Part I

CONTEMPLATION
Highlighting how the living world is poorly served by mechanistic metaphors that deal with inert substances, this chapter outlines liquid life’s key concepts, terminology, and principles that inform the characterisations depicted in sections 01.12, 01.13 and 01.14, which re-problematise the potency of the material realm.
Air

The air is a single, moving fluid that stretches from the heavens to the earth. The higher you go in the air, the less there is of it, but it never actually ends. About halfway from the earth to the moon — say, a hundred thousand miles aloft — one molecule of the air may meet another only every week or so, and the solar wind is as likely to send that molecule into interplanetary space as back down toward the earth. Still, there is just a touch of the air even way up there. (Logan 2012, 7)

The ground is our interface with the core of the world, which exerts a gravitational pull on gaseous molecules that constantly tug upwards into the vacuum of space. In this rarefied realm, our bodies appear to be made up of hierarchies of solid parts, while the air that surrounds us seems as nothingness. If we shut our eyes and enter the realm of the senses, the sun warms our faces and the mischievous air pulls our clothing, as if to raise us aloft. The ancient desire of flight succumbs to this world of flow, which does not wish us bound to the ground but compels us to be free, like wraiths, and rise with the air currents.
If there is magic on this planet, it is contained in water. (Eiseley 1973, 15)

Residing at the boundary between water and other media, our construction of reality is shaped by encounters between our naked senses and the impacts of physics and chemistry on water. Our bodies have learned to carry and contain inner seas. Although this oxide of hydrogen is a versatile and common molecule on Earth, it is also abundant in space accounting for around 10% of interstellar matter, or space ‘dust’, which takes the form of ice. Arising from the primordial clouds of gas that produced the Sun and other stars, it forms in warm, dense regions of space where complex, ionic chemical reactions between hydrogen and oxygen occur. Although the liquid phase of water is relatively rare in the cosmos, it is relatively abundant on our planet, occupying 70% of its surface and its origin is enigmatic. Our already ‘wet’, water-containing planet acquired even more of the stuff during the cometary collisions that characterised the Hadean epoch to form our first seas around 4.6 million years ago. In liquid form, it is a universal solvent with paradoxical properties that are associated with the emergence of ‘life’, which is characterised by constant flux and leaky bodies.

I could see a turbulent stream flowing down between the hills. I could see trees set deep into the ground like huge, one-legged creatures. The stillness of what I could see was only the surface to what lay underneath. Under the bark of the trees I could see rivulets of water, streams of sap flowing up and down the trunk. Under the roof of the house I could see the bodies of people asleep, and their stillness, too, was only superficial — their hearts were beating gently, their blood was rippling in their veins. (Tokarczuk 2003, 1)
Earth

The body of a soil is a sky where seeds and worms and ions fly. (Logan 2007, 171)

Around 3 percent of the Earth’s surface is made up of a thin layer of organic matter, which ranges from a few centimetres to several metres deep, and is folded into much more durable inorganic substances such as sand and clay. These soil amalgams are ‘living hypermaterials’, with complex metabolisms that actively process and organise their substrates, as a continuous, self-producing system. They also host many diverse communities of soil-dwelling creatures. Our own human bodies resonate with the character of this ‘humus’, which references the ancient belief that we sprang from the earth.

People born where the soil is light and sandy are small, with fair, dry, skin. At first glance they seem rather weak and lacking in energy, but they’re like the sand — dogged and able to hold on to life just as pine trees hold on to the sand in which they grow. (Tokarczuk 2003, 190)

The varied composition of our soils betrays our ‘geostory’, a non-human narrative fabric, which is woven through tectonic plates, meteorite impacts, and ice ages (Latour 2013). Permeated by liquid life, these giant bodies orchestrate many acts of ‘biochemical burning’, or metabolism, without need for a central organising system such as DNA, or even a brain. Collectively, soil’s myriad processes orchestrate an unbroken cycle of continuous exchanges that link the living and the dead. Through its expanded and active relationship with death, the metabolic decoherence of a discrete body is neither a passive process, nor a final destination. Soils provide a place for this ‘energetic pause’ of living matter, where constituent molecular systems are released from the constraints of one set of metabolic relationships and, through an active process, are reincorporated into others. Soils may even
be thought of as regenerative ‘hyperorganisms’, whose continual flow and assimilation of resources maintains the cycles of life on this planet, and have done so for the last 3.5 billion years.
... at first the muon was thought to be the Youkawa meson mediating nuclear forces. When it was proved, that the muon is insensitive to the strong force, it was not concluded that ‘muons do not exist’ but ‘muons are not mesons’. This reminds us of the imaginary case treated by [Saul] Kripke where cats are found to be demons. One should not conclude ‘that there turned out to be no cats, but that cats have turned out not to be animals’. (Corsi, Chiara and Ghirardi 1993, 270)

Animism holds that all things, living and non-living, have a spirit and soul. Before the Enlightenment, these occult forces were thought to govern the natural world, under the guidance of an ‘invisible hand’ that was arbitrated by angelic and demonic activities (Vivenza 2005). These concepts are so deep-rooted in our cultural imagination that even during the scientific revolution, the demon as trickster concept was used widely to characterise the unreliable nature of reality. During the seventeenth century, the effects of nature’s mysterious agents started to be named, explained, and actualised, as a tangle of invisible rays. Most of these intangible forces could only be inferred, rather than evidenced, until the nineteenth century when advanced imaging techniques such as photography were developed, which could convert them into readable, physical traces. Ephemeral phenomena that could not be recorded in this manner continued to be attributed to unreliable senses and weakened minds. By the twentieth century, the mysterious effects of angels and demons were replaced by metaphors that generated vivid conceptual models of how material processes work. While many of these models could account for the nature of matter through mathematical formulae and simple causes and effects, others could not decipher the peculiar nature of certain (quantum) effects. Cats are still a favourite metaphor, which have taken the
place of demons, since as contradictory creatures,\(^1\) they embody
the uncertain realms beyond the laws of classical science.

