

Woolf, the arts aim to expose the world's indeterminate relationality and weave new sensations with it.

Woolf described a fully relational world of motion: 'a world where each part depends upon the other, the serene, impersonal, and indestructible world of art'.³⁵ Woolf's world of art is not one of interior monologues but of impersonal processes and transformations. She said she wanted to 'achieve a symmetry by means of infinite discords, showing all the traces of the mind's passage through the world'.³⁶ Word and mind are not static or distinct but pass through one another and leave traces of their transformation. Instead of logical or ontological negation or contradiction, Woolf was interested in what she called 'discordant harmonies',³⁷ that is, relations of simultaneous but not necessarily harmonic change.

For Woolf, the world is not substances chopped up into discrete non-relational units. 'Life is not a series of gig lamps symmetrically arranged; life is a luminous halo, a semi-transparent envelope surrounding us from the beginning of consciousness to the end'.³⁸ Life is a luminous halo, for Woolf, precisely because 'human beings [are] not always in relation to each other but in *relation to reality*'.³⁹

Woolf thus imagined her work as an ongoing discovery of relational patterns of motion. For example, in *Mrs. Dalloway*, the main character sees the world, not as discrete solid objects, but 'laid out like a mist [...] spread ever so far, her life, herself'.⁴⁰ For Woolf, knowledge of the fixed states of static objects was impossible, because as the waves collide and diffract, they change the water's entire relational surface. As Mrs Dalloway says, 'our apparitions, the part of us which appears, are so momentary compared with the other, the unseen part of us, which spreads wide'.⁴¹ 'Beneath it is all dark, it is all spreading, it is unfathomably

deep; but now and again we rise to the surface and that is what you see us by.⁴² Another character in *Mrs. Dalloway*, Septimus Smith, similarly sees a tree ‘connected by millions of fibres with his own body’.⁴³ For him, the world spreads its fibres through our bodies because the world is relational.

Woolf was probably attracted to Lucretius’ accounts of epiphany because of her own experiences. But in reading and translating his poem, she was helped in her understanding of them and their integration into a larger naturalistic philosophical framework offered by Lucretius. There were many influences on Woolf’s understanding of her epiphanic moments, but Lucretius was certainly a major influence for her.⁴⁴

Quantum Entanglement

Contemporary physicists may have left behind the ancient practice of oracle, but some still adopt the idea of radical relationality in their own way. Just as certain physicists credited Lucretius with the notion of indeterminacy, they also should have credited him with the related idea of *relational* indeterminacy. Lucretius described relationality as a process of cosmic ‘weaving’,⁴⁵ similar to what physicists call ‘quantum entanglement’.⁴⁶

In the words of the Austrian physicist Erwin Schrödinger, ‘entanglement’ is ‘*not ... one* but rather *the* characteristic trait of quantum mechanics, the one that enforces its entire departure from classical lines of thought’.⁴⁷ Quantum entanglement means that scientists cannot describe the state of a pair or group of particles independently of others’ states. Entanglement occurs even when vast distances separate the particles. Their materiality and motion are relational. The measurement of the position, momentum, spin and

polarisation of one entangled particle correlates with other entangled particles. In quantum physics, it is not possible to specify a system's state by listing the state of all its subsystems or local regions *individually*. 'We have to look at the system as a whole, because different parts of it can be entangled with one another.'⁴⁸

In 1935 Albert Einstein, Boris Podolsky and Nathan Rosen famously argued that if entanglement were true, quantum physics would be incomplete, since it could not predict each discrete change independently. If it were complete, they argued, then it would have to be *non-local* – which would imply that distant agents were acting on local ones without any physical connection. Einstein later called this effect 'spooky action at a distance' and profoundly disagreed with it. Einstein wanted things to have objective non-relational properties, whether they were measured or not. He wrote:

That which really exists in B should not depend on what kind of measurement is carried out in part of space A; it should also be independent of whether or not any measurement at all is carried out in space A. If one adheres to this program, one can hardly consider the quantum-theoretical description as a complete representation of the physically real. If one tries to do so in spite of this, one has to assume that the physically real in B suffers a sudden change as a result of a measurement in A. My instinct for physics bristles at this.⁴⁹

Einstein was all right with the idea that space and time were locally relative to one another. However, he was not okay with the idea that nature was globally relational such that a change in one distant location would have a correlated simultaneous change in another. The so-called 'EPR paradox', named after the authors above, remained a theoretical

controversy until John Bell put forward a mathematical theorem and thought experiment that proved Einstein wrong in 1964.⁵⁰ However, it was only with Alan Aspect's 1982 EPR-based experiments in Paris (repeatedly confirmed over the past forty years)⁵¹ that entanglement (relational correlations between distant quantum events) was proven to be undeniably real. All 'local realist' theories of causality have now been proven false.⁵²

This position's philosophical consequences are radical, even though there is no universally accepted interpretation of them. We experimentally know, though, that local material motions are relationally entangled and correlated with global ones. Each local region relationally entangles in some way with the rest of the universe. This entanglement does not *necessarily* mean that there is action at a distance or retroaction in time. Nor does it *necessarily* follow a deterministic global wave function for the entire universe, as David Bohm speculated.⁵³ Some physicists have even argued that it may be experimentally *impossible* and practically *unnecessary* to explain entanglement by a broader causal framework precisely because of quantum physics's indeterministic nature.⁵⁴ At the moment, the indeterminism of entangled relations and their emergent patterns are experimental givens of physics. No framework has experimentally shown that entanglement derives from any deeper deterministic or non-relational principle.

But if entanglement is fundamental, it means that there are no discrete relations or *relata*. There are only global relational transformations in the whole entangled universe. Each local change co-occurs and in a precise correlation with the rest of the indeterministic universe. If entanglement is fundamental, it also means that there are no discrete causes or effects because there is nothing that is not relational.

There is only a 'qualitative transformation of the whole', as the philosopher Henri Bergson was fond of saying.⁵⁵

If entanglement is true at the tiniest scales, it is also true at the larger ones, although entanglement's immediate effects may not be perceptible. The physicist Karen Barad has explicitly tried to bridge this divide by emphasising relationality across scales. She writes that

bodies do not simply take their places in the world. They are not simply situated in, or located in, particular environments. Rather, 'environments' and 'bodies' are intra-actively co-constituted. Bodies ('human', 'environmental', or otherwise) are integral 'parts' of, or dynamic reconfigurings of, what is.⁵⁶

Entanglement is also central to the quantum measurement problem. Any measurement of the universe is part of and entangled with what is measured. There is no purely neutral observer or objective measurement. In the words of the physicist Carlo Rovelli,

The [quantum] theory does not describe things as they 'are': it describes how things 'occur', and how they 'interact with each other.' It doesn't describe where there is a particle but how the particle shows itself to others. The world of existent things is reduced to a realm of possible interactions. Reality is reduced to interaction. Reality is reduced to relation.⁵⁷

In this chapter, I have tried to show how Marx and Woolf were influenced directly by Lucretius' theory of relationality, each in their own way. I have also argued that quantum physicists have elaborated an experimental principle of relationality that resembles that of Lucretius (as I read him) and which I think they should recognise, but which they often do not. More specifically, I have argued that

Marx used the idea of relationality as the basis of his concept of sensuous practice (and metabolism) and that Woolf used it in her relational aesthetics of rapture. Quantum physicists also use it in their experimental understanding of quantum entanglement.

But how do all these indeterminate relations build up into the stable objects we see around us? In the next chapter we look at how the tradition of kinetic materialism has answered this question with the key ideas of *process* and *pattern*.

Notes

- 1 Karl Marx and Frederick Engels, *Marx & Engels Collected Works, Volume 1: Karl Marx 1835–43* (London: Lawrence and Wishart, 1975), 40, 45. Hereafter *MECW*.
- 2 *Ibid.*, 438.
- 3 *Ibid.*, 471.
- 4 *Ibid.*, 491.
- 5 Karl Marx, *The First Writings of Karl Marx*, trans. Paul M. Schafer (New York: Ig, 2006), 57.
- 6 Karl Marx and Frederick Engels, *Marx & Engels Collected Works, Volume 5: Karl Marx 1845–47* (London: Lawrence & Wishart, 1976), 3.
- 7 Marx and Engels, *MECW, Volume 1*, 39, 50.
- 8 *Ibid.*, 39.
- 9 Marx and Engels, *MECW, Volume 5*, 3.
- 10 There is no doubt that Hegel also influenced Marx's idea that truth must be proven in historical practice.
- 11 *Ibid.*, 4.
- 12 Marx and Engels, *MECW, Volume 1*, 458.
- 13 Karl Marx and Frederick Engels, *Marx-Engels-Gesamtausgabe, Vol. 2* (Berlin: Dietz, 1975), 240.
- 14 Karl Marx and Frederick Engels, *Marx & Engels Collected Works, Volume 3: Karl Marx: March 1843–August 1844* (London: Lawrence and Wishart, 1975), 276. My translation.
- 15 Karl Marx and Frederick Engels, *Marx & Engels Collected Works, Volume 30: Marx: 1861–1863* (Lawrence and Wishart, 1988), 62, 63, 78.
- 16 *Ibid.*, 290.

- 17 Karl Marx, *Capital: A Critique of Political Economy*, Vol. 3, trans. David Fernbach (New York: Penguin, 1993), 959.
- 18 Ibid., 949.
- 19 Ibid., 161.
- 20 Karl Marx, *Capital: A Critique of Political Economy*, Vol. 2, trans. David Fernbach (New York: Penguin, 1992), 226.
- 21 Karl Marx, *Theories of Surplus-Value, Part III*, trans. Jack Cohen and S. W. Ryazanskaya (Moscow: Progress Publishers, 1971), 309.
- 22 Karl Marx, *Capital: A Critique of Political Economy*, Vol. 1, trans. David Fernbach and Ben Fowkes (New York: Penguin, 1990), 376.
- 23 Karl Marx, *Economic and Philosophic Manuscripts of 1844* (London: Lawrence and Wishart, 1982), 181.
- 24 Marx, *Capital Vol. 3*, 949.
- 25 Ibid., 964. See Paul Burkett and John Bellamy Foster, 'Metabolism, Energy, and Entropy in Marx's Critique of Political Economy: Beyond the Podolinsky Myth', *Theory and Society* 35 (2006): 109–56.
- 26 Marx and Engels, *MECW, Volume 3*, 296.
- 27 See Thomas Nail, *Marx in Motion: A New Materialist Marxism* (Oxford: Oxford University Press, 2020), ch. 5.
- 28 Titus Lucretius Carus, *De Rerum Natura (On the Nature of Things)*, ed. Walter Englert (Newburyport, MA: Focus Publishing, 2003), 1.1–30.
- 29 Ibid., 1.921–30. My transcription of Woolf's annotations/translations from her copy of Lucretius' *De Rerum Natura*, Book I, lines 919–28. Woolf's translations in parentheses.

*fiet uti risu tremulo concussa cachinnent
et lacrimis (INSPIRING WIND) salsis umectent ora genasque.
Nunc age, quod super est, cognosce et clarius audi.
nec me animi fallit quam sint obscura; sed acri
percutit thyrsos laudis spes magnae cor
et simul incussit suavem mi in pectus amorem (SMITTEN DEEP)
Musarum, quo nunc instinctus mente vigenti (PRICKED HEART)
avia Pieridum peragro loca nullius ante (roam trackless wilds)
trita solo. iuvat integros (VIRGIN) accedere fontis
atque haurire iuvatque novos decerpere flores.*

- 30 Ibid., 3.28–30. My transcription of Woolf's annotations/translations from her copy of Lucretius' *De Rerum Natura*, Book III, lines 28–9. Woolf's translations in parentheses.

