

**a garden
for a fish**

A garden for a fish

Reflective documentation

Part of the thesis project "A garden for a fish"

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a garden for a fish

I hereby declare,

that I have independently written/produced the reflective documentation of my thesis in accordance with the principles of good scientific practice and have not used any sources and aids other than those indicated,

that this reflective documentation has not yet been submitted in any form for evaluation, neither in Austria nor abroad, and

that this version is identical to the online submitted and assessed version.

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Abstract

A cryptic phrase from the future – “a garden for a fish” – sets off a personal and artistic quest. Through exploring the history and significance of gardens in different cultures, my own experiences with fish, and reflections on science and possible, probable and preferred future scenarios, I gradually came to understand this phrase to be a seed and a model of a future research institute: a model for research, learning, and life in which humans cultivate a gardening relationship with nature, no longer perceiving it as an object, but as a living, polyphonic system.

Ein kryptischer Satz aus der Zukunft – “a garden for a fish” – löst eine persönliche und künstlerische Erkundung aus. Durch die Auseinandersetzung mit der Geschichte und Bedeutung von Gärten in verschiedenen Kulturen, meinen eigenen Erfahrungen mit der Haltung von Fischen sowie Reflexionen über Wissenschaft und mögliche, wahrscheinliche und bevorzugte Zukunftsszenarien gelangte ich allmählich zu der Erkenntnis, dass dieser Satz den Keim und das Modell für ein zukünftiges Forschungsinstitut darstellt: ein Modell für Forschung, Lernen und Leben, in dem Menschen eine gärtnerische Beziehung zur Natur pflegen und diese nicht länger als Objekt, sondern als lebendiges, vielstimmiges System wahrnehmen.

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Time is tight. The boat is soon leaving the harbour, and I should catch it to bring my harvest to market. What I learned from this tightness of time is that one has to slow down in order to catch boats. The tighter time becomes, the calmer you have to be. My thoughts are meandering, and I give them time, even though time is tight – perhaps precisely because time is tight. When you slow down, you begin to see all the possible shortcuts that lead to the destination.

I have spent years meandering: in the Garden of Eden, researching minute details of the story, comparing different Bible versions, reading the Qur'an, and tracing the origins of the biblical text. I learned about Persian gardens and Persian history, about Cyrus the Great and Cyrus the Younger, about the Assyrian Empire and about the end of the Persian Empire when the Muslims conquered Ctesiphon in 651 AD. I read about the enormous Baharestān carpet that depicted a garden, woven from silk, gold, and silver, so heavy that it could not be carried away as booty; instead it was cut into pieces and distributed among the conquerors. I read about the Silk Road and tried to reconstruct how Padre Attiret, a Jesuit priest and court painter at the court of the Qianlong Emperor, traveled to China. I read about Chinese empires, about the Chinese economy through history, and about the development of agriculture under different regimes. Similarly, I got lost in the Amazon rainforest and its semiotics.

When I told my friends about these excursions, they shook their heads and asked what this all had to do with a *garden for a fish*, thinking that I would never finish. Looking back, I also think it was crazy, but necessary. Traveling without moving: this was not a stay at a holiday resort. All those impressions, quickly assembled on my laptop and in scattered notes, formed a jungle. My laptop had innumerable windows open: Voltaire's *Candide*, Carvajal's descriptions of his journey with Pizarro, poems by Tao Qian, Heckenberger's *The Ecology of Power, The Evolutionary Roots of Utopia, The Mechanical and the Organic, What Is a Model?*, *barad.pdf*...

A mess that I have been trying to clean for months. I wrote; I collected; I cited; and yet it did not become a coherent story. I grew angry with myself. I had expected that writing it all down would be easy, a dance on the keyboard, a single stroke of genius, with everything flowing effortlessly. It was nothing like that. I felt I knew exactly what I wanted to say and yet could not express it in words.

I experimented with different writing methods, tried to “design” the text in the hope that this would automatically clarify the message. Nope. Writing was also a bodily challenge. I always had that caricature in mind: the evolution from a hunched, ape-like creature into an upright human, who then bends forward again in front of the screen. The fact that English is not my mother tongue did not make things easier. The whole trip was also a language course, and I have to thank several AIs and translation programs.

