



# Alternative Knowledge Transmission:

Raising Awareness of the Multi-dimensional  
Significance of Overlooked Organisms  
with a Focus on Lichen

Estelle Yang

Under the direction of Adrien Payet  
Master of Science Nature Inspired Design-2023

**ENSci**  
LES ATELIERS

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◦ Rémy Poncet, Head of “Connaissance des Espèces” of MNHN	
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## Acknowledgement

My gratitude to lichens, the gentle knowledge holder  
to Adrien Payet for his patience and attentive ear  
to Aléa for their intuition, trust and support  
to Jen Hauser for his generosity in sharing  
to my peers for their encouragements ad mutual empathy  
to Estelle for moving forward



\* All photos are taken by Estelle Yang unless stated otherwise

# Prologue

As I learn more about lichen, the more I am drawn to its unassuming nature.

Lichens are hidden in plain sight, they are present almost everywhere- from the city to the highest mountains and the lowest elevation. Lichens simply be, in their quiet and static forms, a graceful existence.

Historically, lichens have often been burdened with a negative connotation. Is it alive? Is it trash? Is it a parasite? Is it harmful to the trees? Does it transmit disease? Not many of us take the time to get to know the complexities of what lichens truly are, moving beyond their outward appearance that seem to fall outside conventional aesthetic norms. We are aware of their ubiquitous presence yet lichens rarely find their way into our conversations. I feel a sense of injustice about the stigma around lichens, as if they were close friends of mine who have been heavily misunderstood by the society. Indeed, what initially piqued my interest in lichens as a child was their odd-looking appearance. Over the years, I would often pause to stand before a rock or a tree, to greet them. However, our interactions have remained superficial. Now, well into my adulthood, having gone down various paths and journeys, making both right and wrong decisions. Along the way, I have learned, unlearned, and reconstructed many things. Despite these experiences, I find myself returning to my childhood encounter with lichens, in full dialogue with the unfinished lessons.

How can we build an intimacy with the modest lichen that just quietly exist? Can we cultivate a different appreciation for beauty and challenge the mainstream standards with the odd-looking lichens? Can we imagine an alternative way of being through lichen's rhythm? Will learning from lichens inspire a different set of ethics that becomes deeply innate? Can we further cultivate that seed so labels eventually render unnecessary because they have become normalcy?

Lichens do not have feet, cannot walk nor fly; with movement almost imperceptibly slow. They are grounded, resist nothing, taking things as they come, allowing them to unfold at their own pace naturally. I cannot resist seeing lichens as a fitting embodiment of "Dao" The wisdom of "Wu Wei" or "effortless action" nestling within a tiny ecosystem- humble yet powerful. For this reason, you might get a sense of where I draw the parallels and recognise these principles weaving in and out, guiding the thought process of this *mémoire*. Lao Zi believed that the most important teachings are beyond the power of words to describe; therefore, I will give my best attempt to incorporate his philosophy adequately in an intuitive way that is best understood to me.

“ We need another figure, a thousand names of something else, to erupt out of the Anthropocene into another, big-enough story.”  
Donna Haraway, *Tentacular Thinking: Anthropocene, Capitalocene, Chthulucene*

## Introduction

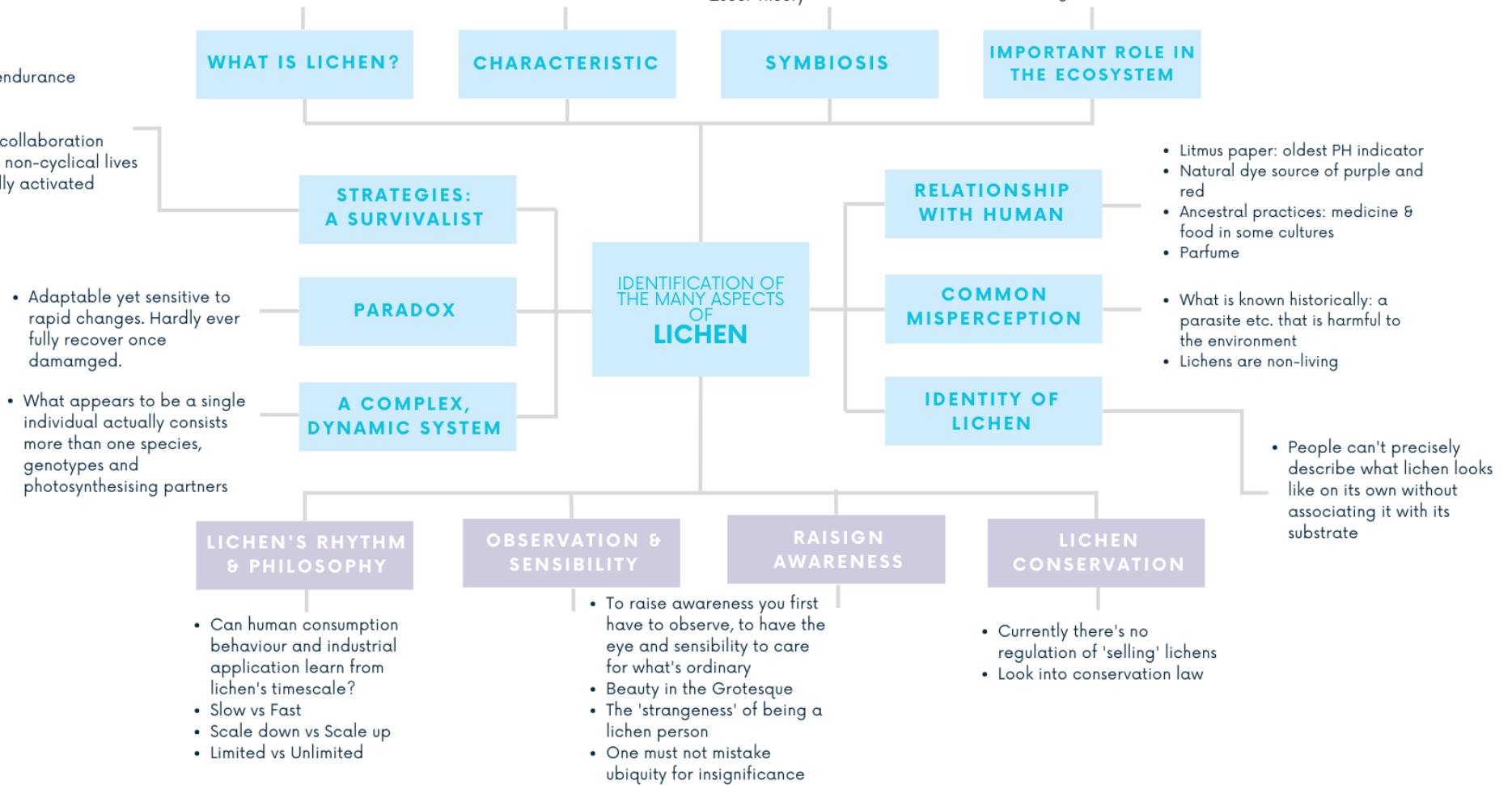
In the face of ecological crisis, biomimicry is an increasingly influential design methodology, grounded in “a new way of viewing and valuing nature.<sup>1</sup>” To steer away from extraction, the goal is to generate innovative solutions for human-centered challenges, learning from successful biological strategies, functions and adaptations observed in the intricate living world. This approach underscores the importance of addressing all dimensions within a system of networks over a mere imitation of superficial aesthetics. Biomimicry stands as a promising tool with aspirational potential, applicable to a diverse industries. Nevertheless, it is worth noting that current application of biomimicry is often viewed through Western and conservationist<sup>2</sup> standpoints. There appears to be an assumption that nature somehow harbours solutions to the various problems initially created by humans, designed without nature being the starting point of ethics. This brings attention to a potential contradiction, suggesting that nature is seen as being here for us rather than with us. Now this attitude towards the way of nature<sup>3</sup> differs quite a bit from the animistic worldview instilled in my upbringing. One concept from chaos theory, known as the butterfly effect, suggests that seemingly trivial changes can trigger significant and unforeseen outcomes in dynamic systems over time. Confronted by environmental crisis, this notion highlights our interdependence, emphasising that our actions have inevitable impact on one another within a larger system. To recognise this profound interconnectedness and nature's intrinsic role beyond a set of tools to validate innovations<sup>4</sup>, may benefit from a deeper examination that extends to include the ‘mindset’ of nature, starting with, if I may propose, paying attention to the small and underrated.

The Anthropocene<sup>5</sup>, as a discursive cultural concept holds the capacity to challenge and question established narratives by incorporating other-than-human entities into the discourse. In this paper, I will explore a context that embraces and centers on lichens: an often overlooked category of living organisms. Through various methods, my objective is to unveil the multi-dimensional essence of lichen, integrating aesthetic, scientific, industrial and philosophical facets. A sincere invitation is extended to readers to come on an intimate journey with me, acquainting ourselves closely with lichens as more than just a subject matter but as our shared ‘Kin<sup>6</sup>’. This endeavour aspires to kindle curiosity, evoke emotions, and encourage reflection-engaging with organisms we don’t generally relate to. Above all, weave ourselves into a tapestry that seamlessly connects us with both the inner and outer world toward a richer and more integral biosphere.

# GARM ENT OF EARTH

- Resiliency/ endurance
- Adaptability
- Diversity
- Interspecies collaboration
- Non-linear & non-cyclical lives
- Physiologically activated when wet

- What lichen is composed of?
- How does it function?
- Where can it be found?  
Habitat & Substrate & Climate ( from tropical rainforest to arctic tundra )
- Etymology of lichen
- Shape
- Form
- Texture
- Colour
- Touch & other senses
- wild not domesticated
- self-organising
- contamination
- humble/modest
- unassuming
- elegant
- quiet
- Origin of the word symbiosis was coined to describe the fungi-algae relation of lichen. Greek for 'together' [sym-] and 'living' [bio-]
- Tao Te Ching 'Oneness'
- Interspecies collaboration: A micro-landscape fungus+Algae+bacteria+yeast etc.
- Queer Theory
- Food source for small insects to caribou. Deer 'moss' is a lichen.
- Nesting materials
- Nutrient cycling: nitrogen
- Camouflage for lacewing larvae
- Natural sponge: Absorb/ release moisture back into the environment
- Natural sunscreen
- Regulate Climate



“ To love is not to celebrate one’s own reflection in the face of one’s double, but to recognise the value of what one can never know”  
Sylvain Tesson & Linda Coverdale, *The Consolations of the Forest: Alone in a Cabin on the Siberian Taiga*

## Etymology

My earliest memory of lichens was from one of the regular hikes we took with my parents as a young girl. We live close to Yangmingshan Nation Park in Taipei, so every weekend, we would take our dog out for a long walk there. During these hikes, I remember being attracted by these things covering the rocks with their obscure patterns and colours. I used to touch them, brushing my fingers over the covered surface, feeling their rough texture as we passed by. I was always curious about what they were. It was obvious to me that they were not a part of the rocks but something that had grown on them. I later found out its name was lichen and in Chinese, it is called “地衣” /di yi/. “地” /di/ meaning Earth, ground or land. “衣” /yi/ describes an external covering such as, a piece of clothing or garment. “Garment of Earth” that covers astonishingly 10% of the Earth’s surface.

In volume 181 of the *New Book of Tang*, Chancellor, Cao Que of the Tang Dynasty (618-907) recounts:

教舞者數百，皆珠翠襍飾，刻畫魚龍地衣，度用繪五千。

*Hundreds of dancers, all adorned with pearls and jewels, the ground cloth drawn with fish and dragon patterns, costing a total of 5,000 bolts of fabric.*

The text portrays the role of Cao Que in the context of organising a court celebration where he recruited hundreds of dancers adorned with pearls and jewels. Amidst this lavish display, there is the opulent “ground cloth”, where the term “地衣” /di yi/ was used to describe the luxurious imperial tapestry, a creation demanding an enormous amount of fabric to produce.



