

# Design Everywhere, Design is Everywhere!

## From Cells to Cities

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Design means different things to different disciplines, groups of people, across time and within the cultural frameworks where it is discussed. So, its importance and definition therefore also changes depending on whom exactly you're talking to – and when.

Perhaps, within a modern context we might think of design as the selection of an ideal form, or strategy that addresses a particular challenge. Maybe we consider it to be located within the making of an object, or the execution of a particular skill set in the choice of materials, shapes and media. But while design embraces all of these things - it is not limited by them. Indeed, if our notion of design is constrained by a particular practice of making, or set of expectations then we are missing out on the scope of its potency.

Design is a form of choreography, a synthesis, or provocation that precedes the existence of something and pervades throughout its lifetime and beyond. It may embrace many scales, ideas, materials, relationships, values, ethics and countless other forms of experience. It is intrinsically interwoven with the way that we see the world and experience it. In fact, the agencies a designer works through are impossible to apprehend all at once. The skill of the designer is then in how they compose not only in the present but how their decisions may also influence the past, as well as the future.

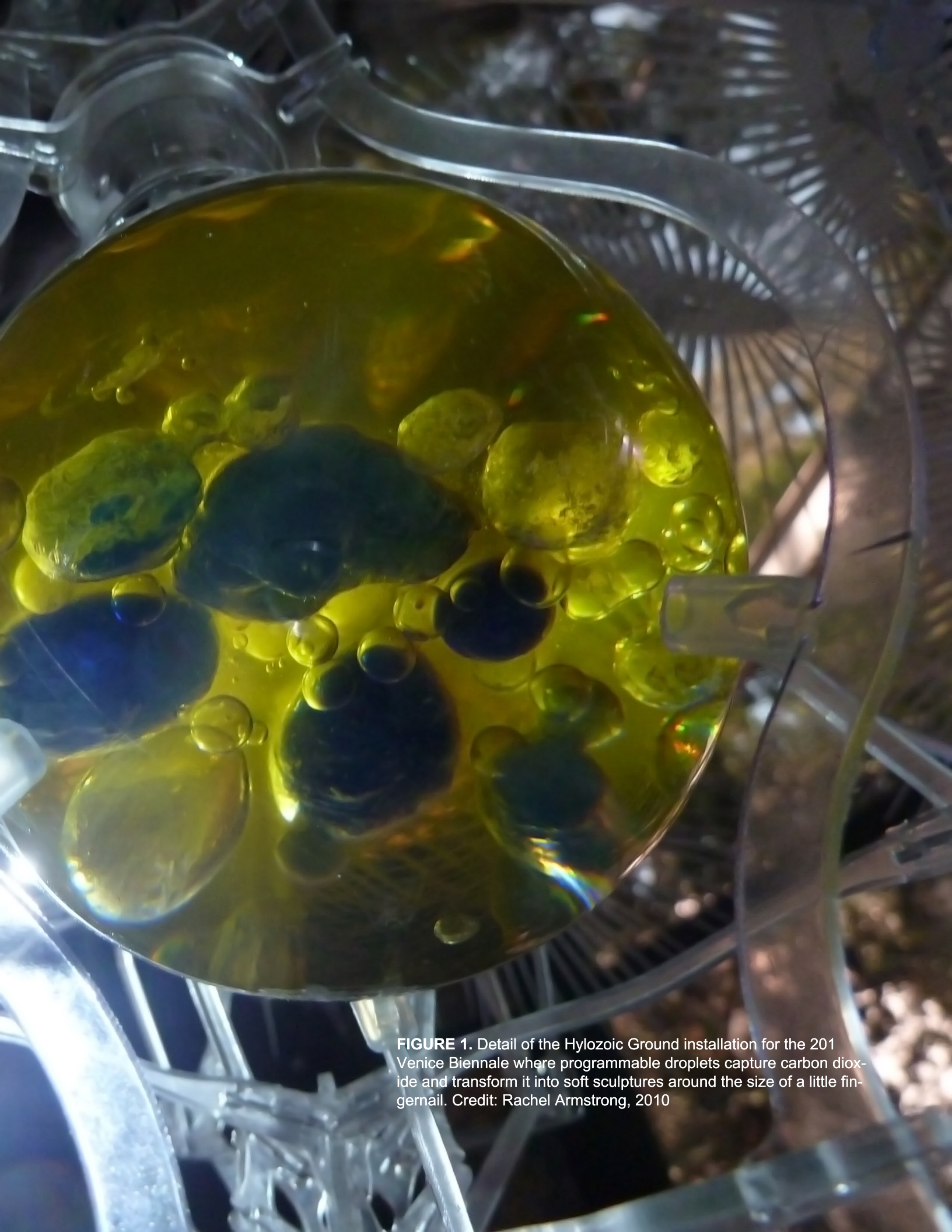
In today's modern era that is shaped by industrialization and a particular kind of commercial framework, we have become accustomed to design practices based on inert, predictable materials, a human scale of operations, anthropocentrism, disposability, commodity and determinism. All of these are centered on the production of objects, so "good" design therefore is valued by these systems.