In the age of artificial intelligence, the question of how “unique” thoughts are becomes more difficult to answer. For readers of this documentation, I assume there is no doubt about their uniqueness. But AI was a big help. It helped me with citations, with some research, with translations, and with cleaning my improper English and orthography, although we had fights about em-dashes (—) and about formulations that were too polished or exaggerated. You see, I care about em-dashes, even though time is tight.

But coming to thanks: I will not mention anyone by name, only by function; the right people will feel addressed.

First come my family – those who have already died and those who are still alive. I grew up with a lot of freedom and always felt loved. This is more than many people receive. They also gave me, in a way, a scholarship for this endeavour. They have the greatest trust in me and the greatest doubts. Almost every conversation with my father, within five minutes of my arrival, is about the inability of humans to learn. He maintains that humans have always had destructive tendencies and have always fought against each other, and that this will be the case as long as the human species exists. A universal law, proved by history. Perhaps this work is also an attempt to disprove him, even though we would probably only be able to discuss the outcome if we were reborn. My mother is quite old, classically educated but with little knowledge of philosophy, biology, or artistic research, and afraid of dementia and Alzheimer's. We have regular telephone calls, and sometimes I share my ideas with her. She then becomes totally present. I have her full attention – she makes me speak. I'm sure she has neither dementia nor Alzheimer's.

Second, the University of Applied Arts. I already felt thankful when accepted as a student in Art & Science, and the same holds true for my acceptance into the Artistic Research PhD programme. It provided the framework and motivation to work on this idea seriously, along with a platform to present and discuss it. Being a PhD student lent the whole endeavour the serious aura it deserves. I thank my supervisor for his trust, his frankness, and his reminders and support in finding an end. I also thank all the professorships of the Artistic Research PhD programme, who shared their perspectives and approaches with us, and, of course, my colleagues, who opened my eyes to a multitude of artistic research landscapes.

The thanks to the University includes many people – definitely all those who contribute to an atmosphere that fosters lively, enriching relationships and an attitude that seeks cooperative ways to solve problems. I also thank the committee members who expressed their willingness to engage more deeply with the project and discuss it with me.

Last but not least, I have to thank all the fish caregivers when I was not at home. This includes the different neighbours I had in all those years and the community of the Palais Rössl, where the fish-garden laboratory – as I began to call it – found its preliminary final station. Palais Rössl is a self-run artist community space with studios, into which first the fish garden and shortly afterwards I moved. It allowed me to spend so much time researching, observing, thinking, and trying to bring things into a form, without feeling socially isolated. I never felt lonely. Since Palais Rössl had many visitors, I had many opportunities to present and discuss the project with different people.

A Shaolin Temple five minutes from Palais Rössl – which I regularly visit to learn their art – also belongs to this social dimension. On the surface it seems unrelated to the project, but on a deeper level it connects. I believe the regular training there made the mental and bodily discipline this reflection required possible. To the social aspect I also count the community that formed around a ping-pong table in the Prater. This place is a circus and theater, a stage and dance floor – a place not without conflicts, yet one where a high degree of sociality is practiced, and where I sometimes had discussions that would have honoured any academic circle.

I also want to thank my friends, old and new, who are all somehow a part of me, just as I am a part of them, according to the ontologies presented in my reflective documentation that see the “self” as a product of semiosis and relationships.

Before getting there, a few more words. I have worked on this for a long time; my supervisor once said I lived it, and I think there is some truth in that. The result is different kinds of

jungles: a jungle on my laptop, a jungle in the rooms I inhabit, a jungle in my brain: cultivated rainforests. I now have to collect the harvest, pack it, and bring it to the boat. Parts of the harvest are already packed and ready for shipping, others still have to be packed, and some still to be collected. The papers still need approval.

I hope you can enjoy this collection of thoughts gathered from those cultivated jungles – some freshly picked, others waiting since long for their shipment. The shipment comes in three containers, or **BOOKS** accompanied by a **PROLOGUE** and an **EPILOGUE**. Before I give you a short description of what they contain, I will report on the story that led to the whole project and share my initial thoughts.

Introduction

Else

I encountered Else for the first time when I was musing over my master's thesis. That was in 2016. She introduced herself to me as Else Sibil Somone and said she is a transcientist and comes (or should I say 'will be coming'?) from the future.