Chinese characters frequently communicate meanings through a fusion of visual components. The interrelation between character elements and artistic depictions is inseparable. Each character is made up of strokes arranged in a specific pattern that represent the shape, form, or attributes of the object or concept being described. “地衣” /di yi/ is one of those words that, the moment it’s spoken, instantly conjures a vivid and poetic image in your mind- the Mother Earth adorned in a delicate, living garment.

As I basked in the mental images of the beautiful fusion of earth and cover, I could not help but notice another linguistic connection. /di yi/ when pronounced, sounds exactly like the words “第一”, which mean “ the first” or “number one” in English. This term is commonly used to indicate an order, such as in a competition or a list where something is placed in the front position. In disturbed lands, lichens are usually the first to re-establish themselves. “地衣第一”, “lichen the first”, mirrors the concepts they represent - perhaps a delightful coincidence?

Having learnt the etymology of lichen in my mother tongue, Mandarin Chinese, I became curious about the meaning of lichens and how they might be portrayed in other languages. A search in both *Le Dictionnaire Culturel En Langue Française* and *Le Dictionnaire de l’Académie Française* reveals a surprising connection: apart from its biological definition, lichen is essentially linked to dermatoses, defined as “skin disease of an unknown cause,” such as *Lichen Planus* and *Lichen Sclerosus*. Perhaps it is the purplish patches grouped together that evoke a resemblance between some crusty lichens and the scaly appearance of skin lesions. Historically, the word lichen comes from Latin which itself was borrowed from the ancient Greek word “leikhein,” literally meaning “to lick.” A further interpretation by Zonca (2023), involves viewing lichen as a tongue that sensually “licks” its base. Lichen as a sexual and erotic organism, conveying a metaphorical craving for intimacy with the substrate it clings to. Another interesting revelation is found in the German language: *Flechte*, the German word for lichen, not only describes skin conditions but also derives from the verb, *flechten*, signifying “to braid” and “to weave.” Weaving involves the process of interlacing different strands of yarns to create fabric, just as yarns are woven to form fabric used for garments. This semantic link corresponds with the underlying meaning of the Chinese term “garment of earth.” As the British naturalist, Trevor Goward describes, fungi are “Earth’s first weavers”, aptly represents the interwoven relationship among the composite organisms that constitute what we call a lichen.

# Biological Function: “**We** Are All Lichens”

- Scott F. Gilbert & Jan Sapp & Alfred I. Tauber, A Symbiotic View of Life: We Have Never Been Individuals

## Micro-ecosystems

Lichens are commonly mistaken as plants; as a matter of fact, for a long time, they were classified as plant-life until the turning point in the late nineteenth century. Lichen is a composite organism composed of a mycobiont: a lichen-forming fungus and photobionts: photosynthetic partners which are either green algae or cyanobacteria. The photosynthetic partner provides energy by converting sunlight and carbon dioxide into carbohydrates via photosynthesis. In exchange, the thallus which is the body of the lichen (made up of fungal filaments called hyphae) provides shelter for protection, minerals and water which are taken in directly from the atmosphere. Unlike vascular plants, lichens do not need soil to grow as they don't have roots to soak up water from the ground nor vascular tissues to transport nutrients around.

Lichens have been the poster-child for the biological phenomenon- symbiosis. The term was first introduced in 1877 by the German scientist, Albert Bernhard Frank to describe the nature of lichens. Lichens, in most cases, are made up of one mycobiont and one photobiont, however, in a small percentage of lichens, a mycobiont can have two photobionts with both green algae and cyanobacteria involved. In 2016, an unexpected second “mycobiont” partner- yeasts was discovered in a study led by mycologist, M. Catherine Aime. A single-celled fungi found in the cortex (skin) of species such as Wolf lichen (Latin name: *Letharia vulpina*) that produces chemical to help fend off predators. This discovery might offer an explanation on the challenges scientists have been facing in attempting to recreate lichens in the laboratory, even when combining species that form successful partnerships in nature<sup>7</sup>. In a conversation with scientist, Rémy Poncet, Head of “Connaissance des Espèces” of Museum national d’Histoire naturelle, it was pointed out how remarkable this partnership is, especially considering that Basidiomycota is a distant branch from Ascomycota in the classification.

It is the interspecies dependencies as a collective force that enable lichens to survive in a wide range of habitats and endure through extreme climate. In the article, “A Symbiotic View of Life: We Have Never Been Individuals,” co-authored

by biologist Scott F. Gilbert, historian of biology Jan Sapp, and historian and philosopher of science Alfred I. Tauber questions the notion of biological individual and argues that humans have never been individuals but exist as a self-sufficient holobiont<sup>8</sup> akin to lichens. Healthy humans are largely dependent on the gut-associated microbiota that live in our digestive tracts. They generate enzymes not found in the human genome, aiding in the digestion of fibres that, without their assistance, would be otherwise indigestible. Without the specific internal gut environment of humans, these microbiota would not survive either. In essence, human bodies co-exist, co-develop, and co-evolve with a diverse more-than-human composites harboured within us, redefining the notion of a “biological individual.”<sup>9</sup> Sociologist, David Griffiths took on a queer ecological perspective building on Gilbert, Sapp and Tauber’s work, the observation of social and sexual behaviours in non-human species is often employed as a comparison to how humans interact. The issue lies in scientists’ tendency to interpret nature through a heteronormative narrative, with an “undue emphasis on sexual reproduction between two individual human bodies”, thereby leaving out the diverse communities and identities that fall outside of non-normative practices<sup>10</sup>. Griffiths argued that in reality, human bodies only reproduce “sexually” sometimes while the interconnected “mesh”, a term borrowed from Tim Morton, of microbes transcend boundaries and reproduce constantly. Griffiths proposed that we view the social and sexual diversity of nature as they truly are, concurrently examining human social interaction and sexuality through a “natural” lens, might offer insight for human practices beyond the constraints of heteronormative framework.

“How does a gathering become a ‘happening,’ that is, greater than the sum of its part?”

- Anna L. Tsing, *The Mushroom at the End of the World*.

Canadian lichenologist Trevor Goward described lichens as 'fungi that have discovered agriculture.' This relationship has also been characterised, at one time, as a captor/captive dynamic, suggesting that fungi dominate in their interaction, 'living off the work of others.'<sup>11</sup> Although, the nature of the relationship between the fungal and photosynthetic partners-whether parasitic or mutualistic- is still up for debate, I prefer to see it as a mutually beneficial one. Neither mycobionts nor photobionts compete to be the center stage, on the contrary, it takes humility to step back so not to be in front of others. They join forces on a level playing field, embracing each other's individualities. A collaboration where they transform differences into strengths. Lichens seem to grasp the concept of there is no “self” in the self cleverly. In Dao De Jing, chapter 7, heaven stands for the movement of time. Earth represents the transformation of form<sup>12</sup>. Lichen is a

dynamic community of symbiotic complexities; if you separate the fungi, from the photobionts, there would not be a lichen as a functional ecological unit. Similar to the sage in the passage, lichen is an all embracing form who takes the supporting role that unites diversity by converging as an entirety whole. In Daoist philosophy, the liberation through selflessness is grounded in recognising the insignificance of the individual self and acknowledging that the unity of all living and non-living entities in the universe is the way to be<sup>13</sup>. Together, we are greater than alone.

天長地久。

天地之所以能長且久者，以其不自生，故能長生  
是以聖人退其身，而身先，外其身，而身存  
不以其無私邪，故能成其私。

*Heaven is eternal and Earth is immortal  
the reason they're eternal and immortal  
is because they don't live for themselves  
hence they can live forever  
thus the sage pulls himself back  
but ends up in front  
he lets himself go  
but ends up safe  
selflessness must be the reason  
Whatever he seeks, he finds*

## Growth Forms

Lichens have a variety of forms and here are the three main types:

1. Crustose (crusty) - forms a crust and grows directly on and in a substrate, such as soil, trees or rocks and sometimes even man-made structures. Powdery appearance.
2. Foliose (leafy) - resembles flat, lobed leaves or foliage, with distinct upper and lower surfaces that are different colours. A helpful method to distinguish between a foliose lichen and a crustose lichen, especially when they look similar on a rock face, is to use a needle. If the needle can pass underneath the lobes, it indicates a foliose lichen.
3. Fruticose (bushy or hairy) - 3 dimensional, long, narrow branches give the appearance of hair or a mini-shrub. Shrub-like fruticose lichens typically grow on soil, appearing upright, while hairy fruticose lichens grow on branches, appearing upside down. Unlike foliose lichens, the surface of fruticose lichens look the same on all sides



Crustose Lichen



Foliose Lichen



Fruticose Lichen (bushy)  
Photo courtesy of Jason Hollinger



Fruticose Lichen (hairy)  
Photo courtesy of Jason Hollinger

## Beauty in Serendipity

There are two main forms in lichen reproduction. It is worth noting that lichens are *poikilohydry*, meaning they cannot regulate their internal humidity in the way animals can. They can put hydrophobic compounds in their outer layer but they lack the structural mechanism to maintain water content and maintain humidity. Therefore, on a dry day they can become brittle. Take reindeer lichen (Latin name: *Cladonia rangiferina*) as an example; when it's crunched, it fragments into tiny pieces. The fungus and a alga would then go off and start a whole new lichen when they reach a suitable environment.

1. **Vegetative (Asexual) reproduction** (lichens produce two special structures to promote fragmentation):
  - **Isidia:** a peg-like structure grows on the surface of thallus with a cortex (skin), fragile fragments contain algae and fungi that break off, usually about 1mm tall with a hard and rough appearance
  - **Soredia:** soft powdery appearance, produced from within the lichen. In contrast to isidia, they do not have an outer cortex, they are released in small packages that contain algal cells, fungal tissues and sometimes cyanobacteria.
2. **Sexual reproduction:** *Apothecia*, also known as the fruiting bodies, is the sexual reproductive structure where *ascospores* or spores formed within an ascus, a sac-like structure. You can identify fungi by looking at the way they produce spores, for example, Ascomycetes fungi, have the appearance of jam tarts. Spores are developed inside a cylindrical shell filled with fluid and as the humidity changes, their osmotic pressure increases, equally when it rains, the pressure of the raindrop falls onto the lichen and shot the spores vertically up and out of the ascus, at an acceleration that is high enough to catapult the spores out through the surface layer into the air.

Lichen reproductive structures can be interchanged and mixed into various combinations. Nevertheless, they exclusively reproduce using one mode, either with the fragmentation of isidia, soredia, or the dispersal of spores through apothecia. From the conversation with Poncet, I understood that since vegetative reproductive organs contain all the necessary elements for reproduction; all it requires is to hopefully land in a suitable environment with the right conditions when broken off. On the other hand, the sexual reproduction of spore dispersal is entirely random, relying heavily on chance encounters with various mechanic processes they happen to stumble across- be it through raindrops, wind dispersion, or transported by fauna. If fortunate, the spores will land on an algae, initiating the symbiotic exchange. The arbitrary nature

of dispersal might seem rather risky; however, given the ubiquitous presence of lichens, it clearly works quite well. In either scenario, the formation of a lichen demands an incredible amount of luck and impeccable timing. Moreover, what is intriguing is that even though lichens largely depend on external factors for successful reproduction, they embrace the manner of 'Wu-Wei', going with the natural flow without excessive force, and simply allowing events to unfold organically.

The concept of Wu Wei, rooted in Daoist tradition can be translated to “effortless action,” “non-action,” “non-doing” or “principle of least resistance” as Mathews proposes to be one of the living systems principles- an organism will seek to achieve its goals in ways that minimise resistance to its activities. Methods that minimise resistance are likely to be those that least hinder the goals of others. Therefore, the path of “least resistance” is a path in which one aims to fulfil their own objectives while, to the greatest extent possible, accommodating the objectives of others.<sup>14</sup> Contrary to a culture focused on overconsumption and relentless production that debilitates our vital life systems, Wu Wei does not mean complete inactivity but suggests an alternative approach to doing and being. It encourages stepping back from the constant pursuit of things, appreciating the present moment, and avoiding the destructive consequences of human arrogance and control. This concept aligns with Buddhist teachings, which stress the importance of contentment and gratitude for what one has, while letting go of the desire for unnecessary excess. In the face of the ecological crisis, there presents a great opportunity for us to truly confront one of the root issues lies in unconscious human activity, driven by the pursuit of insatiable wants. Newton’s third law states for every action there is an equal and opposite reaction. This principle can be correlated with the importance of being mindful with the intention and motivation behind what we do, as our present behaviour will inevitably reflect on the consequences we will face. Embracing Wu Wei can serve as a significant step towards establishing a deeper appreciation and respectful relationship with the Earth, leading to a profound sense of unity.

