, and through contact with matter, in fact eliminates this 'substance dualism'.

To understand how the rhythmic entanglement of brain, body and world emerges we must rely on different levels of description: philosophical, psychological and artistic. For a good example of how artists themselves have intuitively attempted to do this, we can look to the Catalan artist Antoni Tàpies who describes his painting as

> organic elements, forms that suggest natural rhythms and the spontaneous movement of matter; a sense of landscape, the suggestion of the primordial unity of all things; generalized matter; affirmation of and esteem for the things of the earth . . . . meditation on a cosmic theme, reflections for contemplation of the earth, of the magma, of lava, of ash . . . . [In] Buddhist meditation, they also seek the support of certain *kasinas* that sometimes consist of earth placed in a frame, in a hole in a wall, in charred matter (Tàpies in Ishaghpour 2006, 117).

Along with post-war European and American abstract art, I focus on examples of 'matter painting', which Laurence Alloway describes as 'a form halfway between painting and sculpture' (Alloway 1960, n.p.). I examine the underlying dynamics of thoughts and feelings involved in viewing this kind of art in the hope of digging deeper into what we mean by 'abstraction'. Art historian David Sylvester suggests that matter painting symbolises the 'massive materiality of the physical world, the relationship between man and the raw materials with which he builds, the inchoate matter which is at once responsive and resistant to his will to impose a form upon it' (Sylvester 1997, 171). But rather than being merely a vehicle for the act of painting, 'the thick opaque matter of these paintings seems not only to have a life but to have lived, to have been weathered and ravaged by time' (171). And for the philosopher Martin Heidegger in *The Origin of the Work of Art*, art 'does not cause the material to disappear, but rather causes it to come forth for the very first time' (Heidegger 2002, 46).

Abstraction is often understood as a place of lucid, conceptual calm but it can also be agitated by 'a swirling viscosity, an oneiric vagueness of forms' (Gooding 2001, 89). In matter painting and other abstract works, the artwork is not entirely a finished product of intentional thought. As art historian Rosalind Krauss writes, '[T]o say that works of art are intentional objects is to say that each bit of them is separately intended' (Krauss 1981b, 6).[1] In examining the sculptures of Auguste Rodin, Krauss shows us the importance of processes of facture and how they are relaxed to allow the textures of matter to emerge, so that these sculptures are poised between organised intention and unorganised matter. It is often by relaxing rational judgement of a painting's 'meaning' that we become sensitive to the rhythms it suggests. For the philosopher Gaston Bachelard in *Earth and Reveries of Will*, artists are 'sensitized to the rhythms of matter' (Bachelard [1948] 2002, 39). In moulding matter, 'there are no more sharp edges, no more breaks. It is a continuing dream … it is rhythmic, with a heavy rhythm that takes hold of the whole body' (107).

An obvious instance of this rhythmic connectedness is speech. For example, psychologists maintain that

> our speech and our body motions exhibit wave-like characteristics that are both personal and cultural … . [T]he analysis of rhythmic entrainment and music benefits from thinking about the transformations as not happening solely inside a particular body, but happening across several, or many bodies … . The advantages of this approach are that we are discouraged from trying to look inside a particular brain/body to find the answers to the special aura that such events have, but are looking rather at the aura of the whole (Becker 2011, 65–67).[2]

Psychologists study how different brains are coupled through 'neural entrainment', as demonstrated by individuals listening to the same story. Rhythm, interval, voice modulation and story structure help to synchronise brain oscillations that not only follow speech but anticipate what might be coming next (Hasson et al. 2012, 2015). This coupling extends to the visual modality, in interpreting gestures and facial expressions, which also amplify, modulate and entrain brain oscillations so that they synchronise across subjects.

The studies I examine in later pages show that this synchronisation not only occurs between humans but can also happen between humans and films, artworks and music. This interaction and synchrony of brain, body

[1] Compare this with Jasper Johns, who states: 'Intention involves such a small fragment of our consciousness and of our mind and of our life. I think a painting should include more experience than a simply intended statement' (quoted in Sylvester 1997, 465).

[2] See also Thaut, who writes that 'evidence of direct frequency entrainment in rhythmic synchronisation suggests that rhythm in music can have a profound influence on the organisation of movement in time and space … rhythmic stimulation provides a continuous time reference to the motor system' (Thaut 2005, 43).

and world have been studied in Andy Clark's 'extended mind' theory, where the author states that 'a good deal of actual thinking involves loops and circuits that run outside the head and through the local environment' (Clark 1998, 206).[3] An example of the way in which our brains rely on non-brain things in the world to function is how we use global positioning technology to navigate through the city. In his 'material engagement theory', Malafouris (2013) makes the strong point that this coupling of what is traditionally assumed to be the domain of the mind with the matter outside of it should not be understood simply as a tool for enhancing everyday cognition. This is because the qualities of the matter or material structure cause cognition itself to make new connections and this plasticity emerges from the interconnections of brain, body and world. If art helps to extend the mind in a cooperative feedback process, it is not just for performing calculations or carrying out daily tasks.

Figure 0.1 Louise Bourgeois, *End of Softness* (1967). Bronze, 18.1 × 51.1 × 38.1 cm. The Nelson-Atkins Museum of Art, Kansas City, Missouri. Acquired through the generosity of the William T. Kemper Foundation – Commerce Bank, Trustee, 2004.40. Image: John Lamberton/Nelson-Atkins Museum of Art © Louise Bourgeois/ Licensed by VAGA at Artists Rights Society (ARS), New York, NY/ Copyright Agency, 2020.

[3] Some reservations about extended mind theories and art are discussed in detail in Minissale (2013, 251–276).

Many artistic practices I examine in this book suggest that extended mind is a different kind of mind, a brain made up of matter that is in contact with matter through the hands, skin and body, coupling sensations with memories, dreams and rhythmic kinds of reverie. An example of this is given by the French novelist Pierre Loti:

> Bored and annoyed by the rain, I thought to distract myself by melting a tin plate over the fire and then pouring the scalding hot liquid into a pail of water. The tin formed a sort of twisted block, a fine light silver in colour very like a lump of ore. I stared at it dreamily, for a long while (quoted in Bachelard [1948] 2002, 212).

This reverie sensitises us to the muscular yet liquid allure of Louise Bourgeois's *End of Softness* (1967). For Bachelard, 'matter is a centre of dreaming' ([1942] 1999, 52). Significantly, for him it is 'the dream state which attends the plying of matter' (3). This is an important observation because it suggests that the attraction to matter and its rhythms, which is so important in producing and viewing matter painting and abstract art, has a closer relationship to daydreaming than to detached, rational observation. This engagement with matter in its unsettled and disordered aspect affects the psychology of observation, prompting nonlinear sequences of thought and sensation. The unpredictable rhythms of matter exhaust attempts to take control of it, and instead our mind drifts into a kind of dreaming with eyes wide open, our imagination cued by the granular textures and rhythms, the twists and turns of the matter itself. This suggests that reverie can be extended and situated, that it is not all in the head.

This 'extended reverie' is more forcefully suggested by Bachelard, for whom it is crucial 'to contemplate the universe with an imagination open to the energies of matter' (278). Poetic language, he writes, 'when it is used to translate material images, becomes a veritable incantation to the forces of energy' (6). He cautions against different kinds of phenomenology, which often 'remain too "formal," too intellectual' because they objectify 'forms and not forces' (171). Studies of form, as we see in art and gestalt psychology, are 'condemned to be only psychologies of concept or structure; they are scarcely more than psychologies of the image-filled concept' (85). This 'static realism' is inferior to the 'dynamic nature of the imagination' (85) with its sources in the oneiric.

In *Rhythm, Music and the Brain*, Michael Thaut discusses how it is common for spatial images to arise in the mind while listening to music:

> [S]ound durations can express extensions and distances; rhythmic and melodic contours can express images of lines and geometric figures; vertical stacks of sound can evoke pictures of multidimensional forms and layered objects. One of the most impressive and illustrative ways to study such translations can be found in the writings and works of Paul Klee (Thaut 2005, 16).

We discern rhythm primarily from movement, by recognising repeat structures (periodic structures) and through variation or differentiation. The paradox, of course, is that paintings do not move or make a sound. This is similar to the way in which music is perceived as movement even though nothing in music actually moves. It may be the case that we project motor routines onto sound experienced as pulses or constants. Intervals and changes in volume and tempo may be felt as rhythmic shifts in time and place.

Danijela Kulezic-Wilson discusses the French composer Michel Chion's theory of 'transsensorial perception', which is 'neither specifically auditory nor visual as it becomes decoded in the brain as rhythm after passing the sensory path of the eye or ear' (Kulezic-Wilson 2015, 40). The theory holds that, although the senses pick up rhythm, there is a fundamental interpretative mechanism in the brain that is able to intuit rhythm beneath the senses. What can trigger the feeling of rhythmic processes in the brain and body is an awareness of simultaneity and sequentiality, an understanding of how events or features occur or seem to affect the senses. The impression that something is moving when it is in fact static is not new.[4] There are numerous ways in which it is possible to infer rhythm in a static medium such as painting or drawing. A well-known perceptual principle, the 'law of common fate', holds that two or more lines with similar features placed next to each other will suggest that they are moving together, when compared to other details: the two backslashes in 'http://' appear to switch to the right while the colon remains stationary. This may seem self-evident but is often not made explicit enough in our 'reading' of abstract art, where such lines and patterns are far more complex. Winawer et al. (2010) show that static pictures produce motion effects in the brain, supported by sensory neurons. Summarising many of these principles, Thaut concludes:

> In the broader sense, every work of art possesses rhythm. Because rhythm deals with the discernible structure of temporal organization of an artwork's 'building blocks' into an arrangement of its physical elements into form-building patterns, rhythm is one of the most important components of an artwork . . . . [R]hythm can also be transposed to visual-spatial elements, for example, by organizing patterns of deflections in lines, by patches of distinct coloring, or by arranging similarly shaped objects in spatial configurations. The rhythms of speech and the rhythms of statements and dialogues, in conjunction with movements, can express dramatic rhythms in theatrical plays. The distribution of syllables and inflection

[4] Johann Wolfgang von Goethe suggests that one should close one's eyes before the Laocoön and then open them very briefly to receive the overall impression: 'By this means he will see the whole marble in motion . . . it is a flash of lightning fixed, a wave petrified at the moment it rushes towards the shore' (quoted in Lampert 2012, 95).

points in poetry and the distribution of elements of motion of the human body in dance are examples of rhythms in other art forms (Thaut 2005, 4).