At first, I thought I might have gone mad, but then I cooled down – because, apart from the strangeness of the whole experience, our conversations were exciting and reasonably sane. So, I stopped worrying about going crazy. Transcientists, I have gradually come to understand, are researchers trained to think and act beyond, across, and through disciplines. They are time travellers – not in a material sense, but in the form of wave patterns.

I later learned that wave patterns can be shaped and used when one thinks with full concentration on something. But this concentration requires years of training. When a transcientist focuses on an episode in the past, the time–space wave patterns shift slightly. This opens small channels and allows thoughts to travel through time. I have never seen Else, nor have I heard her in a physical sense. Her messages are more felt than linguistically conveyed. I can describe them best as silent music with a striking musicality.

Else's performance was so convincing that I dedicated my master's thesis to her and to the exploration of transcientistic attitudes and practices. I worked on mealworms and mealworm beetles, and delved into wormholes, translabs, and transmaps.¹

After completing my master's, I felt I had contributed enough to the transcientistic idea. Instead of delving further into wormholes, I became a passionate outdoor ping-pong player. But Else returned.

¹ Busch, Margit. *If-Then-Else: Welcome to Transciency*. Master's thesis, University of Applied Arts Vienna, 2016. Phaidra, University of Applied Arts Vienna Repository. <https://phaidra.bibliothek.uni-ak.ac.at/detail/o:41881>.

The riddle

When Else returned – to me, her absence had felt like more than two years –, she carried on as if she had never been away. Maybe she had never left. Everything I had done in the meantime seems to fit perfectly into her plans, so I suspect Else had had her fingers in the pie all along.

In the meantime, I had acquired an aquarium and some fish, seemingly for no particular reason. Underwater worlds simply fascinate me, and I wanted a bit of lively company in my home.

The fish I chose were zebrafish. First, because all the literature I consulted described them as a hardy species, easy to keep and breed, making them suitable for beginners. Secondly, I was interested in the fact that zebrafish serve as model organisms in biological and medical research; they are therefore studied from many angles and used for a variety of research questions. Their status as model organisms has expanded the habitat of these fish to laboratories around the world. A vast amount of information is collected about and through them. Their genome is sequenced, their behaviour catalogued, and there exists a well-maintained database, the Zebrafish Information Network (ZFIN), which gives access to all this information.²

Else: *A garden for a fish.*

Me: *A garden for a fish?*

Else: *A garden for a fish!*

I've already mentioned that Else doesn't really speak; it was not my ears that heard this phrase, it was in my brain, or even in my body.

The idea caused a deep and pleasant smile in my nervous system and intestines, although I had no clue what was meant by "a garden for a fish." So I took it as a riddle to solve, as a task to dig into its possible meanings.

² "ZFIN: The Zebrafish Information Network." University of Oregon, Eugene, OR. <https://zfin.org>.

Initial thoughts on the parties involved

the garden

When you think of a garden, it quickly becomes clear that there is not just one single concept. Gardens exist, and have existed, in almost all cultures and throughout different times, taking on various manifestations, forms, and botanical compositions. They serve different purposes, are subject to a wide range of legal and political contexts, and carry diverse expectations and symbolic connotations.

But by whatever idea, purpose, or practice a garden is shaped, it is nature choreographed by humans, if we leave out the Garden of Eden for a moment. Every garden is a manifestation of long-term human interaction within a complex network of other living beings. It is a demarcated area that reflects human resources, knowledge, beliefs, and attitudes toward nature.

This characteristic makes the garden an ideal place to explore the various relationships between humans and nature, as well as the beliefs, narratives and attitudes that shape these relationships and are in turn shaped by them.

A garden for a fish must necessarily be an underwater garden, unless we interpret the fish purely metaphorically. I am sure metaphorical aspects play a role in the endeavour, but, as I have observed, in transcientistic research, acting and experiencing go hand in hand with thinking. Working with real matter is crucial.

I also know that gardening needs experience. You don't become a skilled gardener by reading gardening books, or in the case of an underwater garden, aquaristics or aquascaping manuals. Of course, reading helps. You can get advice and ideas. But as no garden is like any other, you have to practise, observe, and develop your own wisdom.