## Beauty in the Grotesque

Historically lichens have been associated with diseases or parasites, taken as threats to the environment, or even perceived as lifeless. Lichens do not stand out in the crowds. They don’t scream for attention but quietly exist. Describing

lichens often involves mentioning the trees, rocks, ground, or substrate they are attached to, as people seem to find it challenging to precisely define what lichens are. Lichens have been largely dismissed.



Gong Shi from the Qing Dynasty  
Photo courtesy of Christie's

Since the Song Dynasty (960-1279) to Qing Dynasty (1644-1911), Chinese artists and scholars often draw inspiration from nature without physically venturing into it. Instead, they would take refuge in their studies, using “Gong Shi” or scholar's rocks that resemble well-known mountain peaks, as a source of creative inspiration. Like landscape paintings, represent a condensed reflection of the scenery as imagined by scholars in their studies or small gardens. While many scholar's rocks resemble mountain ranges, their abstract forms often evoke images of dragons, phoenixes, flourishing plants, and even figures. Nevertheless, the most captivating aspect for literati is the abstract silhouettes of the rocks that provoke and expand their vivid imagination. Can humans learn to recognise beauty in the eccentric shapes of lichens? Can we challenge our mainstream beauty standard by beginning with appreciating the little organisms all around us? Can the stunning patterns, colours, shapes and textures of lichens serve as a scholar’s rock that will eventually made their way onto our pedestals, into our hearts?

## Naming & Identity

Lichens are commonly known as lichenised fungi, and the classification of a lichen is primarily based on the fungal partner. Consequently, lichen classification is a component of fungal classification and given that the majority of lichens are lichenised ascomycetes, lichen classification is closely intertwined with the subject of ascomycete classification. Upon learning about the intricate world of lichen nomenclature, I couldn't help but frown initially. The complex scientific names, though undoubtedly practical in the realm of botanical communication, seemed to me like imposing a heavy metal door shutting out the vibrant imagination I had for what lichens could represent. It is rather challenging to connect the captivating shapes, textures, colours, and interactions with substrates to the seemingly sterile scientific names. I am not inclined towards labelling or categorising them within the overly restrictive classification system, where the mycobiont component receives credit with a capital letter. While I acknowledge the utility of codes of botanical nomenclature in



facilitating scientific discourse, I find these names somewhat inadequate for a broader audience. It would be a shame to deter curious minds from further exploration due to the intimidating nomenclature.

Common names, on the other hand, are playful and fun. Instead of optical microscopes, we have our naked eyes to observe where lichens are named based on their colours, forms and the substrates they inhabit. Common names are dynamic, and a single species may have various common names reflecting different cultural perceptions and imagination. Instead of *Vulpicida tilesii*, the brilliant bright yellow foliose lichens are affectionally known as Limestone Sunshine Lichen. Rather than *Bryoria trichomes*, these hair-like lichens hanging from branches are called as Old Man's Beard and Witch's Hair for their long and stringy appearance. The stalky, inflated-looking fruticose lichen, *Dactylic arctica*, growing up to 7 centimeters tall, is cheekily dubbed Dead Man's Fingers. How delightful is that? Instantly, the names resonate with what we observe, encouraging us to look closer.

Just as humans commonly use names given by their families rather than referring to each other as "Homo sapiens," we also create endearing nicknames for those who are close to us, reflecting the significance they hold in our hearts. The way we name things influences our perception of them. The underlying meaning of words can either empower or create barriers in our connection with each other. Personally, my fascination with lichens has grown stronger, knowing that in Chinese, they are referred to as the "garment of earth." It feels like a cherished treasure I carry with me, deepening my connection with these remarkable organisms wherever I encounter them.

If we were to assign a new meaning to the word 'lichen' that transcends its negative associations with diseases and aligns more closely with its inherent spirit, what could that be?

“As long as we imagine that humans are made through progress, nonhumans are stuck within this imaginative framework too”  
Anna L. Tsing, *The Mushroom at the End of the World*.

## Time & Rhythm

The alarm clock rang in the morning, and with the opening of the eyes came an inexplicable sense of urgency. Before the brain had a chance to react, the subconscious mind had already arranged the pending to-do list for the day, preparing to race against time. With a slightly faster heartbeat and shallow breathing, this sense of pressure is uncomfortable but people seem to have grown accustomed to it and seldom question why they have such a physical response. Time is a captivating and intricate concept. Despite its intangibility, it is deeply experienced by people. Since the advent of industrialisation nature-based time has evolved to clock-based time and the common perception of time has almost always been equated as a form of transaction. Time is to be spent, given, lent, managed or dominated. One can have time; conversely, one can lose time. The negative experience associated with time being wasted or the lack of time is a prevalent modern phenomenon, closely linked to our well-being.

This structure of time, in a way, dictates our everyday routine, even though intrinsically, we yearn for a rhythm that aligns more comfortably with our essence.

Lichen, on the other hand, operates on a refreshing timescale in contrast to the embedded “time line of progress,” to borrow anthropologist, Anna L. Tsing’s term, in which time is as seen linear, profit-driven, and fixated on efficiency and productivity. Lichen falls outside of this time category, they have an extremely slow growth rate. How fast they grow depends on a variety of environmental factors from temperature, humidity, acidity in the rain, air quality, light accessibility to the substrates they grown on. In temperate areas, most of the species grow 0.5-7mm per year on average. Fruticose lichens are among the fastest growing lichens. When it comes to human intervention to “cultivate” growth, they resist to conform, they take their time. You are confronted with organisms that are so far removed from the mainstream rhythm of producing, living and being, marching to their own beat. They are anarchists who defy industries’ tendency to dominate and domesticate for their own interest.

In *Repairing with Lichen*, a micro-rewilding project involving the creation of prototype tiles to encourage lichen growth on urban surfaces, artist and designer, Penelope Cain, raises a central question: “How can we look through lichen’s time span instead of human’s wish for an expected outcome within a project duration?” This question can extend beyond lichens to other living organisms where the focus should shift from what living organisms can achieve for us in the collaboration towards how we can attend to them?

How can we move past transactional demands and, instead, acknowledge the inherent value of a process that embraces time as expansive? Time, with its capacity for learning, interaction, reflection, creation, expression, meditation and simply being with. Can we transform the negative perceptions typically associated with the passage of time? In *Braiding Sweetgrass*, Kimmerer shares the story of the “Three Sisters”—corn, beans, and squash, each plant follows its unique rhythm and order of germination, a critical factor for both their relationship and the overall success of the crop.<sup>15</sup> Can the radical rhythm of lichens liberate humanity from the “time line of progress,” a space often overwhelming and all-consuming? Perhaps it can redirect us toward a temporal rhythm in alignment with nature for our collective survival. This is a narrative worth envisioning.

## Lichen and Humans

Lichens and humans have a long history. The use of lichens by humans date back to ancient times, it’s been used by cultures throughout the world in many ways, such as for medicine, dyes, food, poison and bio-indicators. Specific uses of lichen varied depending on different cultures. Lichen thalli are rich in secondary compounds which is evident in the spectacular colours they come in, ranging from bright yellow, red, orange, green to brown, shades of white and grey, and even black. These colours are the byproduct of the complex chemicals, and more than 700 chemical compounds have been identified and isolated in lichens. Notably, 90% of these compounds are unique and not found elsewhere in nature. One of the more toxic chemicals is called vulpinic acid which can induce paralysis in respiratory organs. Wolf Lichen (*Letharia vulpine*) contains these chemicals and was historically used to poison foxes in Scandinavia. Usnic acid, one of the more common chemicals that is used medicinally is known for its antibacterial and anticancer properties.<sup>16</sup> For those lichens that contain usnic acid have a yellow-green colour, such as the fruticose lichen, Oak Moss Lichen (*Evernia prunastri*), which can be used to make a bright yellow dye. Commercially they are collected and cooked in vats to extract

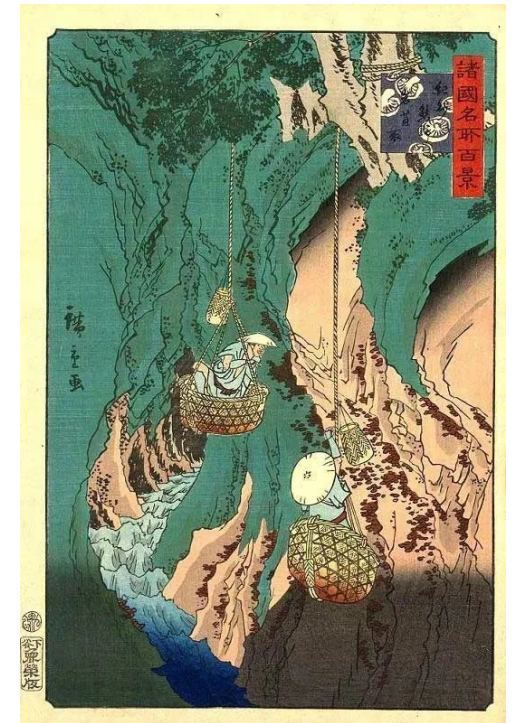


Shoes made of Horsehair Lichens  
Photo courtesy of Stephen Starnoff

the essence for making “concrète,”<sup>17</sup> a fixative added to the manufacture of perfume to give the perfume its “base notes” with floral essence being the “top notes.” The base notes evaporate slowly and help the scent last longer.<sup>18</sup> The concentrated liquid “concrète” will then be shipped to the hub of the long-established French perfume industry in Grasse. The use of Tree Moss Lichen (*Pseudevernia furfuracea*) dates back to the Eighteenth Dynasty of Egypt (1550/1549 to 1292 BC). Its aromatic and preservative qualities were used in embalming, and it served as a light-weight, highly absorbent packaging material. Egyptians also ground and mixed Tree Moss Lichens with flour in bread-making.<sup>19</sup> There are many types of fruticose, hair-like lichens, one of which is Old Man’s Beard (*Usnea*). Abundant in the boreal forest, characterised by a mix of deciduous trees and conifers in North America, it serves as a vital resource for clothing, footwear and food<sup>20</sup> for the

Indigenous communities. Litmus, a water-soluble dye mixture extracted from lichen species like *Lecanora tartarea* and *Rocella tinctoria*, is used in litmus paper. It is a quick pH indicator to determine whether a solution is acidic or alkaline, though it lacks precision as it doesn't offer a defined value. In acidic conditions, blue litmus paper turns red, while red litmus paper shifts to blue in alkaline conditions.<sup>21</sup>

While there are numerous edible lichen species, they were primarily consumed during periods of famine in times of dire need. However, some specific types of lichen are considered staple foods in certain regions. In China, lichen is widely known domestically as “地皮菜” /di pi cai/ or “天仙菜” /tian xian cai/ and it is consumed as a healing food due to its rich content of amino acids, minerals, and calcium. Among the most well-known edible lichens is the Rock Tripe Lichen (*Umbilicaria esculenta*), also commonly referred to as Navel Lichen, as its scientific name suggests. The French name, “La tripe de roche,”



Kishū Kumano iwatake tori by Japanese Woodblock artist, Chinpei Suzuki (1829-1869), illustrating *Iwatake* hunter risking their life gathering Rock Tripe from dangerous cliffs at Kumano in Kishū. Photo courtesy of Library of Congress of the United States.

directly translates to “rock tripe,” with the “tripe” referring to the stomach lining of a ruminant. Contrasting the secondary meaning of "tripe," which implies poor-quality food and suggests that lichens, akin to tripe, are low-value substances found on rocks, there is irony in the fact they are considered a delicacy in countries like China, Korea and Japan.<sup>22</sup> Native to East Asia, Rock Tripe is called *shi er* in Chinese, meaning “rock ear” and *iwatake* in Japanese, meaning “cliff mushroom.” They are rich in vitamins, making it a valuable resource for both culinary and medicinal purposes. Its long history of consumption is recorded in 《本草綱目》 *Ben Cao Gang Mu* (Compendium of Materia Medica), possibly the most comprehensive medical book of traditional Chinese medicine ever existed. Compiled and written by Li Shi-zhen (1518-1593), a medical expert of the Ming Dynasty (1368-1644). One record of the culinary use of Rock Tripe Lichen recounts:

廬山亦多，狀如地耳，山僧採、曝、饋選，洗去沙土，作茹，勝於木耳，佳品也

*Lu Mountain is also abundant with a lichen resembling ground ear. Monks from the mountains gather, sun-dry, and select it. After washing away the sand, it is cooked and surpasses wood ear, making it an excellent product*

Rock Tripe Lichen is known for its sweet taste and slightly cold property. It is believed to have benefits such as detoxifying, cooling and promoting blood circulation, improving vision, and resolving phlegm. When cooking Rock Tripe as an ingredient, it is recommended to soften them in boiling water first then gently rub to remove any remaining sand, and the tiny thorns on the back for a smoother texture.



