

How do *Agnieszka Kurant* and *Tomás Saraceno* incorporate evolutionary principles and generative design in their art, and how can *Henri Bergson's* philosophy of creative evolution and *Ernst Haeckel's* depictions of nature deepen our understanding of their practices?

INTRODUCTION

With the development of the times, contemporary art design has broken the boundaries and restrictions on the picture, making it have unlimited stretch, and more dynamic sense. The artist can integrate with the work, showing what the artist thinks and creativity, breaking the single expression of traditional art. The generation of generative design has expanded the expressive power of contemporary art. With the development of artificial intelligence and other technologies, generative design is used in a variety of fields, such as painting, architecture, industrial design and so on. The integration of artificial intelligence into design has helped people design more art designs that break away from tradition, and these creative designs are mostly inspired by artists and scientists' research on natural life.

One of these is the illustrated book of biological illustrations, *The Art Forms of Nature*, published by the German biologist *Ernst Haeckel*, who studied the natural forms of organisms as they evolved, with implications for science and art. The book summarises Haeckel's worldview of the beauty of order and symmetry. This had a great impact on painting, architecture and design in the early 20th century, where the elaborate, perfectly symmetrical variety of constructions in nature brought science and art closer together. And several artists in the *Art Nouveau* movement were influenced by this book.

In addition, the French philosopher *Henri Bergson* considered human life to be a 'continuity' of consciousness. In his *Creative Evolution*, he mentioned that the entire universe is a process of creative evolution, which is driven by the *Élan vital*. Matter,

life, and consciousness are the core of the evolution of life, and they seem to be unrelated, but in fact they are an inseparable whole. The '*continuity*' is the free creation of consciousness, the creation of life forms, and therefore the evolutionary process of living beings is also the process of the creation of consciousness. Matter, on the other hand, is the result of the stagnation or weakening of '*continuity*', which is also a psychological process, an absolute movement that leaves matter without relative stasis. *Élan vital* as a forward force, drives the development of different evolutionary systems, and the life activity creates in continuity.

Meanwhile, in the works of artists *Agnieszka Kuranth* and *Tomás Saraceno*, both explore and practise approaches and concerns for social development through non-traditional artistic media and methods of expression. In their works, Tomás Saraceno explains the origins and construction of the universe through the study of spiderweb-like structures, and is committed to the creation of utopia worlds, using spiderweb structures and building materials to push the boundaries of traditional nature. Through materials such as lenticular prints and sculptures, Agnieszka Kuranth's practice explores how complex societies, economies and cultures can be defined in terms of operate in ways that differentiate between fiction and reality or nature and culture. She explores phenomena such as the evolution of civilisations and social movements through analyses of collective intelligence, the immaterial and digital labour.

OVERVIEW OF THE THEORY

Bergson believed that the world was divided into two parts, life and matter. He believed that the universe has opposite movements, upward life and downward matter. Life has a strong vigour and when it encounters the obstacles of matter, it endeavours to open a path through it. It always maintains the capacity for free movement, which is the specific process by which life fights and differentiates itself

from matter. This lies in the uplifting power of the life-impulse, and the capacity for free activity which life manifests is an expression of the will and of the *Élan vital*.

'Continuity' is a fundamental concept in Bergson's philosophy. Thus, in his theory of evolutionary creation, Bergson rejected the mechanical evolution of *Darwin* and *Spencer*, as well as the philosophical theories of purposiveness and divine creation. He believed that evolution does not develop according to a designed programme and that one cannot foresee the direction, purpose and end of evolution. Evolution originates from life itself, a continuous process of generating new paths and innovations. This is why the world is divided into life and matter. And human beings are unique in that the spiritual element, the role of consciousness, allows people to constantly fight against themselves in society, to constantly progress their own selves and to open up to society. Therefore, human life can break through barriers to spiritual freedom.