*his ibi me rebus quaedam (THRILLING AWE) divina voluptas
percipit atque horror (RAPTURE), quod sic naturatua vi,*

- 31 My transcription of Woolf's annotations/translations from her copy of Lucretius' *De Rerum Natura*. Woolf's translations in parentheses.

nam sua cuique, locis ex omnibus, omnia plagis (SHOCKS) (2.1112)

Denique si vocem rerum natura repente. (SHOCKS) (3.931)

vim subitam (SHOCK) *tolerare: ita magno turbidus* (IN TURMOIL)

imbri (SEETHING) (1.286)

impetibus (SHOCKS) *crebris, inter dum vertice torto* (CURLING EDDY) (1.293)

denique per maria ac montis fluviosque rapacis (WHIRLING). (1.7)

verrunt ac subito vexantia turbine (WHIRL) *raptant,* (1.279)

- 32 Ibid., 3.28–30. My transcription of Woolf's annotations/translations from her copy of Lucretius' *De Rerum Natura*, Book III, lines 28–9. See note 30 above.

- 33 Virginia Woolf, *Mrs. Dalloway* (1925) (Orlando, FL: Harvest/Harcourt, 1981), 68. My italics.

- 34 Virginia Woolf, *Moments of Being: Unpublished Autobiographical Writings*, ed. Jeanne Schulkind (New York: Harcourt Brace Jovanovich, 1976), 72.

- 35 Virginia Woolf, *The Essays of Virginia Woolf, Volume 6: 1933–1941*, ed. Stuart N. Clarke (London: Hogarth Press, 2011), 121.

- 36 Virginia Woolf, *A Passionate Apprentice: The Early Journals (1897–1909)*, ed. Mitchell A. Leaska (San Diego, CA: Harcourt Brace Jovanovich, 1990), 393.

- 37 Virginia Woolf, *Between the Acts* (New York: Harcourt, Brace, 1941), 175.

- 38 Virginia Woolf, *The Essays of Virginia Woolf, Volume 4: 1925–1928*, ed. Andrew McNeillie (Orlando, FL: Harcourt, 1994), 160.

- 39 Virginia Woolf, *A Room of One's Own* (1929) (Orlando, FL: Harcourt Brace Jovanovich, 1981), 114. My emphasis.

- 40 Woolf, *Mrs. Dalloway*, 9.

- 41 Ibid., 153.

- 42 Virginia Woolf, *To the Lighthouse* (1927) (Orlando, FL: Harcourt, 1981), 62.

- 43 Woolf, *Mrs. Dalloway*, 22.

- 44 Thomas Nail, *Virginia Woolf: Moments of Becoming* (Redwood City, CA: Stanford University Press, under review).

- 45 See Thomas Nail, *Lucretius I: An Ontology of Motion* (Edinburgh: Edinburgh University Press, 2018); Thomas Nail, *Lucretius II: An Ethics of Motion* (Edinburgh: Edinburgh University Press, 2020); and Thomas Nail, *Lucretius III: A History of Motion* (Edinburgh: Edinburgh University Press, 2022).

- 46 There is now an extensive literature on this phenomenon. See David Mermin, 'Is the Moon There When Nobody Looks? Reality and the Quantum Theory', *Physics Today* 38, no. 4 (1985): 38–47; Amir Aczel, *Entanglement: The Unlikely Story of How Scientists, Mathematicians, and Philosophers Proved Einstein's Spookiest Theory* (New York: Plume, 2003); and Louisa Gilder, *The Age of Entanglement: When Quantum Physics Was Reborn* (New York: Alfred A. Knopf, 2009).
- 47 Erwin Schrödinger, 'Die gegenwärtige Situation in der Quantenmechanik', *Die Naturwissenschaften* 23, no. 48 (1935): 844; English translation, 'The Present Status of Quantum Mechanics', in John A. Wheeler and Wojciech H. Zurek (eds), *Quantum Theory and Measurement* (Princeton, NJ: Princeton University Press, 1983), 152.
- 48 Sean Carroll, *The Big Picture: On the Origins of Life, Meaning, and the Universe Itself* (New York: Dutton, 2016), 100.
- 49 Max Born (ed.), *The Born–Einstein Letters: The Correspondence Between Albert Einstein and Max and Hedwig Born, 1916–1955* (New York: Walker, 1971), March 1948.
- 50 See Mermin, 'Is the Moon There When Nobody Looks?'.
- 51 For a longer introduction and list of these experiments in history, see Aczel, *Entanglement*.
- 52 Mermin, 'Is the Moon There When Nobody Looks?'. See also Peter Holland, *The Quantum Theory of Motion: An Account of the Broglie–Bohm Causal Interpretation of Quantum Mechanics* (Cambridge: Cambridge University Press, 2004).
- 53 Holland, *Quantum Theory of Motion*.
- 54 Arthur Fine, 'Do Correlations Need to be Explained?', in J. Cushing and E. McMullin (eds), *Philosophical Consequences of Quantum Theory: Reflections on Bell's Theorem* (Notre Dame, IN: University of Notre Dame Press, 1989), 175–94; Tanya Bub and Jeffrey Bub, *Totally Random: Why Nobody Understands Quantum Mechanics (A Serious Comic on Entanglement)* (Princeton, NJ: Princeton University Press, 2018); and Bas C. van Fraassen, 'The Charybdis of Realism: Epistemological Implications of Bell's Inequality', *Synthese* 52, no. 1 (1982): 25–38.
- 55 Henri Bergson, *Matter and Memory*, trans. N. M. Paul and W. S. Palmer (New York: Zone Books, 2005), 104.
- 56 Karen Barad, *Meeting the Universe Halfway: Quantum Physics and the Entanglement of Matter and Meaning* (Durham, NC: Duke University Press, 2007), 63.
- 57 Carlo Rovelli, *Reality Is Not What It Seems: The Journey to Quantum Gravity*, trans. Simon Carnell and Erica Segre (New York: Riverhead Books, 2018), 134–5.

III. Process and Pattern

Chapter 5

Ancient Process and Pattern: The Minoan Labyrinth, the Eleusinian Mysteries and Weaving Strings

What is a process? And if matter and motion are processes, why does the world look like relatively solid objects?

We tend to think of processes as things that happen to substances. We imagine, for example, that an object at point A successively transforms as it moves to point B. The standard view is that change occurs when *something* changes into *something* else. Formed substances such as cocoons, one imagines, undergo modifications until they become other formed substances such as butterflies. In this definition, something about the substance remains the same throughout the process of change. The process is secondary or ‘accidental’ to the substance. This definition assumes something solid and identical, then thinks of change as the *difference* between solid states.

However, this is not the only way to conceive of change. What would it mean to say that there was a change that was not a change *of something*? If matter and motion are ontologically primary in the genealogy of thinkers I have been tracing in this book, how do they account for the stabilisation of indeterminate fluctuations that we see around us?

This chapter and the next aim to trace the history of answers to this question within the tradition of kinetic materialism. The first section gives a philosophical definition of the term ‘process’ and the second develops the ancient

historical roots of this idea. In the next chapter, I then outline the reception of the ideas of process and pattern for modern kinetic materialists.

What is Process?

A process is an ongoing transformation of matter in motion. It is a change that changes itself, not a change in something else that remains what it is. Matter is not a continuous or discontinuous substance that changes, and motion is not a continuous or discontinuous alteration of a substance. Matter and motion, in the history I am tracing, are *indeterminate processes*.

In a world of processes, there are no fixed substances or static forms. Matter flows, cycles and circulates in metastable patterns. A metastable pattern is an ongoing process that restores and repeats itself slightly differently each time, like a whirlpool or an eddy in water.

Processes are *relational* because they cannot be isolated or abstracted from a continual transformation without breaking the process into discrete pieces. They are *indeterminate*. In its most radical formulation, a material process has no beginning or end. If a process had an absolute beginning or end, its beginning or end would limit the process and introduce something unchanging. In doing so, it would destroy the process. Absolute beginnings and endings would also be non-relation for the same reason.

But processes can also create stabilities. The way processes iterate, cycle and weave together sustains metastable patterns that create the qualities and quantities of the stable things we see around us. These metastable ‘things’ result from ongoing actions that repeatedly iterate. For example, because heat is constantly dissipating from matter, nothing

can ever be the same thing twice. Due to entropy, all movements of matter in the universe are irreversible. Metastable forms emerge and dissipate because the universe flows from hot to cold. Because of this directionality, the flow of matter can eddy, whirl and entangle itself into stable patterns that give solidity and durability to the world.

By this definition, 'identity' is not a static position or unchanging form but a cycle or habit in indeterminately swerving matter. A thing is what returns to approximately the same place periodically. A difference is not a distinction between two identities but rather a flow or process that cycles into singular recursions. In other words, persistence precedes existence.

For example, when we say that an object changes, such as moving from point A to point B, point A is not a static position but a metastable region formed by iterating indeterminate processes. Matter affects and folds over itself like

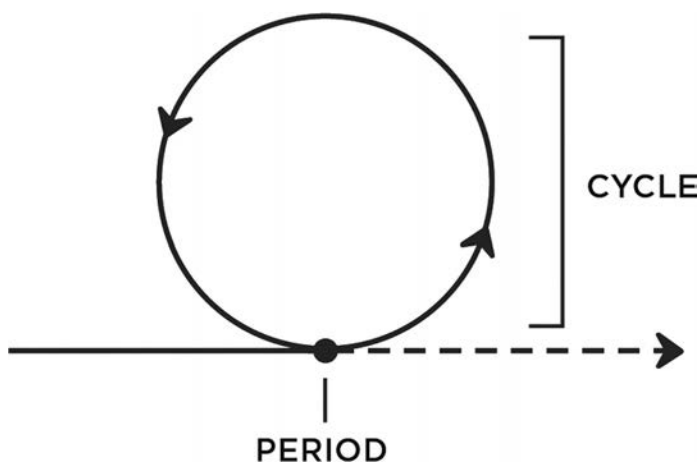


Figure 5.1 Cycle and period. Matter flows and cycles iteratively in a limited area, returning to a similar but never identical spot, before continuing on.

a vortex. Processes cycle, fold and entangle. A particle or point is just a local region where an indeterminate process interacts and intertwines with itself very closely.

As the ‘process object’ moves from process A to process B, everything changes simultaneously. This *global change* is the relationality I discussed in Chapter 2. When we watch a cocoon turn into a butterfly, everything in the universe is changing together at the same time relative to everything else. Even when things look static, they continue to change relative to everything else.

Movement and stasis, like continuity and discreteness, are not opposed. They are just relative descriptions of processes. The iterative or looping pattern in which matter continually affects and transforms itself is what we can call a ‘fold’. Each time a material process affects itself in a fold, it changes. This is why matter is singular, kinetic and iterative. Each fold also weaves together with the motions of others like interlocking vortices.

Over time, folds can be knotted together into durable composites. We do not live in a world of chaotic and incomprehensible flux. We live in a world that follows emergent orders and relatively stable patterns of motion. This is because matter moves together and entrains itself into converging and diverging patterns.

Processes intersect and habitually fold into periodic cycles. These cycles then organise themselves by size and scale into larger loops and layers. To put things simply: Energy flows in, cycles through, and then flows out – *of everything*. Structure and form are the metastable by-products of energetic flows. We should not think of forms as fixed, unchanging entities but as fabrics woven from criss-crossing threads. We might call this fabric of processes a ‘field’. A field emerges when a group of processes all fold together,

entrained, and give the appearance of a formal unity. Fields are like schools of fish; each alteration weaves into a tessellated and changing whole. A field is a process of processes ordered in such a way as to produce the global effect we call stable reality.

This does not mean there are no relative conflicts between various folds or fields. Larger and more powerful folds can swallow up and entrain smaller ones, as when animals eat one another. Social fields can go to war and unravel one another. Fields also have indeterminacies and instabilities that can make them fall apart or dissolve.