Subspecies of murex snails and the colours they produce. Photo extracted from Insider Business, courtesy of Emily Christian courtesy of Zohar Amar.

When it comes to common human lichen usage, I would be remiss if I did not mention the history of lichen dyes. Purple textiles were much coveted and held in high esteem in the ancient times. Archeological evidence displays that the shellfish purple dyes were used as early as 2000 BC on the Mediterranean island of Crete. It has been said to be a colour that invokes passion, lust and love<sup>23</sup>. During the Roman period, purple became political. “Tyrian purple,” prepared from several marine molluscs species, known as murex, were regarded as a symbol of wealth, power and status by the Phoenicians. It is a stench reeking and painstaking process that begins with



Hypobranchial gland removal.  
Photo extracted from Insider Business,  
courtesy of Emily Christian

the delicate manual removal of the hypobranchial gland of the murex snail one by one. Inside these tiny sacs contain the dye precursor, from which only a few drops of pigment can be derived. As a result, it takes thousands of murex snails, approximately 45 kilograms to produce a single gram of pure "Tyrian Purple".<sup>24</sup> The odor was considered an indicator of authentic murex textile. With the high demand of murex purple inevitably follows by resource depletion. Some species of lichens, including *Roccella tinctoria* and *Roccella fuciformis*, were discovered to produce orchil, an nearly identical dark red purple dye to murex snails. Lichen dye researcher, Karen Diadick Casselman, in her extensive source book on lichen dyes suggests that "The combination of murex and lichens was thus an economic response to an ecological and environmental crisis- the over-exploitation of natural resource."<sup>25</sup>

Amidst environmental challenges, there has been a revival of interest in natural dyes in various industries. Lichens, valuable as dyestuffs, are not intended for commercial projects. If one wishes to experiment with lichen dyes for small-scale personal projects, it is crucial for me to emphasise the ethical practice of "salvage botany," as Casselman recommends. This approach involves a non-exploitative utilisation of "found" lichens, those that have fallen to the ground, become detached from their substrates, or would otherwise be destroyed. She also advises against large group outings with the primary goal of collecting lichens for dyeing. Each lichen project should be planned with care and mindful consideration. It would be a shame to see a repetition of what happened to murex snails with lichens.



Tyrian purple threads (top left), orchil lichen (center), orchil-dyed silk and wool (right). Photo courtesy of Isabella Whitworth

## Lichen in the ecosystem

Lichens has a vital role in the eco-system, they provide habitat, shelter and serve as a food source for many small animals and invertebrates, such as tardigrades, snails, grasshoppers, termites and slugs, to name a few. Brussels Lace Moth caterpillar (*Cleorodes lichenaria*) blends itself by mimicking lichens and uses them for camouflage. During winter, Reindeer or Caribou graze on a substantial amount of Reindeer Lichens (*Cladonia rangiferina*) which is a great source of carbohydrates. Lichens are also nesting materials for birds. Since lichens obtain the nutrients and minerals they need to survive directly from the air, they inevitably take in the toxins from the polluted air, each lichen species has inherent tolerance to different pollutants. Some of the more sensitive species will disappear in areas with poor air quality. Lungwort Lichens (*Lobaria pulmonaria*), for example, are highly sensitive to air pollution and prefer to be in old forests. These species are on the decline and becoming increasingly rare. Common Orange Lichen (*Xanthoria parietina*), on the other hand, are nitrophytes, meaning they thrive in nitrogen-rich environment and can be commonly found in urban areas on wayside trees. Lichens are as fragile as they are resilient; they can be found in harsh climates, such as extreme cold in Arctic and Antarctic regions, alpine areas, arid deserts. They are the only organisms known to survive exposure to UV radiation in outer space. Lichens exhibit tolerance to drastic dehydration, enabling them to endure periods without water, during which they appear 'immortal' due to their high cell wall flexibility. Lichens also play an important role in soil formation processes; they are one of the first pioneer species to occupy land surfaces and turn rocks into soil with the chemical they produce.<sup>26</sup>



A lichen mimic-  
Brussels Lace Moth Caterpillar  
Photo courtesy of Steve Ogden



A hummingbird nest  
Photo courtesy of Wild Birds Unlimited



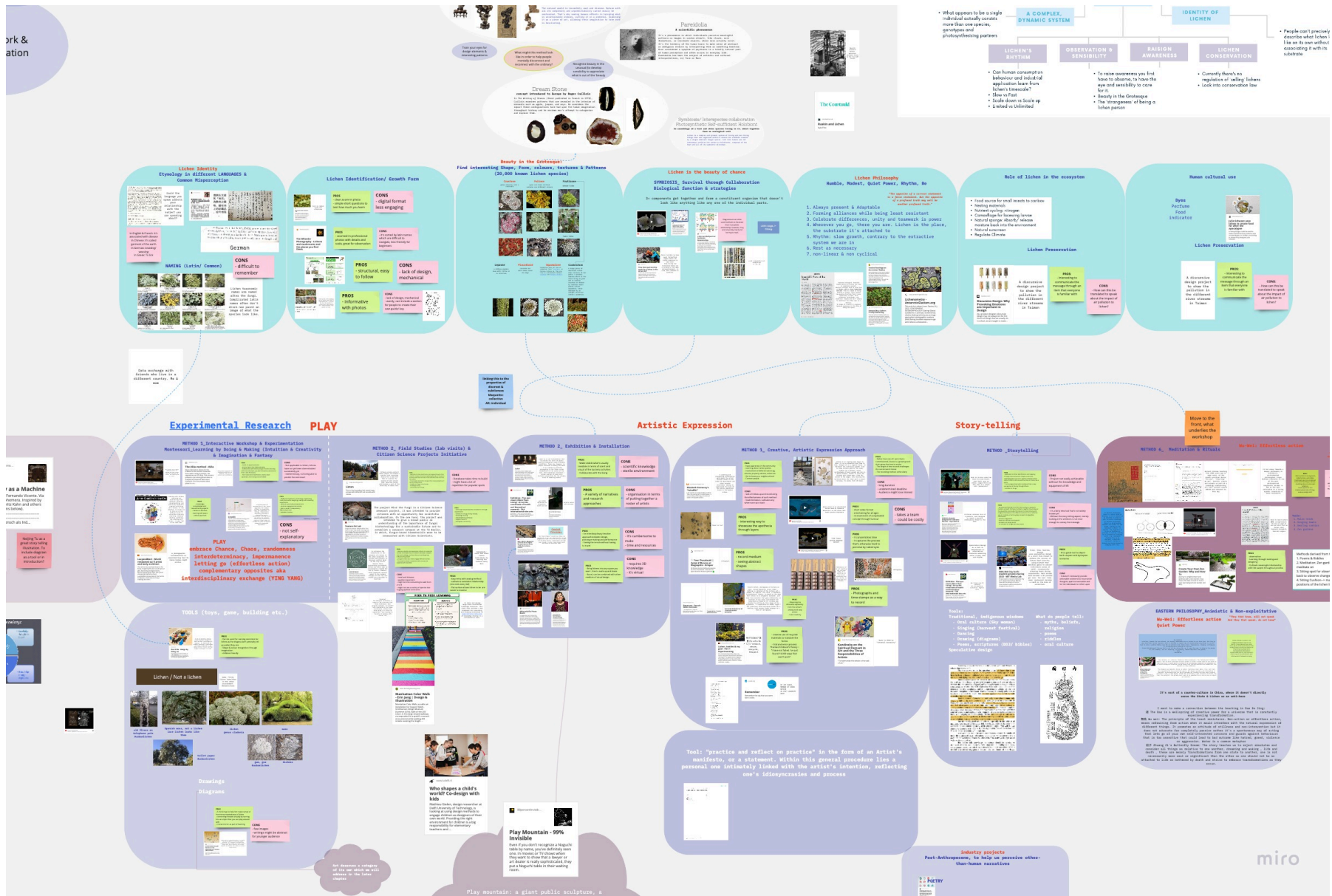
Common Orange Lichen

## Knowledge Transmission Methods

Amongst the likes of contemporary designers, artists and researchers with heightened global awareness comes the emergence of practices that integrate regenerative and biological elements, such as plants, mycelium, bacteria, algae and other living forms. The dynamism of the living materials disrupts the conventional boundary between the creatives and their chosen mediums. When working with organisms that are growing and evolving, an entirely different relationship is formed. This shift requires stepping away from the role of a 'conductor' who orchestrates, relinquishing a certain degree of control and stepping into the role of a co-creator during the process<sup>27</sup>. In order to work with living organisms, acquiring information from scientific papers are imperative. Science is often perceived as an objective discipline that primarily emphasises data, facts, and empirical evidence. However, these technical publications are usually written in an impersonal style filled with multi-syllable jargons and diagrams that read like a piece of puzzle. Despite the ultimate aim of research is to serve the general public, at the end of the day, scientists are typically not trained to communicate with the public, nor is the public trained to read scientific literature. The complexity of its formulation becomes a barrier, making the knowledge inaccessible for a wider understanding, thus making its dissemination challenging. While this approach is commonly seen as unbiased and has undoubtedly resulted in significant advancements in knowledge and understanding, it is equally important to recognise the limitations of traditional forms of education and awareness-raising. Although valuable, they may not always be sufficient to inspire and bring about meaningful change.

I am composed of various biological elements—human cells, microbiota, water, and proteins, to name a few. However, I am also shaped by intangible aspects like personality, thoughts, emotions, energy and spirit. If you were to ask a friend who I am and what I am, beyond acknowledging that I am a clump of cells, they would likely describe my personality or how I make them feel. As a member of the general public myself, it seems to me that there is an apparent lack of sensibility that could be included as an effective medium to share knowledge. This section attempts to put into context methodologies identified through the exploration of different case studies. Beyond the methodologies, an ineffable emphasis is placed on tenderness, nurturing, and connection towards the featured subjects. Each project follows a unique path in co-creation, engaging diverse stakeholders and processes. These insights are drawn, centred around the efforts of alternative knowledge transmission methods that not only strike a chord in our hearts but also highlights the importance of raising sensibility in our collective pursuit of understanding.





Categorisation work process

“If my heart can become pure and simple, like that of a child, I think there probably can be no greater happiness than this.”  
Nishida Kitaro, Japanese philosopher

## Learning-by-Doing

### o Self-initiated Experimentation

“Everything begins with an idea.” In her photography series, *Nurture Studies* (2012), German artist, Diana Scherer, explored the growth of plant roots which she grew from seed over a span of six months within the limited space of a vase<sup>28</sup>. These captivating images revealed the complex structure of the root movement developed hidden beneath the vases they had grown into. Scherer was fascinated by the behavioural patterns and the intelligence<sup>29</sup> of the root system. Each plant exhibited a distinctive appearance, completely different from one another. Shades of white and yellow, along with the textures and the thickness of the roots, depending on the plants, reminded her of yarns<sup>30</sup>. This observation inspired her to replicate the weaving of textiles by allowing the root systems to take on the role of a weaver. After a year of experimenting in partnership with Radboud University in Nijmegen, Scherer managed to develop a template system that could guide the roots’ growth, like yarn, weaving themselves into the geometric patterns found in nature. This marked the inception of her ongoing project, *Interwoven*, which has been unfolding for the past eight years. More than an original technique developed to transform plants into a material for innovative application, behind these delicately patterned root textiles conceal a poetic and passionating process that emanates through her work.