\(^1\) Erwin Schrödinger’s famous thought experiment involves considering the
effects of a sample of radioactive material on a cat locked inside a window-
less box, which is at the same time, alive and dead.
Monsters

Monsters exist, but they are too few in number to be truly dangerous; more dangerous are the common men, the functionaries ready to believe and to act without asking questions. (Levi 1986)

To explore the potential of liquid life is to make monsters. At the heart of evolution, without monsters, there is no change. Only stasis.

I have beheld the birth of life. I have seen the beginning of motion. My pulses throb even to the point of bursting. I long to fly, to swim, to bark, to bellow, to howl. Would that I had wings, a carapace, a shell — that I could breathe out smoke, wield a trunk — make my body writhe, divide myself everywhere — be in everything — emanate with all the odours — develop myself like the plants — flow like water — vibrate like sound — shine like light — assume all forms — penetrate each atom — descend to the very bottom of matter — be matter itself! (Flaubert 2005, 190)

Monsters are only monstrous when an ethics is absented.
… we can’t see other people’s Angels, only our own.
(Rimbaud 2004a, 161)

Angels, and their demonic counterpoints, are transitional beings whose substance is relative, since they are incorporeal and immaterial when encountered by mortals, but embodied and substantial when compared with God (St. John of Damascus 2017). Thomas Aquinas considered angels to be a range of intermediate beings that governed natural law and helped divine forces regulate the universe. In Jewish, Christian and Islamic folklore they play a symbolic role, relaying messages between Heaven and Earth (Stiles 1996, 9), where their wings represent freedom from the material world through flight. They are advisors, conveyers of partial knowledge from enlightened realms and revealers of visions (Stiles 1996, 9) that communicate through many levels of meaning with indeterminate, and even dubious status.

Genesis [the] ‘origin book’ … is the first book and it tells the origin of everything (but it does not tell of the creation of angels). The apparent omission raise[s] troubling implications: it either call[s] into question the completeness of the biblical text, or allow[s] for the possibility that there exist certain creatures which ha[ve] not been made by God. (Sowerby 1983, 19)

While cats stand in for paradoxes and thought experiments in physics — angels and demons are used throughout this book as ethical vehicles for liquid life, which highlight the role of moral agency and decision-making, within the uncertain terrains that characterise the living world. Although modern science has provided many insights into our knowledge of the planet, its account of ‘life’ is incomplete. While we can name the elemental building blocks of the organic realm — carbon, hydrogen,
nitrogen, sulphur, phosphorous—this information still cannot be used to build life from scratch. In search of a better understanding of life's processes, liquid life draws upon those realms that exist beyond the established portfolio of scientific methods that comprise the Modern Synthesis (see section 04.2). Its aim is to develop an ecological engagement with the natural realm, so that its animating forces can be better characterised and engaged through experiment. Both angel and monster, this book conveys ethical questions between knowledge disciplines about our understanding of ‘life’, and juxtaposes science with uncertainty, so that alternative realms and bodies may be called into being.²

It seems ironic that human experiences known by artists and saints and yogis in different cultures over the millennia, and repeated over and over again in quite different situations, are dismissed as superstition and illusion, but an elementary particle that only exists as a nanosecond impulse on a screen seen only by a handful of high priests at CERN at a cost greater than the construction bill for the Great Pyramids is considered to be ‘scientifically real’. Elementary particles are no more real than angels or garden dwarves; they are … ‘brought forth’. Elementary particles are brought forth by linear or ring accelerators, just as angels or bodhisattvas are brought forth by meditation. Physics … is a language. (Thompson 1991, 20)

² In a (hyper)complex reality, we can coherently be many simultaneous things without contradiction: a woman, employee, daughter, mother, citizen, angel, and monster.
A new angelology of words is needed so that we may once again have faith in them. Without the inherence of the angel in the word — and angel means originally ‘emissary,’ ‘message bearer’ — how can we utter anything but personal opinions, things made up in our subjective minds? … We need to recall the angel aspect of the word, recognizing words as independent carriers of soul between people. We need to recall that we do not just make words up or learn them in school, or ever have them fully under control. Words, like angels, are powers that have invisible power over us. They are personal presences, which have whole mythologies: genders, genealogies (etymologies concerning origins and creations), histories, and vogues; and their own guarding, blaspheming, creating, and annihilating effects. For words are persons. This aspect of the word transcends their nominalistic definitions and contexts and evoked in our souls a universal resonance. (Hillman 1991, 28–29)

John Dee and Edward Kelley claimed to have spoken with angels during scrying sessions in 1581, where they acquired knowledge of a language, which bore similarities to calculation tables, with its own alphabet, grammar, and syntax that was documented in manuscripts and workbooks. They asserted this Enochian code, or keys, could reveal the language of angels and so, communicate with other dimensions of reality (Harkness 2008, 5).

Metaphorically allied with angels and transitional beings that enchant our habitats and render our world more liveable, liquid life invokes its own angelology to better describe and engage with the many varied aspects of the living world.