Some fields can even produce relatively stable patterns that conceal their metastable nature and generate an apparent 'conflict' between our perception of them and their processual nature. For instance, rocks tend to move very slowly compared to human lifespans, so they appear stable. However, at larger timescales, rocks flow like rivers across the earth. This was a great insight of general relativity: space and time are relative to fields of motion. Our perception of stability is not wrong; it's just relative. Humans can pretend the world is not relational processes, but they are likely to be continually surprised when all that was supposed to be solid melts into air.

In this chapter and the next, let's take a closer look at some of the ancient and modern ways that the tradition of kinetic materialism has understood the emergence of patterns from indeterminate processes.

The Minoan Labyrinth

As we have seen, Minoan religion strongly emphasised ambiguity and 'uncertainty ... in or between two states of existence'.¹ Such ambiguity *between* states is consistent with

the belief that nature is more like a process of metamorphosis than an underlying substance.

As I described in Chapter 2, Minoan religion was also comprised of ecstatic rituals in natural cult settings with no temples or particular gods.² The lack of a fixed building or a fixed particular god is also consistent with the idea that the sacred was a process that one could not fix in a single person, space or time.³

Furthermore, many scholars have also commented on the processual nature of Minoan art.⁴ One of the most cited scholars of Minoan art, H. A. Groenewegen-Frankfort, wrote eloquently on the centrality of movement for the Minoans.

Cretan art ignored the terrifying distance between the human and the transcendent which may tempt man to seek a refuge in abstraction and to create a form for the significant remote from space and time; it equally ignored the glory and futility of single human acts, time-bound, space-bound. In Crete artists did not give substance to the world of the dead through an abstract of the world of the living, nor did they immortalize proud deeds or state a humble claim for divine attention in the temples of the gods ... For life means movement and the beauty of movement was woven into the intricate web of living forms which we call 'scenes of nature'.⁵

Human figures in Minoan art displayed what Groenewegen-Frankfort calls a rhythmic dynamism or 'absolute motion', in which every movement has 'a countermovement within the figure, which makes it appear self-centered but never at rest'.⁶ Groenewegen-Frankfort believes that this is evidence for a Minoan worldview based on immanent processes and not transcendent conceptual abstractions.

Another piece of evidence for Minoan process thinking was the religious importance of the *labyrinth*. The origins of

the Greek word *labyrinthos* are shrouded in mystery. The most recent linguistic scholarship on the Minoan roots of this word suggests that it may have originally referred to the meandering structure of one or several ritual caves on Crete.⁷ The oldest textual evidence for these caves' importance comes from three Linear B tablets recording religious offerings from Knossos, the largest city on Minoan Crete. The tablets say that the Minoans gave one jar of honey to all the gods and one jar and some linen cloth to *da-pu2-ri-to-jo po-ti-ni-ja* or 'the Mistress of the Labyrinth', Potnia. Scholars agree that these tablets gave special reverence to the mistress and her labyrinth by mentioning her separately from the other gods. This would also make the labyrinth one of the most sacred places on Crete.

What do we know about the nature and importance of this labyrinth? Scholars still debate the word's earliest etymology, but we know that from the eighth century BCE onwards, the word described twisted or tortuous pathways.⁸ We also know that Minoan and Mycenaean cult architecture is not tortuous, but that the Minoans used sacred caves with twisted passageways. Therefore, several scholars have argued that if the term *da-pu2-ri-to* corresponded to *labyrinthos*, then Potnia's sanctuary should be in a meandering cave.⁹ In this way, the meandering structure of Potnia's sanctuary connects to the ecstatic visions of Minoan cave cults and to the legacy of Hellenistic underground labyrinths.¹⁰

Just as the term 'meander' originated from the name of a winding river in western Anatolia, the 'labyrinth' may have derived from the peculiarities of a Cretan cave noted for its twisted corridors.¹¹ The classical archaeologist Barbara Montecchi has suggested that the Greeks probably used the term *labyrinthos* to describe anything with tortuous or underground passageways.

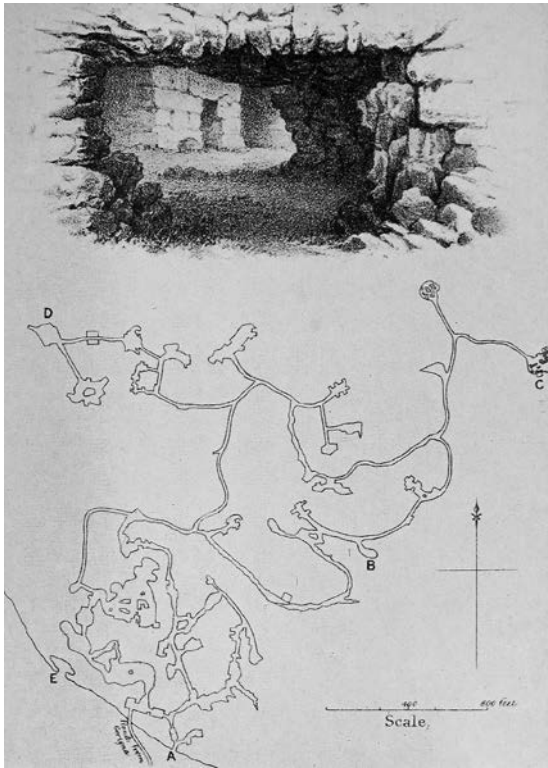


Figure 5.2 A sketch by Sieber of the Gortyna Cavern, Crete.

Meander patterns more generally had been used widely on Crete since the Neolithic and had a special significance before the term *da-pu2-ri-to* or *labyrinthos*. The first depiction of the iconic ‘labyrinth’ (figure 5.3) was adopted by the Mycenaeans around 1250 BCE and mythologised by Homer in the story of Theseus fighting the Minotaur.¹² But the labyrinth image was also an iteration of the older Minoan spiral meander pattern.

How is the labyrinth evidence of a process ontology in Minoan thought? The fact that the most sacred mistress of



Figure 5.3 Silver drachma, Knossos, 300–270 BCE. Obverse: head of Hera, wearing ornamented stephanos, triple-pendant earring and necklace. Reverse: labyrinth, flanked by A–P, ΚΝΩΣΙ(ΩΝ), ‘of Knossians’, below.

the Minoans oversaw the meandering underground labyrinth suggests that the Minoans thought of the nature of things as similarly tortuous, iterative and open-ended. To worship the divine, one had to journey through the meandering tunnels of Potnia’s cave. One had to move from the light down into the darkness to ‘see’ more clearly without using one’s eyes.¹³ At the heart of the underground cult site, the Minoans drank a ritual beverage,¹⁴ saw ecstatic visions in the special darkened inner chambers of the Earth, and then returned from the darkness along the same labyrinthine path into the light.¹⁵

Archaeological evidence of these ecstatic cave rituals is well established, and connects them to the older Neolithic seasonal fertility rituals of death and rebirth.¹⁶ Several Minoan cave scholars have also hypothesised that the experiences of entering, meandering through and exiting the caves functioned as a religious ‘transition from one state to another (from dark to light or from one world/condition to another)’.¹⁷ Since the Minoans also used caves as burial sites,

it seems likely that their ritual ecstatic journeys into caves were related to death and rebirth.

In one of the most active cult caves on Crete, Psychro, the Minoans inserted beautiful double axes into the stalagmites and created niches in the cave walls where they made offerings.¹⁸ As I discussed in Chapter 1, the double-bladed axe was one of the most important images of the mistress of the labyrinth and expressed well the ambiguity and continually folded process of life and death, light and dark, in its 'visual palindrome'.¹⁹

Philosophically, all this strongly suggests a process-view of the world where life and death were two dimensions of the same meandering process of nature. We have little or no evidence of major binary oppositions, hierarchical values, or a single god or substance in Minoan culture. One entered and exited the labyrinth-cave via the same place but was transformed in the *process*. The Minoans' ritual emphasis on process may also help make sense of the prevalent spiral meander patterns in Minoan art. The spiral meander pattern has no beginning and no end but is an endless process of iterative transformation similar to life and death.²⁰ 'The meander is the figure of the labyrinth in linear form', as Carl Kerenyi says.²¹

Although we don't have explicit written evidence that the Minoans had a process-view, the spiral meander is consistent with a worldview that emphasised ambiguity, relationality and processes. In short, the Minoan world was not just indeterminate flux. It also had labyrinthine patterns that folded and ebbed in and out of one another in iterative spirals, just as the cave ritual took one down into the darkness and back up into the light.

In this way, we can hypothesise that instead of *thinking* about the world as either a changing substance or a chaotic flux, the Minoans *performed* the world's folding

and unfolding movement in the patterned iteration of the braided labyrinth-cave ritual.

The Eleusinian Mysteries

The Archaic Greeks continued this process-ritual of life and death in their own way in the 'Eleusinian mysteries'.²² The Eleusinian mysteries were one of the oldest and most widely celebrated rituals in Greek culture.

Eleuthia was a Minoan figure of birth and may have been related to later rituals at Eleusis. So despite the unknown etymology of the pre-Greek word 'Eleuthia', several scholars have conjectured that it was related to Eleusis's rites, because both have underworld labyrinths where one descended into darkness and was reborn into the light.²³ Archaeologists have confirmed the existence of the cave of Eileithya, which Homer recorded near the Cretan city of Amnisos in the *Odyssey*.²⁴ This was the same cave where the Mycenaeans made cult offerings to Enesidaon/Poseidon, the lord of the underworld.²⁵

In this cave Eileithya received 'in Amnisos, a jar of honey',²⁶ according to the same series of Linear B tablets that recorded 'a jar of honey' for 'the Lady of the Labyrinth'. If the labyrinth was initially a cave, some scholars suggest that Eileithya may have also been the 'Mighty Potnia', who was explicitly invoked by the priests at Eleusis and who 'bore a strong son' from the underworld.²⁷ The names and precise rituals changed between Minoan Crete and Mycenaean Eleusis, but the Archaic Greeks seem to have preserved at Eleusis the basic idea of a tortuous cave cult dedicated to the process and pattern of ongoing death and rebirth.²⁸

Very recent archaeological discoveries even reveal that the Mycenaeans who lived in Eleusis in the twelfth and



Figure 5.4 Drawings of shapes and motifs of pottery from near a platform in front of the Mycenaean Megaron B at Eleusis.

eleventh centuries BCE were still making ritual offerings of burnt pig parts in vessels decorated with the Minoan spiral meander pattern in the exact location of the later temple of Eleusis.²⁹ In this way, they may have been keeping the memory of an earlier Minoan ritual alive that was passed down to the Archaic Greeks.

The oldest archaeological evidence we have for the Eleusinian mysteries' mythological basis is a ritual cup from the Minoan middle period showing a snake priestess, shaped like the sacrificial tubes that the Minoans used in cave cult activity. The chthonic serpent priestess on the cup is next to two floating female figures, suggesting a trifold movement between the divine, the living and the dead. The priestess is also looking down at a narcissus flower, which strongly connects her to the Greeks' flower maiden they called Persephone. The scholar of Greek religion Carl Kerényi has argued that Persephone was another name for the Minoan Potnia of the labyrinth who travelled to the underworld and returned to the light.³⁰ 'The mistress was at the center of the true labyrinth, the underworld; she bore a mysterious son and conferred the hope of a return to the light.'³¹

During the Archaic period, the mystery rites of Eleusis similarly included meandering dances around the 'well of the beautiful dances' (*kallichoron phrear*), from the Greek word *chora*, connected with the unlimited and indeterminate

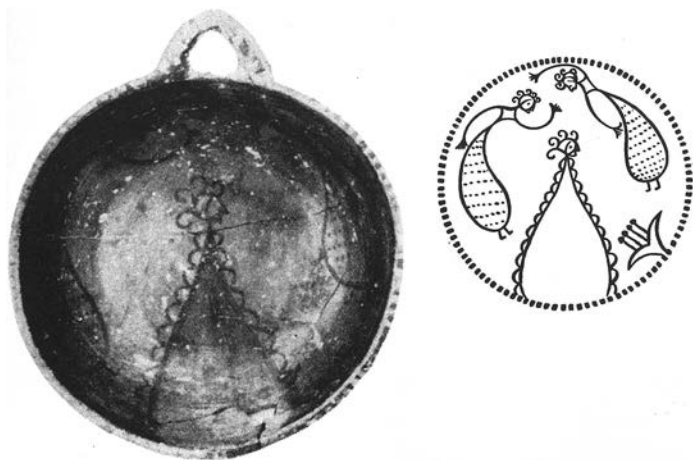


Figure 5.5 Persephone with two companions, on a cup of the Middle Minoan period from the first palace at Phaistos. Archaeological Museum of Heraklion, Crete.