*Nature Studies*, August 08, 2010  
Photo courtesy of Diana Scherer

What spoke to me initially in Scherer’s work was the time aspect, as time symbolises movement and growth. Followed by her general attitude of not rushing the process, having the necessary time to “study, research, doing and producing” is

essential. From a commercial standpoint, it could be seen as a limitation whether or not a material could be reproduced in quantity at speed, however, I would argue the slowness component here is actually a virtue, especially considering overproduction and overconsumption are the many causes of present environmental challenges. As mentioned previously, lichens have an extremely slow growth rate, and their rhythm cannot be easily altered nor replicated. There has not been a successful case where lichens 'do' exactly what the humans want. Hence, lichens emerge as rebels in the world of biodesign, challenging the notion of the usability of an organic material amidst of popular options that could be more or less directed as instructed. This raises questions about industries' obsession with relentless production efficiency to meet our needs. Although lichens have been used for many purposes throughout history by human, It is not my intention to simply present lichen as a source of material.

Scherer is currently working on the possible wearability and scalability of the root textile, such as oat, hoping it could be worn in the future. While an inevitable level of "control" plays a role in this process, for example, guiding root growth to form patterns, feeding a certain ratio of soil mix to achieve various root colours, additional growing light to speed up growth where there's insufficient natural light,<sup>31</sup> Scherer's inquiry begins with nature, committing to the most ethical and low-energy cultivating methods. Since the roots have an agency to weave themselves while searching for nutrients and water<sup>32</sup>, she views them as a collaboration rather than an exploitation. Moreover, Scherer does not force the results to conform to a predetermined perfection; instead, she revels in the process of nurturing and caring for the plants, embracing the unpredictable factors inherent in plant growth. Typically documented in otherwise dry scientific languages, she speaks through her photograph and textile pieces to translate the complex science into a playful and aesthetic format<sup>33</sup>. This approach enable communication to a much broader audience. It is precisely her simple intention that allows her work to evoke such pure emotions in people.

*Interwoven*, stemmed from a collection of art portraits, it was throughout the course of her conducting experiments with hundreds of plants,<sup>34</sup> with a curious mindset, not having any specific attachment to the outcome that open up to new insights and gradually led to an interdisciplinary project with a more deliberate intent, which has since become a significant part of her practice. The collaborative role she took on has evolved and expanded<sup>35</sup> into so much more along the way. In the next session, we will take a closer look at the work of Aléa, whom in my opinion, embodies a similar spirit.

## ○ Workshop

Alèa, a Paris-based experimental myco-fabrication studio, was formed under the self-initiated experiments carried out between peers and creative collaborators, Miriam Josi and Stella Lee Prowes. Bonded by a mutual fascination and quest to deepen their respective practice with fungi, through trial and error, they developed a unique bio-inclusive<sup>36</sup> method which later became their on-going research project, “Back to Dirt”. On the contrary to how mycelium is traditionally inoculated in a germ-free, lab environment in case of contamination. The designers opt for soil as a mold, welcoming the organisms in different soil environment to be an integral part of the growing process, aiming to de-sterilise mycelium-led design. This truly challenges the contemporary notion of lab-grown materials where bacteria are often deemed as undesirable

The designer as a:

- Observer
- Forager
- Gatherer
- Cultivator
- Investigator
- Alchemist
- Facilitator
- Communicator
- Translator
- Community builder

Josi, in her dissertation proposes the concept of a designer as an overarching term for the variety of roles designers step into while working with mycelium. In my view, this shift transcends traditional design backgrounds and applies to anyone with a curious mindset. Before each workshop, the participants are asked to collect organic wastes from their locality. This includes items like toilet paper rolls, coffee grounds, shredded paper and more. This initial stage of material gathering is not merely a preparatory step; it marks the beginning of the workshop itself. It encourages participants to actively observe and identify potential sources of organic waste, whether it's at their local café, supermarket, or even within their own homes, such as on their bookshelves with outdated magazines. The simplicity of the table serves as a gateway to a dynamic

educational experience, setting itself apart from traditional learning structures. It opens participants to a new perspective and prompts them to reconsider their relationship with the living organisms, in this case, mycelium in the process of experimentation. Providing participants who are new to the subject with an active role will help them stay engaged throughout the learning process. They will gain a better understanding of their responsibilities and visualise in advance how their roles can fluidly transition from one to another.

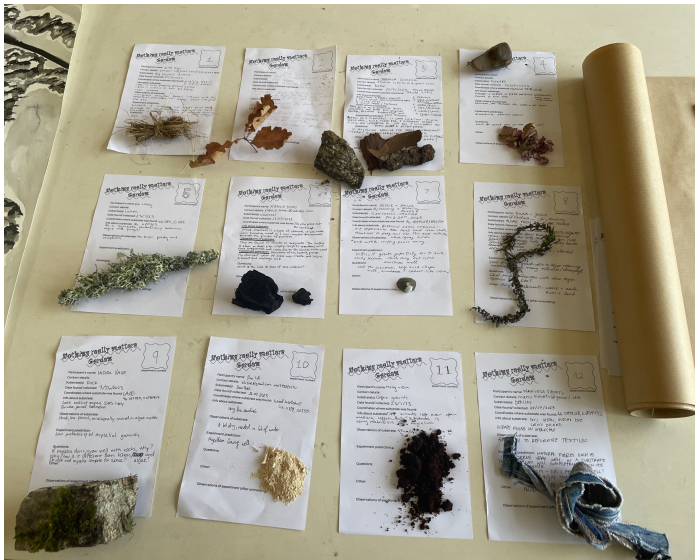
During the summer, I had the pleasure of assisting Aléa in a one-week workshop titled 'Nothing Really Matters,' held at the Domaine de Boisbuchet in southwest France. Alongside thirteen curious participants from around the world, we collectively conceptualised the development of an ephemeral garden using the “soil as a mold” method. This unique garden also serves as a 'living material library' that will grow, evolve, and decay over time. Participants explored the vast 150-hectare site, observing and identifying organic substrates in various corners. They conducted experiments, exploring the properties of how mycelium interacted with these substrates. Engaged in brainstorming sessions in regards to how to organise the garden and display the final presentation. It's lively. It was particularly interesting to observe how the participants seamlessly transitioned from one role to another, under the guidance of both Josi and Prowse. They began as an observer, noticing what was around to foragers collecting organic substrates, to cultivators, mixing mycelium with the substrates. Morphing into alchemists, trying out different formulas. Further along, participants transformed into investigators, monitoring and documenting their progress and to community builders where everyone rolled up their sleeves. Together, they prepared a plot of land for planting the biodegradable capsules and tended to the garden that mirrored the location where the substrates were initially collected on site.



It all begins with observation

In the end, the workshop provided participants beyond the practical engagement with mycelium; it was a collaborative effort that connected us to the locality of the space, offering alternative visions related to the limits of control, reconciling with temporality, and fostering different caring relationships with the living beings in and around us. Participants did not take home with a “tangible” product per se, as the results took time to form. It was uncertain at the time whether or not the substrates would have made a suitable home for the mycelium. Undeniably, not having an immediate outcome could translate into frustration for some participants. One of the challenges in holding an experimental workshop is to manage people’s expectations in regards to the unpredictability of the material, as noted by the designer duo. Nevertheless, the beauty of an open-ended experimentation also lies in the new perspectives and conversations that emerge through the ongoing questioning and challenging of our preconceived notions about time, matters and places.

If I may extend the list of roles Josi proposed, I would venture to say, ultimately, designers are an excellent storyteller. Storytelling is the art of using words and actions to unveil the elements and images of a narrative<sup>37</sup>. In the context of a workshop, the designers story tell the knowledge and new concepts of their findings in bitesize information, through engaging activities. It it a safe space for participants to get inspired, to share, to try and make mistakes while having the experts around to guide you through the process. The participants after a workshop are equipped with necessary tools to get started and further explore on their own. After the Nothing Really Matter workshop at Boisbuchet, Aléa continued to exchange with the participants and are pleased to know that some of them went home and conduct their own experiments, building their own dialogues with mycelium. One participant tried to grow a floatable vest, while another attempted to create a living painting with mycelium. The knowledge has been passed on and taken on new forms.



Organic substrates sourced from local foraging



Results harvested from the soil, where every mycelium cylinder contains a locally sourced substrate. Each one of them showcases a specific material characteristic. Photo courtesy of Andres Alejos

The origin of 'Initial Design Workshop' at the Bauhaus training was created based on the Montessori methods devised by Mariā Montessori, where imagination, intuition, creativity and fantasy are the basis of training. It was created analogue to how children play.<sup>38</sup> It is not surprising that workshops have long been a popular and effective format in the world of design. This made me reflect on how early exposure to the intricacies of lichens and their ecological importance could encourage children to develop a deeper connection to nature and perhaps a greater appreciation for the subtle but vital components of the environment. Could this, in turn, potentially influence their overall behaviour with the world around them at a young age and lays the groundwork for future discussions surrounding ecological issues? How different would our relationship to the world be if individuals were given such exposure in the form of a workshop?

Perhaps one of the difficulties with "Nothing Really Matter" and other workshops that collaborate with living organisms is the layers of philosophical concept often involved. I wonder how bio-designers would translate abstract concepts for a younger audience? For Aléa, they revealed "The use of metaphors are powerful. We also prefer to use casual language, avoiding overly intellectual rhetoric to stay true to our voice. Additionally, we see working with mycelium as having pedagogical value in itself; it provides an immersed multisensory experience where complex concepts and nuance can be understood through hands-on experimentation." In another conversation with, Jen Hauser, biomedica researcher and art curator for "On Microperformativity" shared " ... it's not just making it as simple as possible, it's making connection with the unexpected and even for children, how would you explain the "garment of earth"... how to tell a story which is not making things under complex but creating interdisciplinary links and bridges."

Both creatives highlight the importance of using language as a tool for conveying messages. Storytelling can be a powerful tool and how we tell the stories matter- an aspect I will explore in more detail in a separate session down the line. For now, to follow the thread of experiments and workshops, both of which rest on the underlying intent of play. In fact, spoken language is a symbolic system, also regarded as a form of play.<sup>39</sup> It seems valuable to move forward and further investigate the spirit of play.

“Play is as important as oxygen, nutrient and love”  
Penny Wilson, professional Playworker at PATH

## Play

Have you ever observed how dogs play? If you grew up with dogs like me, you would have the pleasure of witnessing them in a rough-and-tumble play until they exhaust themselves out, panting with their tongues sticking out. Everyday at a certain hour, they would nudge me to take them out to the dog park playing with other dog friends, all an initiation on their part. Dr. Stuart L. Brown, a psychiatrist, play researcher and founder of the California-based, not-for-profit organisation, National Institute of Play, spent his career on researching the well-being of play says, as adults manoeuvring through the complex and demanding reality of modern world, dogs, our fellow primates “help us remember” the importance of play. His research shows that children who are play deprived tend to have results in reduced curiosity, difficulty in emotional regulation, limited repertoire of responses in adapting to surprised social situations<sup>40</sup>. Play is a state of being that all mammals possess. According to Brown, attempting to define what play is defeats the very essence of play, much like explaining a joke. At its most fundamental level, play proceeds without a complicated intellectual framework. The definition is ineffable as play can manifest in various forms and have different meanings for each person in different situations. However, the state of what play feels like can be understood in a brief description, as articulated by Brown:

“To be considered ‘play,’ the experience must be apparently purposeless and done for its own sake. Play is voluntary, it frees the player from a sense of time pressure. It has improvisational potential, it is inherently pleasurable and we yearn for more when it’s gone. While in a state of authentic exuberance, we delightfully engage with a playmate, play object, or playful thought. Each type of play evokes a state devoid of ego and therefore diminished self-consciousness. Each player contributes his or her own spin to play, exercising his or her own ‘play personality.’ Arriving in this ‘state’ of play evokes intrinsic motivation, sustains engagement, and moves the player to the next level of mastery.<sup>41</sup>”



We can all agree  
Children are play experts  
When they play, the sheer joy of playing is all they focus on  
The world stops for a moment  
With no sense of time, goals or plans  
Children are very good at world making with other children  
Children are wonderful creators of imaginary make-believe  
Out of nothing, that's how they make sense of the world

Through play, children have the opportunity to explore and engage with their environment, interact with others, and develop critical skills such as problem-solving, communication, and creativity.<sup>42</sup> Neither of my nephews, aged 5 and 7, particularly enjoys playing with adults, often describing it as 'boring.' As a result, their playtime with adults doesn't go very far. Their direct comments suggest that adults can sometimes come across as a little too rigid, stern, and that we might not offer the same level of imagination and creativity- a reminder, perhaps, of a lack of effort to play on our part.