3 John Dee asserted that the Biblical Patriarch Enoch was the last human to speak in the language of angels and so coined the term ‘Enochian’ (Harkness 2008, 147).
... you have to look at everything that changes and moves, that doesn't fit into a shape, that fluctuates and disappears: the surface of the sea, the dances of the sun's corona, earthquakes, the continental drift, snows melting, and glaciers moving, rivers flowing to the sea, seeds germinating, the wind that sculpts mountains, a foetus developing in its mother's belly, wrinkles near the eyes, a body decaying in the grave, wines maturing, or mushrooms growing after a rain. (Tokarczuk 2010, 110)

Although existing lifeforms may already be read as liquid bodies such as venous and arterial circulations, or cerebrospinal system, they are inevitably framed within the conventions of the bête machine. This Enlightenment metaphor frames the characteristics of life as being appropriate for discourses of efficiency, geometric perfection, hierarchies, and determinism. To circumvent these biases, an apparatus for producing direct encounters of liquid bodies is needed. The Bütschli system (see section 09.1) is introduced in this context, as an apparatus that provides a counterpoint to established mechanistic narratives. Operating through the activities of dynamic droplets, it generates direct encounters with a polysemic 'language of angels' (see chapter 09). Arising from the intersecting fields of olive oil and strong (3M) alkali, it generates a semiotic system that conjures dynamic material expressions from liquid states through the actions of matter at far-from-equilibrium states (Armstrong 2015). These computations acquire specific value in conversation with observers and how they are read, is established through juxta-

4 M refers to the 'molar' strength of a solution where one 'mole' of matter (M), equates to the atomic mass of a compound in grams, which is dissolved in one litre of solvent (usually water). In this specific case, the atomic mass of sodium hydroxide is 40, so one mole is 40g and for a 3M solution, 120g of the compound is dissolved in a litre of water.

5 Computation in this sense is not a symbolic operation but an actual, material event made up of iterations of events. It alludes to the kind of platform that Alan Turing was concerned with, in understanding how nature computes.
positions of diverse hermeneutic conventions — such as science, poetry, and design. Revealing a generative ‘angelology’ of material expressions and associated terms, these Bütschli ‘angels’ provide an apparatus, or lens, through which the creativity of liquid life can be examined, experimentally engaged, and reviewed without recourse to the framework of the *bête machine*. 
Angels and Ethics

Every reference to angels is incidental to some other topic. They are not treated in themselves. God’s revelation never aims at informing us regarding the nature of angels. When they are mentioned, it is always in order to inform us further about God, what he does, and how he does it. Since details about angels are not significant for that purpose, they tend to be omitted. (Erickson 1983, 434)

The indeterminate status of angels means they are difficult to characterise and so embody an ethical dimension that asks us to embrace their protean identities and multiple forms, so that we may begin to apprehend the alternative forms of knowledge they convey. Such beings are compatible with Donna Haraway’s notion of Chthulucene, and in this book angels personify the ‘ongoing generative and destructive forces that characterise the natural worlding and reworlding of the planet’ (Haraway 2016).

Many kinds of angels have been described throughout the millennia. The Sumerian bee goddess, flourished in the Mesopotamian civilisation of Sumer between 5300 and 3500 BCE, alongside the first known (bird-)winged figures such as lions and humans, which are thought to be the inspiration and archetype for biblical angels. Bees in particular, have been regarded as purveyors of order since ancient times. Their hives have inspired the organisation of many Mediterranean temples attended by the oracular melissae, who induced ecstatic trances by drinking fermented honey, or mead. The pillars of faith in Islam state that an angel, created from light, accompanies each raindrop, while in Estonian folklore, birds move as angels from the Earth to the heavens taking the souls of the deceased with them. Such a diversity of beliefs is framed by a range of spiritual perspectives that describe various relationships with the natural realm that

6 The cosmos turns around a central world tree in Estonian folklore, of which the Milky Way (linnutee or birds’ way in Estonian) is a branch.
differently incorporate the presence of angels into their communities. As new understanding arises, the messages that angels convey also change along with their nature.

… angels [are a] prism through which to study broader changes in contemporary society. (Sowerby 2016, 4)

During the European Middle Ages, the relationships between angels and demons were formalised into Christian doctrines and their cultural significance significantly increased between the eighth and twelfth centuries. Angels in particular, provided the vehicle through which the ethical principles upon which societies came together could be discussed. As most people did not travel (Sowerby 2016, 2), the concepts associated with angels were shaped by local customs, superstitions, obsessions, and fables where ‘the wealth of disparate narratives involving angels led men and women of all sorts to expect their own interactions with these spirits’ (Keck 1998, 209). Such angelology helped make sense of people’s actions, their outlook, and provided narratives about how societies were organised. Angelology was more than a set of doctrines and practices, it also inspired ways of living and inhabiting the world, and in the eighth and ninth centuries the church began to mount resistance to the direct worship of angels as a form of resistance to paganism by reducing the diversity of angels. While the calling upon angels with names other than Raphael, Gabriel and Michael was condemned (Keck 1998, 174), it was not possible to eradicate the public appetite for them. During the twelfth and thirteenth centuries, their absence from the book of Genesis stimulated scholastic debate, rational argument, philosophy, logic, and reason. These new pedagogical systems benefited the wider social and economic communities of medieval Europe in their rapid transition towards an urbanising, profit economy (Keck 1998, 81). In the transition towards the industrial revolution cultural utilitarianism through secularism, ‘brute’ materialism and rationalisation of material events banished ethical and moral debate. Instead, the principle of ‘survival of the fittest’ stood in for notions of fairness within society.
(Irons 1901). With competition and inequality at the heart of modern ‘progress’, a truth-bearing language to counter the anti-vitalist concepts of the *bête machine* is still needed to restore a sense of human ‘purpose’ in the world.