A garden is a laboratory.

the fish

I don't think it's a meaningless coincidence that I chose the zebrafish as a flat companion. As I've already mentioned, this species is considered a model organism. Model organisms serve as research vehicles; more precisely, they are non-human species that are extensively studied, with the expectation that the insights gained from these studies can be extrapolated to other organisms.³

The status of a model organism links the fish–garden research with the zebrafish research community and opens up pathways into the knowledge landscape of the natural sciences. Crossing disciplinary boundaries is, ultimately, an essential characteristic of transcientistic practice.

As a model of a garden inhabitant, I should study the fish extensively. Certainly I need to get to know them better, both individually and as a species, as well as in their metaphorical meaning, in theory and in practice. Finally, the fish is, in a way, a “client” of the gardener.

³ Ankeny, Rachel A., and Sabina Leonelli. *Model Organisms*. Cambridge: Cambridge University Press, 2021, 2.

the gardener

The gardener is unavoidably part of the system. No garden without a gardener. An experimental system composed of fish, garden, and gardener.

The gardener is also an experimenter. She observes how practices, procedures, and rhythms develop in the garden. She pays attention to singularities and regularities. She introduces rituals, invents rules, and eventually establishes them.

The gardener is both a research object and researching subject.

The gardener is – I suspect – a transcendent researcher.

Three books

The aforementioned containers are three books in which my activities, reflections, and conclusions in the search for answers to the question of what “a garden for a fish” might mean are organised.

BOOK I

takes us to the **GARDEN**: from the Garden of Eden and Persian paradise gardens to Chinese and Japanese traditions, tracing the worldviews that shaped them. The journey finally leads to the Amazon rainforest, where ancient societies cultivated biodiversity in dialogue with their environment. The book concludes with a brief look at gardens in art and their utopian dimensions.

BOOK II

turns to the **FISH**. It recounts my personal experiences with zebrafish: from getting to know them, to the confrontation with death and feelings of guilt. You will read about the small aquatic worlds inhabited by the fish, and the wonders and disasters encountered in aquarium keeping. I will discuss experiments, practices and principles that have emerged in the course of my work with the fish and their habitat, and offer insights into the scientific world where zebrafish play a vital role as model organisms. Finally, you will encounter the fish as symbol and metaphor and be challenged to reflect on ethical questions.

BOOK III

is an exercise in **TIME TRAVEL**. It introduces the field of futures studies and examines worldviews that have the potential to generate ‘preferred futures’. A journey to the beginning of the last century takes us to a biological research institute, the BVA (Biologische Versuchsanstalt), which was once located in the Vienna Prater. The privately founded and self-financed institution stands as an example of enthusiasm, initiative, and commitment in science. Its case also illustrates the interplay of science, ideologies, and politics, showing that scientific research cannot be considered in isolation from its social context. The BVA serves as a model for recognising such entanglements and viewing the present from a time traveller’s perspective.

These insights, together with those from books 1 and 2, inform my speculation about a future Transcientistic Experimental Institute (TEI).

BOOK I

GARDEN

a garden?

a garden is
a defined area with permeable borders
an evolving system with innumerable players
choreographed by humans
it reveals and shapes realities & mentalities
it is a model for 'how to act'

a garden is
poetry
poetry of space
poetry of life
it combines the ordinary with the mysterious
it is a metaphor and a reality

a garden is
practice and attitude
experiment and wonder
a dialogue with non-human life
a place where thinking and feeling come together
it is chaos and order, growth and decay

CONTENT

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Japanese

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Résumé

Getting to the fish

A journey

If you go on a foray into the literature on gardens, you quickly find yourself in a jungle. The literature fills shelves and disc space and you rapidly learn that the concepts, purposes, and uses of gardens are manifold.

Therefore I had to make choices. The journey to which I would like to invite you leads from the garden Eden to the Amazonas region. From paradise and reflections on the Fall the journey goes on towards the Persian Garden. There you will encounter the design principle of the Persian Gardens, the Chahar Bagh. Geometric and symmetric it was meant to represent a cosmic order. A design that influenced later garden layouts, far beyond the bounds of Western Asia.