“We don't stop playing because we grow old; we grow old because we stop playing.”  
George Bernard Shaw, Irish playwright

## o Citizen Science

Sounding Soil is an example of a playful approach to engage both children and adults with the micro-organisms underground in order to raise soil awareness. Initiated by researcher and artist, Marcus Maeder, as a part of his doctoral research in environmental sciences at ETH Zurich. it is an interdisciplinary research and citizen science project in which volunteers and scientists work together to monitor the biodiversity of the soil through sound. The collaboration with the living organisms found in the soil is established by the sound monitoring technique, known as ecoacoustic. Citizens of Switzerland are able to borrow soil microphone free of charge for a week to explore on their own. Through the process of sound monitoring, participants can learn about different soil type such as, meadows, allotments, vineyard, grass land, permaculture soils etc. As well as the wide variety of soil fauna that contributed to the nutrient-rich healthy soils. The

more complex sounds you can hear, the greater diversity of underground organism there are, which is a sign for healthy soil ecosystem<sup>43</sup>. One of the characteristics of play is uncertainty.<sup>44</sup> The outcomes of soil sound diversity cannot be predetermined, consequently, there is always a sense of excitement and surprise involved of what you might hear or not hear. Once recorded, participants are free to use their imagination to interpret the “voice” of the soil and decipher the messages they are trying to convey from the underground world. Interesting recordings will then be added to the sound map of Swiss Soils. This is a fun way to engage individuals to the natural world while contributing valuable data to scientific research. By collecting and uploading the sound recordings to the sound map creates a sense of community, enhancing the social aspect of learning and promoting collaboration and information exchange amongst enthusiasts. Another similar project, *Lichen Walk*, takes place in Brussels, participants of all ages and background are welcomed to engage in a 3-hour walk, exploring nine different locations in the city to learn about lichens, their symbiotic relationships, and their role in the urban environment. Participants are guided through stops and specific meeting points by an interactive map. The goal of this project is to facilitate people to observe and develop an increased sensitivity towards non-human entities, exploring and bringing attention to the importance of lichen diversity within an urban environment. Through careful observation, participants can discover that living organisms thrive in unexpected places throughout the city, adapting to urban spaces initially intended for the comfort of human.

Citizen science projects provide a unique opportunity for knowledge transmission by bridging the gap between scientific expertise and public engagement. Participants in citizen science projects are not just passive recipients of information, but active contributors to the scientific process. Through their involvement, they acquire new knowledge, skills, and perspectives that can be shared with others. The inherent playfulness embedded in citizen science projects not only break down traditional barriers to learning but also inspire appreciation for the living organisms. These projects effectively translate intricate scientific concepts into activities accessible to individuals across all levels of scientific knowledge and age groups, fostering inclusivity and transforming learning process into an enjoyable shared experience for participants. By immersing oneself in the natural habitats of living organisms brings closer the physical and emotional distance between the observed and observers. Field studies create an intimacy that deepens connection between humans and the often overlooked worlds by shifting them from a mere backdrop to the foreground. Recognising that humans are not the sole inhabitants, it is, in fact, a shared ecosystem where diverse living and non-living entities coexist.

“For beauty to work, there must be a surface capable of receiving the wound.”

Timothy Morton, *Realist Magic*

## ○ Artistic Expression

Dutch cultural historian, Johan Huizinga, was recognised to be the first to masterfully analysed the link between play and culture, wrote in his seminal work, *Homo Ludens*, “in acknowledging play you acknowledge mind, for whatever else play is, it is not matter... Play only becomes possible, thinkable and understandable when an influx of mind breaks down the absolute determination of the cosmos.” This enchanting immersion of the process reminds me of the state of *flow*, a concept introduced by psychologist Mihaly Csikszentmihalyi. When a creator invests a deep level of attention and large amount of energy into an activity, to the point where one’s perception of surroundings disappear. It is as though you enter a different reality when you are fully immersed in the process of creating, an autopilot state where you do without thinking, your hunger or fatigue are no longer felt, your body disappears and movements seem to take place automatically. During these activities, it is described that one loses a sense of time and self-consciousness, everything just sort of rushes out, leading to a feeling of effortlessness and great fulfilment that is often experienced by musicians, artists, writers, sportsmen and performers. Artistic expression provides a unique avenue for individuals to explore and communicate complex concepts and emotions.

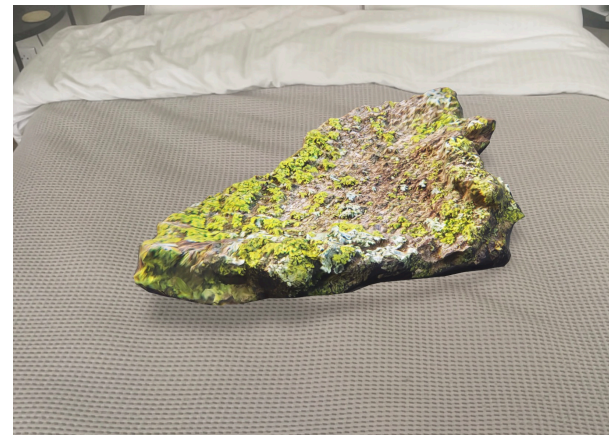
Projects involving lichens are especially prolific in the realm of art, serving as a favoured muse for both artists and thinkers who reflect upon the growing climate awareness. Given their slow growth, low yields and the near impossibility to domesticate, lichens rarely make their way into commercial production, remaining immune to exploitation. A beautiful work particularly illustrating the temporal rhythm of lichen is *Arazzo*, an ongoing embroidery landscape initiated in 1996 by Italian artist, Claudia Losi. This expansive canvas with wool embroidery is annually presented at the Fondazione per l’Arte Moderna e Contemporanea, revealing its continuous evolution akin to the growth and decay of lichens on a rocky surface of a boulder. At each session, guests are invited to discuss themes related to Losi’s work, drawing on their personal practices and sensibilities as these conversations unfold concurrently with the growth and erosion of the wool embroidered tapestry. It is a poetic and meditative process, allowing the artist to create in 'lichen time'—evolving, growing,

and connecting with her work side by side. A precious approach that speaks volumes in contrast to conventional one-off commissioned work, where speed is often equated with value.

Amy Youngs, a faculty member in the Department of Art at Ohio State University, leads the art research group known as The Lichen Likers of the Living Art & Ecology Lab. This fairly young group, comprised of five other students, delves into the fascinating symbiotic world of lichens to inspire a more sustainable way of living. Youngs shared that the group follows a set of ethical guidelines in development for close observation and mindful art projects. It means that they collect lichens that are already detached from the substrate and ensure to return them outside, allowing lichens to continue to sporulate. Youngs and her students have been working on developing 3D models<sup>45</sup> of lichens, and their recent project involves bringing them into augmented reality. They use photogrammetry to capture numerous photos of lichens and convert those 3D models into tiny scales, enabling them to be viewed on mobile phones. The idea is for people to interact with these lichen species in their local environment at different scales. This method is interesting, as lichens are typically seen in colonies, but through technology, viewers can examine an enlarged, small portion of lichen, from different angles, providing a fresh perspective.



Ruffle Lichen in my living room

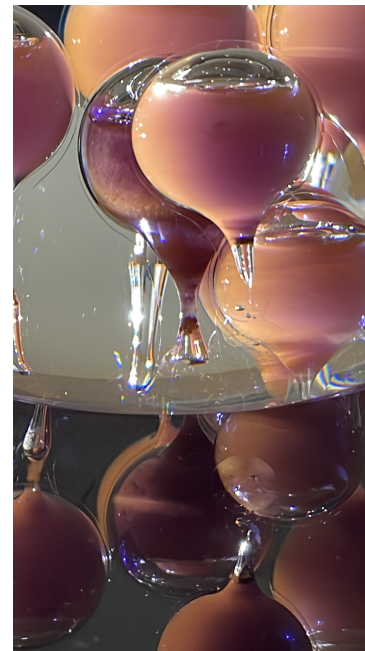


Yellow Lichen on my bed

VolvoX is an installation created by an interdisciplinary team of educators, researchers, artist and musician. Jean-Marc Tom Georgel & Thomasine Giesecke (artists in residence Chair arts & sciences), Bruno Palpant (physicist, CNRS, CentraleSup'Elec, University of Paris Saclay) & Jean-Marc Chomaz (artist-physicist, SPIRAL, CNRS, École polytechnique, IPParis). In a conversation with Chomaz, he shared that this process begins with a paper he read, prompting him to seek of a method for visualising particles that are imperceptible to the eyes. He took his inquiry to different experts, each of whom contributed to the making of the project. For the final presentation, Chomaz reveals that he did not want it to be an interactive installation, but one that invites people to observe the changes through seeing and reflecting. VolvoX questions the convention notion that minerals are inert by using an updated magic lantern to reveal the lively movements within a precious mineral: gold. When observed at the nanoscale, gold appears exquisite, departing from its typical yellow colour to showcase hues like red, blue, and green, challenging our common perception in the macroscopic world. This poetic installation is complemented by a sound piece curated to interact with the emotions of the dancing gold in the crystal ball. Designer and artist, Es Devlin is vocal about her influence by Philosopher Timothy Morton's writing. In a manifesto directed at artists, he said "please don't preach, just amaze us into changing our mind." This ethos is effectively embodied in the work of VolvoX.



Gold particles appear orange on one side



Gold particles appear pink as you move



Gold particles seen through the magic lantern

“ Humankind has not woven the web of life. We are but one thread within it. Whatever we do to the web, we do to ourselves.  
All things are bound together. All things connect.”  
Chief Seattle, 1854

## Storytelling

### ○ Indigenous Wisdoms

Stories unfolds in between the space of the teller and the listeners’ imagination. When we hear a story, we conjure mental images in our minds to interpret the words, serving as a foundation of human learning and teaching.<sup>46</sup> In her book *Braiding Sweetgrass: Indigenous Wisdom, Scientific Knowledge and the Teachings of Plants*, Robin Wall Kimmerer, scientist and artist of the Potawatomi Nation, seamlessly weaves scientific knowledge with indigenous wisdom through storytelling a harmonious coexistence of different knowledge systems. Skywoman falls from the sky and is caught by animals who work together to create their home, known as Turtle Island. The Earth is formed, and Skywoman becomes the mother of all life. One particular chapter called "The Gift of Strawberries," Kimmerer reveals that strawberries are referred to as the heart berry, *ode min* in Potawatomi. When Skywoman buried her daughter in the earth, strawberry emerged from her heart, as the first fruit-bearing plant among the various berries. Wild strawberries are gifts from the fields which Kimmerer uses to illustrate the “gift economy,” a concept of reciprocity and the mutual relationship between humans and the Earth. Nanabozho, recognised as the Original Man in Anishinaabe culture, is a mystic figure- part man, part spiritual being. He embodies the life forces that guide the Second Man (humans) who are to follow in his footsteps, learning how to navigate their existence as the most recent inhabitants of Earth. The Creator provided Nanabozho with “Original Instructions” directing him to “walk in such a way that each step is a greeting to Mother Earth.”<sup>47</sup> He had just arrived on Earth and did not quite understand what to do, as everything was new to him. The world of plants and non-man species already existed in harmony, fulfilling their roles in the ecosystem without disrupting the sacred purpose of other beings. They became his generous teachers, sharing their knowledge with him. Nanabozho understood he had to rely on the wisdoms that came before him and was very grateful. Through Nanabozho's stories, Kimmerer imparts lessons about ethical behaviour, the sacredness of the natural world, and the interconnectedness of all living beings. Nanabozho became a powerful symbol in Anishinaabe society, connecting people with the land while emphasising humans’ responsibilities as reciprocal caretakers of the Earth.