All of these stories are a lure to proposing the Chthulucene as a needed third story, a third netbag for collecting up what is crucial for ongoing, for staying with the trouble. The chthonic ones are not confined to a vanished past. They are a buzzing, stinging, sucking swarm now, and human beings are not in a separate compost pile. We are humus, not Homo, not anthropos; we are compost, not posthuman. (Haraway 2016)

By embracing the concept of angels, liquid life upholds an ethical view of the organising principles of the living world and the way it is, or should be inhabited, as a counterpoint to the Anthropocene. In our transitioning towards an ecological era, liquid life upholds the diversity in our approaches towards an understanding of the innate strangeness of the natural realm, its complex epistemologies of ‘being’ (Latour 1993), and our relationship with them through its discourses with angels.
Angels and Ecocide

The angel would like to stay, awaken the dead, and make whole what has been smashed. But a storm is blowing from Paradise; it has got caught in his wings with such violence that the angel can no longer close them. The storm irresistibly propels him into the future to which his back is turned, while the pile of debris before him grows skyward. This storm is what we call progress. (Benjamin 1969, 257–58)

Despite our best efforts to resist the atrocious environmental legacy of intensive global industrialisation, we are losing our connection with those agents that mediate exchanges between the living and non-living realms. The Anthropocene, which embodies this worldview through the logic and practices of machines, is driving angels from the complexity of living realm, resulting in catastrophic losses in biodiversity, which carries clear messages of impending disaster in the Sixth Great Extinction.

To mitigate what we can of the present ecocide and establish alternative approaches that may secure our ongoingness, conceptual frameworks, and metaphors that embrace vitality are urgently needed. Most pressingly, if we are to break away from the enduring habits that have scarred the surface of our planet, it is imperative that the stranglehold of the machine metaphor upon all aspects of ‘life’ must be broken.

Seeking to renew our relationship with the natural world, liquid life draws on the irreducibility and strangeness of fluids, which conjure forth the vital forces that flow through the world’s metabolic networks. Within our guts, cells and environments, hubs of vitality nurture its presence. Like the wind, we cannot see it, but we know it is here by the effects it exerts on other things and how it makes us feel. Through the countless, irreducible acts of ‘being’, liquid life (re)introduces the ‘soul substance’ into the contemporary discourse of ‘life’.
Bête Machine

[T]he appeal to mechanism on behalf of biology was in its origin an appeal of the well-attested self-consistent physical concepts as expressing the basis of all natural phenomena. But at present there is no such system of concepts. (Whitehead 1925, 128)

René Descartes replaced the ancient, spiritual view of the living world (Dickinson 1911, 2–8) with an extreme model of humanity, where the rational soul (mind) and body were made up of qualitatively different substances. While people were capable of rational thought and therefore, had souls (which departed when the body machinery no longer worked), non-human life did not and was regarded as a mere bête machine governed by the laws of mechanics. Observed sensibilities were not considered to extend to anything more sophisticated than reflexes and instinct (Newman 2001). This view enabled science to begin invasive studies, where the living bodies of animals and human cadavers could be dissected without concern for religious, or ethical dilemmas, since the ‘appearance’ of pain was thought to be no more than an unconscious reflex (Admin 2013). The machine metaphor proved such a successful approach to understanding the living world that Julian Offray de la Mettrie took this to its logical extreme, referring to the human creature as as soulless, self-winding automaton — ‘L’homme machine’.

Brilliantly, the concept of machine not only describes atomism’s worldview; it embodies its ideas. Its principles and operations can be tested and reinforced by mechanical technologies. The demonstrable and (potentially) perfectible success of machines is not only inspiring; its self-reinforcing procedural simplicity is peerless.

Like atomism, machines are built from fundamental parts and are structurally assembled according to mechanical principles, which are derived from classical physics. Its components are inert, lifeless, and unchanging, so it has to be powered by ex-
ternal forces (fossil fuels, electricity, computer programs, etc.), which tip it away from equilibrium and command it into action. Lumbering from molecule to molecule, and joint to joint, the *bête machine* (the material apparatus of life) has no innate agency and is blind to its environmental context. Organised within a hierarchy of inert geometric objects, it embodies a 'brute' mechanical view of reality. Through our quest to incorporate their benefits into our lives, machines have become so sophisticated they are more than workhorses for industrial processes. Through personalised gadgets and robots, they have become our companions, acquiring this status through our projections of their worth on to them. Validated through our ability to incorporate its logic into our daily lives, the machine worldview with its automata (alluding to self-movement), robots (workhorses) and cyborgs (hybrids of human/animal/machine), pervades everything we do. Indeed, we have reached the point where we believe that we are little more than ‘survival machines’ guided by ‘informatic’ selfish replicators (Dawkins 2006, 24–25).