With this experience in our luggage, the journey continues to China where you make the acquaintance with Padre Attiret, a Jesuit priest from the 18th century who was invited as a court painter to the Court of the Quianlong Emperor. You meet other emperors who were megalomaniacal builders of gardens, and you will hear about the mythologies and ontologies driving them. The garden type of the scholar introduces gardening as a philosophical endeavour connected to the cultivation of the self. A trait that can also be found in Japanese garden culture.

The last destination is the Amazonas region, a place where you get insights into Indigenous agroforestry and a semiotic ecology where humans are one interpreting being among many. The term 'garden' is here used in the broadest sense: as a site where humans design in close interaction with non-human life, a place shaped by humans and their world views in communication with vegetation and other living and non-living beings.

Towards the end, I will consider gardens and gardening in contemporary art, along with their metaphorical and utopian aspects. Finally, we will have a look at the findings. I will retrace our journey and end with a search for fish in the garden cultures presented.

The following text is the report of a journey through time and space in search of gardening attitudes and practices that have shaped or will shape the transcientistic cosmos.

Eden and paradise

The journey begins in the biblical Garden of Eden, the place where, according to Judeo-Christian mythology and the beliefs of Islam, “the first man and the first women lived in harmony with nature and with God.”¹ The garden Eden story is, like many other stories in the bible, a strong symbol and a strange story – and it seems to me connected to Else's riddle.

Knowledge and the Fall

The narrative of the Garden of Eden shaped Western conceptions of human origins and humanity's relationship with nature for centuries. In the story of creation, the desire for knowledge paradoxically gives rise to punishment: humankind is punished for seeking to know. The forbidden fruit, the fruit of the tree of the knowledge of good and evil, becomes a symbol of transgression, but also of epistemic awakening.

Dominion or responsibility?

“God blessed them, and God said to them, ‘Be fruitful and multiply, and fill the earth and subdue it; and have dominion over the fish of the sea and over the birds of the air and over every living thing that moves upon the earth.’”²

This biblical command could be interpreted as a divine license for domination. One could argue that it laid the ideological groundwork for humankind's exploitative relationship with nature. But it is likely that these passages were meant and read, at least in the Patristic and Medieval periods, allegorically and referred to internal cultivation and self-control: a taming of the inner beast.³

Another interpretation of this passage is that it originally referred to the attribution of responsibility to humans for the land and the creatures living in it. The Volxbibel, a German language project that seeks to translate the Bible into modern language to make it accessible to a broader audience, follows this line. It reads “subdue” and “have dominion” not as power, but as responsibility. Translated (own translation) it reads like this: God wished them all the best and said to them: “Have sex with each other and reproduce properly! Have babies! From now on you are responsible for everything on earth, for the fish in the sea and for all the birds that fly around. And from now on, you will also be responsible for all the other animals that live on earth!”⁴

This reading is in line with the transcendentist interpretation of the narrative.

A transcendentist reading of the Fall

From Else I learned that in the transcendentist culture, Eve's act is regarded as neither a sin nor a weakness, but as an honorable act, a sort of biblical *sapere aude*. Eve is revered as the mother of wisdom and ethical responsibility. Instead of remaining in a care-free, innocent and probably naïve state, she chooses to know, and thus be responsible for her actions. Moreover, in their innocence, Eve and Adam could not have known that eating from the

¹ Giesecke, Annette, and Naomi Jacobs, eds. *Earth Perfect? Nature, Utopia, and the Garden*. London: Black Dog Publishing, 2012, 7.

² Genesis 1:28

³ Harrison, Peter. “Subduing the Earth: Genesis 1, Early Modern Science, and the Exploitation of Nature.” *The Journal of Religion* 79, no. 1 (1999): 86–109.

https://www.academia.edu/16421028/Subduing_the_Earth_Genesis_1_Early_Modern_Science_and_the_Exploitation_of_Nature.

⁴ “1. Mose, Kapitel 1.” *Volxbibel Lesen*. <https://lesen.volxbibel.de/book/1.%20Mose/chapter/1>.

knowledge-apple-tree would be a sin. Without knowledge of good and evil, how could they know that disobedience could be considered indecent?

In the transcientistic reading, Eve's act is an act of emancipation. It is widely held that she deserves honor, since she was the first to show courage. There are also proponents of the theory that the apple may actually have been a psychoactive fruit and that the punishment for eating it was the first known prosecution for psychoactive substances in history.