In a painting, a line that is broken or dotted can also be felt as rhythmic, as a pulse, and lines that are repeated alongside each other can be read as vibrations. This was a common Futurist device. In order to suggest motion in a static medium such as painting or sculpture, the Futurists attempted to agitate the psychology of the observer by providing simultaneous contrasts and collocations, and multiple and clashing light sources, and by repeating the lines of objects with emphasis to suggest centrifugal and centripetal forces. The Futurists called these lines in their paintings and drawings 'force lines' (*linee-forza*).

In Umberto Boccioni's high-contrast charcoal drawing on white paper, *Muscular Dynamism* (1913), the black outlines of a nude body walking are repeated, suggesting vibrations, motion, blur and rhythmic momentum. Boccioni read the philosophy of Henri Bergson, who believed that the past, present and future dissolve into each other like musical notes. Boccioni's drawing suggests not only how the past, present and future flow, how it takes time to stretch or to walk, but also how it takes time to rhythmically drag the charcoal across the paper to get from one point of the pictorial space to another and to repeat the process. In Brian Petrie's study of Boccioni, he observes how the artist interpreted Bergson's 'duration', the sense of time flowing, as a muscular and temporal stretching forward. In Boccioni's drawing (Figure 0.2), the implication is that in order to walk with purpose towards some destination there had to have been the initiation of an impulse to extend the leg, bend the knee and push forward the torso, which we see as taking place in the present, while there is also a sense of the future, becoming manifest in muscle readiness for the body to anticipate the next step. For Bergson, the human body is 'like a moving boundary between the future and the past' (quoted in Petrie 1974, 146).

Many writers on art are sensitised to this kind of 'rhythmic seeing'. Clearly inspired by Bachelard, Mel Gooding refers to the modality of abstraction as

> a kinetic representation of the world experienced as flux, as a complex of sensations in which it is impossible to hold anything still. In this thrilling place our sensorium is assailed by the teeming facts of the actual, and their poetic realisations have the flickering inconstancy of fire. Painting of this kind revels in the evanescence of the elements, in the ceaseless play of light and shadow, in the intensities of colour, in vivid creatures, in the rhythms of free dance and the dissonances of jazz. If the art of an achieved poise is a function of reverie, of daydream, then this art of the perpetual movement has its equivalence in nighttime dreaming, and is characterised as a swirling viscosity, an oneiric vagueness of forms (Gooding 2001, 88–89).

Figure 0.2 Umberto Boccioni, *Muscular Dynamism* (1913). Pastel and charcoal on paper, 86.3 × 59 cm. Image: The Museum of Modern Art, New York/Scala, Florence. Out of copyright.

Sylvester also understood static images rhythmically. He describes André Masson's paintings as 'the insistent rhyming between shapes close to one another' (Sylvester 1997, 452). A depiction of hands and fingers produces a 'vigorous and systematic rhyming, which gives the picture a very rapid tempo' (452). This is consistent with the finding that, in watching a film, individuals share various synchronies in brain activity while looking at delicate hand movements (Hasson et al. 2004). The rhythmic synchronies in reading hand movements seem important. Tapping the fingers in time to a steady beat or adjusting the rate of breathing to sing along with a song are other examples, besides speech patterns, that demonstrate how the brain, body and external rhythms in the world can synchronise. Current research paradigms balk at the complexity of such a simple

moment. Kelso et al. (2013) show that rhythms can become coordinated or synchronised across multiple levels of organisation from the microbiological to the phenomenal; for example, finger tapping is produced by the brain's own rhythms in synchrony with external beats.

Sylvester may have been inspired to make his observation of the rhythmic qualities of fingers and hands by noting how Jasper Johns described his own painting, *White Flag* (1955) (Figure 0.3), as a change in rhythm: 'The change has two speeds. In the stars it's *allegro vivace*, agitated movement, flickering and exploding. In the stripes it's *andante*' (Sylvester 1997, 464). How can such a remark be understood as more than simply a metaphor, as a phenomenon that is experienced as rhythm, even though the fixed image does not move? Cotter et al. (2017) show how curved shapes provide certain rhythmic pleasures. Kim and Blake (2007) find that motion-sensitive areas of the brain are activated in abstract paintings that suggest motion. This helps to explain how some abstract paintings are often felt to be rhythmic. Bar and Neta (2006) suggest that angular and jagged edges are often associated with threat and agitated rhythms, while rounded edges help to produce comforting feelings and soothing rhythms. These responses have to do with haptic sensibilities, intertwined with rhythmic and emotional registers. There

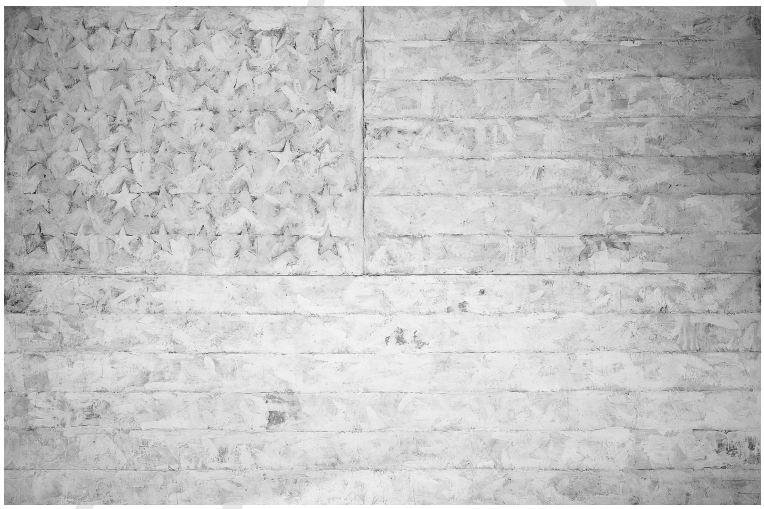

Figure 0.3 Jasper Johns, *White Flag* (1958). Encaustic and mixed media, 198.9 × 306.7 cm. Digital Image © Private Collection/ Christies Images/Bridgeman Images © Jasper Johns/ARS. Copyright Agency, 2020.

are pleasurable sensations to be explored with continuous smooth shapes and intervals, texture and surface. Similarly, the eye tends to stop and sample the edges in irregular 'sharp objects' with jagged edges, creating jerky rhythms. And a group of small stars could be subliminally perceived as little pinpricks or shimmering points of light. Johns's own understanding of the 'two speeds' also switches from the stars to the stripes and back again, which suggests a complex dynamic complicated by the tendency for eyes to search the visual field in iterative, rhythmic movements both for large-scale scenes and in discerning rhythm in the handling of paint. In *White Flag*, the encaustic technique of mixing oil and wax reveals an intricately patterned surface on close inspection.

We engage with the 'higher' conceptual level when we make an analogy with musical terms, but this analogy is felt and experienced and is not just a turn of phrase. The terms describe motor sensations and muscle memory, which are experiential. In addition, the artistic process itself is a way of making explicit the properties of different kinds of matter. The technique of encaustic is painstaking: Johns prepared the ground of three panels with beeswax, building up multiple layers with a collage of newsprint and shreds of fabric cut out for each star and stuck onto the surface. He then dipped the panels into molten beeswax, applying pigments with more quantities of beeswax. The material process creates an overall effect where the flat image is transformed into a textural, sculptural surface. A simple design gives way to a densely patterned complexity, suggesting arrested contingency, change or decay. The fluidity of the medium dries and hardens, capturing the brushstrokes and waxy drips in a frosty white sculptural field. Scraps of newsprint suggest everyday moments and political events caught or suspended in the body of the flag. As one invests time to discover the rich detail, the artwork is transformed from an image (the American flag) into a sculptural and textural phenomenon. This experience also involves appreciating the labour-intensive aspect of the work and the temporally extended nature of perception (rather than instant image recognition). The fine-grained surface of the work is chaotic, exceptionally full of information, with uncountable marks, grooves, blotches and drips. In viewing the surface, which is the result of meticulous activity, one becomes sensitised to this 'material' and technique, and the mental image of the flag is lost. The work flickers between image and matter: it is both a timeless flag and an expressionist painting. The observer uses prior knowledge about the flag to imagine its colours, as if present perception is haunted by a memory of how the flag once was, perhaps even how it will continue to be, as a kind of museum artefact. We are mind wandering: looking back and looking forward, looking at the work

while examining our own feelings, becoming lost in pipedreams. Johns is said to have had a dream about creating this piece. As with so many of his works, *White Flag* reflects back various conditions of viewing at the same time as it suggests phases of the existence of matter: the flag seems veiled with mould or glowing in the moonlight, embalmed and powdery or translucent and creamy; whichever 'phase' we settle on momentarily, the longer we look, the more associations spring to mind. The white flag is the conventional sign for a truce, but it also signifies whitewashing and erasure.