… a human society based simply on the gene’s law of universal ruthless selfishness would be a very nasty society in which to live. But unfortunately, however much we may deplore something, it does not stop it being true … if you wish … to build a society in which individuals cooperate generously and unselfishly towards a common good, you can expect little help from biological nature. Let us try to teach generosity and altruism, because we are born selfish. Let us understand what our selfish genes are up to, because we may then at least have the chance to upset their designs, something that no other species has ever aspired to. (Dawkins 2006, 3)

Reaching to the status conferred on ancient gods, their ubiquity and potency is deployed at the scale and power of natural forces, like the atomic bombs that razed Hiroshima and Nagasaki in August 1945 during the final stages of World War II. Mechanical systems also provide substitutes for natural phenomena, like
the Moonlight Towers of Austin, Texas (Oppenheimer 2014), which floodlit the city with artificial night light, not only replacing the moon, but also ‘improving’ upon its performance, or the Norwegian Rjukan sun, which consists of three giant mirrors that extend daylight for the town. The influence of machines on our existence is so profound that they even epitomise the human project — specifically, the *anthropos*, which is built upon a particular kind of power and forms of privilege that elevate humanity over other life forms (Braidotti 2013, 65–66). In this way, the machine embodies and articulates the Enlightenment project of objectivity and progress, extending its reach and impacts through colonisation and the global marketplace.

While the mechanistic principles of the *bête machine* have contributed significantly to the modern understanding of the natural world, they do not speak perfectly for the extraordinary phenomenon of the living realm. In many ways, ‘life’ is a counterpoint to machines: while it obeys the laws of physics, it cannot be predicted by them; it is probabilistic, while machines are deterministic systems; life expresses its far-from-equilibrium states through its (hyper)complex materiality, while through their rigid embodiment, machines transform the external inputs of energy that tip them away from relative equilibrium into simple, predictable, unchanging chains of causes and effects; the living realm is deeply correlated with its surroundings, yet machines are not sensitive to their environmental contexts. These fundamental incompatibilities present a situation where characteristic and important phenomena associated with living things, cannot be discussed or explored through the logic of the *bête machine* and are therefore excluded from relevant (ethical) debates.

Even when non-human matter is imagined through its biomolecular components, the observed behaviour of the whole is ‘other’ than the sum of these parts. Whatever it is that emerges through the ‘brute’ body of the *bête machine*, its irreducible, sensible, and irrepressible presence allies much more closely with Descartes notion of the soul than with an unthinking, unfeeling assemblage that awaits instruction by an external agency. More than a mechanism, the agency of living matter squeezes through
the gaps of our capacity to ‘reduce’ its nature into a set of simple causes and effects — declaring itself ‘liquid’.
Entropy

... the whole organic world constitutes a single great individual, vague and badly co-ordinated it is true, but none the less a continuing whole with inter-dependent parts: if some accident were to remove all the green plants, or all the bacteria, the rest of life would be unable to exist. This individuality, however, is an extremely imperfect one — the internal harmony and the subordination of the parts to the whole is almost infinitely less than in the body of a metazoan, and is thus very wasteful; instead of one part distributing its surplus among the other parts and living peaceably itself on what is left, the transference of food from one unit to another is usually attended with the total or partial destruction of one of its units. (Huxley 1912, 125)

Our planet formed around 4.6 billion years ago from collisions between colossal gas and dust clouds that clumped together to form our solar system. Since its inception, it has been permeated with instability and change. As our world cooled, convection cells in its molten iron core formed and cast magnetic fields around the planet, which established the dynamic material conditions in which life could emerge. Today, the boundaries between these bodies continue to move and subduct as tectonic crusts, while the planet’s magnetosphere dances in the Sun’s strange ionised winds. In this sheltered yet turbulent realm, a transition from inert matter to life became possible. Arising from such a vivacious place, it is little wonder, then, that since ancient times, the dynamic character of the planet has been considered a ‘living’ being, whose nature varies according to differing perspectives.

Plato’s organicist view proposed the planet possessed both soul and intelligence, while the hylozoism of pre-Socratics regarded all matter to some degree was ‘alive’ and Plotinus understood that all beings were interconnected. Such concepts can be traced through to the modern era in various schools of thought.
such as, Thomas Aquinas's natural theology, Ralph Waldo Emerson and Henry David Thoreau's nature writing, Rachel Carson's Silent Spring and the eco-activism of the late 20th century (Ruse 2013).

While starkly contrasting with the mechanistic approach of the scientific revolution that operated according to predictable laws, notions of a ‘living world’ became incorporated into the perspectives of ‘systems’ sciences.

The experiment is not traditional, reductionist, discipline-oriented science, but a new, more holistic level of ecosystem science that has been called ‘biospherics.’ (Odum 1993, 878)

Specifically, James Lovelock and Lynn Margulis championed the Gaia hypothesis, which regards Earth as a self-regulating ‘organism’, and imagined these principles could be applied through climatological, biogeochemical, and bacterial mechanisms to produce Earth-like environments in off-world settlements and spaceships (Anker 2014). While cybernetics and systems science generated a framework that provided more fluidity in the relationships between ‘components’ (or ‘living’ beings) than the mechanistic model of the living world, from a material perspective, life itself also did not seem to comply with the classical laws of physics. According to Erwin Schrödinger, it characteristically avoided the inevitable decay towards thermodynamic equilibrium — or inertia:

An organism’s astonishing gift of concentrating a ‘stream of order’ on itself and thus escaping the decay into atomic chaos — of ‘drinking orderliness’ from a suitable environment — seems to be connected with the presence of ‘aperiodic solids’, the chromosome molecules, which doubtless represent the highest degree of well-ordered atomic association we know — much higher than the ordinary periodic crystal — in virtue of the individual role every atom and every radical is playing here. To put it briefly, we witness the event that existing order displays the
power of maintaining itself and of producing orderly events. (Schrödinger 2012, 77)

Ernst Mayr observed that biology is unique among the sciences, as certain principles of physics cannot be applied to biology, nor do biological principles apply to the inanimate world (Mayr 2004, 21).