Yet, at the beginning of the third millennium, we are changing our values and expectations of the world. A tipping point is approaching – and may already have begun - where human design and engineering has reached such intensity, scale and impact that it is changing the course of planetary events. This epoch has been called the Anthropocene (Crutzen and Stoermer, 2000) where we have never been so prosperous, or numerous as a species. Yet, we are also aware that the cumulative impacts of the way we have been working over the last 150 years are reverse-terraforming our planet. Now, we face the prospect of a gaping 6th great extinction where over the last 10,000 years human activity has reduced the liveliness of the planet by causing the disappearance of many species, like the Ice Age megafauna (Kerr, 2003).

Above us and beyond us, looms the prospect of a fourth wave of human expansion, which could take us to life beyond our home planet. A new wave of Apollo 8 Orphan entrepreneurs is investing personal fortunes into space ventures. Planetary Resources is planning to harvest asteroids for mineral resources (Planetary Resources, 2013), and Elon Musk aims to establish a colony, and even die, on the Red Planet (Becque, 2013). Yet we are almost as blind to our cosmic prospects and opportunities as John Milton (Milton, 2008), when he wrote *Paradise Lost*, since the nature of reality now seems strange. Indeed, the visible fabric that we inhabit constitutes only 5% of reality, the rest of it being 68% dark energy and 27% dark matter (Moskowitz, 2011). Caught in between two existential voids – extinction, or escape – perhaps, like Milton, we may find cause to remain optimistic about our human potential. Despite the chaos of adversity maybe we can find new bounty here on Earth

through allegiance with a hypercomplex material realm that exceed the expectations of a modern world. Instead we now have access to a constantly changing landscape of variation, heterogeneity, singularity and tipping points that collectively, constitute a new understanding of – and potential relationship with – "Nature" (Van Mensvoort and Grievink, 2012).

Our current apprehension about the sustainability of our present is accompanied by a rapidly changing sense of our being in the world - whereby for the first time in a couple of millennia, Western civilization has started to understand reality through a different lens. Rather than being made up as a series of hierarchically ordered, discrete objects, which characterizes the modern worldview, we now view life as being complex, networked and in a state of permanent flux. This perspective may be thought of as an ecological era, which has been shaped by a range of overlapping developments in many disciplines including, philosophy, science, technology and cultural theory – particularly over the last century. However, our participation in this cultural paradigm shift is entirely independent of its symptoms such as, whether we believe in climate change, practice good green citizenship, or recycle our waste. Nor is our interest in ecology merely an academic attitude. It has become an everyday reality with the advent of the Internet, which has sprung us from previous limits imposed by – geography, identity, culture and materiality. Now, we can simultaneously and coherently explore new ways of being and living through interconnection, complexity and process. However, modern views, materials and tools that are designed to simplify a messy world still largely surround us. However, the ecological era does not invite us simply to substitute one hegemony for another, where for example, choosing a process-based reality is 'better' than dwelling in an object-centered per-



**FIGURE 1.** Detail of the Hylozoic Ground installation for the 201 Venice Biennale where programmable droplets capture carbon dioxide and transform it into soft sculptures around the size of a little fingernail. Credit: Rachel Armstrong, 2010

spective. Rather, it presents us with a stack of overlapping and competing ideas that are available for dealing with the colossal changes in which we are immersed.