One thing that is important in enriching the experience of this work is an appreciation of the medium: molten wax – the fluidity of events in the wider world and mind, a complexity of durations – suddenly 'turning to stone'. The artist Robert Smithson's ideas provide a new perspective on this kind of abstraction:

> [T]he mind and things of certain artists are not 'unities,' but things in a state of arrested disruption . . . no materials are solid, they all contain caverns and fissures. Solids are particles built up around flux, they are objective illusions supporting grit, a collection of surfaces ready to be cracked. All chaos is put into the dark inside of the art (Smithson 1996, 106–107).

It is motor imagery, a sense of rhythm, detecting texture and gesture, that allows painting to be felt as a series of complex fine- and coarse-grained vibrations across brain, body and world. Complementing this observation are the empirical studies I discuss in Part II, which reveal how the brain functions not as an ordered and linear set of processes but as a system of numerous unstable networks, where neurons are jittering on the edge of chaos, continuously ready for and acting in concert with spontaneous events in the external environment. These studies emphasise that the brain is a dynamic system of neural oscillations that travel across and are supported by particular brain areas, making functions (thoughts) richly intertwined over time. This approach is particularly appropriate as a description of what happens when one is viewing artworks over temporally extended periods.

Why Matter? Why Now?

Recent texts in philosophy and art history attest to a burgeoning interest in matter and materialism. Yet there seems to be a dearth of serious, detailed discussion of the brain and the biology of the body as part of this 'new materialism'. Similarly, there have been many recent texts in psychology and neuroscience on art, but none of these addresses the topic of matter and materiality that is of central

importance to art.[5] In other words, what has not been joined up is the matter of the brain and the matter in art. Mind wandering is a form of abstraction involved in both the production and reception of abstract art. Mind wandering – involuntary non-logical thought – creates rhythmic connections between abstract art and abstract thought. This path was opened up by Bachelard in his works on the 'imagination of matter'. One of Bachelard's major objectives was 'to match the psychological study of reverie with the objective study of the images that entrance us' (Bachelard [1938] 1987, 107). He was interested in mapping the non-dualist substance that joins mind and matter through feeling, non- or semi-conscious thought, the oneiric and reverie – aspects of psychology that are studied today as 'mind wandering' and which are attuned to rhythms in art – a spell which is broken by the interference of logical and analytical thought.

Over the last decade there has been a renewed interest in understanding materialism in art. This is reflected in the many different readings in *Materiality*, edited by Petra Lange-Berndt (2015). Similarly, *A Questionnaire on Materialisms*, a recent issue of *October* (2016), contains forty-one responses from artists, curators and theorists writing about what 'new materialism' means to them. However, in all but one of these texts, consideration of the physical processes of the brain and the matter of the brain itself is left out of the equation.[6] This is the case with new materialism more generally, as we see in Coole and Frost (eds.), *New Materialisms* (2010); Dolphijn and Van Der Tuin, *New Materialism* (2012); Barrett and Bolt (eds.), *Carnal Knowledge* (2012); and Cox et al. (eds.), *Realism Materialism Art* (2018). It appears that what is needed is a new kind of 'neuromaterialism'. In this book I attempt to suggest what this 'neuromaterialism' might look like.

The anthropologist Tim Ingold is concerned that matter has been swept up into abstraction, whether Marxian, semiotic, philosophical or cognitivist:

[5] These are discussed mainly in Parts II and III. A note here on disambiguating terms. Materiality refers to the study of materials in various disciplines, from archaeology to philosophy and the sciences. Materialism, and historical materialism in particular, refers to the theory of how materials and the way they are exploited affect social, political and economic structures, even consciousness. Matter is used to examine key phenomena that may be compared in the domains of brain, body and art, even if these emerge in each domain in different ways. For example, the matter of rhythm, metastability (between order and chaos) and complexity are examined in each domain in order to reveal interactions. I do not suggest that matter amounts to the same thing underlying all domains.

[6] Only Caroline A. Jones seems to understand the bigger picture that I aim for here: 'Cranial grey matter, white matter, glia, and those billions of other neurons distributed throughout the body (more numerous in the gut than in the brain) fully participate in this thing we call *thinking*' (Jones 2016, 61).

[M]aterials appear to vanish, swallowed up by the very objects to which they have given birth. That is why we commonly describe materials as 'raw' but never 'cooked' – for by the time they have congealed into objects they have already disappeared. Thenceforth it is the objects themselves that capture our attention, no longer the materials of which they are made (Ingold 2007, 9).

In anthropology and archaeology, materiality is meant to explain how social systems of interaction affect and are affected by materials. But, as Ingold notes, such engagements are not

with the tangible stuff of craftsmen and manufacturers but with the abstract ruminations of philosophers and theorists . . . . What academic perversion leads us to speak not of materials and their properties but of the materiality of objects? It seemed to me that the concept of materiality, whatever it might mean, has become a real obstacle to sensible enquiry into materials, their transformations and affordances (Ingold 2007, 2).

Somewhat opposed to this view is the archaeologist Christopher Tilley, who writes:

The concept of materiality is required because it tries to consider and embrace subject–object relations going beyond the brute materiality of stones. I am going beyond an empirical consideration of the stone to consider its meaning and significance. In doing so, I move from a 'brute' consideration of material to its social significance. This to me is what is meant by the concept of materiality (Tilley 2007, 17).

This view is supported by Daniel Miller (2007), an anthropologist specialising in material culture, who suggests Ingold may be prone to primitivism, positing an ideal kind of materiality untainted by modern industrial processes. It is interesting that these lively and informative discussions of materiality tend to revisit the age-old dualism between 'brute' materialism and linguistic and sociopolitical systems.

Other tendencies within new materialism attempt to overcome this dualism. An influential text for artists and art theorists is Jane Bennett's *Vibrant Matter*, where the author suggests that 'every thing is entelechial, life-ly, vitalistic' (Bennett 2010, 89). She explains that even the trash is alive:

[W]hat if the swarming activity inside my head was itself an instance of the vital materiality that also constituted the trash? . . . [I]t is easy to acknowledge that humans are composed of various material parts (the minerality of our bones, or the metal of our blood, or the electricity of our neurons). But it is more challenging to conceive of these materials as lively and self-organizing, rather than as passive or mechanical means under the direction of something nonmaterial, that is, an active soul or mind (Bennett 2010, 10).

Bennett's preferred principle is a vital materialism that flows through everything. But this is another case of the missing brain and its dynamics:

how do the actual particles across the different domains swarm? How do the activity in the head and in the trash intermingle beyond a metaphor? More details are required to describe how these domains come together materially.[7]

There are various studies that attempt to integrate scientific theories and advances in our understanding of matter with approaches in the humanities, such as Katherine Hayles's *Chaos Bound* (1990) and her more recent *Unthought* (2017), which attempts to outline how non-conscious somatic and sensorimotor engagements with objects and materials constitute knowing beyond so-called detached reasoning. Karen Barad in *Meeting the Universe Halfway* maintains that matter is not a fixed entity but is 'agentive' and that it is 'produced and productive, generated and generative' (Barad 2007, 137), a continuous reality that smooths out traditional dualisms. Donna Haraway (1997) critiques another important dualism: male/female, the gender essentialism inherent in traditions of knowledge and in modern science and technology, where form and the active intellect are equated with the male principle while matter and passivity are associated with the female. Meanwhile, Johanna Drucker reminds us that

> Aristotle divided the world of substance into matter and form, the stuff things are made of and the patterns or shapes they assume or are given. The philosopher aligned each with gendered attributes, matter, and material, with *mater*, the mother, and form with the paternal or masculine. These categories passed into European thought by way of those great translators and exhaustive compilers (Drucker 2009, 10).

This can be seen, for example, in Aristotle's text *On the Generation of Animals*, where he suggests that the father is form (sperm) and the mother (maternal blood) is formed by the sperm and that matter desires form 'like the female desires the male' (quoted in Didi-Huberman 2006, 210).

Haraway's text is situated in the poststructuralist tradition that reveals the fallacy of the dualism between the material and the semiotic, showing how both are implicated in structuring the world and our categories of knowledge. This is entirely in keeping with the philosophers Gilles

[7] Ian Buchanan suggests that the explanatory gap in Bennett's understanding of what an assemblage is (that is, how things are connected) is an ethical problem because it describes assemblages of materials or things but

> does not say anything more here about the nature of the relationships between these items and the street, or the weather, or indeed herself, save the way they caught her eye. … Bennett attributes her perception of these objects to a happy combination of her own perceptual openness and what she calls the 'thing power' of the objects themselves (Buchanan 2016).

Deleuze and Félix Guattari's attempt to show how speech, text, intellect and sensation are different 'movements' of matter. As John Marks writes:

> Deleuze and Guattari's commitment to materialism means that they eschew the rigidities of linguistic structuralism in favour of analyses of the way in which systems – biological, physical, social – demonstrate self-organizing tendencies that cannot be traced back to the agency of specific individuals or components within the system (Marks 2006, 13).