A chemical compound once formed would persist for ever, if no alteration took place in surrounding conditions. But to the student of Life the aspect of nature is reversed. Here, incessant, and, so far as we know, spontaneous change is the rule, rest the exception — the anomaly to be accounted for. Living things have no inertia and tend to no equilibrium. (Huxley 1870, 75)

Despite their protean nature, living systems remain stable within chaotic environments by shedding heat, which actually results in a minuscule increase in overall cosmic entropy and so, comply with the second law. From a highly localised perspective, however life appears to contravene this principle, as its it operates through highly local, specific molecular, and quantum effects, which maintain their relevance to particular microniches.

… there are places where matter creates itself, coming into being on its own out of nothing. They are always just small chunks of reality, not essential to the whole, and as a result they are no threat to the balance of the world. (Tokarczuk 2010, 203)

Ilya Prigogine described the material systems that possess these characteristics as ‘dissipative structures’ (Prigogine 1997, 27), which are paradoxical objects/assemblages that arise from the persistent flow of matter through a space (see section 08.9). Dissipative structures remain stable by dispersing energy into their surroundings, becoming increasingly structured during the process of ‘dissipative adaptation’ (England 2015; Wang 2014)
(see section 08.10). Such dissipation-driven adaptation of matter is not unique to life but applies to all forms of dissipative structures in the physical world, from the formation of volcanoes to the crystallisation of snowflakes. The most primordial forms do not self-replicate, but spontaneously arise from collisions at energetically charged interfaces between lively matter/energy fields. While these fields persist, dissipative structures continue to be produced. Physical constraints on the system keep the performance of these bodies in check. Should these limits be loosened, they can reconfigure and adapt rapidly to altering circumstances. While not all dissipative structures are alive, all living things are dissipative systems, where organisational stability is produced by continual activity and flow, with all constituent substances (not just genes) actively participating in life’s flux. Some of these agents persist by using all possible diversionary material strategies within their reach and, therefore, evade the direct pathway towards thermodynamic equilibrium — a form of material inertia, or death. Dissipative systems are also compatible with notions of niche construction, where agents exhibit a reciprocal relationship with their surroundings through energy-shedding activities that include, but are not limited to, metabolic exchanges. In turn, these events have a feedback effect in the system, producing anisotropy and therefore enabling the production of increasingly complex (or hyper-complex) structures, which further resist the energetic descent towards thermodynamic equilibrium. While such physical principles alone do not inevitably result in biology, their countering of entropic forces through dissipative adaptation constitutes the very process of living, and is the start of a transition from lively matter towards life (Ball 2017b).

A thousand incidents arise, which seem to be cut off from those which precede them, and to be disconnected from those which follow. Discontinuous though they appear, however, in point of fact they stand out against the continuity of a background on which they are designed, and to which indeed they owe the intervals that separate them;
they are the beats of the drum which break forth here and there in the symphony. Our attention fixes on them because they interest it more, but each of them is borne by the fluid mass of our whole physical existence. Each is only the best illuminated point of a moving zone which comprises all that we feel or think or will — all, in short, that we are at any given moment. It is this entire zone which in reality makes up our state. Now, states thus defined cannot be regarded as distinct elements. They continue each other in an endless flow. (Bergson 1922, 3)

The driving forces of these operations may be envisaged as dynamic fields of activity and quantum phenomena that are capable of odd material behaviours. These are largely factored out of classical scientific narratives, which are based on the average behaviours of large numbers of atoms whereas life’s processes produce their effects at the (sub)microscopic scale, with many fewer atoms in play.

... physics doesn’t make a distinction between life and not-life. But biology does. (Eck 2016)

Alfred North Whitehead proposed a fluid view of the living realm where ‘actual occasions’ are the ‘final real things of which the world is made up ... drops of experience, complex and interdependent’ (Whitehead 1979, 18) and ‘the flux of things is one ultimate generalisation around which we must weave our philosophical system’ (Whitehead 1979, 208). Such plastic models of the material realm draw attention to protean and fluid phenomena, which is not a solution to uncertainty, but an attitude of iterative engagement with events that are context-sensitive and framed by chemical laws. The operational framework for these processes must therefore be updated continually, so that the conditions for the next iterations of decisions may be appropriately shaped.
As systems dissipate energy, they drift in an irreversible direction and by doing so become ‘exceptional,’ … not perfect or ideal. ‘A bird is not a global optimum for flying … It’s just much better at flying than rocks or worms.’ (Eck 2016)

How matter at far-from-equilibrium shapes life’s complex modes of embodiment may be experimentally observed, explored, and tested by applying the principles of liquid life through identifying a portfolio of native materials, apparatuses, and prototypes, some of which will be explored in this book (see chapters 08 and 09).
Liquid Bodies

The onion has many skins. A multitude of skins. Peeled, it renews itself; chopped, it brings tears; only during peeling does it speak the truth. (Grass 2008, 4)

Liquids are non-bodies, as they are constantly changing and therefore possess no formal boundaries. Possessing their own logic these protean structures assert their identity through their environmental context. They are pluripotent, not amorphous, being forged by oscillations and iterations of material expressions. Arising from interfaces, they persist through local connections and networks, which have the capacity to internalise other bodies as manifolds within their substance. Such multiple entanglements invoke marginal relations between multiple agencies that exceed the classical logic of objects, being capable of many acts of transformation. Although their behaviour may be approximated by classical laws, like the liquid parcels described by Lagrangian hydrodynamics, they resist complete reduction into this framework.