Figure 5.6 Minoan 'snake tubes' found in the sanctuary room at Gournia, Crete. Gournia 1935, left. Gournia 1935, middle; Gournia, 1936, right.

darkness (*khaos*) of the Earth.³² In Classical Greece, authors similarly imagined the underworld as a *labyrinthine* path. For instance, Plato described the underworld as having many twists and turns, and Proclus said it had a ‘three-fold’ path.³³ In this way, the Mycenaeans and Archaic Greeks may have woven Minoan fertility rituals into the myth of a goddess who travelled to the underworld and was initially called *Sito Potnia*, ‘Potnia of the Grain’, in Linear B inscriptions found at Mycenae and Pylos.³⁴ Tablets from around 1400–1200 BCE also refer to ‘two queens and the king’, which likely refers to Demeter, Persephone and the god of the dead,³⁵ described in the ‘Hymn to Demeter’ (c. 675–625 BCE).³⁶

To sum up this complex historical transition: The Mycenaeans and Archaic Greeks divided the Minoan Potnia into the goddess Rhea (the mother goddess of flow) and her daughter Demeter (of the grain). Then they added Demeter’s daughter, Persephone, ‘she who shines in the dark’, who they also called the flower maiden or *Kore*; the feminine form of *koros*, meaning ‘sprout’. Finally, they added a male god of the underworld. Together, the two queens and the king tell a similar but distinctly Archaic story of nature as an endless process of composition, decomposition and recomposition.³⁷

The Archaic ‘Hymn to Demeter’ sang of a world of process and endless seasonal patterns. Persephone was out picking flowers in a beautiful meadow called Nysa, from the Greek word *nýsta*, meaning ‘tiredness, drowsiness, sleepiness’. Notably, Nysa was also the birthplace of Dionysus, the god of intoxication. In this meadow, Persephone discovered the most ‘wonderful, strange, and extraordinary’ narcissus flower, the same flower that the Minoans painted on their frescoes and the sacrificial cup I mentioned above (figure 5.5). More specifically, the flower was the sea

daffodil, whose bulb contains a psychotropic and oneirogenic drug that enhances lucid dreaming.³⁸ According to the hymn, the flower inspired reverential awe, holiness, honour and worship (*sebas*). It smelled so sweetly that it struck all of the gods in the wide heavens, the whole Earth and the salty seas with astonishment and wonder (*thambe-sas*). They all shook with laughter, joy and playful delight (*athúro*).³⁹ In this way, Persephone's drug experience recalls the ecstatic cave rituals on Minoan Crete.

But when Persephone reached for the flower, she was swallowed up by the Earth and taken to the underworld. The flower was a trap laid by Zeus and Gaia. Persephone's



Figure 5.7 Lily fresco. Minoan, 1570–1470 BCE, from Amnisos. Archaeological Museum of Heraklion.

mother, Demeter, who came from Crete,⁴⁰ heard Persephone's screams and searched everywhere for her, but none of the gods or birds would say what had happened. Eventually, Hecate and Helios told her, and Demeter went into mourning. She wandered the Earth as an older woman and would not let anything grow.⁴¹ Demeter eventually arrived at the city of Eleusis and took up residence as a nanny with the king. Her hosts offered her wine, but she refused and chose to drink only a 'sacred' (*hósios*) 'herbal potion' (*kukeon*) of 'barley meal, mint, and water'.⁴²

The gods finally begged Demeter to come back so that winter would end, and they promised to return Persephone. However, before Persephone left the underworld, Hades, lord of the underworld, sneaked a 'flowing seed', *rhoies kokkon*, into her mouth.⁴³ According to the Oxford Greek Dictionary and the Greek botanists Theophrastus and Dioscorides, *rhoia* was the 'corn poppy' (*Papaver rhoeas*).⁴⁴ This is the same opium-bearing poppy depicted in Minoan art with slits down its sides pouring out opium milk, and adorning the ancient ecstatic goddess of flow, Rhea.⁴⁵ It was also the poppy that Demeter held in her hands with her barley bushels in Greek carvings. Indeed, it was also the poppy that the Roman poet Ovid said Persephone was picking in the meadow and that Demeter ate in mourning, and whose milk she fed to the dying child she nursed in Eleusis.⁴⁶ According to the hymn, because Persephone ate the poppy, she had to sleep for half of the year in the underworld.

The Greek mysteries of Eleusis were a ritual retelling and performance of this myth. Initiates (*epoptes*), meaning 'those who have seen first-hand', heard the story of Persephone, sacrificed a piglet, walked 18 miles from Athens to Eleusis, fasted, and searched with torches in the dark for Persephone



Figure 5.8 Minoan female figurine with poppy pod crown. Archaeological Museum of Heraklion.

just as Demeter did. Then many entered the darkened *teles-terion* or inner ‘initiation hall’ of the temple. Columns filled the hall like the sacred groves and labyrinthine caves of Crete. There, the initiates drank, just as Demeter did, the ‘sacred herbal potion’ (*kukeon*) containing a carefully prepared psychedelic barley fungus called ergot, the source of lysergic acid diethylamide (LSD).⁴⁷ In this way, the initiates underwent the ego death, transformation and rebirth common in many psychedelic experiences.⁴⁸

Initiates to the mysteries learned the most profound secret of nature – that everything flows (*rhoía*). The goddess of flow (Rhea) mixes (*kukeon*) everything together in cycles

of decomposition and recomposition. Everything is reborn as something else. As the Greek poet and mystery initiate Pindar wrote, 'Blessed is he who has seen these things before he goes beneath the hollow earth; for he understands the end of mortal life, and the beginning [of a new life].'⁴⁹ The priestesses of Eleusis intended initiates to *undergo* the more general *process* of death and rebirth, like the flowing seeds, sprouts and flowers of Persephone herself.

What does this have to do with the process-view of nature? In these mystery rituals during the Archaic period, there was no religious doctrine or belief about fixed forms or essences, although many later Classical Greeks such as Plato and Pindar predictably offered such transcendent and Orphic interpretations.⁵⁰ As an Archaic ritual practice, though, Eleusis emphasised the performative process of destruction and recreation immanent to the natural processes. The ritual was a relational way of knowing through Demeter's psychedelic grain and Persephone's psychotropic poppy.

The great *mystery* was this: Nature comes into being and passes away in a patterned process like the seasonal growth and death of plants. Nature composes, decomposes and recomposes itself endlessly in iterated cycles. Nothing is static. For the Archaic Greeks, the great mystery of nature was not obscure because it transcended nature, but because it was so profoundly immanent to nature and the knower. Processes fold, cycle and weave into the textures and patterns of daily life. The 'mystery' is that we see the *objects* of everyday life but not the *processes*. In the mystery rituals, Demeter's grain revealed (*mustérion*) a vision of the immanent processes and patterns of nature by direct gnostic initiation (*mústēs*) with one's eyes closed (*múō*) in the darkened cave.

This is philosophically important because it suggests that, for the Archaic Greeks, being was not an object of sight or static knowledge (*epistēmē*), but a sensuous process of becoming and transformation, just like Demeter herself, the iterative 'bringer of the seasons'.⁵¹

Weaving Strings

Lucretius built on this mythopoetic tradition of process and pattern in his own way. He explicitly connected his materialist philosophy of nature with what 'the ancient, learned poets of the Greeks sang' of as 'mother earth goddess of Cretan Mt. Ida'.⁵² However, for Lucretius, only as long as we think of her as the immanent *natural processes of the earth*, and not as a transcendent person who rewards and punishes us, can we 'declare that earth is the mother of the gods'.⁵³

The Earth is the creative and destructive source from which and within which all terrestrial bodies flow. Lucretius says that Mother Earth is the 'unlimited and ever-renewing source' of the flows of springs and rivers, the volcanic flows of matter itself, and the wild flows of plants and animals.⁵⁴ 'Nature remakes one thing from another, [but] she does not allow anything to be born unless it is aided by another's death.'⁵⁵ According to Lucretius, the Earth is the mother of the gods because she contains the 'first threads' (*primordia*), which spread out and weave into many things in many ways and figures.⁵⁶ For Lucretius, visible things are pattern-forms that nature weaves from the mixed movements of its various shoots and branches (*semine*), like the sprout-maiden Persephone.⁵⁷ Lucretius' image of the weaving mother goddess was not original to him, of course, but probably came directly or indirectly from the Homeric myth of Ariadne, who guided Theseus through the labyrinth of the Minotaur

with a string. The names Ariadne and Athena, the Greek goddess of weaving, originated from the original Minoan language and the weaving mistress, Potnia of the labyrinth.⁵⁸

The key theory that Lucretius introduced into this older process-view was that of *simulacra* (images, films or membranes). In his poem, Lucretius describes how nature is woven (*exordia*) together into things (*rerum*) through swerving flows. As matter flows, it weaves different lengths and measures that make things, just like the *textum* of lines and metre in poetry.

Lucretius describes how threads of matter weave together all things and unweave them again. Life and death are two dimensions of the same natural process. In particular, Lucretius uses the word 'simulacra' to describe the way that sensuous things are composed of folded and woven first-threads or *ordia prima*.

I have further shown how the nature of the mind,
and life is braided together from matter,
and is eventually unraveled back into its first-threads,
now I will begin to treat for you what closely relates
to these things: that there exist what we call *simulacra*,
which, like membranes ripped from the outer surface
of things, fly back and forth through the air ...

I have shown how nature is woven together
through spontaneous flows of endless motion
and through various formative lengths
which measure the creation of things⁵⁹

For Lucretius, there are no absolutely discrete things – only thread-like processes. Visible things are 'drawn out' and continually woven by matter. The simulacra theory is significant in this material kinetic tradition because it rejects the idea of fixed 'essences'. According to Lucretius,

below the manifold and moving simulacra there is no 'real thing' that remains the same despite the peeling away of its membranes.

In this way, simulacra are not copies of things – *things are simulacra*. Things have the forms they do because their simulacra move or *draw out their figures*.

I say, therefore, that forms and fine figures of things
are sent out from things, from their outer surface⁶⁰

Strands or strings of matter always figure form.⁶¹ The first-threads are the sprouts of things, and like sprouts, they shed their outer husk, rind, bark or shell (*corpore eorum*)⁶² as they move. In this way, moving matter draws out the forms of things like a picture or woven pattern.

First of all, since in the case of visible things
many things give off *corpora*, in part scattered loosely,
as wood gives off smoke, and fire heat,
and in part more closely woven and compacted, just as at
times
when cicadas shed their smoothly rounded clothing in
summer,
and when calves while being born give off films
from their outer surface, and likewise when a slippery
serpent
sheds its covering on thorns (for we often see
bushes decorated with their fluttering body-armor).⁶³

Lucretius is quite explicit about the patterned nature of things. Matter (*corpora*) pours out of things (*diffusa solute*) and weaves (*contexta*) figures together like fabrics, clothing (*tunicas*) or armour (*vestem*).⁶⁴ When nature weaves these membranes loosely, they scatter like smoke. When nature weaves them more tightly, they come off like a whole shell or snakeskin.