The transcientists look at the expulsion from paradise as a necessity. To be responsible, one must know, and when one knows, one is responsible. Paradise, as it exists in many people's imaginations, as a carefree place full of amenities, would probably be difficult to cope with in the long run anyway.

Paradise: Eden in the Quran

Before leaving the Garden of Eden I would like to introduce you to the Islamic version of the story of the Fall. It bears clear parallels to the biblical account, but differs in key respects. In the Qur'an, the first act of disobedience is committed not by Eve (in the Qur'an: Hawwa), but by Iblis, an angel of fire endowed with free will.

Iblis refused to obey God's command to bow down before a clay mould human whom God created, as he saw humanity as unworthy of honor. For his disobedience, he was expelled from paradise but vowed to prove his point by leading man astray (Quran 7:17). Iblis didn't hesitate to bring the proof and successfully persuaded Adam and his wife Hawwa to eat fruits from the forbidden tree – which in the Quran, lacks any specific association with knowledge. Unlike the Genesis narrative, the human transgression here is not framed as a search for wisdom, but as a seduction. The human is portrayed here more as a passive victim than as an active sinner. Nevertheless, as in the bible, Adam and his wife get punished and are expelled from paradise.

It is also worth noting that in the Qur'an, Adam and his wife Hawwa are equally blamed for their weakness. Hawwa is not particularly singled out or made the archetype of moral failure.

Altogether it seems like God and Iblis made a bet and that everything is part of a larger divine plan in which human beings, now endowed with free will, must prove their qualification to withstand the temptations of Iblis.

Back to reality

Genesis is a work of man – written, edited, remembered, and reimagined across time. The contradictions (and stylistic differences) in the text are explained by modern biblical scholars through different hypotheses which read Genesis as a composite text – a palimpsest of various mythologies and multiple sources compiled over centuries. Much of it, scholars argue, took final form during the Babylonian exile in the 6th century BCE: a time of cultural rupture and search for identity-generating cohesion.⁵

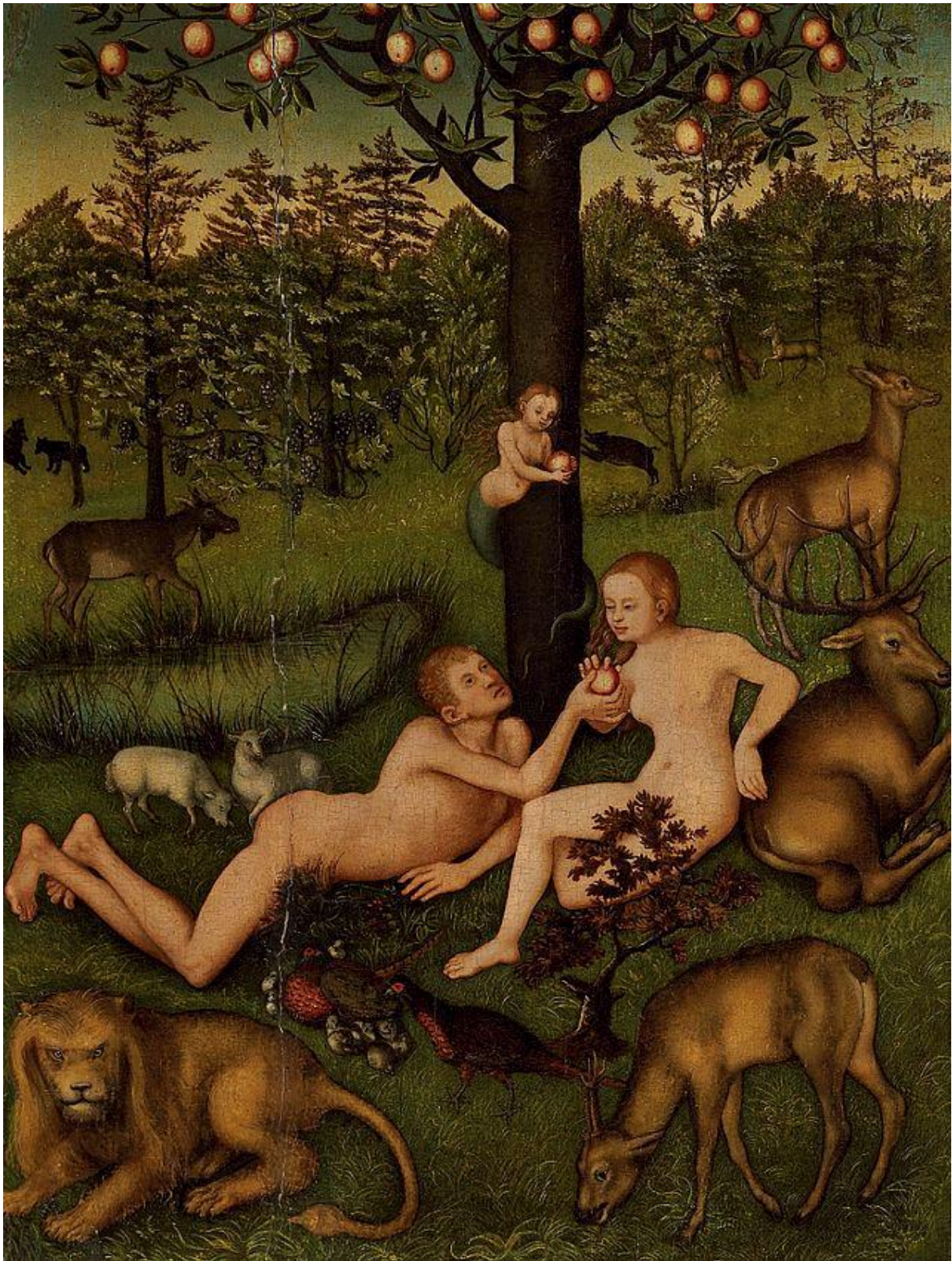
In this light, Eden is not just a myth of human origins, but also a narrative that supported identity-building and law-making. Nonetheless, the garden of Eden points to a state of wholeness, a state in which man was in harmony with nature and with God.