Giving rise to the very acts of life, such as the capacity to heal, adapt, self-repair and empathise, the diversionary tactics of liquid bodies de-simplify the process of embodiment through their visceral entanglements. While they are strange, they are not the invention of fanciful imaginations but exist outside of the current frames of reference in which our global industrial culture is steeped. Aspects of their existence stray into the unconventional and liminal realms of auras, quantum physics, and ectoplasms, which invite poetic engagement.

… every creature is contained within certain limits of its own nature, and inasmuch as those invisible operations, which cannot be circumscribed by place and bounds, yet are closed in by the property of their own substance … (Ambrose 2009)
Liquid bodies also challenge the idea that embodiment is ‘just’ a question of anatomy and physiology. Intersecting with each other across multiple interfaces, they generate a bounded spectrum of events, structures, and inter/intra-relationships. Inseparable from their context. Offering alternative ways of thinking and experimenting with the conventions of making and being embodied, they possess the capacity to surprise us.

Liquid bodies are political agents, which redefine boundaries and conditions for existence in the context of dynamic, unruly environments. Radically transformed, monstrous, coherent, raw — and selectively permeated by their nurturing media, they embody alternative ways of ‘being’. While the choreographies that shape their iterations invite us to articulate the fuzziness, paradoxes, and uncertainties of the living realm, they remain instantly recognisable like — tornado, cirrus, soil, embryo, biofilm. Challenging the structure of our grammar beyond the causality implied in the links between nouns (objects) and verbs (process), they invite us to invent monsters that defy all existing forms of categorisation taking us beyond the conventions of grouping and relational thinking. Making possible a new kind of corporeality by relating one body to another, liquid bodies produce contradictions of morphology and existence, which invite alternative readings of how the world is sorted, ordered, agentised, and valued.
Liquid Consciousness

If animals were soulless, they were just machines. Therefore they didn’t feel pain—they only acted as if they did. (Admin 2013)

With the senses deemed untrustworthy, the \textit{bête machine} denies non-humans the capacity to perceive, or interpret reality, and are deemed to behave like blind automata awaiting cogent instruction. Since rational thought is entangled with Descartes’ conception of the soul, liquid life’s innate agency raises questions about the quality of decision-making and capacity for self-awareness of liquid bodies, providing a model for non-human thought (see section 05.9).

Provoking an expanded notion of consciousness that is situated at interfaces, ‘liquid consciousness’ is sensitive to the environment, responding to the flows between lively fields of matter/energy, which comprise a primitive mode of self-observation. Since action and matter are intrinsically coupled in a liquid body, there no need for an internal model of the world to instruct it, so it does not anticipate the nature of reality \textit{a priori}.

The main problem with \textit{#emergence} as a metaphysical idea is that it’s too atomist at the outset. It denies that consciousness is the very process of self-individuation, as one awakes from dormancy. (Fuller 2018)

Always discovering its context, liquid consciousness constantly reveals a world that is tinged with mystery. With persistence, it begins to differentiate between the mundane — where molecular species hurtle towards stability — and the extraordinary diversions of molecular assemblages at far-from-equilibrium states, which enable it to persist awhile. Becoming increasingly sophisticated, pervasive liquid bodies develop an indulgent palette of natural resources, food sources, waste materials, energy fields, and act on opportunistic events. Neither fully defined by
any specific locale nor set of material resources, they are permeable to their particular circumstances and constantly capable of change.

... there's certainly intelligence there, of a kind ... they know what they're doing. Look at it this way. Granted that they do have intelligence; then that would leave us with only one important superiority — sight. We can see, and they can't. Take away our vision, and the superiority is gone. Worse than that — our position becomes inferior to theirs because they are adapted to a sightless existence, and we are not. (Wyndham 2000)

Without a predetermined, idealised form towards which to aspire, ‘liquid consciousness’ becomes optimised to its surroundings. Depending on the complexity of bodies, the richness of their environments, specific events, and sustained experiences, the character of thought is contingently shaped by its contexts. Some liquid bodies lose the capacity to respond to light because they live in darkness, others are primarily informed by ambient vibrations by which they navigate the world, while a few, like web-building spiders, extrude their mind maps into structural forms that penetrate their world (see section 07.14).

So the octopus thinks: ‘All right. I’m going to make an intelligence test for humans, because they show a little bit of promise, in a very few ways.’ And the first question the octopus comes up with is this: How many color patterns can your severed arm produce in one second? (Williams 2011)

While theirs is not a human version of existence, their responsive apparatuses of liquid bodies forge appropriate agency within their habitats, which empowers them to act independently of humans, or other observers, and become co-authors in the unfolding narratives of their ‘living’ world.
Liquid Life

Liquid life is a paradoxical, planetary-scale material condition, with no fixed shape, but a characteristic readiness to flow and therefore takes on the shape of any container. Forged by the persistent instabilities of an uncertain realm, it is unevenly distributed but spatially continuous and is what remains when logical explanations can no longer account for the experiences that we recognise as ‘being alive’.