In *Political Affect* (2009), John Protevi studies the 'political physiology' of brains, bodies and social relationships. Here, political messages are not only linguistic and semiotic but also affective, modelling physiognomic responses. This approach complements Manuel DeLanda's *Intensive Science and Virtual Philosophy* (2002), which proposes a holistic, entangled view of material objects, milieus, and technological and linguistic systems and brings together different kinds of scientific processes studied by complexity theory and in Deleuze and Guattari's philosophy.[8]

With all these different understandings of matter, we might be in danger of losing sight of matter itself. As Ernan McMullin sagely warned us many years ago:

> It is not as though there is an absolute constituent or aspect of the world called 'matter', which different philosophers have described in ways more or less apposite. This would do if we were talking of hydrogen or nebulae. But for a 'second-level' notion, a somewhat different account is required. The 'matter' the philosopher singles out is constituted (not ontologically, of course, but epistemologically) by the conceptual system that defines it. Does this mean that there are as many 'matters' as there are different systems? This would be the opposite error. It is possible for different philosophies to focus upon the 'same' principle. But this identity is something to be carefully established, not casually assumed on the basis of an accidental similarity of term or of problem (McMullin 1963, 1).

The common principle in all these treatments of matter, and one which I will pursue in my investigation into the matter in art, is that matter should be understood as a dynamic complexity shared by the brain, body and art. This requires a rejection of rigid dualisms such as mind/matter, form/matter and active/passive, in favour of 'matter-movement', a term used by Deleuze and Guattari, along with 'matter-energy' and 'matter-flow'. Deleuze understood 'rhythm as matter' (Deleuze 2003, 107), which suggests that matter is not simply to be understood as something

[8] DeLanda (2002) attempts to show the links between Deleuze and Guattari's philosophy and dynamic systems theory. Protevi (2001) looks at the accompanying notions of hylomorphism and self-organisation in the history of philosophy. Bonta and Protevi (2004) treat Deleuze and dynamic systems theory with regard to its potential for geographical concepts. Bell (2006) follows up on this work, suggesting how dynamics systems theory and chaos in the brain might work for philosophical method.

that fills in an outline or form that is absolutely fixed and discrete; rhythm passes through things or things elaborate rhythm with their own activity to create an ecology of things vibrating together. The aim in this book is to provide some grasp of this wider ecology, which includes the rhythms of the brain, by looking to art and its varied materials, following the 'flow of matter', the Deleuzoguattarian phrase that has moved many of these authors. It is important to be more specific in our objectives with the help of neuroscientific, phenomenological and aesthetic approaches: to follow the flow of matter as it circulates through brain, body and world.

What this short literature review has revealed is one significant omission: an avoidance of engaging rigorously with the 'rhythm-matter' of the brain. In these works, what seems most difficult to acknowledge is that the brain is not just a meaning-making machine that pulls rank over matter: there are many intervals during which the brain rests in itself as disorganised matter. Bergson asserts that, in these intervals, 'pure perception, which is the lowest degree of mind – mind without memory – is really part of matter, as we understand matter' (Bergson [1896] 2004, 297). It is art that helps us to intuit this.

Monica Wagner's essay 'Material' (2015) offers a useful summary of the etymological roots of matter and materiality. However, artworks are never reducible to terms traced etymologically – they are not simply illustrations of statements or concepts. Such a notion ignores the many unspoken uses of matter in art that are messy and awkward, or even dirty, and which do not conform to such enunciations. What would an alternative art history consist of? It might trace the 'illogical' human-beast metamorphoses of antiquity; the countless apotropaic symbols, zoomorphic talismans and amulets that still affect superstitious minds the world over; the medieval marginalia that sprout marvellous and hideous menageries of mutant buffoons; the viral proliferation of abject objects, orifices and excreta catastrophically thrown together in the abyssal pictures of Hieronymus Bosch. Not far from this broader understanding of matter are Matthias Grünewald's suppurating wounds of Christ and the dark matter of Francisco Goya's nightmares. These examples point to a very different psychology of matter compared to what the philosophers discussed. This matter is convulsive, affective, infectious and on the edge of chaos. In these examples, we see matter imagined in a way that is used to destabilise rigid boundaries. Here, matter possesses an oneirically charged morphing power over hand–eye coordination: sometimes a surfeit of technical finesse bursts into spontaneous improvisation to produce vibrating lines, restless shapes and forms, mass and viscous elasticity. This kind of feverous creativity is inspired by images of lava, stormy seas and avalanches at the back of the mind. It is this quality of

matter, formless because unsettled, evading the grasp but registering rhythmically, which unleashes an unpremeditated artistic dexterity.

Bachelard writes: 'If our dreams are monsters, it is because they translate energies' (Bachelard [1948] 2002, 79). These energies are undoubtedly sensual and rhythmic, stretched by the torsion of affects and drives, twisting away from rational analysis. This psychology of matter provides for much of the brain's metastability, allowing it to inform artistic practices. This happens in complex improvisations inspired by mental images of matter's spontaneity, or artists have more passively allowed matter to 'remain' in its raw state within their completed works. The artist Robert Morris describes this process, where sculptors left arbitrary traces of the facture of their bronzes to suggest contours and to reveal the qualities of the medium:

> The visibility of process in art occurred with the saving of sketches and unfinished work in the High Renaissance. In the nineteenth century both Rodin and Rosso left traces of touch in finished work. Like the Abstract Expressionists after them, they registered the plasticity of material in autobiographical terms. It remained for Pollock and Louis to go beyond the personalism of the hand to the more direct revelation of matter itself . . . . [T]he employment of gravity and a kind of 'controlled chance' has been shared by many since Donatello in the materials/process interaction. However it is employed, the automation serves to remove taste and the personal touch by co-opting forces, images, and processes to replace a step formerly taken in a directing or deciding by the artist (Morris 1993, 44).

This notion of co-opting forces allows matter to have more of a role in deciding the outcome of the work and reveals the nature of matter rather than simply the intention of the artist. The artist allows areas of the work to remain unfinished within or alongside the more finished areas, reflecting the struggle between the two psychologies: deliberate and less so, composition and non-composition. The work of art preserves the external signs of this tension, which can be perceived by the viewer.

Even with the meticulous illusionism of traditional painting, which is far from the spontaneity of abstract art, it is possible to experience the effects of visual composition and non-composition. For example, in Giovanni Bellini's *St. Francis in the Desert* (c. 1480), the schist and strata of the rocks, which take up nearly all the pictorial space, can trigger involuntary experiences of staggered rhythms and mind wandering. Similarly, the depiction of clouds and earth in art can provide relief from following or constructing a narrative about the whole painting. Such intervals help to produce moments of daydreaming associated with mind wandering. In *Earth and Reveries of Will*, Bachelard writes: 'Quite often dreamers see heaps of rocks in cloud-filled skies' (Bachelard [1948] 2002, 142).

This is something we can also experience with Albrecht Dürer's *Tall Grass, Great Piece of Turf* (1503), a remarkable work of observation executed with subtle gradations of colour and opacities of pigment within a densely structured network of lines, which strike us as precious and skilful patterns of growth in nature. And yet the artist seems to suggest something which is far from the world of skill: a humble sod of earth, a patch of dirt and soil, blades of grass criss-crossing each other with careless abandon. The viewer alternates between the two psychologies of observation: from the daylight consciousness of the artist's technique, following the long stems that end in tight buds at the top of the painting, we lower our eyes to the earth where we imagine its depth and experience sensations of lush grass and dark soil. The artist might have experienced circular reveries and abstractions, wandering away from and back to the precise dexterity required for the execution of this work. In all these examples, whether in a deliberate attempt to imitate matter in its raw state or by glimpsing matter in its raw state (a knotted skein of paint catching the light), the mind is released to drift in wordless reverie.

The 'base' carved by Bernini to resemble a cloud in *The Ecstasy of St. Teresa* (1647–1662) retains some of the roughness of the marble before it is refined. To the observer who pays close attention to this work, it is not only the ripples in the saint's cloak and the jagged edges of the clouds that create breaks and rhythmic striations, but also the jagged matter of the marble itself, which the artist has preserved. Bernini refrains from overworking the marble, allowing its irregular granularity to remain discernible, while the fluttering robe reveals a higher level of completion leading up to the ideal 'luminosity' of the face. There is a hierarchy of refinement here, looser and coarser at the base, tighter and more polished above. It is remarkable that the form of the figure conveys thought, as does the relative formlessness of the coarser marble. St. Teresa's ecstasy seems to vibrate through the posture of the body and the fluttering of her robes, increasing in arbitrariness with the cloud petrified in stone.

There are many sculptures by Rodin where such a deliberately 'unfinished' state of coarse 'shapelessness' is evident rather than subliminal. The presence of 'unfinished' matter in artworks is even more prominent in the matter paintings of Jean Dubuffet, Jean Fautrier and Antoni Tàpies, who magnify this presence to attract reverie. Daydreaming tendencies can be prompted by the physical qualities of the matter itself. Bachelard describes the general effects that a sculpture in wood can produce:

> A dialectic of torsion and free flow can be seen in the play of dark wood and light . . . . it offers a *portrait of energy* . . . . Hard matter is contemplated *dynamically*

as a 'kernel of resistant matter' in 'a base of soft substance' .... Such a *material tableau* speaks to the dynamic being within the worker. Through our material and dynamic imagination, we experience the knot's external form awaken in us an internal force .... Perception is best described phenomenologically as movement *towards* .... Thus the material imagination *engages* us dynamically (Bachelard [1948] 2002, 40).[9]

This understanding of matter, which artists have been familiar with for centuries, can also be found in the domain of philosophy, particularly in the work of Gilbert Simondon who challenged the traditional presuppositions of 'hylomorphism'. Steven Shaviro explains:

Hylomorphism presumes that materiality, or the 'sensible' (that which can be apprehended by the senses alone), is passive, inert, and intrinsically shapeless, and that it can only be organized by an intelligible form that is imposed upon it from outside, or from above. Simondon argues that hylomorphism, with its rigid dualism, ignores all the intermediaries that are at work in any actual process of formation or construction. In fact, matter is never entirely passive and inert, for it always contains incipient structures. Matter already contains distributions of energy, and potentials for being shaped in particular directions or ways (Shaviro 2012, 52).[10]

Particularly interesting here is the emphasis on the dynamism of the imagination (nonlinear, oneiric, daydreaming) working with the dynamism of the sculptor's action and the lines and knots (which also appear rhythmic, dynamic and nonlinear) to give form to the imagination (rather than the imagination giving form to the inert materials). It is this confluence of psychology, the attributes of matter itself and descriptions of artistic creativity as relinquishing conscious control that find affirmation in recent research into mind wandering.