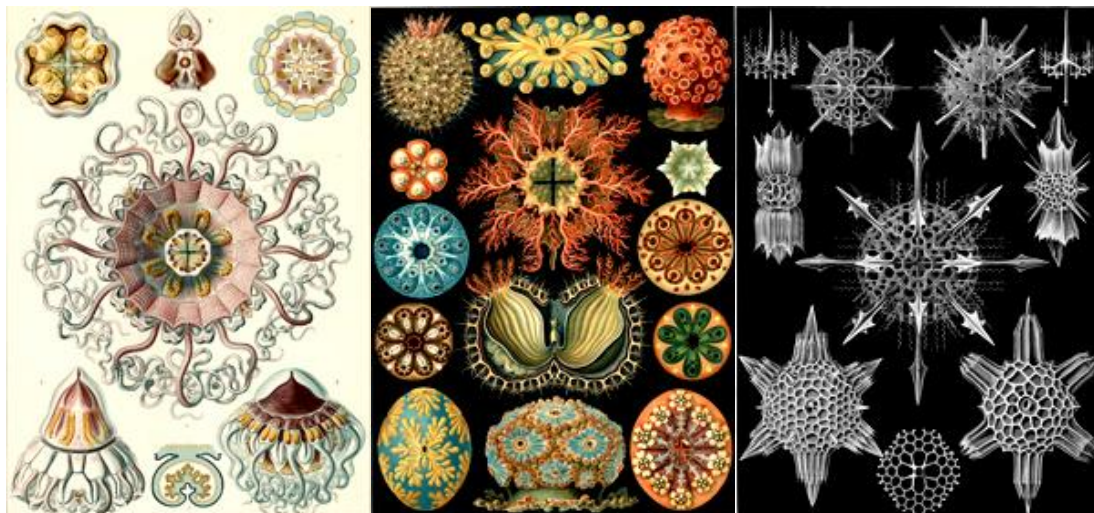
In his early work *Time and free will*, Bergson distinguishes between time and freedom. He argued that 'time' could be divided into two concepts: inherent time or continuous time. It is indivisible, an extension of time related to the continuous flow of human states of consciousness, and objective time. People create a new moment in every moment, creating life and existence.

Therefore, Bergson's ideas had a profound influence on the art world at that time, and *Cézanne*, the 'father of modern art', was a representative. Cézanne's constructive painting method abandons the structure formed by splitting and opposing elements, and he adopts continuous dynamic brushwork, which makes Cézanne's paintings reflect Bergson's aesthetics of life, and expressive life is not produced through fixed forms, but created in the process of formation.

At the same time, *Deleuze* was also influenced by Bergson's philosophy of life as a constantly changing and creative whole. As one of the representatives of the

post-structuralist trend in the late 20th century, Deleuze believed that there is no absolute and unchanging basis for knowledge, and that it brings opportunities for invention and creativity. This has led to the tremendous growth of post-structuralism.

Ernst Haeckel studied natural forms during biological evolution, and the beauty of order and symmetry in this has had a great impact on science and art. The perfect symmetry possessed by the biotypes he studied emphasised composition to deepen the visual impact. This had a great impact on painting, architecture and design in the early 20th century, and the book brought the world's understanding of the intricate, perfectly symmetrical variety of configurations in nature to a closer connection between science and art. And several artists in the *Art Nouveau* movement were influenced by this book.



'ART FORMS IN NATURE'(1904)by Ernst Haeckel

For example, in plant evolution, plant patterns, as paintings of nature, show the endless charm and colourfulness of life. In every plant pattern, it not only reflects its appearance characteristics, but also contains profound knowledge of biology, ecology and art design. Plant pattern is a specific morphological structure or arrangement pattern in or on the body of a plant, and its evolution follows the law of biological evolution and. These patterns may appear on the leaves, stems, flowers, fruits or seeds of plants.

In ancient China, porcelain, embroidery and calligraphy and painting often appear such as peonies, orchids and other plant motifs, these motifs are not only decorative, they also carry the meaning of good luck, wealth and longevity. In the ancient Greek and Roman civilisation, the ranunculus leaf pattern on the top of the column (Acanthus) decoration and the grapevine on the wall are the classic expression of plant patterns. Ancient Egyptian frescoes, decorations in the lotus and grass stems, is for the symbol of life and regeneration. Ancient Indian and Middle Eastern sculptures and textiles also featured frequent botanical motifs, such as the linden tree and flowers in palace gardens, which are a deep expression of the civilisation's respect and admiration for nature at that time.

At the same time in the *Art Nouveau* movement, the *Stile Liberty* was born. This new style was faithfully naturalistic and distinctly decorative. The artists used nature as a source of inspiration but obviously stylised it and extended it by adding elements such as flowers, flames, shells, seaweeds, grass filaments and insects.