In today's modern society, where scientific knowledge and technology often take the forefront, it is easy to overlook the value of traditional practices as a means of transmitting knowledge. Oral traditions have been valued as a fundamental aspect of Indigenous ways of knowing for centuries, it is shared across generations, connecting children, youth, and adults with each other. These stories, passed down by elders, serve not only as a source of entertainment but are seen as a means of instilling resilience and strength, celebrating identity, affirming cultural ways of knowing, and emphasising the importance of spirituality and connection to life, nature, family, and community.”<sup>48</sup>

Scientists and researchers are often the first to hear the stories of the world- “the very facts of the world are a poem,” writes Kimmerer, suggesting scientists’ responsibilities in translating these stories to the people. However, data and “rational inquiry” speak a very different relationship to what we could have had with the hearts and spirits of the world. Scientists, akin to Indigenous elders holding wisdoms and knowledge, might consider going one step further by stepping into the role of contemporary storytellers, sharing critical knowledge in an integrated space where objectivity, sensibility and spirituality all have a voice. Science can be poetic.

Kimmerer further reveals, “Stories are living beings, they grow, they develop, they remember, they change not in their essence, but sometimes in their dress. They are shared and shaped by the land and culture and the teller, so that one story may be told widely and differently.”<sup>49</sup> As the world undergoes transformation, the dynamism of stories evolves. In the context of a climate imperative dialogue, there is a need for individuals to create new narratives that delineate their own lived experiences, learning and establishment of “ancestral and contemporary connections to place.”<sup>50</sup> Earth does not belong to anyone, humans, Second Man, are merely passerby with a temporarily physical existence, cohabiting with entities who came before us and those who will easily outlive us. It is crucial to stay attuned to these diverse conversations and perspectives of the other-than-human entities that nurture us, much like the “heart berries.”

#### ○ Storytelling of the future\_Speculative Design

Through the use of storytelling, Indigenous communities have been able to preserve and pass down their knowledge, beliefs and traditions across generations. I would like to draw parallels with speculative design—a methodology that shares a commitment to envisioning desirable scenarios, essentially engaging in a form of digital storytelling about the future through prototyping- a radical way of telling, thinking and doing. The connection between Indigenous storytelling

and speculative design lies in their shared ability to immerse audiences to explore the realms of collective imagination. Indigenous stories derive narratives from a distant ancestral and cosmological past that we have never experienced while speculative scenarios are crafted from analytical data, research and science fiction for a future where we have not yet arrived. Both serve to inform our present and future selves. Speculative design carries forward the essence of storytelling, allows designers to convey a hard to grasp concept into a believable format through crafting alternative scenarios of the possible future ways in order to challenge current norms, generate debates and imagining new possibilities.

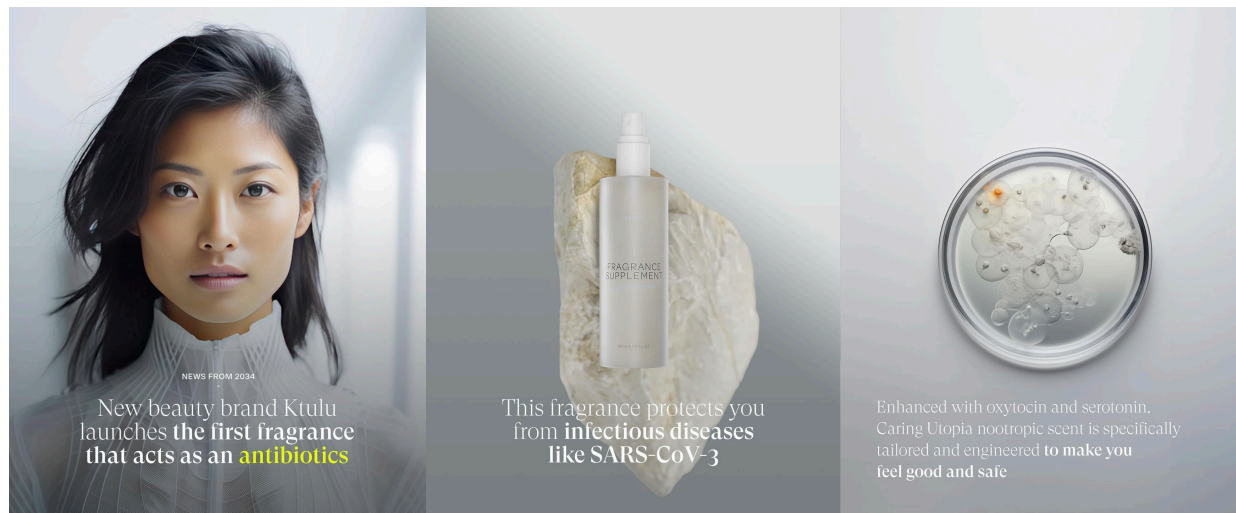
Imprudence, a Paris-based speculative design studio, founded by designer Julien Tauvel and Gerald Obringer, is made of a diverse team of writers, designers, futurists, and researchers. Collaboratively, they delve into the domain of creativity and imagination for 'desirable futures' with the aid of technologies such as AI, VR and AR. Imprudence's design process entails identifying the current dominant cultural trends, subcultures and emerging practices, then they anticipate the landscapes of the tangible to far futures through a combination of scientific research, interviews with influential thinkers and foresight studies. Their examination includes a close scrutiny of the structural elements shaping these scenarios, such as infrastructure technologies, media and communication, environment, and demographic characteristics.<sup>51</sup> Once the structural elements are defined and after breaking away the common and predictable narratives, the team selects the most prolific scenario to develop the speculative future journey. To provide a closer look, here is a press release I've composed for their most recent creation, a debut project unveiled at the Dutch Design Week 2023, showcasing a future beauty product line designed for extreme climates:

It's 2035, where the world is unrecognisable. Climate change has become the new normal. Scorching heatwaves one day, erratic storms the next, unpredictable climate is a part of our everyday life. With temperature reaching over 40 degree celsius, lathering on thick layers of sunscreen is not adequate anymore. In fact, individuals cannot safely step outside without wearing protective garments that shield them from the radiation, UV and SO<sub>2</sub> in the atmosphere. As we project into the future, it becomes evident that urban living will bring forth significant challenges, such as, air pollution, resource constraints, biodiversity loss, antibiotic resistance, extreme temperatures, pandemics that can lead to health implications. In response to the threat of extreme conditions raises an intriguing inquiry- Can our bodies produce our own protective wear?



People have a natural aversion to germs motivated by the feeling of disgust. Our beliefs about hygiene, dirt, and health have deep historical roots. Ever since the discovery of germ theory, the society has been linking germs with causing adverse effects on human health. This led to a big push for sterilising things to fight germs. The outbreak of COVID-19 in 2020 further exacerbated the stigma around germs. However, as the influential thinker, Bruno Latour explains, “This is a global catastrophe that has come not from the outside like a war or an earthquake, but from within. Viruses are completely inside us. We cannot completely eject them. We must learn to live with them.” As it turns out, we're more connected to germs than we thought. In a healthy human body, around half of the cells aren't even human; they are a mix of bacteria, viruses, fungi, and archaea that live on our skin, in our mouth, and in our digestive systems. We need microbes to help maintain gut and skin health against infections. We need these tiny microorganisms for our own survival now and the future.

“ What if our skincare routines could protect us and enhance our immunity to better endure extreme climates at the same time? Is it possible for skincare to actively facilitate communication between the microbes within us and those in the atmosphere? How would these products influence our beauty experience?” These are few of the questions asked by the founder of Imprudence, Julien Tauvel. He believes the beauty industry, traditionally centred on superficial aesthetic enhancement, has the potential to be an agent of change.



Speculative beauty brand, Ktulu. Photo courtesy of Studio Imprudence

The name KTULU is an ode to the neologism coined by the scholar, Donna Haraway. In her book *Staying with the Trouble*, Haraway proposed that there will be a new epoch, the “Chthulucene” where humans will come together to live in harmony with non-human species. KTULU, has reimagined the role and transcends the boundaries of traditional beauty, designed to specifically address Anthropocentric challenges we are currently grappling with. It paves the way for a future where beauty is intertwined with the wellbeing of our minds and the ecosystem. In the face of undeniable Anthropocene impact, we dare to envision a future in which beauty products are co-produced by both humans and the living organisms that adapt to our unique body environment. The new beauty industry will no longer be driven by trends and marketing but prioritise the collective well-being of humans and non-human entities, marking a new era of interspecies collaboration, embracing who we truly are.

## Reflection

Within every natural being, there exists a rhythm and harmony that can sometimes be beyond the scope of human understanding. Such complexity should be approached with reverence and curiosity driven by the intrinsic love and care that I believe resides in all of us. My intention is to celebrate the hidden aspects of lichens beyond the limited perception of viewing them merely as a resource for human extraction. Magnifying the hopeful and beautiful narratives is vastly more inspiring than focusing on the fear-based disruptive narratives. Through engaging activities that involve observation, imagination and creation with lichens in an ethical and mindful way, the aim is to encourage people to pay attention to some of the formed and formless essence of these remarkable organisms with the intent of re-establishing connection and reciprocity.

Categorising the methods into Learning-by-Doing, Play, and Storytelling took some time to consider, as all of them share the underlying intent of play. Apart from the provided case studies, numerous other formats can also fit into the subcategories and be employed either individually or in combination with other methods. For instance, a self-initiated experiment can be merged with citizen science in the format of long-term documentation by keeping an observation journal. This involves recording the coordinates of the chosen lichen, revisiting it annually at around the same time to measure and map its growth. It can be achieved by tracing the lichens with grid tracing papers, allowing easy comparison through overlapping. This approach serves to enhance observation skills, objectivity in the documentation process, as well as patience and focus. Outdoor activities offer an excellent means of reconnecting people with their environment, workshops can be designed in the form of a scavenger hunt, where participants receive cues to identify and map out the variety of lichens in the area.

Under artistic expression, drawings and paintings offer another enjoyable method for documenting and learning through the process. Ernst Haeckel, a German biologist, naturalist and artist of the 19th century, is renowned for his meticulous pencil and watercolour illustrations of the diverse array of organisms collected during his expedition. This approach requires one to take time to carefully observe for the subject, developing a certain sensibility to appreciate subtle details while exercising creativity by translating the species using different chosen mediums. It is also an opportunity to train the

imagination to identify design elements, much like what ancient Chinese artists do with *Gong Shi*, serving as an inspiration for pattern design projects, for example.

In the realm of storytelling, short films are a powerful medium for transmitting knowledge. An excellent example is the *Green Porno* series that began in 2008, conceived, written, and starred by Isabella Rossellini, where she reenacts the mating rituals and sexual behaviours of various animals, providing both educational and entertaining content. Stephen Axford, a fungi enthusiast and macro photography specialist, documents the beauty and growth of fungi through stunning time-lapse photography. Cristina Goettsch Mittermeier, co-founder of Sea Legacy, a non-profit ocean conservation platform and a marine biologist, often emphasises the effectiveness of photography as a storytelling medium in conservation wildlife, revealing the hidden world of the ocean through her breathtaking photographs.