Another way to think about this kind of 'letting be', the 'release' of form (along with its cognates, formal and formalism) into sensation and reverie, is to turn to Heidegger's term *Gelassenheit*, or 'deferred-willing', meaning to allow things to appear in their own way without forcing them. Heidegger was also interested in thinking outside the distinction between activity and passivity, cultivating the 'willing of non-willing'

[9] Similarly, Deleuze and Guattari write:

> [I]t is a question of surrendering to the wood, then following where it leads by connecting operations to a materiality, instead of imposing a form upon a matter: what one addresses is less a matter submitted to laws than a materiality possessing a nomos [a principle]. One addresses less a form capable of imposing properties upon a matter than material traits of expression constituting affects (Deleuze and Guattari 1988, 408).

[10] Shaviro also points out that it was Bergson who allows for sentience without reflexivity, 'a kind of experience that remains "in itself" ... though immanently coincides with matter' (Shaviro 2018, 197).

(Heidegger 2010, 33).[11] This could be described as going through the exertions of mindfulness in order for a 'will-less' mind wandering to occur. We might imagine this as counting one's breath in meditation, counting sheep when trying to sleep or counting blades of grass. Rather than distancing us from the artwork, it helps to ease the passage from voluntary to involuntary thought.

In *The Origin of the Work of Art*, Heidegger discusses how art reveals the struggle between the earth and the world. As John McCumber writes, for Heidegger the work of art discloses matter in particular ways:

> In a work of art, the unique qualities of its materiality – its media – are not overcome but highlighted. It is part of the business of a statue to bring forth the striations in its stone or the grains in its wood, of a painting to bring forth the colors in its pigments, of a poem to show the semantic, as well as the auditory, beauty of its words. The work of art treats matter not as something passive and receptive but as something dynamic and configurating . . . . The form's action on the matter in a work of art is, therefore, not geared to materializing the form itself; it is supposed to bring the matter forth in its own uniqueness (McCumber 2013, 169).

This principle, that form can have a role in revealing matter's own uniqueness, can be seen consistently in matter painting and abstract art. For Heidegger, the world, while resting on the earth, strives to manipulate it. The world is an opening mechanism: it cannot allow or endure anything that is closed, and this is related to the kind of rational thought that we often impose on artworks. On the other hand, 'the earth, as both sheltering and concealing, tends always to draw the world into itself, and keep it hidden there' (Heidegger 2002, 26). It is only by 'letting it be' – *Gelassenheit* – that we can come closer to intuiting its contours. An interesting way to think about art is Heidegger's notion that the world is impatient and tries forcefully to open up the earth, while the earth is patient, where patience is important for 'letting it be'. I would add to 'letting it be', 'letting it happen'. But observing art also lets it happen *to us*. In art history, something of this kind has been given explicit form in Krauss's *Passages in Modern Sculpture*, where she suggests that an attitude of 'humility' (Krauss 1981a, 283) should allow a passage to open between the viewer and the artwork. A somewhat more existential nuance is provided by Timothy Leary in *High Priest* (1968):

[11] There is an obvious relation to quietism and Heidegger's awareness of Meister Eckhart's use of the term *Gelassenheit* in the context of renunciation of self-will, leaving matters up to the will of God, although 'Heidegger explicitly seeks to distance his thought from any deferential obedience to a divine will' (Davis 2010, xi).

Existential means you study natural events as they unfold without prejudging them with your own concepts. You surrender your mind to the events. Transactional means you see the research situation as a social network, of which the experimenter is a part. The psychologist doesn't stand outside the event but recognizes his part in it (quoted in Belgrad 1998, 150).

It seems that deferred-willing facilitates a feeling of being one with an artwork. This involves *feeling* relaxed with messy things, being absorbed in what we might call arbitrary movements of matter. This relaxation emerges from observing matter or letting it take its course, rather than micro-managing its behaviour, which would arrest its concretion over time. Patience allows matter the time to develop. In his own way, Dubuffet explains this psychology when he describes his working with matter as a kind of partnership that allows the 'accidents' and qualities of matter to remain in the finished work. This should not be understood as the artist actively expressing a mood so much as passively allowing the patterns of matter-movement to remain as they are, as a record of the artist observing them because of the way they affected his or her mood. Importantly, art in this sense is not the construction of an expression but rather the avoidance of construction, a deconstruction of the expression of anything prior. To see art in this way requires a change in the traditional understanding of expression as a movement crossing the internal domain of the artist to become external signs lodged in the artwork. Rather, expression becomes the preservation of the arbitrary movement and consistency of matter, co-emergent with the artist's un-self-conscious thought. This approach and practice can produce images of completely abstract 'landscapes' (or dreamscapes), gravel and moss, erosion, or constellations, that give rise to rich associations in our reverie. Dubuffet called such works 'landscapes of the brain' that open onto the 'inner dance' of the painter's mind (Dubuffet et al. 2006, 119).

Diverse artists in the modern era have pursued this goal. In Gutai, the Japanese artistic movement, their manifesto of 1956 clearly outlines a philosophical and aesthetic attitude to matter that is shared by many artistic practices discussed in this book:

[P]aint, pieces of cloth, metals, clay or marble are loaded with false significance, so that, instead of just presenting their own material self, they take on the appearance of something else. Under the cloak of an intellectual aim, the materials have been completely murdered and can no longer speak to us. Lock these corpses into their tombs. Gutai art does not change the material: it brings it to life. Gutai art does not falsify the material .... The spirit does not force the material into submission. If one leaves the material as it is, presenting it just as material, then it starts to tell us something and speaks with a mighty voice (Yoshihara [1956] 1996, 695).

Similarly, Carl Andre explains that he is 'less interested in imposing a form on matter than revealing the properties of the matter' (quoted in Cummings 1979, 187). Robert Morris, referring to a stick that allows paint to drip rather than being controlled by a brush, writes that it is 'in far greater sympathy with matter because it acknowledges the inherent tendencies and properties of matter' (Morris 1993, 43). He adds:

> Certain art is now using as its beginning and as its means, stuff, substances in many states – from chunks, to particles, to slime, to whatever – and prethought images are neither necessary nor possible. Alongside this approach is chance, contingency, indeterminacy – in short, the entire area of process (Morris 1993, 67).

Receptivity and attunement to unorganised matter in artworks, celebrating contingency and process, became the stated aim of a number of postwar artistic practices, producing new ways of making art. It also led to a shift towards a psychology of viewing art that had hitherto been only implicit or peripheral. These observations lend new perspectives to abstract art, at least as it has been theorised, which I discuss further in Part III.

It is important to recognise that both the production and reception of a work of art are activities that share a 'non-cognitive' element. It is interesting that in the realm of reception this 'abandoned' matter barely makes an appearance when art history is written, perhaps because such writing is always already a project of meaning construction and organisation. Krauss is an important critic of the pure opticality of high modernism and its pretensions to being 'the display of reason, of the rationalized, the coded, the abstracted, the law' (Krauss 1993, 21), which she believes leads to an increasingly positivist art history. An important corrective to the cognitive understanding of vision, according to which modernist art requires conscious and willed looking, is that this kind of vision, in convoluted ways, represses the 'optical unconscious', the influence of barely conscious desires, fears and drives when looking at art. On this view, looking at matter painting that references or uses earth and soil, dirt and the scatological, only to extract semiotic or cognitive information is a form of repression.[12]

We are not just deciphering images but also registering the rhythms they suggest, which become internalised as cues for wordless thought.

[12] According to Mauzerall, even Krauss's acute observation of the material forces in artworks is part of a mechanical Freudian psychoanalytical system of interpretation, which also 'reduced matter to a sign' (Mauzerall 1998, 92). This can be seen in Krauss's interpretation of Max Ernst's *The Master's Bedroom* (1920), where she suggests that the artist consciously structured his painting to illustrate various Freudian theories about the mechanics of repression.

Sylvester points to a similar, longstanding distinction between saying something, using linguistics or semiotics, and showing something, which 'corresponds to Wittgenstein's distinction between what can be *said* and what *shows* itself, and the point about art is that it shows rather than says' (Sylvester 1997, 465).[13] What 'shows itself' is felt, intuited, and seems to come and go in a rhythm that is very different from the mechanical seriality of the everyday, which we are conditioned to internalise:

> Ideas are inscribed *in* actions whose repetitive, ritualised performances are borne by concrete individuals who are thereby practically constituted as compliant or agentic subjects. While such performances are institutionalised in rituals and ceremonies, they also become sedimented at a corporeal level, where they are repeated as habits or taken for granted know-how: lodged in the bodily memory that Bourdieu calls habitus or phenomenologists refer to as a lifeworld. It is indeed this nonreflexive habituality and the way it imbues objects with familiarity that makes artifacts, commodities, and practices seem so natural that they are not questioned. It is in this sense that ideology or power operate most effectively when embedded in the material, practical horizons and institutions of everyday life (Coole and Frost 2010, 34).