Liquid life is not a homogeneous life force, but a kind of ‘metabolic weather’ — a dynamic substrate, or hyperbody, that permeates the atmosphere, liquid environments, soils, and Earth’s crust. ‘Metabolic weather’ refers to complex physical, chemical, and even biological outcomes that are provoked when fields of matter at far-from-equilibrium states collide. It is a vector of infection, an expression of recalcitrant materiality and a principle of ecopoiesis, which underpins the process of ‘living’ events. These arise from energy gradients, density currents, katabatic flows, vortices, dust clouds, pollution, and the myriad expressions of matter that detail our (earthy, liquid, gaseous) terrains (see section 05.23). Since our unique planetary conditions are the generative source of this unique material phenomenon, as long as they remain, life is ‘effectively’ immortal.

Liquid life is also a worldview — a phantasmagoria of effects, disobedient substances, evasive strategies, dalliances, skirmishes, flirtations, addictions, quantum phenomena, unexpected twists, sudden turns, furtive exchanges, sly manoeuvres, blind alleys, and exuberant digressions. It discusses a mode of existence that is constantly changing, not as the cumulative outcomes of ‘error’, but as a highly choreographed and continuous spectrum of events that arise from the physical interactions of matter at far-from-equilibrium and their associated cascades of events.

Few men are gifted with the capacity of seeing; there are fewer still who possess the power of expression … the external world is reborn … natural and more than natural,
beautiful and more than beautiful, strange and endowed with an impulsive life like the soul of its creator. The phantasmagoria has been distilled from nature. (Baudelaire 1995, 12)

Steeped in the fluid conditions of hypercomplexity and hyper-object-ness, liquid life exceeds our ability to observe, or comprehend it in its totality, owing to its massively distributed nature. Typically, we recognise its epiphenomena as discrete beings, which draw sustenance from the immense continuum of unevenly distributed, planetary scale, metabolic events that underpin its myriad forms of expression. At far-from-equilibrium states it ambles through transitional molecular states and entertains rebellious quantum phenomena, which evade permanent commitments to form or function. Seeking strategies of disobedience through meandering pathways, it moves in directions that evade thermodynamic efficiency and equilibrium’s death drive. Neither purposeless, nor goal oriented, it contemplates the spectacle of ‘living’, revelling in its indulgences and resisting the efficiencies of material transaction that coerce it towards inertia. Culturally speaking, this resistance shares resonances with Charles Baudelaire’s flâneur, who resists the path towards consumer transaction within the ‘arcades’ of experience (Benjamin 1997, 79–80). Such diversions forge the very processes of life.

The crowd is his element, as the air is that of birds and water of fishes. His passion and his profession are to become one flesh with the crowd. For the perfect flâneur, for the passionate spectator, it is an immense joy to set up house in the heart of the multitude, amid the ebb and flow of movement, in the midst of the fugitive and the infinite. To be away from home and yet to feel oneself everywhere at home; to see the world, to be at the centre of the world, and yet to remain hidden from the world — impartial natures which the tongue can but clumsily define. The spectator is a prince who everywhere rejoices in his incognito. The lover of life makes the whole world his family, just like
the lover of the fair sex who builds up his family from all
the beautiful women that he has ever found, or that are or
are not — to be found; or the lover of pictures who lives
in a magical society of dreams painted on canvas. Thus
the lover of universal life enters into the crowd as though
it were an immense reservoir of electrical energy. Or we
might liken him to a mirror as vast as the crowd itself; or
to a kaleidoscope gifted with consciousness, responding to
each one of its movements and reproducing the multiplicity
of life and the flickering grace of all the elements of life.
(Baudelaire 1995, 9)

Liquid life creates a platform for thinking with and through
fluids, where the defining characteristic of our planet is ac-
nowledged within the concept of life itself. Such expanded
perspectives also engage with alternative power and identity
relationships that move towards inclusive, horizontal interrela-
tions, which are consistent with an ecological era. Proposing to
distribute agency more equally within an expanded notion of
immanent spaces, liquid life dilutes, decentres, and reduces the
environmental impact of the *anthropos* in the construction of
industrial processes (Steinberg and Peters 2015). It also raises
critical questions about notions of society that embrace all hu-
mans and even includes species that have become so intrinsic to
our biology they are integral to our being. For example, bacte-
rial commensals (bacterial microbiome), symbionts (pets) and
even ‘living’ fossils (mitochondrial bodies, viral, and bacterial
gene sequences in ‘junk’ DNA) are fundamental to our exist-
ence, their diffusion within our flesh conferring us with unique
character. As members of our ‘fluid’ communities, their rights
and (potential) responsibilities are emphasised, as are notions of
agency and modes of conversation. Such considerations invite
alternative notions of personhood, currently potentially extend-
ed to chimpanzees, dolphins (Revkin 2013), machines (Prodh-
han 2016), land, rivers (Rousseau 2016) and planet (Vidal 2011).
These recognitions may also extend to building coalitions (Bas-
tian 2006) for (environmental) peace and include plants (an-
cient trees) (Martin 2000), insects (bees and other pollinators), soil organisms (mycorrhiza) and other creatures upon which our immediate existence depends. Although such notions could potentially extend indefinitely to embrace every being on the planet, from a ‘lived’ perspective, the appropriate limits and relevance are bestowed by community members through shared ethical concerns and values, which are at the heart of ecological change.

While liquid life is effectively immortal, its epiphenomena are not. At some point, beings reach thermodynamic equilibrium, where their deceased matter lies quiescently, patiently waiting for its reanimation through compost where it is assimilated back into the cycles of life and death.

This book does not set out to resolve the questions it provokes, but to stimulate conversation and debate about fundamental issues that enable the development and interrogation of an alternative technological platform than the machine, with an associated ethics that is appropriate for issues that characterise the third millennium.