Simulacra are not copies but, like snakeskin or smoke, are entirely material and immanent to things. Lucretius thus jettisons the Platonic theory of model and copy, subject and object, and replaces it with a thoroughly materialist theory of active and diffractive simulacra.⁶⁵

The forms of things are drawn by moving figures, but the flow of the *corpora* cannot be strictly linear because it is habitually (*solerent*) swerving.⁶⁶ However, when matter swerves together in certain patterns it can produce the appearance of a relatively linear sequence of images. Therefore, the string figures are not static images flying through empty space. As they move, they diffract with one another and with the air itself. They only preserve their figure when they persevere in their order of motion.

For why those should fall and separate from things
more than those which are thin; there is no possibility of
uttering,
especially since there exist on the outer surface of things
corpora
which are many and minute, which can be thrown off in
the same
order which they had before and preserve the form of the
figure,
and much more quickly, being less able to be impeded
in as much as they are few and are located right up front.⁶⁷

Matter is continually falling (*cadant*) off things (*recedant*).⁶⁸ Still, when it is thrown (*iaci*) off in the same order or pattern (*ordine eodem*), its form is preserved by its kinetic figure (*formai servare figuram*).⁶⁹

In other words, matter is active in the shapes that it traces out in space. Objects have no static form or essence. As their Latin root suggests, objects are what are ‘thrown off’, *iaci*, ‘-jected’. But beneath objects there are only processes.

There is only the process of simulacra flying off things in ways that more or less preserve their figure in mid-air.

This is how Lucretius described a world of processes and patterns that weave and unweave everything around us. In the next chapter, we see how Marx, Woolf and a few quantum physicists adopted the ideas of process and pattern from Lucretius and how they applied these ideas to politics, art and science.

Notes

- 1 Robert B. Koehl, 'The Ambiguity of the Minoan Mind', in Eva Alram-Stern, Fritz Blakolmer, Sigrid Deger-Jalkotzy, Robert Laffineur and Jörg Weilharter (eds), *Metaphysis: Ritual, Myth and Symbolism in the Aegean Bronze Age. 15th International Aegean Conference, University of Vienna, 22–25 April 2014* (Leuven: Peeters, 2016), 470.
- 2 See Bogdan Rutkowski, *The Cult Places of the Aegean* (New Haven, CT: Yale University Press, 1986), 149; Oliver Dickinson, *The Aegean Bronze Age* (Cambridge: Cambridge University Press, 1994), 265; and Vesa-Pekka Herva, 'Flower Lovers, After All? Rethinking Religion and Human-Environment Relations in Minoan Crete', *World Archaeology* 38, no. 4 (2006): 590.
- 3 See Herva, 'Flower Lovers'; Anne Baring and Jules Cashford, *The Myth of the Goddess: Evolution of an Image* (London: Arkana, 2000); R. F. Willets, *Ancient Crete: A Social History from Early Times until the Roman Occupation* (London: Routledge, 1965); and Marija Gimbutas, *The Gods and Goddesses of Old Europe, 7000 to 3500 BC: Myths, Legends and Cult Images* (Berkeley: University of California Press, 1974).
- 4 See Carl Kerényi, *Dionysos: Archetypal Image of Indestructible Life*, trans. Ralph Manheim (Princeton, NJ: Princeton University Press, 1976).
- 5 Henriette A. Groenewegen-Frankfort, *Arrest and Movement: An Essay on Space and Time in the Representational Art of the Ancient Near East* (London: Faber and Faber, 1951), 186.
- 6 Ibid., 199.
- 7 For the suggestion that Linear B *da-pu2-ri-to* came from Linear A (-) *DU-PU2-RE* and that the latter meant 'sacred cave', see Francesco Aspesi, *Archeonimi del labirinto e della ninfa* (Rome: 'L'Erma' di Bretschneider, 2011), 11–37. For different interpretations of Linear A *DU-PU2-RE* and the texts in which it is attested, see recently

- Brent Davis, 'Syntax in Linear A: The Word-Order of the "Libation Formula"', *Kadmos* 52, no. 1 (2013): 43 n.6. See also Barbara Montecchi, 'The Labyrinth: Building, Myth, and Symbol', in Eva Alram-Stern, Fritz Blakolmer, Sigrid Deger-Jalkotzy, Robert Laffineur and Jörg Weilhartner (eds), *Metaphysis: Ritual, Myth and Symbolism in the Aegean Bronze Age. 15th International Aegean Conference, University of Vienna, 22–25 April 2014* (Leuven: Peeters, 2016), 165–74. See also Antonis Kotsonas, 'A Cultural History of the Cretan Labyrinth: Monument and Memory from Prehistory to the Present', *American Journal of Archaeology* 122, no. 3 (2018): 367–96.
- 8 Montecchi, 'The Labyrinth', 166.
- 9 See Montecchi, 'The Labyrinth', 173; Kotsonas, 'Cultural History'; and Giulia Sarullo, 'The Cretan Labyrinth: Palace or Cave?', *Caerdria* 37 (2008): 31–40.
- 10 John C. Montegu, 'Note on the Labyrinths of Didyma', *American Journal of Archaeology* 80, no. 3 (1976), 304–5.
- 11 Ovid compares the Labyrinth's passageways built by Daedalus with the winding course of the Meander river. Ovid, *Metamorphoses Volume 1: Books 1–8*, trans. Frank Justus Miller, ed. G. P. Gould (Cambridge, MA: Harvard University Press, 1984), VIII.162–8.
- 12 Montecchi, 'The Labyrinth', 170.
- 13 Loeta Tyree, 'Diachronic Changes in Minoan Cave Cult', in Robert Laffineur and Robin Hägg (eds), *POTNIA: Deities and Religion in the Aegean Bronze Age* (Liège and Austin, TX: Université de Liège and the University of Texas at Austin, 2001), 39–50 (43).
- 14 For fascinating evidence of drinking vessels in ecstatic cave ritual, see *ibid.*
- 15 There are many possible causes of ecstatic states in Minoan caves, including drugs, music, dancing and even reduced oxygen levels in certain cave spaces. See Yafit Kedar, Gil Kedar and Ran Barkari, 'Hypoxia in Paleolithic Decorated Caves: The Use of Artificial Light in Deep Caves Reduces Oxygen Concentration and Induces Altered States of Consciousness', *Time & Mind: The Journal of Archaeology, Consciousness and Culture* 14, no. 2 (2021): 181–216, <https://doi.org/10.1080/1751696X.2021.1903177>.
- 16 Tyree, 'Diachronic Changes'; Martin P. Nilsson, *The Minoan-Mycenaean Religion and Its Survival in Greek Religion*, 2nd edn (Lund: Gleerup, 1950), 470.
- 17 Tyree, 'Diachronic Changes', 44.
- 18 *Ibid.*, 41.
- 19 Cited in Koehl, 'The Ambiguity of the Minoan Mind', 471.

- 20 Ibid., 469–70.
- 21 Kerenyi, *Dionysos*, 90.
- 22 Baring and Cashford, *Myth of the Goddess*, 377–85.
- 23 Nilsson, *The Minoan-Mycenaean Religion*, 521; R. F. Willetts, *Cretan Cults and Festivals* (Abingdon: Routledge, 2013). See also Fritz Schachermeyer, *Die Minoische Kultur des alten Kreta* (Stuttgart: Kohlhammer, 1967), 141–2.
- 24 Homer, *Odyssey Volume 1: Books 1–12*, trans. A. T. Murray, ed. George E. Dimock (Cambridge, MA: Harvard University Press, 1919), XIX.189.
- 25 Tablet KN Ma 719. Cited in Bernard C. Dietrich, *The Origins of Greek Religion* (Bristol: Bristol Phoenix Press, 1974), 221.
- 26 Tablet KN Gg 705. Cited in Sarullo, ‘Cretan Labyrinth’, 38.
- 27 Dietrich, *Origins*, 167. See note 198 on the evidence for this phrase being used during the rites of Eleusis.
- 28 Dietrich says that ‘a strong memory of a divine son and a cave cult have survived in Eleusis’. Ibid.
- 29 Michael B. Cosmopoulos, ‘Cult, Continuity, and Social Memory: Mycenaean Eleusis and the Transition to the Early Iron Age’, *American Journal of Archaeology* 118, no. 3 (2014): 401–27; and Michael B. Cosmopoulos and Deborah Ruscillo, ‘Mycenaean Burnt Animal Sacrifice at Eleusis’, *Oxford Journal of Archaeology* 33, no. 3 (2014): 257–73. Kerenyi makes a strong but more speculative case for mystery cults in Mycenaean Megaron B. See Carl Kerenyi, *Eleusis: Archetypal Image of Mother and Daughter*, trans. Ralph Manheim (Princeton, NJ: Princeton University Press, 1967), 18–25.
- 30 Kerenyi, *Dionysos*, 106–7. See also John Chadwick, *The Mycenaean World* (Cambridge: Cambridge University Press, 1976), 84–101; and Ann Suter, *The Narcissus and the Pomegranate: An Archaeology of the Homeric Hymn to Demeter* (Ann Arbor, MI: University of Michigan Press, 2002), 162. I also agree with some degree of continuity between the Minoan Potnia and Persephone.
- 31 Kerenyi, *Dionysos*, 118.
- 32 Ibid., 93. See also Kerenyi’s discussion of the dance around the well at Eleusis, called the *kallichoron phrear* or ‘well of the beautiful dances’. Kerenyi, *Eleusis*, 70–2.
- 33 Plato, *Phaedo*, ed. and trans. Chris Emlyn-Jones and William Preddy (Cambridge, MA: Harvard University Press, 1917), 108 A; Proklos, *In Platonis Rem publicam commentar: Vol. II*, ed. Wilhelm Kroll (Teuber, 1901), 85 6: *triodous*.

- 34 George E. Mylonas, *Mycenae and the Mycenaean Age* (Princeton, NJ: Princeton University Press, 1967), 159.
- 35 In Crete, Poseidon was often given the title wa-na-ka (*wanax*) in Linear B inscriptions. He was the king of the underworld, and his title E-ne-si-da-o-ne indicates this. See Dietrich, *Origins*, 181–5.
- 36 ‘Wa-na-ssoi, wa-na-ka-te (to the two queens and the king). Wanax is best suited to Poseidon, the special divinity of Pylos. The identity of the two divinities addressed as wanassoi, is uncertain.’ Mylonas, *Mycenae and the Mycenaean Age*, 159. The two queens and the king may refer to Demeter, Persephone and Poseidon. See Chadwick, *The Mycenaean World*.
- 37 The Archaic version is more patriarchal. See Suter, *The Narcissus and the Pomegranate*.
- 38 ‘The narkissos flower figures prominently in Minoan art, on a sacrificial knife and wall paintings and a golden ring, probably the emblem of a shamanic priestess, depicting women as “bee ladies” experiencing a vision, and even a ceramic plate showing a Persephone snake-goddess with her flower. We can identify it as *Pancratium maritimum*, the sea daffodil, of the amaryllis family.’ Carl A. P. Ruck, ‘Mixing the *Kykeon*, Part 3’, *ELEUSIS: Journal of Psychoactive Plants and Compounds* New Series 4, (2000), 23. See also Carl A. P. Ruck, *Sacred Mushroom of the Goddess: Secrets of Eleusis* (Berkeley, CA: Ronin, 2006), 78–9; Maha M. Soltan, Ahmed R. Hamed, Mona H. Hetta and Ahmed A. Hussein, ‘Egyptian *Pancratium maritimum* L. Flowers as a Source of Anti-Alzheimer’s Agents’, *Bulletin of Faculty of Pharmacy, Cairo University* 53, no. 1 (2015): 19–22; and Stephen LaBerge, Kristen LaMarca and Benjamin Baird, ‘Pre-sleep Treatment with Galantamine Stimulates Lucid Dreaming: A Double-blind, Placebo-controlled, Crossover Study’, *PLoS One* 13, no. 8 (2018): e0201246.
- 39 Homer, ‘Hymn to Demeter’, in *The Homeric Hymns*, ed. and trans. Susan Shelmerdine (Newburyport, MA: Focus Publishing, 1995), lines 5–15.
- 40 First century BCE Diodorus of Sicily also says that the mysteries came from Crete, V.77.3. Cited in Kerenyi, *Eleusis*, 24.
- 41 In *The Narcissus and the Pomegranate*, Ann Suter argues that the myth of Demeter was added to the older myths of Persephone in which Persephone accomplished the journey on her own without Demeter or Hades.
- 42 Homer, ‘Hymn to Demeter’, lines 205–10.
- 43 *Ibid.*, lines 270–375.