Mindful interaction with the overlooked living beings facilitate the recognition of our interconnected role in the world. We are not detached outsiders but caretakers of the system that continues to sustain us, even amid its deterioration. I have formulated three questions that I believe are essentials to ask for effectively transmitting knowledge. They are as follows:

1. How can we extend the invitation to everybody from all walks of life and different educational backgrounds, especially when it comes to complicated subjects? Knowledge should not be reserved for only the elite but should be delivered in a way that is all-inclusive and welcoming.
2. How can we convey messages in a genuine and heart-to-heart manner, led by love, curiosity, and care, rather than fear and transaction?
3. How can we preserve the curiosity and playfulness of children in our approach to learning and transmitting, ensuring that this playful mindset transcends into every aspect of adult life?

After analysing various existing projects, participating in workshops and exhibitions, and interviewing designers, artists, educators, and scientists involved with living organisms, I noticed that they sometimes struggle to introduce themselves as a specific role. Regardless of their initial backgrounds, many held dual or multitude titles, such as artist-designer or physicist-artist. One common link I observe among these creatives is that they all embrace an intrinsic sensibility and are

strong observers which permeates through their work. It's almost as if their initial title does not sufficiently encapsulate or allow the space for them to speak about these emotions. If art is the shared vocabulary for these very raw, tender and vulnerable dimensions, it has remained integral to their process and is what unites them in interdisciplinary projects. Art, for lack of a better word, has never been separated as a distinct category but is intertwined within. It brings to mind the challenges of naming and categorising lichens. Having a single fixed label or any label at all just seems inadequate. The realisation of the rigidity in adhering to a specific label or identity becomes a liberating force for new possibilities. The methods these creatives employ do not follow strict design or art traditions but entangled in exchanging and interchanging with the livings that are strong conveyers of emotions and "poetry." This openness and fluidity provide room to the unknown serendipity that might arise through different collaborations, leading to something extraordinary that is *greater than the sum of its parts*.

This exploration marks the starting point of shaping my own collaborative workshop and practice. Each aspect I have addressed in the mémoire deserves its own dedicated time for a deeper development. Through this preliminary research, I have had the opportunity to meet many wonderful and kind people who generously share their knowledge with me.. Their openness moves and motivates me. Although the journey of transitioning into a new field can be bumpy and uncomfortable, you keep moving forward because the essence, the spark, the curiosity in you will guide you through the discomfort, towards where you need to be.

# Interview & Conversation

o Rémy Poncet, Head of “Connaissance des Espèces” of MNHN

## **(Extract from our conversation) Lichen has two kind of strategies for dispersal and colonisation:**

1. Sexual reproduction: genetic exchange. Spore that are spread by the wind or other mechanic processes and they randomly fall on a substratum, there are some energy in them to produce a kind of ‘root’ to begin to forage for food and to associate with algae. You have to have luck for one spore to quickly find algae and begin the symbiosis exchange. in order for them to have sugar access generated by algae. When these two individuals are closed enough and managed this exchange, thallus of the lichen, in another word, the thallus of the mushroom become bigger and bigger. Then, after that a lichen is created. It’s a slow process where a whole bunch of luck is needed to have all the right conditions to appear. To have the meeting of two independent organism that create a third organism. It’s completely random.
2. Asexual dispersal capacity: the form of lichens small leaves, finger like structures, part of thallus that are into dispersal that are broken by the wind, snake, fauna etc. and they are transported by the rain and by the wind. They come with all that’s needed for a new individual and all they have to do now is to find a suitable place to grow on. It’s sort of a colonised approach. Not so much for algae because there will be a division later on for the algae. Whether it’s mutualistic or parasitic, it’s a debate on the reach of the research field. There’s At least one specie of fungi and at least one species of cyanobacteria. It’s possible that there’s some genetic exchange between the fungi and the algae, depending on the life stage of the species. It’s complex but not completely demonstrated, if it happens it’d be very interesting. It’s more or less like if you can exchange part of your genome with a tree to do something, then after you get it back. It’s not just an exchange of genomes, it’s that all the genomes exist in a photobiont ( algae, cyanobacteria and in the fungi, and some proteins (in the fungi?) activate and deactivate them depending on the needs.

In most of the species, having what we called the cortex which is this kind of hardened roof layer on top of the lichen (the skin of the lichen). It’s assumed that all the big lichens have some of the yeast in the ‘skin’ of the lichen. What’s interesting is that yeast belongs to Basidiomycota. It’s a far branch from Ascomycota in the classification of fungi so that’s pretty odd because you need to have associations of at least two classes, Ascomycota, asidiomycota plus cyanobacteria or algae.

**What is the current research obstacle?** Only a few labs in the world that are working on this topic. At MNHN, they are mostly working on genetics and biodiversity to have the checklist of the French (including overseas) territories. They don’t work on the fundamental of biophysics, evolutionary, biology all the labs are working on in Northern America.

○ Aléa, experimental mycofabrication and material research studio

**What is your relationship like with mycelium and how are mycelium used to inform decisions in your practice?**

Aléa: We consider mycelium as a collaborator. Mycelium has agency and challenges the perceived control designers have over materials. While we guide its growth, it consistently surprises us. We try to embrace unexpected outcomes as part of the design process. Even failures tend to guide us and inform new design directions. We are curious about how we can collaborate with another organism in reciprocity.

**Discuss a time when you worked on an interdisciplinary project. What was the biggest challenge, and how did you overcome it?**

Our current research project, “Back to Dirt” which explores the use of soil as a mold in myco-fabrication involves a lot of interdisciplinary exchange. We engage with scientists specializing in myco-remediation, such as Danielle Stevenson, a multidisciplinary scientist focused on applied remediation using fungi.

Conversations with Danielle illuminated the scientific perspective on our intuitively driven, non-sterile approach of practicing myco-fabrication. Her insights brought clarity in some aspects but also introduced complexity. She provided numerous hypotheses on why our process worked that didn't always align with the narrative we had imagined. Designers tend to be good storytellers and part of the challenge when collaborating across disciplines is in surrendering to how that narrative evolves. This could be seen as a challenge but it also has helped us to accept the unknown and that we may not get a definitive understanding of how our process works.

Our collaborations also transcends academia and even humans; applying our process includes cooperation with all kinds of living systems, the mycelium and the soil's biodiversity, but also farmers, construction workers, institutions, galleries, students...

**What's your experience with hosting workshops, any pros and cons?**

We run workshops at various design institutions, universities and in our studio. We love bringing people together. There's a beauty in the convergence of people who meet over a common curiosity and the potential that holds. Of course, depending on the context, there are challenges. In our experience, one is managing people's expectations regarding the material. Since results are not immediate, if at all, this can cause feelings of frustration. However, we have observed that in reflection, more comes from the experience of adapting to a new temporality, leading to more interesting conversations that question our preconceptions and relationship to materials, resources and time.

**How would you convey a hard to grasp concept or transmit knowledge to individuals (adults/ children) that have no prior understanding of the subject matter?**

A: The use of metaphors are powerful. We also prefer to use casual language, avoiding overly intellectual rhetoric to stay true to our voice. Additionally, we see working with mycelium as having pedagogical value in itself; it provides an immersed multisensory experience where complex concepts and nuance can be understood through hands-on experimentation.

**How can one establish a balance between objectivity and sensibility in research?**

A: A balance between objectivity and sensibility is something we actively navigate perhaps without directly referring to it as such. Maybe as designers we tend to have a more intuitive approach to research that needs to be supported by facts and science. The same time our less informed inquiries might open up a new area of research. The balance comes from recognizing our limits and emphasizes the need to exchange across disciplines.

**Can you tell me your earliest memory of lichens and your thoughts about them?**

Stella: My earliest memories are of my mother pulling the car over whenever she spotted a lichen covered branch and hauling it into the car and home. We even had a lichen family tree in our house.

Miriam: I think the first time I was in touch with lichen was when rock climbing as a little kid with my father in Ticino. I remember their colors and patterns spanning over the rocks, how slippery they got when it rained and the conversations with my dad about geology and time.



**Is there anything else you would like to know about lichen? What would be a fun way for you to learn about them? What brings out your inner child to play?**

Humor, laughter and bonding with others AND getting your hands dirty.

**What is your life philosophy?**

S: Embracing change in all forms (which i'm learning also means to accept the present)

M: yes i agree. That applies also to my general approach to life, which has changed too. In my twenties I was all about being independent, now I accept and embrace interdependence.

# Glossary

**Animism:** a worldview that emphasises a deep interconnectedness between humans and the environment that all entities, living or non-living- from plants, animals to rocks and rivers- have spirits. In animistic traditions, these spirits are often considered integral to the natural world, influencing the daily lives and interactions of communities and shaping cultural practices

**Anthropocene:** the term made a dramatic appearance in the year 2000 by atmospheric chemist Paul Crutzen and limnologist Eugene Stoermer. It suggests that humankind has entered a new geological time interval characterised by the visible and lasting impacts of human activity on all aspects of the Earth's system. Following the Holocene, the formal name of our current epoch, Anthropocene, an unofficial unit of geologic time, has widely gained recognition as a cultural term in various disciplines

**Bio-inclusive:** an environmental ethic proposed by philosopher Freya Mathew that re-situated humans as a part of nature

**Biomimicry:** a coined word based on the ancient Greek word bio= life, mimicry= mīmēsis, to imitate. A practice that aims to emulate form and abstract biological strategies and living processes found in nature for human innovation

**Composite organisms:** organisms that are made up of at least two independent organisms

**Cortex:** the protective outer most layer of a lichen thallus, think of it as the skin of a lichen

**Dao De Jing 《道德經》 :** an ancient Chinese body of knowledge written in a concise form of poetry and riddles that date from about the fourth century BCE, attributed to the sage 老子 /lao zi/ or the “Old Mater”, whom I will refer to as Lao Zi. Dao (道), known as the Way, comes from the Chinese term for the path, embodying harmony within all aspects of the living and non-living, as well as through the balance of vital energy, an interconnected web of energy- Qi (氣). De (德) represents the virtues in harmony within oneself and other beings. Jing (經) suggest a scripture or a classic, perhaps is a more fitting translation here. Dao, therefore, is the fundamental principle that underlies the natural order of the universe. In other words, it is the flow of nature, the way of the Universe

\* Which is the correct spelling? You might find the interchangeable spelling confusing in various versions of the text available. To put it simply:

- Lao Zi & Dao De Jing: Hanyu Pinyin romanisation, which is the officially adopted system used in China nowadays.
- Lao Tsu & Tao Te Ching: Wade-Giles system romanisation, developed by Thomas Francis Wade in the mid 19th century. This method aimed to represent the sound of Mandarin Chinese, particularly in older publications from the West.

Hence, I recommend using the Hanyu Pinyin system for accuracy, as it aligns more closely with actual pronunciation of the words. The commonly seen form, Laozi might be misleading, as in Chinese, words are written as separate characters, not one word as in Romanisation - 'Lao' and 'Zi' spelt separately, therefore makes more sense to me.

**Heteronormative:** the belief that heterosexual relationships are the norm or standard

**Hyphae:** long, branched thin filaments that form a mass network called mycelium

**Medulla:** a loose woven of fungal filaments (hyphae) in the interior of the thallus located under the algal layer beneath the cortex of lichen

**Montessori:** a method of education that is based on self-directed activity, hands-on learning and collaborative play<sup>52</sup>

**Mycelium:** similar to root system of plants to mushrooms, it is a network of thin filaments called hyphae that provide nutrient to the fungus. Mycelium can be used to grow biomaterials

**Mycobiont:** fungal component of lichen that absorbs water and minerals and serves as a protection for photosynthetic partners

**Myco-fabrication:** the creation of biodegradable materials using mycelium

**Phoenicians:** civilisation originated in the Levant region of the eastern Mediterranean, in the area of modern Lebanon

**Photobiont:** photosynthetic partners such as, green algae or cyanobacteria that turns sunlight to sugar in order to provide nutrient for the fungal partner

**Substrate:** the surface or material on which an organism or process operates or grows. It provides a foundation or support for something to develop or occur.

**Symbiosis:** a close, prolonged relationship between two or more unrelated biological organisms, be it mutualistic, commonsalistic or parasitic

**Thallus:** the vegetative body of a lichen, comprised of loose fungal filaments called the medulla



Lichens are so much more radical than I thought

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