The most important characteristic of the art style born in the *Art Nouveau* movement is that it is full of vigour, waves and flowing lines. It was a way of energising traditional decoration and expressing itself as if it were growing out of a plant. It also shunned the eclectic historicism of the Victorian era in terms of architectural style and interior design. By selecting and 'modernising' certain elements extracted from the *Rococo* style (e.g. flames and shell textures) by *Art Nouveau* designers, instead of historically derived and highly Victorian fundamental structures or realistic naturalistic decorations.

By Ernst's research and exploration of natural ecology, Art Nouveau got unprecedented development, and at the same time laid the foundation for modern art. In modern art, there is also a lot of generative design using plants and animals as design elements, which is widely used in painting, architecture, industrial design and

other fields, combined with artificial intelligence, once again breaking through the creativity of human beings on art and life.

CASE STUDY 1

Artist *Agnieszka Kurant* focuses on collective intelligence in various social, economic and ecological systems. She works on the '*phantom capital*', which refers to the invisible or imagined forces that affect society economically and politically. She often uses sculpture, lenticular prints, and works on paper to represent and suggest invisible forces in society. She explores the 'unknowns' of knowledge and the economic exploitation of capitalism by integrating elements of science and philosophy and analysing phenomena such as collective intelligence, virtual capital, immaterial and digital labour, civilisation and social movements as political acts.

Her masterpiece '*Collective Intelligence*' is the main focus of her artistic practice. She observes 'Collective Intelligence' as a phenomenon in colonies of slime moulds, termites and bacteria, a developmental behaviour that occurs among social organisms. Both ant colonies and bacterial colonies are organisms with collective behaviours and characteristics. At the same time, human beings, as social beings, also have a 'Collective Intelligence', which is reflected in the Internet, social movements and cities. This new form emerges in unpredictable ways from the interactions of complex social, economic and ecological systems.



'Collective Intelligence' (2017) by Agnieszka Kurant

Agnieszka Kurant studies non-human intelligence, from microbes and animals to artificial intelligence, and the exploitation of society by capitalism. She explores the transformations to which humans are subjected and the creativity of the 21st century workforce for the future through labour, economics, society and science. She examines how complex social, economic and ecological systems operate between fiction and reality or nature and culture.

The popularity of zeitgeist is also a phenomenon of collective intelligence, leading the zeitgeist all over the world while creating new cultural directions and trend elements. Taking collective intelligence as a starting point, Agnieszka Kurant produces new art forms based on thousands of non-human and human beings, combined with naturally growing art such as living organisms or geological formations.

Agnieszka Kurant's work *'The End of Signature'* also creates a novel approach to the production of an art form by collecting more than 100 signatures and using artificial intelligence to merge them into a collective signature on which the machine rewrites a

signature. The distorted structure makes the signature appear as if it has been scribbled down by an invisible hand and materialised as a sign.

'Emergency Exit' was designed by Agnieszka Kurant and another architect, Aleksandra Wasilkowska. It was exhibited at the Polish Pavilion at the 12th International Architecture Biennale in Venice, Italy in 2010. The work explores the 'movable hole between cities': a space between two cities, a place of uncertainty and doubt, a place of spatial and temporal discontinuity. Abandoned or unfinished buildings, rooftops and tunnels, for example, hint at the dangers and uncertainties inherent in this space. Strong, ironic allusions to capitalist urban safety regulations aimed at controlling and eliminating risks and accidents as part of capitalism's exploitation of society.



'Emergency Exit' (2010) by Agnieszka Kurant

The work is made up of composite materials such as metal cages, and the overall arrangement of the cages is multiple and repetitive, creating an ambiguous visual effect that echoes the decaying and controlled society. The cages are designed to resemble birdcages, but are stacked on top of each other in such a way that they also

serve as a platform for escape, allowing the viewer to escape through the cages to a place of safety. This work symbolises the ultimate freedom from urbanism and escape from the control of capitalism. By appealing to and inspiring the anger of the masses, it makes it a social laboratory for a social collective that inspires and energises people to dare to rebel and break out of their bondage.