- 44 See Theophrastus, *Enquiry into Plants*, trans. Arthur F. Hort (London: Heinemann, 1916), Book 9, chapter 12, line 4; Pedanius Dioscorides, *De Materia Medica*, Book 4, chapter 64. According to Carl Ruck and Danny Staples, the chambered pomegranate is also a surrogate for the poppy's narcotic capsule, with its comparable shape and chambered interior. Carl A. P. Ruck and Danny Staples, *The World of Classical Myth: Gods and Goddesses, Heroines and Heroes* (Durham, NC: Carolina Academic Press, 2001).
- 45 For a translation of *rhoia kokkon* as 'corn poppy', see Henry G. Liddell and Robert Scott, *Greek-English Lexicon, With a Revised Supplement* (Oxford: Clarendon Press, 1996). This is in contrast with the Greek word for pomegranate, which is *rodi*. The ancient Greek botanist Theophrastus explicitly gave the name *rhoias* to the corn poppy that grows among the barley. 'Another kind of poppy is that called rhoias, which is like wild chicory, wherefore it is even eaten: it grows in cultivated fields and especially among barley. It has a red flower, and a head as large as a man's finger-nail. It is gathered before the barley-harvest, when it is still somewhat green. It purges downwards.' Theophrastus, *Enquiry into Plants*, 9.12.4.
- 46 See Ovid, *Fasti*, trans. James G. Frazer, ed. G. P. Gould (Cambridge, MA: Harvard University Press, 1931), Book IV, April 12: The Games of Ceres.
- 47 See R. Gordon Wasson, Albert Hofmann and Carl A. P. Ruck, *The Road to Eleusis: Unveiling the Secrets of the Mysteries* (Berkeley, CA: North Atlantic Books, 2008). The most recent edition of this book contains an appendix by a chemist who demonstrates that one only needs wood ash to make the ergot potion psychoactive without toxicity. For a discussion of the hard archaeological evidence for the use of psychedelic ergot in the mysteries, see Brian Muraresku, *The Immortality Key: The Secret History of the Religion with No Name* (New York: St Martin's Press, 2020). The archaeological evidence was discovered at an Eleusian-based mystery cult in Spain. See Jordi Juan-Tresserras, 'La arqueología de las drogas en la Península Ibérica: una síntesis de las recientes investigaciones arqueobotánicas', *Complutum* 11 (2000): 261–74; and E. Pons et al., *Mas Castellar de Pontós (Alt Empordà). Un complex arqueològic d'època ibèrica (Excavacions 1990–1998)* (Girona: Museu d'Arqueologia de Catalunya, 2002), 481.
- 48 For a description of what such an experience might have been like, see Michael Pollan, *How to Change Your Mind: What the New Science of Psychedelics Teaches Us About Consciousness, Dying, Addiction, Depression, and Transcendence* (New York: Penguin, 2018).

- 49 Pindar, fragment 137, in *Nemean Odes, Isthmian Odes, Fragments*, ed. and trans. William H. Race (Cambridge, MA: Harvard University Press, 1997), 384–5.
- 50 Plato described his mystery experience as ‘in a state of perfection’. Plato, *Phaedo*, 250b–c.
- 51 Homer, ‘Hymn to Demeter’, line 192.
- 52 Titus Lucretius Carus, *De Rerum Natura (On the Nature of Things)*, ed. Walter Englert (Newburyport, MA: Focus Publishing, 2003), 2.600–12.
- 53 Ibid., 2.655–60.
- 54 Ibid., 2.590–9.
- 55 Ibid., 1.263–4.
- 56 Ibid., 2.653–4.
- 57 Ibid., 2.686–7.
- 58 See Kerenyi, *Dionysos*, 99–122. Linguist Robert S. P. Beekes has also supported Ariadne having a pre-Greek origin; specifically being a Minoan from Crete.
- 59 Lucretius, *De Rerum Natura*, 4.28.
- 60 Ibid., 4.42–3.
- 61 Donna J. Haraway, *Staying with the Trouble: Making Kin in the Chthulucene* (Durham, NC: Duke University Press, 2016).
- 62 Lucretius, *De Rerum Natura*, 4.43.
- 63 Ibid., 4.54–62.
- 64 Ibid., 4.55, 4.57, 4.58, 4.61.
- 65 See also Gilles Deleuze, *Logic of Sense*, trans. Mark Lester and Charles Stivale (New York: Columbia University Press, 1990), 266–79. On the question of how to interpret Lucretius’ optical theory, see Thomas Nail, *Lucretius II: An Ethics of Motion* (Edinburgh: Edinburgh University Press, 2020), 153.
- 66 Lucretius, *De Rerum Natura*, 2.221.
- 67 Ibid., 4.65–71.
- 68 Ibid., 4.65.
- 69 Ibid., 4.68, 4.69.

Chapter 6

Modern Process and Pattern: Marx's Motion, Woolf's Waves and Quantum Gravity

Marx's Forms of Motion

The primary focus of Marx's masterwork, *Capital: Critique of Political Economy, Vol. 1: The Process of Capitalist Production* (1867), was to understand the nature of social motion and the *process* of production. Marx's fundamental methodological orientation to modern society was process-oriented.¹ Society, like all sensuous nature for Marx, was nothing other than matter in motion. Social motions are neither predetermined substances nor random events but emergent and dialectical patterns. Various patterns of movement emerge, persist, dissipate and re-emerge historically.

Modern society moves according to what Marx calls a *Bewegungsform*, 'form of motion' or 'motion-form'.² The process of material production creates social patterns or forms of circulation. Matter in motion, as Marx says following Lucretius, produces moving forms, including the 'value-form' that defines capitalism.

Indeed, Marx described the philosophical aim of *Capital* like this: 'it is the ultimate aim of this work to reveal the economic law of motion [*Bewegungsgesetz*] of modern society'.³ But what is a law of motion? Law, for Marx, is something laid down through a process or pattern of motion. Law cannot pre-exist someone actively laying it down through

movement. If Marx believed that law was natural and fixed, this would be an ahistorical and non-dialectical 'ultimate aim' of nature. This would not fit with his theory of the indeterminate swerve that we read in his dissertation.

The whole of part one of *Capital* is a careful theory of how the movement of the material production process becomes 'settled' into patterns of constant exchange and custom, resulting in value or 'abstract labor time'. Once settled, however, these patterns can become unquestioned habits. It may 'seem' *as if* these patterns had always been there or that they were natural forms of motion. We may even *act as if* these patterns are universal laws. But this is not the case.

As Marx says in the postface of *Capital*: only after the social 'forms of motion' have become settled historically can we determine the real effective motions.⁴ Only after the *historical movement* is complete can the *conceptual form* present the 'real form of motion' in contrast to the 'mystical' Hegelian 'idea' which acts as if it were prior to history.⁵ Because matter is an indeterminate process, Marx cannot believe in Newtonian natural law or Hegelian dialectical law.⁶

Instead, Marx got his theory of law from Lucretius. Marx made this clear in his doctoral thesis when he wrote that '*declinatio atomi a recta via* is the law'.⁷ The *swerve* of the atom is the *lex atomi*, or the law of the atom. For Marx, law is simply the tendency for matter to move indeterminately and dialectically through non-predetermined motions. In other words, the law of matter is to swerve away from all fixed laws. This is a strange law, indeed.

However, just because the movement of matter is unpredictable does not mean it is random. For Marx, law is explicitly immanent to the sensuous appearance and qualities

of the matters *in process*. 'For the study of nature', Marx says, 'cannot be pursued in accordance with empty axioms and laws.'⁸ An empty law is a formal law that transcends its historical patterns. Law, for Marx, must be a kinetic form or settled pattern specific to the qualities and domain of its sensuous appearance. Marx's theory here is related to Hegel's description of law as the 'source of a self-kindling movement',⁹ but Marx goes beyond this with the materialist law of the atom's self-swerving. 'That is, it is no external condition of motion but being-for-self, immanent, absolute movement itself.'¹⁰

Only in Lucretius' materialism of the swerve does the law and form of motion become purely immanent. There is no interaction *between* law and motion. Law is *nothing other than* the immanent form or pattern of motion. As Marx writes about capitalism, 'The life process of capital consists only in its movement as value constantly expanding, constantly multiplying itself.'¹¹

Just as the moon traces real patterns in the sky that we cannot see all at once without time-lapse photography, so there are also social forms or laws of motion that we cannot see all at once without the aid of historical concepts. Marx says, 'Just as the heavenly bodies always repeat a certain movement, once they have been flung into it, so also does social production, once it has been flung into this movement of alternate expansion and contraction.'¹² The patterns or laws of social motion are real and immanent, but because they are processes and not discrete things, we tend to mistake the product for the process. This mistake is the central problem that Marx calls 'fetishism'. It occurs when we think that there is a natural hierarchy of one thing over another.

For Marx, economic value fluctuates and changes not because it is 'accidental and purely relative',¹³ but because

there is a secret form of motion (*Form einer Bewegung*) operating beneath the cover of the apparent discreteness of the commodity-form:

These magnitudes vary continually [*wechseln beständig*], independently of the will, foreknowledge and actions of the exchangers. Their own movement [*Bewegung*] within society has for them the form of a movement [*Form einer Bewegung*] made by things, and these things, far from being under their control, in fact control them.¹⁴

Social value, for Marx, is ultimately defined by the process of metabolism or continual interchange (*wechseln beständig*) that I discussed in Chapter 2. Economic values move *as if* they had no qualities, but they still have a specific form of motion. For example, the circulation of capitalist value still depletes the soil, kidnaps people from their homes, and treats women's bodies as wombs to reproduce labour. Social patterns of motion follow hierarchical ways of thinking and acting as if they, too, were eternal principles.

A social form of motion is the hanging-together of collective action in interdependent patterns. What at first appeared to political economists as an 'accidental and purely relative' form of motion, Marx exposed as a specific structure with its own pattern of motion defined by the production and movement of economic value:

All the different kinds of private labour which are carried on independently of one another; and yet, as spontaneously developed branches of the social division of labour, are in a situation of all-round dependence on one another [*allseitig von einander abhängigen*].¹⁵

Together, all these seemingly random individual motions are part of a larger pattern of motion that hangs together on all sides.

The secret of what Marx calls 'commodity fetishism' is that there are laws, forms or patterns of motion that both structure the birth of value and hide beneath the apparent randomness and arbitrary structures of domination and economic exploitation. If we want to create a world without domination, for Marx, we need to see that everything is flexible processes and patterns and not fixed hierarchies. There are no eternal laws, only emergent dialectical ones. This does not necessarily tell us what to do, but lets us know that we have the freedom to experiment with patterns that might be better. The social conflict or antagonism is between those who believe in fixed forms and those who want to experiment with more flexible patterns.

Woolf's Waves and Webs

Woolf also drew directly from Lucretius in her understanding of the world as processes and patterns. Woolf wanted to describe the nature of things as they are below the surface of solid objects, which she says float like corks in the fluid medium of 'reality'. In Woolf's moments of being, she described the world and herself as waves, curled up, iterated and diffracted.