Importantly, this complex machinery runs on linear, repetitive rhythms and methods, anticipated and regulated by the disciplinary controls of the base and superstructures of capitalist economies and technologies. On this view, artworks can produce ruptures in the regular and rhythmic functioning of this machinery. As the philosopher Henri Lefebvre proposes in *Rhythmanalysis* (2004), the continual production of the everyday is based on rhythmic repeats: bodies, actions, processes, machinic automations and transport, the structure of work and play, interactions and communications, all attempting to create order and secure 'the normal', as they measure the psychological and somatic production and passage of time.[14]

[13] Michel Foucault might have added that the two are not commensurable or translatable, although we repeatedly try to make them so.

[14] This thesis by Lefebvre (2004) shares synergies with Hayles (2017), where Hayles pieces together the noncognitive unconscious routines of our everyday life that become the mode of existence that prevails over the exercise of conscious, political and ethical agency. What is not part of this argument is how art and cultural forms can resist the mindless drift into the noncognitive unconscious manipulated by economic and social systems by producing its own kind of noncognitive unconscious or semi-consciousness. It is my argument that art, particularly abstraction, produces a noncognitive unconscious without these manipulations to conform, to consume, to drift. The key is to exercise a cognitive unconscious that is creative rather than normative. For an interesting analysis of how technological and economic systems operate to regulate psychology and behaviour, see Crary (2013). One would think that events in a world dominated by the continual horror of violence, war and displacement would disrupt the serial repeats of learning by rote, shopping, working, watching television. Although these events appear to contradict the view that we are trapped in everyday serial repeats and perceptions, we

Historical Materialism

Is an automatist sketch by Masson self-indulgent and reactionary because it fails to raise consciousness about social inequality or environmental degradation? Some of Herbert Marcuse's philosophical writings, particularly his essay *The Aesthetic Dimension*, continue to be valid today as an important critique of this kind of reductionism. In crude Marxism, materialism would require that the social relations of production must be reflected in the artwork as 'part of its inner logic and the logic of the material' (Marcuse 1978, 2). He notes:

> This schema implies a normative notion of the material base as the true reality and a political devaluation of nonmaterial forces particularly of the individual consciousness and subconscious and their political function. This function can be either regressive or emancipatory. In both cases, it can become a material force (Marcuse 1978, 3).

This is ignored or passed over in vulgar materialism, where consciousness and the unconscious, emotions and the imagination, are 'dissolved into class consciousness' (Marcuse 1978, 3).

For Karl Marx, this leads to an 'abstract materialism' that elevates or intellectualises matter in order to absorb it effectively into mind. In *Critique of Hegel's 'Philosophy of Right'* (1844), Marx attempts to show how this kind of abstract materialism is linked to an ideological system that produces the subjugation of brute matter, understood as chaotic, in a hierarchical organisation of society. Marx castigates Hegel for positing the extremes of matter and mind, and then trying to reconcile them. He writes that, for Hegel, 'each extreme is its other extreme. Abstract spiritualism is abstract materialism; abstract materialism is the abstract spiritualism of matter' (Marx [1844] 1977, 89). According to Marx, Hegel could achieve this reconciliation of two opposing abstractions precisely because they were abstractions. The concept of 'mind', according to Marx, is not in opposition to 'real' matter: both are abstractions from matter that actually exists. He associates Hegel's abstractions with idealism. Marx detects an analogy between Hegel's natural philosophy, which rejects atomistic theory (that the cosmos is chaotic and made of a multitude of atoms), and Hegel's philosophy of right. This is because for Hegel, and some neo-Hegelians, the ordered system of the state develops from a unified and ordered cosmos, and is thus justified. On this view, atomistic theory would undermine the unity of law, divine order, nature, the ethical world, rational process and an ordered reality.

[14] should ask whether the everyday is in fact a kind of narcotic that makes such ruptures seem remote.

Although matter, and particularly matter in motion, is for Marx a fundamental substrate of thought, which he sets against Hegelian idealism, he also criticises advocates of materialism who ignore the importance of the social and historical reality by which matter is transformed into specific practices and systems. For Marx, although matter is primary, it is made knowable by how it is used, exploited or hidden by a system of human interactions – matter is thus known through practice within specific historical contexts. Because this is so, it is possible for humans in the realm of practice and social exchange to transform matter. Whether this leads to a reinvestment in the kind of hylomorphism that values form and rational will over matter, subjugating matter, is a moot point.[15]

According to Marcuse, Marxist aesthetics is in danger of devaluing the inwardness of sensations, emotions and non-conscious processes, which are in themselves material forces, because they do not illustrate or map clearly onto class ideologies. This scorn for inwardness 'is not too remote from the scorn of the capitalists for an unprofitable dimension of life' (Marcuse 1978, 38). Rather than being irrelevant to the class struggle because it does not directly articulate oppression using the language of reason, such inwardness may act as a place of refuge, a bulwark against the ubiquity of the ideologies of capitalism, consumerism, authority and statehood. These ideologies infiltrate every aspect of human life, demanding that our time and inner life be accounted for and made purposeful using the correct methods of rationalistic cognition. The value of Marxist aesthetics is to remind us that our experiments with artistic thought and creativity, and our ability to spend time on them, stem from privileges of class, education, wealth and power.

Marcuse believes that art is revolutionary because it can be 'subversive of perception and understanding, an indictment of the established reality' (xi). This established reality is secured by rational hierarchies of the use value of the products of creativity, limiting chance and non-rational processes that allow for different ways of understanding hierarchies. Art's power consists in fulfilling a cognitive function: 'it communicates truths not communicable in any other language; it contradicts' (10). But it contradicts in ways that negate the reality principle, formulaic narratives, the teleological and positivist faith of science, institutions and the individual ego in whose name neoliberalism is allowed its worst excesses. As Malcolm Miles notes, Marcuse's argument is that:

[15] The artist Carl Andre notes: 'Matter as matter rather than matter as symbol is a conscious political position I think, essentially Marxist' (quoted in Siegel 1970, 178).

art interrupts codes and structures (as of perception) which affirm the dominant order of society, [and] especially when read as the beautiful, [art] is radically other to a world of oppression and repression, so that its presence fractures that realm's surfaces. Art, then, is for Marcuse the location of a radical force against the unfreedom of life under capitalism or totalitarianism (Miles 2014, 12).

When Marcuse writes, '[i]f people were free then art would be the form and expression of their freedom' (Marcuse 1978, 38), this freedom would undoubtedly consist of an escape from the prescriptions of a rational order that suppresses spontaneity. According to Daniel Belgrad, for the American poet Charles Olsen spontaneous composition was

the key to poetry's social relevance. . . . [H]e believed that the conscious mind was the gatekeeper of social proprieties; social alternatives were therefore available first only at the unconscious level. Spontaneous composition avoided the falsifications introduced by a conscious mind that internalized ideological standards. By offering unmediated access to unconscious thought processes, spontaneity provided a vantage point from which to question the culture's authority and created the potential for authentic communications exploring new forms of human relatedness (Belgrad 1998, 29).

Belgrad argues that artists of the 1950s valued acts of spontaneity as a form of freedom, resisting the tight controls and structures imposed by conservative America over social, cultural and economic formations. The artists and writers who were part of this 'culture of spontaneity' did not have a systematic and coherent programme but were united in trying to escape formula, dogma and the kind of control associated with conservative authority and academia. Belgrad writes that 'the practice of spontaneous improvisation was released by "psychic autonomism" adopted by American artists and writers at the outset of World War II' (Belgrad 1998, 9). This was a technique of writing or drawing in an absent-minded or spontaneous manner, important for 'bringing ideologically inadmissible possibilities into awareness' (9). Although the products of this spontaneity were hard to identify with political action, they could be seen as resisting respectable conservative ideals that demanded art be worthy, didactic and, above all, ordered.

There is one sense in which the Surrealist attempt to open up the possibilities of artistic practice beyond reason shares synergies with American abstraction. Belgrad gives an account of the culture of spontaneity, involving the beat poets, abstract expressionists and jazz musicians of the 1940s and '50s, who were inspired to escape the inhibitions of bourgeois culture and authority, some championing 'primitive' or ancient art, which they believed escaped the straitjacket of reason. Although these heterogeneous responses were in many cases essentialist and exoticising,

they were used to attack American conservatism and academic institutions sympathetic to scientific positivism, which cooperated with the aims of the industrial-military complex. Reduced to a stark opposition, 'the primitive', for those invested in the culture of spontaneity, meant access to the non-rational world of dreams and myths, and the somatic dimension through which this world could be experienced. For artists, it also involved modelling matter into art. As Belgrad writes, 'the abstract expressionists did not try to depict Native American life, but to use the forms of Native American art as a "medium of thought"' – or, as the artist Adolph Gottlieb put it, the 'free association of images and symbols which I couldn't explain' (Belgrad 1998, 63). The composition, the rhythms and intervals, and the affective aspects of the symbols and textures of Native American art were used as a way of thinking beyond cognitivist approaches and syntactical and semiotic decoding. By arranging space, rhythm, colour and plane, gesture and composition, and allowing the play of sensation, chance, intuition and automatism, these artists escaped the premeditated and programmatic rational uses of their art, which would turn their works into didactic illustration. Similarly, by learning more about context, cultural comparison and art history, one can sometimes become more attuned to these rhythmic and felt aspects of artworks.[16]

For Belgrad, the culture of spontaneity was part and parcel of the move away from thinking about matter, the universe and art in ways that stemmed from centuries of inferences from Euclidean, Newtonian and Kantian logic. Although primitivism was encrusted with layers of exoticism or mysticism, it provided artists with new ideas concerning composition that avoided painterly conventions learned through rational means at