In fact, this new focus invites designers to think through a new set of conditions centred on notions of ‘ecology’, which is not a static form, or particular materiality, but is in continual flux. Nor is it bounded by particular networks but deeply embedded within and extruded into its environment. It is an unbounded, protean, semi-permeable agency that embraces many future configurations that are yet to be expressed. Ecology is not constrained by human agendas but intersects with them extensively through material and cultural connections. These are produced by the combined interaction between complex interdependent agents and networks that are collectively recognized as its territory. Ecology is not limited to discrete accumulations of identical bodies and environments, but pushes outwards into transition zones that relentlessly explore new relationships with biospherical, technological, cultural, material, and social processes as well as other specific agents such as intestinal bacteria, trees, implants, or gadgets—which even become “part” of them. Some of these relationships are obligate (like the energy-producing networks of mitochondria)—but many, (like smartphones) are associative. Owing to their highly dynamic, materially heterogeneous and networked states, ecologies are porous to invasion. Consequently, they are constantly patrolled and remade at their limits through immune systems, cultural agencies and environmental contexts. An ecology is therefore not an idealized form that can be built from a particular set of components, but a paradox of existence like chameleons, shape-shifters, transformers, mutants, the offspring of multiple parents, bacterial biomes, tissue cultures and changelings that invite multiple social and environmental readings at the level of individual bodies and as a collective. Ecosystems bring great value to design within these communities by sharing networks of materials, operations, and entan-

gling different kinds of bodies with each other to produce meaning, which may be assimilated by human cultures. Yet, despite their inherent fluidity and relentlessly material nature, an ecology does not surrender its sense of “identity”. An ecology is recognizable, coherent, and does not invest in reckless metamorphoses. Rather, it expands the limits of its operations through its relationships and modes of self-expression. Ecosystems raise provocative questions that need to be constantly addressed within their ethical, philosophical, existential, environmental, technical, cultural and unforeseeable contexts to create the conditions for change and dealing with the hyper-complexity of the living world. The full implications of such questions will only become fully apparent as we explore the many contemporary environmental challenges that we face in design and engineering and begin to explore alternative modes of working than modern approaches.

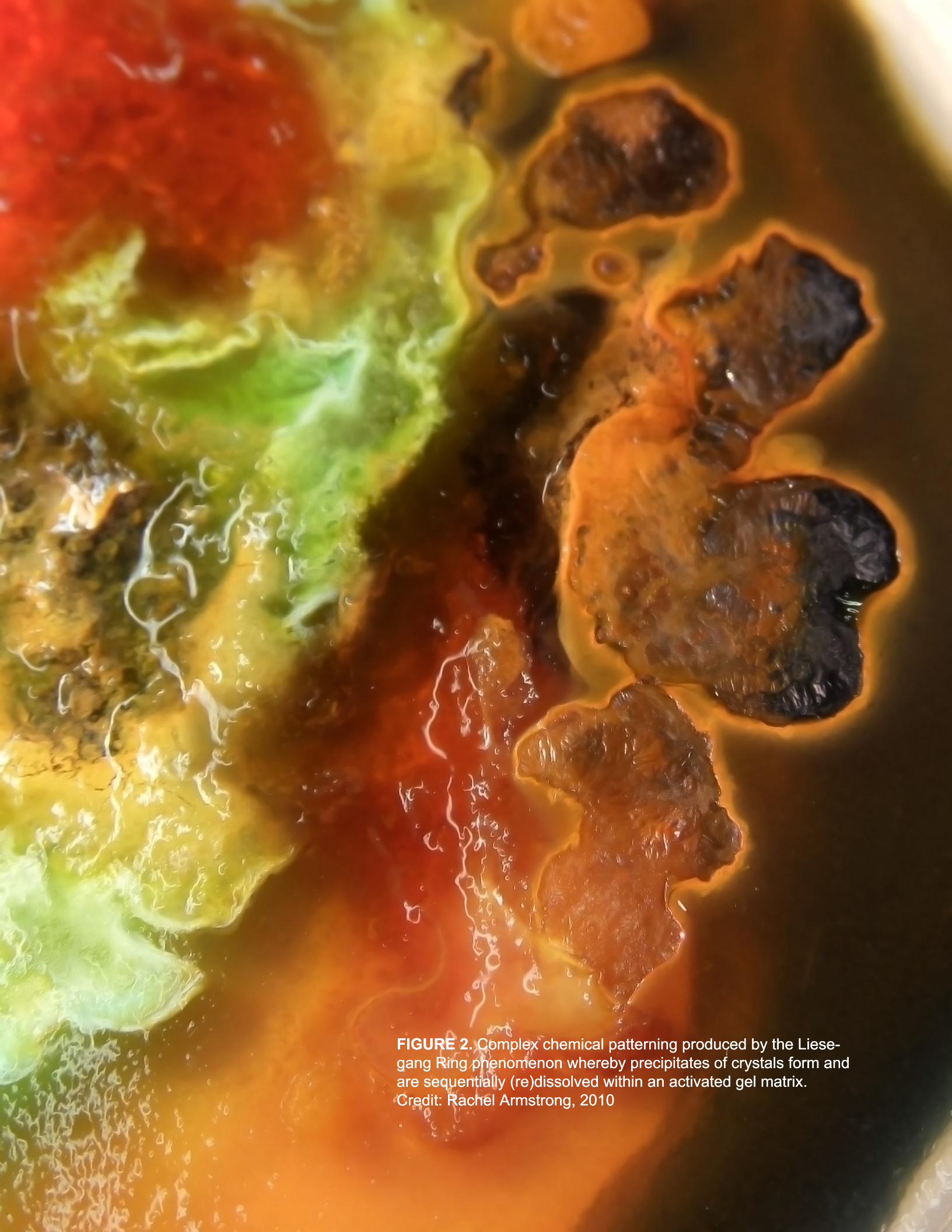
Such possibilities reside within a new range of material and technological systems that possess a new kind of liveliness. By coupling this kind of design thinking with the innate properties of our recently enlivened material realm creates new opportunities in the synthesis of complex, multi materials for developing more qualitatively enriching design tactics and spatial programs. We are starting to develop manufacturing systems that even begin to de-centre human agency by engaging multiple, highly distributed acts of design. In the last 30 years developments in biotechnology in particular have enabled us to work directly with living processes as a technical platform and combine these with classical design methodologies. Fashion designer Iris van Herpen relentlessly explores the synthesis of multiple materials in her couture collections whereby magnetic self-assembly becomes the basis for sculptural details on clothing (Dezeen, 2013). Skylar Tibbitts examines the possibility of 4D printing techniques that twist geometric forms into new configurations