'I see myself as a fish in a stream; deflected; held in place', she wrote.¹⁶ Woolf felt in these moments not like a generic flux but as a particular metastable formation. She was like a fish, a process or flow whose movement with and against a moving current gave the appearance of stability. Woolf said she 'fancies [herself] afloat, [in an element] which is all the time responding to things we have no words for – exposed to some invisible ray'.¹⁷ The world and her body continually changed with one another in a fluid medium of imperceptible relational patterns.

Writing, for Woolf, runs up against the limits of representation precisely because of the fluid nature of reality. How can a static word or idea possibly capture a fluid process? The challenge of writing, for Woolf, was how to say the unsayable. How can we *become* part of the process *through* writing without representing the process *with* writing?

The problem of reconciling *process* and *solidity* haunted Woolf her whole life.

And now is life very solid or very shifting? I am haunted by the two contradictions. This has gone on forever; goes down to the bottom of the world – this *moment* I stand on. Also, it is transitory, flying, diaphanous. I shall pass like a cloud on the waves. Perhaps it may be that though we change; one flying after another, so quick, so quick, yet we are somehow successive, and continuous.¹⁸

For Woolf, the world is neither discrete solid objects, what she called the ‘cotton wool’ of everyday life, nor some vitalistic force. Instead, she wrote that her ‘constant idea’ or ‘philosophy’ was that the world is moving *patterns* whose metastable formations are wholly immanent with the diaphanous flows that fly so quickly through them.¹⁹ This is why Woolf was fascinated by waves and even named one of her novels *The Waves*. A wave is curled and folded up into a relatively solid moving object, but is also a continuously changing fluid process at the same time. Woolf was not just a stream of consciousness writer. For her, *everything* was streaming.

Woolf discovered these moving patterns beneath the surface of appearances in her moments. She wrote that ‘Behind the cotton wool is hidden a pattern; that we; I mean all human beings; are connected with this; that the whole world is a work of art; that we are parts of that work of art.’²⁰ Woolf says she uncovered the world as a patterned

work of art below the apparent discreteness of things. This pattern is not a question of *beauty*, as Woolf put it, but of *being*.²¹ Aesthetic patterns are real patterns, not merely subjective states. Patterns are what weave together all the qualities that make up sensuous reality. This is why Woolf says "The proper stuff of fiction" does not exist; everything is the proper stuff of fiction', because everything is woven of the same process-reality.²²

In her moments, Woolf described 'a revelation of some order', 'some real thing behind appearances'.²³ But we should note that the patterns are immanent to the appearances, for Woolf, and not beyond them. Appearances are not false, but just the tips of the icebergs of reality. The appearances of discrete things are like 'little corks that mark a sunken net'²⁴ of something 'immeasurable; a net whose fibres pass imperceptibly beneath the world'.²⁵ The 'real thing' is not a discrete object but rather an expansive and entangled pattern weaving the world together. These patterns or nets, as Woolf called them, are the 'invisible ... backgrounds', or 'scaffolding', 'behind' but *immanent to* the world.²⁶ They are the processes that sustain metastable appearances – the flows upon which the corks of people and objects float. These background patterns 'prove that one's life is not confined to one's body and what one says and does; one is living all the time in relation to certain background rods or conceptions. Mine is that there is a pattern hid behind the cotton wool.'²⁷ The patterns beneath the cotton wool are not discrete substances or visible things, but this does not mean that they are metaphysical, for Woolf. The patterns are invisible, but not because they are beyond reality. They *are reality* itself, as a web or net of relational processes. As processes, though, they often elude us. Art is needed to reveal them.

Woolf described the kinetic nature of these patterns similarly in her essay 'Modern Fiction'.

Look within and life, it seems, is very far from being 'like this'. Examine for a moment an ordinary mind on an ordinary day. The mind receives a myriad impressions – trivial, fantastic, evanescent, or engraved with the sharpness of steel. From all sides they come, an incessant shower of innumerable atoms; and as they fall, as they shape themselves into the life of Monday or Tuesday, the accent falls differently from of old; the moment of importance came not here but there.²⁸

Life does not occur as a series of accurate empirical descriptions. Instead, it contains innumerable material processes whose iterative movements produce and sustain the forms of life and reality itself. Depending on the relations and the swerve of matter, daily empirical life comes together even though the falling matter itself *is not something empirical*.

This description is a fascinating interpretation of Lucretius – whom Woolf, her Latin tutor, her husband, her father, her brother and many in her Bloomsbury cohort all read closely and discussed.²⁹ Woolf's description of reality above is nearly identical to that of Lucretius in *De Rerum Natura*. Woolf says that matter falls into the 'shape' of things, just as Lucretius described the movement of simulacra weaving into the figures and forms of things. In this way, Woolf and Lucretius both agree that the discrete stuff we see with our eyes is only the surface shape of a deeper kinetic pattern produced by continually folded and woven flows of simulacra.³⁰

Woolf, drawing on Lucretius, thus gave the novelist the same task that Lucretius gave to the poet-philosopher: to describe these unknown kinetic patterns.

Let us record the atoms as they fall upon the mind in the order in which they fall, let us trace the pattern, however disconnected and incoherent in appearance, which each sight or incident scores upon the consciousness. Let us not take it for granted that life exists more fully in what is commonly thought big than in what is commonly thought small.³¹

For Woolf, modern fiction aims to trace these material-kinetic patterns and processes behind life's cotton wool. This is a fantastic proposal. Woolf essentially tells us that art's challenge is not to describe or represent the empirical world but to describe its material processes and patterns. As she says in her autobiography, the description of these patterns is performatively part of them: 'I make it real by putting it into words.' Life exists in these small, invisible, background processes, just as much as in the macroscopic world of people and things.

Quantum Gravity

Lucretius was also an important precursor to process understandings of objects in physics. The quantum theorist Carlo Rovelli argues that 'The very idea of Einstein's, that the existence of atoms is revealed by the Brownian motion of minute particles immersed in a fluid, may be traced back to Lucretius.'³² Einstein proved that solids, liquids and gases are not static objects but metastable processes. He called this the 'kinetic theory of matter', and Lucretius described it two thousand years earlier in his theory of simulacra.

Rovelli also recognises that one of the consequences of Lucretius' theory of indeterminacy is that objects are processes and vibrational patterns.

Due to this indeterminacy, in the world described by quantum mechanics, things are constantly subject to random change. All the variables ‘fluctuate’ continually, as if, at the smallest scale, every thing was constantly vibrating. We do not see these omnipresent fluctuations only because of their small scale; they cannot be observed at large scale, as when we observe macroscopic bodies. If we look at a stone, it stays still. But if we could see its atoms, we would observe them to be always now here and now there, in ceaseless vibration. Quantum mechanics reveals to us that the more we look at the detail of the world, the less constant it is. The world is not made up of tiny pebbles. It is a world of vibrations, a continuous fluctuation, a microscopic swarming of fleeting microevents.³³

The idea that nature is indeterminate relational processes woven together into emergent patterns and cycles is a core aspect of Rovelli’s ‘relational’ interpretation of the quantum theory of gravity. In quantum physics, what appear to be relatively static classical objects, molecules and atoms, are metastable states of vibrating energy fields. Rovelli argues that the same is true for space and time.

‘The world is in a ceaseless process of change’, down to the most fundamental processes of matter and motion in quantum physics.³⁴ It is also possible that indeterminate and relational quantum processes are even more fundamental than space and time itself. This is the theory called quantum gravity. As Rovelli writes,

We can think of the world as made up of *things*. Of *substances*. Of *entities*. Of something that *is*. Or we can think of it as made up of *events*. Of *happenings*. Of *processes*. Of something that *occurs*. Something that does not last, and that undergoes continual transformation, that is not permanent in time. The destruction of the notion of time in fundamental physics is the crumbling of the first of these two perspectives,

not of the second. It is the realization of the ubiquity of impermanence, not of stasis in a motionless time.³⁵

If quantum processes are genuinely fundamental, as Lucretius argued long ago, then even space and time are emergent properties of matter in motion. Our entire universe unfolded itself into stars, galaxies and black holes from an indeterminately high-energy region at the moment of the Big Bang.

Rovelli even argues that the Big Bang did not come from nothing (just as Lucretius argued) but from a previous universe that contracted into a tiny region of quantum space and then exploded into our universe. He and other physicists call this the ‘big bounce’ theory, and many physicists hypothesise that the birth and death of the cosmos has occurred innumerable times before. If quantum gravity is correct, our universe may begin to contract again at some point, and so on in a grand cycle of creation and destruction similar to that described by the ancient Minoan labyrinth ritual – but on a much larger scale than they imagined.

If there were no determinate space, time, matter, physical laws or fundamental fields before the Big Bang, then everything came to be through *processes* and *patterns* of relational iteration. For Rovelli, this is the source of Lucretius’ philosophy and ethics: ‘There is [in Lucretius] a deep love of nature, a serene immersion within it; a recognition that we are profoundly part of it; that men, women, animals, plants, and clouds are organic threads of a marvelous whole, without hierarchies.’³⁶ Rovelli correctly understands that Lucretius’ physics of interwoven processes is also related to his ethical theory, which rejects all fixed ontological hierarchies.

Similarly, Rovelli proposes to visualise the immanent feedback patterns between quantum fields as loops or

bubbles in space. In the late nineteenth century, Michael Faraday was the first to think of the magnetic field as continuous ‘lines of induction’.³⁷ In quantum-field theory, excitations in these energetic field lines produce a ‘vortical whirling’³⁸ or ‘bubbling’³⁹ effect on the surface of the field, causing it to interact with itself and with other fields. In other words, the field lines ‘loop’ back over themselves in cycles of continual feedback and transformation.

This idea is the basis of the ‘loop’ in what Rovelli calls ‘loop quantum gravity’. Loop quantum gravity treats these energy loops as composing the primary fabric of spacetime itself. ‘The closed lines that appear in the solutions of the Wheeler–DeWitt equation are Faraday lines of the gravitational field’, Rovelli argues.⁴⁰ The assemblage of all these active quantum-field loops produces a ‘spin foam network’, so-called because its loops weave together the texture of space itself. Physicists call it a “[f]oam” because it has surfaces that meet on lines, which in turn meet on vertices, resembling a foam of soap bubbles’.⁴¹

In short, the idea is that the feedback patterns of quantum processes are primary ontological aspects at the heart of space and time itself. Objects are first and foremost processes that fold into loops and foams. As Rovelli explains,

In the world described by quantum mechanics, there is no reality except in the relations between physical systems. It isn’t things that enter into relations, but rather relations that ground the notion of thing. The world of quantum mechanics is not a world of objects: it is a world of events. Things are built by the happening of elementary events. As the philosopher Nelson Goodman wrote in the 1950s, with a beautiful phrase: ‘An object is a monotonous process.’ A stone is a vibration of quanta that maintains its structure for a while, just as a marine wave maintains its identity for a while, before melting again into the sea.⁴²

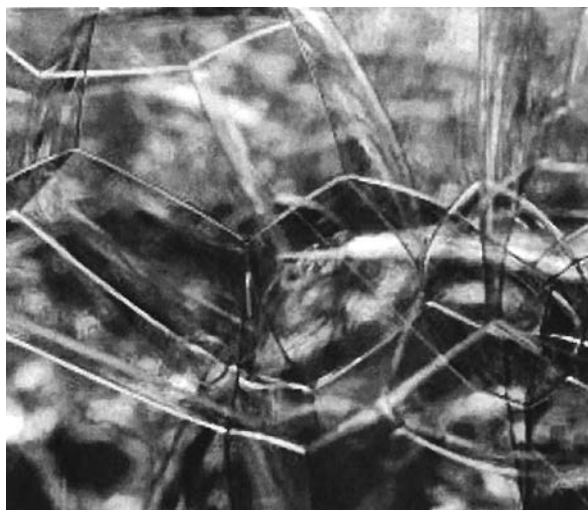


Figure 6.1 Energy loops and folds together to generate space, similar to the way soap forms bubbles.