[16] Historically, there has been a tendency to explain abstract art either in 'contextualist' terms, as a superstructure arising from economic, social and political circumstances, or with a 'formalist' emphasis that is more ahistorical. See Schapiro (1937) for a well-known attempt to suggest the historically specific social and economic paradigms underlying innovations in art such as abstraction. Cheetham (2006) argues persuasively that formalist purity and autonomy, and the 'infection' of social relevance, have always struggled with each other in the history of abstract art. Halley believes that 'abstract art is simply the reality of the abstract world' (1997, 32), a massive network of geometrically organised urban spaces, cells, circuits, apartments and highways that create a spatial and rhythmic sensibility (or alienation) that find its way into the psychology of design and the making of abstract art. Works on abstract art that I engage with in Part III are sensitive to historical conditions but not in ways that are easily understood as commensurate. Similar points are made by Varnedoe (2006); Schimmel (2012) (this is interesting in terms of abstraction which is not geometrical, such as *Informel*); Rosenthal (1996); Belgrad (1998) and others. It is important to acknowledge how historical events are internalised by psychological processes to be externalised back into history through artistic practices. For a psychoanalytical approach to abstraction, which I disambiguate from a psychological approach in Part III, see Fer (1997). Houston attempts to ground 'perceptual abstraction', such as Op Art, 'devoid of narrative and symbolic content in its historical conditions' (Houston 2007, 57).

schools and academies, and was therefore closer to their own dream worlds and reveries. For Bachelard, reverie is a creative mental process that fragments the composition of rational and ideal forms. These fragments are irrational images and juxtapositions that we see in Dada collage – myth, contradictions, paradoxes and metaphors that give rise to a 'decomposition of forces', which breaks with 'the naïve and egotistical ideal of the unity of composition' (Bachelard [1948] 2002, 111).

For the critic Harold Rosenberg, Willem de Kooning's spontaneity was political particularly because it was 'repugnant to bureaucrats, conformists, organization-men, and programmers' (De Kooning and Rosenberg 1974, 36). In 1958, when many of the post-war artists in Europe and America who I examine in this book were producing their most experimental abstract works, Rollo May articulated a view of existentialism as a way to break free from the 'Victorian man' and his rational compartmentalisations, which many artists were intuitively struggling against:

> The Victorian man saw himself as segmented into reason, will, and emotions and found the picture good. His reason was supposed to tell him what to do, then voluntaristic will was supposed to give him the means to do it, and emotions – well, emotions could best be channeled into a compulsive business drive and rigidly structuralized in Victorian mores; and the emotions which would really have upset the formal segmentation, such as sex and hostility, were to be staunchly repressed or let out only in orgies of patriotism or on well-contained week-end 'binges' in Bohemia in order that one might, like a steam engine which has let off surplus pressure, work more effectively on returning to his desk Monday morning. Naturally, this kind of man had to put great stress on 'rationality.' Indeed, the very term 'irrational' means a thing not to be spoken of or thought of; and Victorian man's repressing, or compartmentalizing, what was not to be thought of, was a precondition for the apparent stability of the culture. This compartmentalization went hand in hand with the developing industrialism, as both cause and effect. A man who can keep the different segments of his life entirely separated, who can punch the clock every day at exactly the same moment, whose actions are always predictable, who is never troubled by irrational urges or poetic visions, who indeed can manipulate himself the same way he would the machine whose levers he pulls, is of course the most profitable worker not only on the assembly line but even on many of the higher levels of production (May 1958, 21).[17]

[17] It is interesting that this description of organising daily routines into highly organised spatial cells and compartments and temporal intervals has been likened to the capitalist system of Taylorisation, a geometrical urban, consumer and digital network that is itself abstract. Indeed, abstract artist Peter Halley has tried to paint this inescapable geometric maze in which we are all physically and psychologically immersed. He writes:

> [P]eople live in sealed houses or condos in highly controlled landscapes. They travel in the sealed environment of the automobile along the abstract pathway of the highway to equally artificial office parks and shopping malls. When one speaks of abstract art, it is essential to remember that it is only a reflection of a physical environment that has also become essentially abstract (Halley 1991, 60).

It is interesting that this view of the Victorian man, and the underlying segmentation and rhythms of life, are still valid today. But in all these examples, it is art that was seen to offer a way to exist parallel with reason. Even much later, Deleuze and Guattari see art as being able to produce sensations and affects that undermine not only the Victorian man and the bureaucratic mindset but also the kind of citizen, ego and normative subjectivity that may be seen to flow from it. In *Francis Bacon*: *The Logic of Sensation* (2003), Deleuze discusses rhythms, vibrations and sensations which overflow sense, decorum and dogma, sharing important synergies with Lefebvre's 'rhythmanalysis', which, as I have mentioned, is also a critique of the segments and rhythms produced by the rationalisation of modern life.[18] It is with Bachelard, however, that this rhythmanalysis is linked to the traces of oneiric memory in present perception which artists and writers are able to model.

Chaos

For Deleuze and Guattari, in intensive encounters with art, the brain plunges into chaos (1994, 215) and this could be what happens with some powerful artworks that move the viewer. Deleuze writes about Francis Bacon's 'defacement' of his subjects, brought about by polychromatic strokes and thick impasto, which appeals to direct somatic engagement rather than detached intellectual examination. Nevertheless, as Deleuze and Guattari note, art 'is not chaos but a composition of chaos that yields the vision or sensation, so that it constitutes, as Joyce says, a chaosmos, a composed chaos – neither foreseen nor preconceived' (Deleuze and Guattari 1994, 204).

Scientists have studied in detail the chaotic dynamics of the brain, and embodied emotions and their dynamics. Notable in this regard are Walter J. Freeman, György Buzsáki, Ichiro Tsuda, Emmanuelle Tognoli and J. A. Scott Kelso, who present strong evidence that the brain operates with nonlinear dynamics, metastability and chaotic itinerancy, providing empirical support for the idea of 'chaos in the brain', understood not as stochastic but as an interaction between order and chaos. Many of these researchers have observed dynamic changes in brain activity between different regions and networks, which operate in rhythmic and synchronised ways. Yet the depth of research in this area rarely, if ever, extends to the behaviour of individuals engaged in viewing and

[18] This supports Jones's (2005) analysis of the bureaucratisation of the senses. Jones studies how Greenberg's emphasis on opticality, or the disembodied eye, was the product of a positivist ideology that insisted on the superiority of the detached intellect while denigrating emotional or affective entanglements with art.

making art. In neuropsychology, the study of art is dominated by the reductionist paradigm of examining specific brain areas rather than the dynamic complexity of their interactions.[19] Although nonlinear dynamics and theories of the brain inform some of the language and ideas of Deleuze and Guattari, and those influenced by their work, these ideas would benefit from the precision provided by empirical studies on 'chaos in the brain', which I attempt in Part II. But it is interesting as well that these more recent scientific studies often support the general statements and speculations about the functioning of the brain in Deleuze and Guattari.[20]

N. Katherine Hayles writes that in chaos theory

> regularities of the system emerge not from knowing about individual units but from understanding correspondences across scales of different lengths. It is a systemic approach, emphasizing overall symmetries and the complex interactions between microscale and macroscale levels (Hayles 1990, 170).

This approach requires an ability to cross-reference different levels of description. Hayles writes that, for many scientists

> chaos is more than just another theory. It represents an opening of the self to the messiness of life, to all the chaotic unpredictable phenomena that linear science taught these scientists to screen out. Once roused, they remember that the messiness was always there. Moreover, now they are able to see nonlinearity in a new light, perceiving it as central rather than marginal, beautiful rather than aberrant (170).

[19] There are too many examples to mention but Zeki (1999) and Livingstone (2002) are well-known scientists who have developed theories about our involvement with art from a series of experiments on brain cells, neurons and particular brain areas responsible for processing the basic features of art, such as line, colour and luminance, based on data from fMRI scans, lesion studies and optical illusion diagrams. These approaches look at basic perceptual responses to abstract art and emphasise formalism as triggers for shape and motion detection in geometric forms, colour and luminosity. A good summary of these approaches can be found in Weir and Mandes (2017).

[20] A good example is Grosz (2008), which centres on Deleuze's understanding of sensation in art resisting overly semiotic and mechanical approaches: sensation 'extracts' from chaos (Grosz 2008, 61), art 'protects us from chaos' (56), or wards off chaos. Sensations pass through the body. No particular biological details of how sensations do this or are transformed by the body are examined. Deleuze and Deleuzians are fond of Bacon's notion that art should directly have an impact on the stomach rather than the brain, that it could have a direct effect on the nervous system. It would help to drill down into the details of how this might actually work in terms of neuronal assemblages, oscillations, neurotransmitters, sensorimotor and visceroceptive and other metabolic systems. But this is rarely done, and so the expression often languishes at the vague and general level, even though Deleuze is at pains to go into a lengthy rhythmanalysis of Bacon, exploring a large number of different ways of describing vibration and sensation. Similarly, in Grosz there are some very interesting passages where she describes vibrations and rhythms, and offers various explanations for how sensations are composite or have layers or levels (83).

In the Western tradition, chaos has played the role of the other – the unrepresented, the unarticulated, the unformed, the unthought. Hayles's understanding of chaos is that it is not only a fundamental property described by science but also a method of understanding this property. This 'way of thinking' is important for the humanities as well: 'both scientific and literary discourses are being distinctively shaped by a reevaluation of chaos. It is this vision that defines the contemporary episteme and differentiates it from the modernist era' (Hayles 1990, 177). My study is a product of this contemporary episteme.