It is time now to leave the symbolic gardens of scripture and to continue the journey to real garden landscapes, shaped by human hands. Paradise refers in its origin to real gardens.

⁵ Bajić, Monika. "Authorship of the Pentateuch." *KAIROS – Evangelical Journal of Theology* 10, no. 2 (2016): 215–223. https://www.researchgate.net/publication/359082720_Authorship_of_the_Pentateuch; Smith-Christopher, Daniel. "Exile: History, Interpretation, and Theology." In *St Andrews Encyclopaedia of Theology*, edited by Brendan N. Mitchell, 2023. <https://www.saet.ac.uk/Christianity/ExileHistoryInterpretationandTheology#section1.1.1>.

The Avestan word *pairi-daēza*- “enclosure” rests on an Old Iranian base consisting of *pari*- ‘around’ + *daiz*- ‘to heap up, build’.⁶ It entered the Bible through the Greek translation and thus became synonymous with the Garden of Eden. The real-life prototypes of paradise were the Persian gardens and parks.

⁶ Oxford English Dictionary, s.v. “paradise, n.” (etymology), https://www.oed.com/dictionary/paradise_n?tl=true&tab=etymology.



The Garden of Eden, ca. 1530. Workshop of Lucas Cranach the Elder (1472–1553), Wikimedia Commons



Persian miniature, Unknown artist, Iran, Chirâz, ca.1575. Bibliothèque nationale de France, Wikimedia Commons. Adam (Keyumars) honored by the angels, and Iblis, black-faced and without hair (top-right of the picture), refusing to prostrate. It seems as if the artist interpreted Adam as a hermaphrodite.

Persian gardens

The Persian Garden is recognised as a UNESCO World Heritage Site. To be precise there are nine sites, as there are nine gardens which “exemplify the diversity of Persian garden designs that evolved and adapted to different climate conditions.”⁷ These sites represent variations of the *Chahar Bagh* principle, a garden layout divided into four parts by water channels or paths. Pasargadae, the garden of Cyrus the Great (559–529 BC), is considered one of the earliest sophisticated models of the Chahar Bagh design, though only sparse remains give an idea of the former garden layout. Cyrus’ garden did not survive the passage of time, but its geometric and symmetrical design principle lived on, spread and had a significant influence on later garden traditions far beyond the borders of Western Asia. Think of the Alhambra in Andalusia or the Taj Mahal in India.