People who accept the city as a complex and unpredictable cage of real and imagined spaces can understand the phenomenon of the intangible in urban society. It may change the street, the city or even the whole society. The creative meaning of the 'Emergency Exit' design is to lead to the unknown, to escape from contradictions, to be a catalyst for different emotions and needs. So people can fill in the gaps with their own emotions, ideas and desires.

Agnieszka Kurant works with a variety of scientists (biologists, geneticists, neuroscientists, virologists), academics (sociologists, anthropologists), engineers (computer scientists, robotics specialists), and professionals from lesser-known fields (group hypnotherapists, bird language trainers). This is one of the manifestations of collective intelligence. Their art of collaboration may become a tool that can activate people's minds. As thinking subjects, they can independently ask their own questions or question the status quo around them.

It is conceivable that Agnieszka Kurant's artwork also reveals Bergson's idea of creative evolution, as well as being influenced by the aesthetics of Ernst's biomorphic forms. Collective intelligence is also an expression of the powerful dynamism of life, breaking through the constraints of the social order and creating new cultures and futures. This is the struggle and division of living things (microbes, animals, humans, non-humans) and society, and these embodied free wills also express the emergence of new art forms. By observing the phenomena in the slime mould, termite and bacterial colonies, the artwork is shown in the form of an ant's nest, strongly suggesting the relationship between humans and society. The different colours and

forms of the nests also show the changes and innovations of man and society.

It also 'Continuity' people's resistance to capitalist exploitation and promotes social evolution. Although one cannot foresee the direction of social evolution, it is a continuous process of generating new paths and innovations. The work of Agnieszka Kurańska is critical, reflecting on the transformation of society into a production of data, where people are constantly fighting against themselves, progressing themselves and promoting an open society. She dares to challenge the control of capitalism over society and is committed to forging a collective, equitable approach to the development of the art form.

CASE STUDY 2

Tomás Saraceno is an architect and an artist whose work often incorporates more architectural and structural elements. As a visionary artist who uses his work to describe utopia visions of transport, housing or buildings and other related things, Tomás Saraceno aspires to bridge the gap between art and science, and therefore incorporates technology into his artistic creations. Tomás Saraceno has been working on the construction of natural microsystems, human communities, and self-sufficient urban habitats suspended in the air. In this way, he overcomes the limitations and conflicts of traditional natural boundaries and realises fantasies of a utopia world. He is also dedicated to the art and philosophy of human and non-human co-operation, planetary co-existence and interdependence.

In 2015, he launched a non-profit initiative where he wanted to explore environmental issues through science and art through a diverse international community of artists, architects, geographers and other artists, scholars and technicians. And through solar sculpture, the sculptures are raised by the heat of the sun and infrared radiation from the earth's surface. Breaking the world record at COP21, the United Nations Climate Change Conference held at the Grand Palais in Paris in 2015, this is undoubtedly a