While it is my contention that it is important to understand art, literature and many other domains of human activity in terms of the interplay of chaos and order, there have been various critics of such attempts. Stephen H. Kellert, in *Borrowed Knowledge* (2009), provides a detailed study of the controversies in the literature, and evaluates both the work that employs such methods and its critics. Kellert draws on the work of various scientists who attacked French intellectuals such as Jean-François Lyotard and Michel Serres. As Kellert points out, these scientists were not opposed to the idea of extrapolating concepts from one field to another, but only against extrapolations that are unsupported. Some of the main misunderstandings and unsupported extrapolations are as follows:

1. Enthusiasm for chaos theory has led some writers to overstate its importance, claiming that chaos is a fundamental 'truth' of the universe. But not everything is chaotic.
2. Kellert is at pains to show that sensitive dependence (the 'butterfly effect') has been widely misunderstood and 'should not be conceived of as a story about the special causal powers of one specific butterfly; in a chaotic system, each and every butterfly matters' (Kellert 2009, 9).
3. Kellert explains that a certain pattern, regularity or consistency arises after observation. Chaotic routines may eventually exhibit patterns called 'strange attractors', where the duration of movements and changes of the 'chaotic' system seem to bottom out or gravitate towards a more predictable trajectory as the system becomes more stable or reverts back to learned patterns, drives, memories or stable reference points in the environment. Thus these 'strange attractors' are not 'mysteriously' magnetic.
4. Writers have confused true stochastic behaviour with chaos theory, which is nonlinear behaviour but is still deterministic behaviour:

> [C]haos theory is the study of unpredictable behavior in simple, bounded, deterministic systems. Such behavior is extremely complicated because it never repeats, and it is unpredictable because of its celebrated sensitive dependence on initial conditions: even extremely small amounts of vagueness

> in specifying where the system starts render one utterly unable to predict where the system will end up . . . chaotic behavior is investigated using the mathematical tools that go by the name 'dynamical systems theory' or just 'dynamics' (Kellert 2009, 6).

5. Chaos theory in science and mathematics is quantitative and exacting. It is important to note that this kind of analysis is not the kind that is employed directly in the interpretation of artworks.[21]
6. The unpredictability of chaos is not the same as indeterminacy or Heisenberg's uncertainty. It should also not be confused with complexity theory, 'which studies the intricate behavior that can result from large numbers of subsystems interacting according to simple rules' (Kellert 2009, 8).

In his conclusion, which I embrace, Kellert is broadly positive about 'borrowed knowledge', offering the following attempt to achieve a balance:

> [I]t is indeed important to 'get the science right,' since a mistaken use of a scientific theory or term may disrupt the effectiveness of a metaphorical borrowing. But at the same time, the mathematical structure of a theory does not fix its broader cultural meaning; a narrow focus on scientific correctness . . . runs the risk of missing out on the very real meanings attached to scientific results . . . any attempt to portray such cross-disciplinary transfers as simply misunderstandings of the science rules out the possibility of exploring the impact that science can have on the practices of other disciplines (Kellert 2009, 233–234).

I am also buoyed by the fact that Kellert approves the use of aspects of chaos theory in the work of Walter J. Freeman, 'who demonstrates the possibility of fruitful applications of the techniques of nonlinear dynamics within neurophysiology' (Kellert 2009, 7), which is what I attempt to do in Part II. Kellert's study explains my reluctance to adopt chaos theory, tout suite; I prefer the idea of 'metastability', which can be understood as a (nonlinear) dynamic complexity which features aspects of order and disorder.

The overall functioning of the brain has been described as 'metastable', where metastability, a term taken from nonlinear dynamics, is understood as a process in which ordered set routines and improvisation emerge in different parts of the brain, interacting with each other, in response to environmental stimuli. Bruineberg and Rietveld write: 'we need to understand how the self-organized metastability of the brain-body-environment

[21] But the conclusions reached by these studies are extrapolated and theorised as part of a theory of the psychology of art in Part III, particularly when these scientific works use examples of 'external perturbations' and other similar examples to construct brain-body-world looped interactions and metastable coordination.

system interacts with the self-organized metastability of the brain' (Bruineberg and Rietveld 2014, 10). This understanding of the brain as spontaneously organised and continuously pulsating with rhythms and oscillations that gather and disperse in interaction with the world has made negligible impact on neuroaesthetics or neuroscientific and psychological studies of art, with the result that we are left with rather more 'static' studies of brain states and artworks. Self-organisation is a spontaneous process where global order, rhythms, synchronies or other patterns of coordination emerge out of local interactions between components of an initially disordered system. It can be observed across a broad range of biological, chemical and cognitive phenomena: 'Common examples include crystallization, the emergence of convection patterns in a liquid that is heated from below, chemical oscillators, swarming in groups of animals, and the way that neural networks learn to recognize complex patterns' (Marabissi and Fantacci 2015, 13).

In neuroscience, metastability describes how neural populations work by negotiating aspects of stability and instability, self-organising into larger rhythmic and arrhythmic movements. What at first seems arbitrary or arrhythmic may in fact be a complex set of rhythmic interactions over time. The neuroscientist J. A. Scott Kelso explains that the 'perceptual system (and the brain itself) is intrinsically metastable, living at the edge of instability where it can switch spontaneously among collective states' (Kelso 1995, 223). The challenge for those who seek a deeper understanding of how art affects us is to understand that this metastability emerges not just in the brain but in cooperation with other aspects of the body (the nervous system, muscle groups) that are engaged in the process of viewing or experiencing art. Although precise in its methods and calculations, even nonlinear dynamics would buckle under the strain of dealing with so many variables, but it is important that we open our minds to the idea of a complex metastability, composed of both order and chaos, that is sustained across brain, body and artwork.

This is particularly the case in the process of painting. In *Brushstroke and Emergence*, James D. Herbert suggests that the process of painting is a 'unified mental/material continuum not clearly subdivided into differentiated components' (Herbert 2015, 18). This unified continuum is not an ordered one that proceeds in linear steps. Gerald Cupchik suggests that such art-making can be seen as a 'recursive and stochastic process' where attention to the emerging composition switches from part to whole and back again in a 'motor-sensory loop' (Cupchik 2016, 271). This presents problems for reductionism, that is, the breaking up of a complex set of entangled events in order to study one or two isolated snapshots which are assumed to explicate the whole event. Similarly, the idea of emergence is

about larger events that cannot be traced back to their origins in a linear causal chain. As dynamic systems theory shows, the collective action of various elements can create something irreducible, unpredictable and novel. Related to this idea is the work of philosopher Alva Nöe, who points to larger events, the 'things themselves', rather than the neurons processing aspects of experience:

> What is the causal substrate of the experience of the wine's flavor? Perhaps this substrate is only neural, but perhaps it is not. Perhaps the only way to produce flavour sensations is by rolling a liquid across one's tongue. In that case, the liquid, the tongue, and the rolling action would be part of the physical substrate for the experience's occurrence (Nöe 2004, 220).

This holistic approach challenges the 'computational' understanding of the mind, which may be reductionist in assuming that higher-order phenomena (such as tasting wine) can be:

> collapsed into lower order ones and that lower order phenomena were the ultimate explanatory elements, the 'causes' that science [seeks] to isolate. Yet the breakthrough of nonlinear dynamics has shown us that explanations of self-organizing phenomena can only be given in terms of the qualitative forms of behavior of the system as a whole, i.e., in terms of system properties that resist analysis in terms of the properties of the parts, whether they be individual neurons or discrete input to the system. This implies that in explanations of self-organizing brain dynamics, there necessarily will be relative independence from the nature and properties of the substrate; hence micro-reduction, the aim of traditional explanations, does not work (Freeman and Skarda 1990, 281).

What is required is to challenge the privileged position given to reductionism in the interpretation of art, an approach that is supposed to penetrate, reveal and extract meaning from artworks by breaking down their complexity into 'chunks' of perception. This privileging also assumes that the human factor is the most important in a network of factors involved in the production (and experience) of art.

The rhythms and textures of matter suggested in abstract art, which lie outside of or beneath the exercise of conscious, formal logic, help to produce in the viewer less-than-conscious and more arbitrary mind wandering and reverie. This opens up a new way of understanding art, and of looking at and understanding how we (our brains) respond to art. It is this subliminal and rhythmic process that I propose can be studied by bringing together various levels of description. Each discipline has a different contribution to make to our understanding of rhythm and how it emerges uniquely in each domain of brain, body and world. This book attempts to show how the traditional duality of mind and matter is better understood as differences in degree.

My argument is that the activity of making and viewing abstract art, particularly matter painting, hovers around the mid-point in this scale.

In my last book, *The Psychology of Contemporary Art*, I explored the cognitive and conceptual complexities that modern and contemporary artworks help to produce. The present volume complements the earlier work by examining how rhythm and matter in art produce sensations, feelings and mind wandering. Both philosophy and psychology, and the latest research on rhythmic oscillations in the brain, suggest that non-conscious and daydreaming states are pulsative, and can cooperate with the rhythmic patterns that artworks suggest.

Each discipline has a different contribution to make to our understanding of rhythm and how it emerges uniquely in each domain of brain, body and world. Part I analyses terms such as mind, matter, rhythm and sensation informed by new materialist philosophy. Part II is a meta-analysis of current research in neuropsychology on brain oscillations, and the phenomenon of mind wandering, which abstract art helps to sustain. And Part III demonstrates how these different disciplines can interact in case studies of specific works of art which help to cue rhythmic sensations.