when permeated with fluid (Rieland, 2014). Henk Jonkers seeds his bioconcrete with bacteria (Jonkers, 2007), protocells and supersoils provide programmable chemical computing systems with lifelike qualities (Armstrong & Hanczyc, 2013) and Neri Oxman uses silk worms as a computer-guided agency within the production system of her Silk Pavilion (Flaherty, 2013). It is even possible to wholly print 3D structures from cells that persist within our bodies as wholly functional systems, an approach that is being used in organ replacement (Murphy and Atala, 2014).

Yet, we must question the assumptions underpinning our design and engineering programs and not accept their stated goals uncritically. The Anthropocene largely views human impacts as negative that inevitably result in our extinction. Perhaps then, we should be looking for an alternative term, or frame of reference for the ecological era whereby our demise is not a *fait accompli*. Maybe we should invoke an alternative mythos, let’s call it the Ecocene that refers to a set of ideas and practices, which are starting to emerge in a post-industrial world where we are beginning to understand the importance of environment as integral to our ongoing survival.

The Ecocene is not a new hegemony. It is not simply about biomimicry—copying Nature’s forms and functions—or the greening of things. It is not as simple as substituting an object-centered view of reality and supplanting it with process, complexity, networks, and nonlinearity. It embraces many different approaches and worldviews that are overlapping for the first time. It involves constructing a framework for understanding a world in continual flux that is navigated by many overlapping models of thought, which require different ways of attributing value to natural systems than for example, modern economics, which centers on resource scarcity and ignores qualitative criteria such as creativity (Papazian 2013). The impacts of these convergences are thriving owing to the advent of the Internet. The intersecting





**FIGURE 2.** Complex chemical patterning produced by the Liesegang Ring phenomenon whereby precipitates of crystals form and are sequentially (re)dissolved within an activated gel matrix.  
Credit: Rachel Armstrong, 2010



ideas that shape these conversations also bring about paradoxes in our experience of the environment and therefore influence the way that we work to solve these complex challenges.

In this context, the Ecocene allows us to reach escape velocity from the industrialization, consumer-based economies and monocultures of making so that we can potentially establish a fundamentally different approach to design. Proactively seeking these opportunities may promote the sustained liveliness of our planet. Ultimately we may create the possibility for our ongoing survival through a new capacity for change over prolonged periods that change our legacy within the natural world so that we can talk to next generations – not about sustaining – but of thriving.

### Author Biography

Dr. Rachel Armstrong is professor of experimental architecture in the School of Architecture, Planning & Landscape of Newcastle University, UK. Besides, she is a TED Fellow who innovates and designs sustainable solutions for the built and natural environment using advanced new technologies such as Synthetic Biology - the rational engineering of living systems - and smart chemistry. Her award winning research prompts a reevaluation of how we think about our homes and cities and raises questions about sustainable development of the built environment. She is also lead designer of Project Persephone - Living Architectures, part of Project Icarus Interstellar.

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