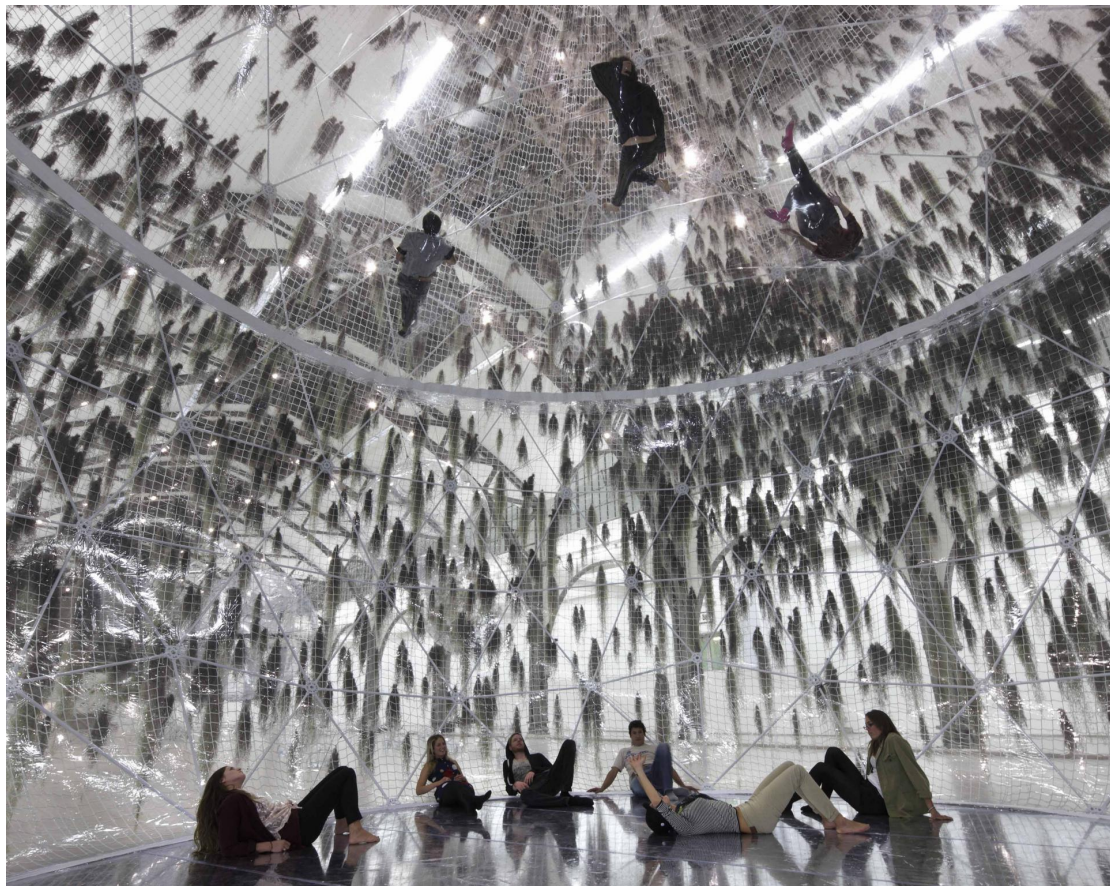
major breakthrough for the scientific and artistic community and a great contribution to environmental protection.

Not only that, Tomás Saraceno is extremely interested in spiders and spider webs. This has allowed the artist to get more creative, refining concepts and ideas related to spiders and spider webs through different forms of knowledge and multiple artistic, scientific and theoretical disciplines.

And *Hybrid Webs* is undoubtedly Tomás Saraceno's best take on the spider-web type of artwork. This is the home city of the Hybrid Webs series of statues. Each sculpture is made entirely of spider silk, presenting a unique geometric galaxy floating in infinite space. The sculptures are manufactured using different species of spiders that are social, unsocial or somewhere in between. Each change of direction of the sculpture allows different types of spider silk to intertwine. This reflects the stabilising techniques required for each sculptural element, such as the type of spider used and the time it takes each spider to complete its web. The sculpture thus symbolises an encounter that may not be successful, thus provoking reflection on human coexistence with ourselves and the natural world.

In *Cloud Cities*, Tomás Saraceno also uses 20 balloon models at once, large or small, which fill the entire gallery space. These balloons give the viewer the opportunity to experience first-hand how these suspended structures interact with each other and how they interact with space - not by observing them from a distance, but by actually being inside them. The works on view shatter conventional notions related to place, time and gravity, as well as conventional thinking about what constitutes a structure. They are idealised and invite the viewer to play a role in the work's effect on a given space. The viewer rises to the top and descends to the ground as the balloon floats, realising a 'dream' that is shared by all the viewers. Similarly, Tomás Saraceno was inspired by soap bubbles and spider webs, both of which he believes have incredible strength and stability. By combining the two, he realised a city that breaks with the

traditional concept of gravity and truly realises the utopian world of a city that floats in the sky.



'Cloud Cities' (2011) by Tomás Saraceno

Tomás Saraceno has also explored research on the sonic properties of spider webs. By collaborating with arachnologists, musicians and sound engineers elsewhere, Tomás Saraceno has utilised the structural properties of spider silk to turn webs into musical instruments. Spider webs act as one of the spider's senses, and through the vibrations of the silk, it helps the spider to be able to hear sounds, get attracted, hunt, and have other social interactions. And Tomás Saraceno succeeded in this one project by pushing the boundaries of interspecies communication and playing live. This observation of non-human modes of communication helps to form the beginning of a peaceful coexistence between species.