Matter and motion weave the bubbling fabric or sea within which spacetime and objects are iterated patterns. The looping nature of objects means that, as the philosopher and physicist Karen Barad writes, matter ‘intra-acts with itself (and with other particles)’.⁴³ Quantum theory is not just a theory of indeterminate processes but of intra-active and diffractive patterns where processes affect themselves and others to produce a tangle of metastable particles. If this is the case, there are not relations between *relata* in space and time, but rather processes weave spacetime. This is why Barad calls it ‘spacetimemattering’.⁴⁴

This is also what ‘entropic gravity theory’ proposes. In the quantum vacuum, which we discussed in the first chapter, the higher the degree of entanglement, the higher the entropy of a specific region. Thus the measure of entropy in a given region, according to physicist Sean Carroll, ‘turns

out to be naturally proportional to the area of the region's boundary. The reason isn't hard to understand: field vibrations in one part of space are entangled with regions all over, but most of the entanglement is concentrated on nearby regions.⁴⁵

The higher the entanglement, the higher the entropy, and the closer the fluctuations are to one another. The weaker the entanglement, the more distant. Thus the laws of spacetime in general relativity, according to this theory, emerge from entropic and entangled processes.⁴⁶ In short, the conclusion of loop quantum gravity and entropic gravity theories is that spacetime is an emergent pattern of quantum processes. This is a big idea and requires more experimental evidence before general relativity and quantum theory can be reconciled in a quantum theory of gravity. But if quantum theory can be experimentally reconciled with general relativity, it will also fit well into the trajectory of kinetic materialism traced in this book.

Now, we have covered a lot of history in this book relatively quickly. So in the next chapter, I will conclude with a brief summary of the key takeaways from this history.

Notes

- 1 For a full argument, see Thomas Nail, *Marx in Motion: A New Materialist Marxism* (Oxford: Oxford University Press, 2020).
- 2 See Karl Marx and Frederick Engels, *Marx-Engels-Gesamtausgabe, Vol. 10* (Berlin: Dietz, 1975), 17, 98, 103, 108.
- 3 Karl Marx, *Capital: A Critique of Political Economy, Vol. 1*, trans. Ben Fowkes (New York: Penguin, 1990), 92.
- 4 *Ibid.*, 103.
- 5 *Ibid.*
- 6 John P. Burkett, 'Marx's Concept of an Economic Law of Motion', *History of Political Economy* 32, no. 2 (2000): 381–94.

- 7 Karl Marx and Frederick Engels, *Marx & Engels Collected Works, Volume 1: Karl Marx 1835–43* (London: Lawrence and Wishart, 1975), 472–3. Hereafter *MECW*.
- 8 *Ibid.*, 68.
- 9 G. W. F. Hegel, *Science of Logic* (1812) (New York: Humanities Press, 1966), 2:365.
- 10 Marx and Engels, *MECW, Volume 1*, 474.
- 11 Karl Marx and Frederick Engels, *Marx & Engels Collected Works, Volume 35* (London: Lawrence and Wishart, 1975), 315.
- 12 Marx, *Capital, Vol. 1*, 786.
- 13 *Ibid.*, 126.
- 14 *Ibid.*, 167–8.
- 15 *Ibid.*, 168.
- 16 Virginia Woolf, *Moments of Being: Unpublished Autobiographical Writings*, ed. Jeanne Schulkind (New York: Harcourt Brace Jovanovich, 1976), 80.
- 17 *Ibid.*, 115.
- 18 Virginia Woolf, *A Writer's Diary: Being Extracts from the Diary of Virginia Woolf*, ed. Leonard Woolf (1954) (Orlando, FL: Harcourt, 1982), 138. My italics.
- 19 Woolf, *Moments of Being*, 72.
- 20 *Ibid.*
- 21 Woolf, *A Writer's Diary*, 85.
- 22 Virginia Woolf, *The Essays of Virginia Woolf: Volume 4: 1925–1928*, ed. Andrew McNeillie (Orlando, FL: Harcourt, 1994), 164.
- 23 Woolf, *Moments of Being*, 72
- 24 Woolf, *Moments of Being*, 116.
- 25 Virginia Woolf, *The Waves* (1931) (Orlando, FL: Harvest/Harcourt, 1959), 214.
- 26 Woolf, *Moments of Being*, 73.
- 27 *Ibid.*
- 28 Woolf, *Essays, Vol. 4*, 160.
- 29 See Susanna Rich, “‘De undarum natura’: Lucretius and Woolf in *The Waves*”, *Journal of Modern Literature* 23, no. 2 (1999–2000): 249–57; and James Morland, ‘The Influence of Lucretius on Unity in *The Waves*’, *Virginia Woolf Bulletin* 38 (2011): 23–6.
- 30 For a full commentary and analysis of this, see Thomas Nail, *Lucretius I: An Ontology of Motion* (Edinburgh: Edinburgh University Press, 2018); and Thomas Nail, *Lucretius II: An Ethics of Motion* (Edinburgh: Edinburgh University Press, 2020).
- 31 Woolf, *Essays, Vol. 4*, 161.

- 32 Carlo Rovelli, *Reality Is Not What It Seems: The Journey to Quantum Gravity*, trans. Simon Carnell and Erica Segre (New York: Riverhead Books, 2017), 37.
- 33 Ibid., 132.
- 34 Carlo Rovelli, *The Order of Time*, trans. Erica Segre and Simon Carnell (New York: Riverhead Books, 2018), 97.
- 35 Ibid.
- 36 Rovelli, *Reality*, 39.
- 37 P. M. Harman, *Energy, Force, and Matter: The Conceptual Development of Nineteenth-Century Physics* (Cambridge: Cambridge University Press, 1982), 80; and L. Pearce Williams, *The Origins of Field Theory* (New York: Random House, 1966), 88, 124.
- 38 Frank Close, *The Infinity Puzzle: Quantum Field Theory and the Hunt for an Orderly Universe* (New York: Basic Books, 2011), 43.
- 39 Rovelli, *Reality*, 187.
- 40 Ibid., 161.
- 41 Ibid., 187.
- 42 Ibid., 135.
- 43 Karen Barad, *Meeting the Universe Halfway: Quantum Physics and the Entanglement of Matter and Meaning* (Durham, NC: Duke University Press, 2007), 14.
- 44 Ibid., 179.
- 45 See Sean Carroll, *Something Deeply Hidden: Quantum Worlds and the Emergence of Spacetime* (Boston: Dutton, 2019).
- 46 For more on a review of entropic gravity and its relationship to loop quantum gravity, see Lee Smolin, ‘Newtonian Gravity in Loop Quantum Gravity’, *Perimeter Institute for Theoretical Physics*, 29 October 2018, <https://arxiv.org/pdf/1001.3668.pdf> (accessed 28 April 2023).

Conclusion

In this book, I have presented the reader with a unique genealogy of what I call kinetic materialism. Instead of defining matter and motion as determinate objects moving on a pre-given background of space and time, I have showcased a history of thinkers who, in my reading, understood matter and motion as *indeterminate relational processes*.

As I said in the introduction, my motivation for writing this history was to show the operation of a long and diverse philosophical tradition that has rejected the hierarchy of beings and the passivity of matter and motion. I did this in part because I still worry that if critical philosophy retains an explicitly or implicitly human-centric view of the world, superior to or separate from matter, conceptual and practical hierarchies will remain entrenched in theoretical and daily practice. In my opinion, indeterminacy, relationality and process are three of the most important ideas from history that can help keep us away from metaphysical delusion and naturalised hierarchies.

The takeaway from this history is not that we should necessarily repeat *exactly* what any of these thinkers did or thought. Different histories and geographies call for novel responses. This is why I organised the book around the three ideas of ‘indeterminacy’, ‘relationality’ and ‘process’. Each thinker in this history articulated and expressed these ideas in their own way. Our experimentation with them

today may be as different from these thinkers as they were different from one another.

I would also like to stress again that kinetic materialism does not tell us what we *should* do.¹ The purpose of my writing this history is to inspire the reader by showing them what kinds of ideas and practical consequences *can* follow for religion, art, politics and science if matter and motion are indeterminate relational processes.

Caution is important, though. What might practically result from these ideas today *could* be worse than what we want to avoid. This is possible, but I think it's much more probable that these ideas will help people see what is poison and what is remedy for themselves, without the unnecessary blindfold of metaphysics and hierarchy. There are no guarantees in politics, but if we want to reduce domination and ecological destruction, we have to be free and willing to experiment more responsively in a world of indeterminate processes. Indeed, it might help us to learn from what others in this alternative tradition, and outside the West, have done and thought.

Unfortunately, the tradition of kinetic materialism has travelled underground in Euro-Western geography, like a mushroom mycelium.² It has often lain dormant, or fruited only briefly in odd places before going back underground. Occasionally, radical naturalists, communists and feminists such as Lucretius, Marx and Woolf have picked and eaten its fruits. More frequently, though, it has only been glimpsed from a distance, misidentified or stepped on by various metaphysical philosophies that have preserved ontological hierarchies explicitly or implicitly.

The genealogy of kinetic materialism is a 'dark' antiquity/modernity buried by so-called periods of historical 'enlightenment'. The Ionian enlightenment of the sixth century

BCE, the Renaissance of the fifteenth and sixteenth centuries, and the modern enlightenment of the seventeenth–nineteenth centuries all waged war against the darkness of kinetic materialism. I call the early formation of kinetic materialism ‘dark antiquity’ because the Western tradition associated indeterminacy with dirt, earth, chaos, void, caves, forests, evil, night and death. Matter and motion are what all these terms have in common and why the European tradition placed them at the bottom of its hierarchy.

Kinetic materialism is also dark because of its emphasis on non-representational, performative and relational ways of knowing. In the West’s prevailing idealism, performative knowledge often does not count as ‘real’ because it is not purely objective and illuminated by rational thought.

Kinetic materialism pops up across religion, art, science and politics because it rejects the ontological division between culture, nature and ‘different’ knowledge domains. Matter, in this tradition, is a shape-changer and a parodic trickster. As the French philosopher George Bataille playfully wrote, ‘It is clear that the world is purely parodic, that each thing seen is the parody of another, or is the same thing in a deceptive form.’³

The genealogy I present in this book is not a story of progressive development from primitive to superior articulations of kinetic materialism. Instead, I have tried to highlight how each thinker or tradition expressed a different historical and thematic way of adopting a similar indeterminate relational materialism. Kinetic materialism traverses religion, mythology, poetry, philosophy, politics, literature and science. It has taken me many years of study, writing and teaching to parse all the candidates and transmission lines, some of which are still uncertain. But this is the first book in which I have tried to connect all the dots.

I have also tried to create an iteration of this kinetic materialism in my own philosophy of movement. But there are so many more ways it can be done and has been done in history and around the world. I hope my future research will take me deep down these other paths as well. I also hope that Western philosophers can recognise some of the assumptions they have made about matter and motion and the dangers of the path they have chosen. It is important to remember that there are alternative pathways within their own tradition. But there are similar dangers and alternative pathways in other cultures and geographies as well. May the fruits of all these alternatives be picked and eaten, inspiring us to experiment everywhere with caution and care.

Notes

- 1 On the question of ethics, see Thomas Nail, *Lucretius II: An Ethics of Motion* (Edinburgh: Edinburgh University Press, 2020).
- 2 For an excellent book on mushrooms, ecology and capitalism, see Anna Tsing, *Mushroom at the End of the World: On the Possibility of Life in Capitalist Ruins* (Princeton, NJ: Princeton University Press, 2021).
- 3 Georges Bataille, *Visions of Excess: Selected Writings, 1927–1939*, ed. and trans. Allan Stoekl (Minneapolis: University of Minnesota Press, 1985), 5.

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