'The Spiders'(2016)by Tomás Saraceno

In his work *Silent Autumn*, he highlights how humans interacting with non-human species can open up new and sustainable possibilities for coexistence. His work connects the viewer to a multitude of species and encourages that people should stay in close contact with non-humans and phenomena. Featuring *Webs of At-tent(s)-ion* (2018) presents the spider's non-verbal communication using intricate webs of threads, demonstrating the spider's utilisation of vibrational perception as a means of adapting to its environment. The use of strings to mimic spider silk allows the audience to create collaborative musical pieces by touching the strings, resonating with the spider's acceptance of vibrational perception.

Unlike *Silent Autumn*, the work *Silent Spring* is a series of glass panels featuring pressed poppies, from which the viewer will feel transported from the gallery to Tomás Saraceno's studio in Berlin-Rummelsburg, where the flowers were taken. Inhabiting the previously contaminated site of the building's former inhabitants (a manufacturer of photographic films and dyes) before the studio, the soil around Tomás Saraceno's studio retains traces of chemical fixation: a reference to the chemicals left over from

people trying to replicate nature's natural coloured pigments and deposited forever on the studio floor, contaminating the neighbouring soil so that all fruits grown in these soils inedible for all the fruits that grow in them, and changing the colour of their landscape forever. This is how Tomás Saraceno wanted to use Silent Spring to gently embody his critique of the way in which the capitalist world sees nature as an inexhaustible material resource.

It is clear that Bergson's philosophy of life is also reflected in Tomás Saraceno's work. His love of spiders is expressed in his work, creating an aesthetic of life in spiders and spider webs, not generated through fixed materials and traditional design forms, but created after being formed over time by using a variety of spiders and constantly changing the environment so that the spider's silks can merge with each other. This reinforces the idea that life is an ever-changing and creative whole. Like the Art Nouveau movement, Tomás Saraceno's work is inspired by nature, incorporating a large number of elements of cobwebs and the study of spiders, with a distinctly personal stylisation. Above all, they are full of vigour, tenacity and fluidity of line, a form of expression that underpins his fantasies of a utopia world, a fantasy art with a complete structure and naturalism.

CONCLUSION

Agnieszka Kurant explores the interactions between society and nature. By modelling the social habits of colonies and colonies of ants, she contrasts the ways in which humans change and transform society. 'Collective intelligence' at its best, Agnieszka Kurant examines non-human intelligence, from microbes and animals to artificial intelligence, as organisms fight against some kind of hegemony in society, exploring the many facets of the evolutionary transformation of organisms and their creativity for the future. She examines how complex social, economic and ecological systems operate between fiction and reality or nature and culture. Based on thousands of non-human and human beings, it combines naturally growing art like living organisms

or geological formations to produce new art forms.

Tomás Saraceno often creates spaces and structures that transcend traditional art by basing them on physical, ecological grounds. His work is filled with designs for utopia worlds that, while mostly inspired by the single species of spider, also reflect the evolution of spiders in order to adapt to their environment. Through multi-dimensional, interactive installations, he explores how humans adapt to the diversity, complexity, and evolving environments found in nature.

Their works are very much concerned with the adaptive capacity of ecosystems and the evolution of society. Ecological sustainability has become an important direction in design. It is not only expressed in art, but also inspires people to see in it the determination to protect the ecological environment. It is an exploration of contemporary art towards the integration of technology and nature. Their works translate complex scientific principles, such as evolution, biology and physics, into visual art, enabling the public to experience cutting-edge developments in science and technology through art. This cross-disciplinary collaboration promotes a new way of thinking about contemporary art, limiting it not only to aesthetic innovations, but also to profound reflections on the future of society, the environment and technology. The interactive elements designed in the work allow people to feel empathy with the work, enhancing the connection between people, art and nature.

With the rapid development of artificial intelligence today, the use of generative design has greatly increased. By modelling the ecology and biomorphology of nature, more innovative designs can be provided. Architecture and urban planning can focus more on the optimal allocation of resources and the sustainable use of the environment. In addition, generative design is industrially capable of coping with more complex

changes, allowing it to flexibly adapt under different environmental conditions to cope with the uncertainties brought about by climate change.

It's not just about breakthroughs in art, architecture and industry, it's about scientists, designers and engineers working together across borders to break with tradition and find innovative solutions.

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