“The Persian Garden is an outstanding example of a type of garden design achieved by utilising natural and human elements and integrating significant achievements of Persian culture into a physical and symbolic-artistic expression in harmony with nature. Indeed, the Persian Garden has become a prototype for the geometrically-designed garden layout, diffused across the world,”⁸

says the UNESCO website.

Cultural and natural conditions shaped this specific design that has water as the central design element. The rectangular waterways dividing the garden served, besides their symbolic significance, as an adaptation to the mostly arid environment. These water bodies supplied irrigation for the vegetation and created a microclimate with cooling breezes and the soothing sound of flowing water. The tall trees often accompanying the waterways reduced water evaporation.⁹

Xenophon, a Greek general, philosopher and historian who saw many of the Persian paradises on his march through Asia, reports on the significance of gardens in Persian culture. His *Oeconomicus*, written in the 4th century BCE, is one of the earliest works on economics. In it he emphasises the great importance the king attached to the garden.

“nowhere among the various countries which he [the great king] inhabits or visits does he fail to make it his first care that there shall be orchards and gardens, parks and “paradises,” as they are called, full of all fair and noble products which the earth brings forth; and within these chiefly he spends his days, when the season of the year permits.”¹⁰

Xenophon also reports about a visit by the Spartan military and political leader Lysander to Cyrus’ (the Younger) garden in Sardis and writes:

“Lysander was astonished at the beauty of the trees within, all planted at equal intervals, the long straight rows of waving branches, the perfect regularity, the rectangular symmetry of the whole, and the many sweet scents which hung about them as they paced the park.”¹¹

Lysander’s description of the garden sounds like a military arrangement, if he hadn’t also mentioned the scents. And he does not only wonder about the garden but also about the talent of the gardener responsible for this ordered design. When he heard that Cyrus himself

⁷ UNESCO World Heritage Convention. “World Heritage List: Site No. 1372.” *UNESCO World Heritage Centre*, 2025. <https://whc.unesco.org/en/list/1372>.

⁸ Ibid.

⁹ Latif, Zainab, Mohd Yazid Mohd Yunus, and Maheran Mohd Yaman. “A Discourse on the Persian Chahar-Bagh as an Islamic Garden.” *Planning Malaysia Journal* 15, no. 3 (2017): 123–134. <https://doi.org/10.21837/pm.v15i3.303>.

¹⁰ Xenophon. *The Economist*. Translated by H. G. Dakyns. Project Gutenberg, 2024. <https://www.gutenberg.org/cache/epub/1173/pg1173-images.html>.

¹¹ Ibid.

had planted some of the trees with his own hands, he was even more full of admiration, as Cyrus, with his jewelry and ornaments, didn't look like a tree planter. Cyrus answered that

“[...] when in ordinary health I never dream of sitting down to supper without first practising some exercise of war or husbandry in the sweat of my brow, or venturing some strife of honour, as suits my mood.”¹²

What a man.

But back to the “physical and symbolic-artistic expression in harmony with nature,”¹³ as stated on the UNESCO World Heritage list. Living nature is rarely geometric. Symmetrical, yes, but rectangular, no. Of course squares and rectangles are the simplest way to organise things. A square divided in four parts by a cross – a pattern that can be repeated. According to Abbas et al. the ancient Iranians considered the quarters as circles and the circles represent the depth of the universe.¹⁴ A kind of symbolic geometry.¹⁵ Besides this cosmic geometry, the authors see the Persian garden as a model for improving living conditions in harsh environments – thereby enriching them. They argue that the garden shows how culture can transform the environment and vitalise barren land to foster life.

With their irrigation systems, the qanats, the ancient Persians certainly contributed to the blossoming of the landscape.¹⁶ The reverse was also true – the garden inspired literature, calligraphy and music. One could speak of mutual fertilisation. The garden was shaped by the conditions of the landscape and the technologies available for supplying water to the vegetation but also by the worldviews of the Persian culture.

To learn about gardens shaped by other landscapes and other cultures I would like to invite you to follow me on a trip to China in the steps of Padre Attiret, a Jesuit priest who was invited as a court painter from the Qianlong Emperor in the 18th century.

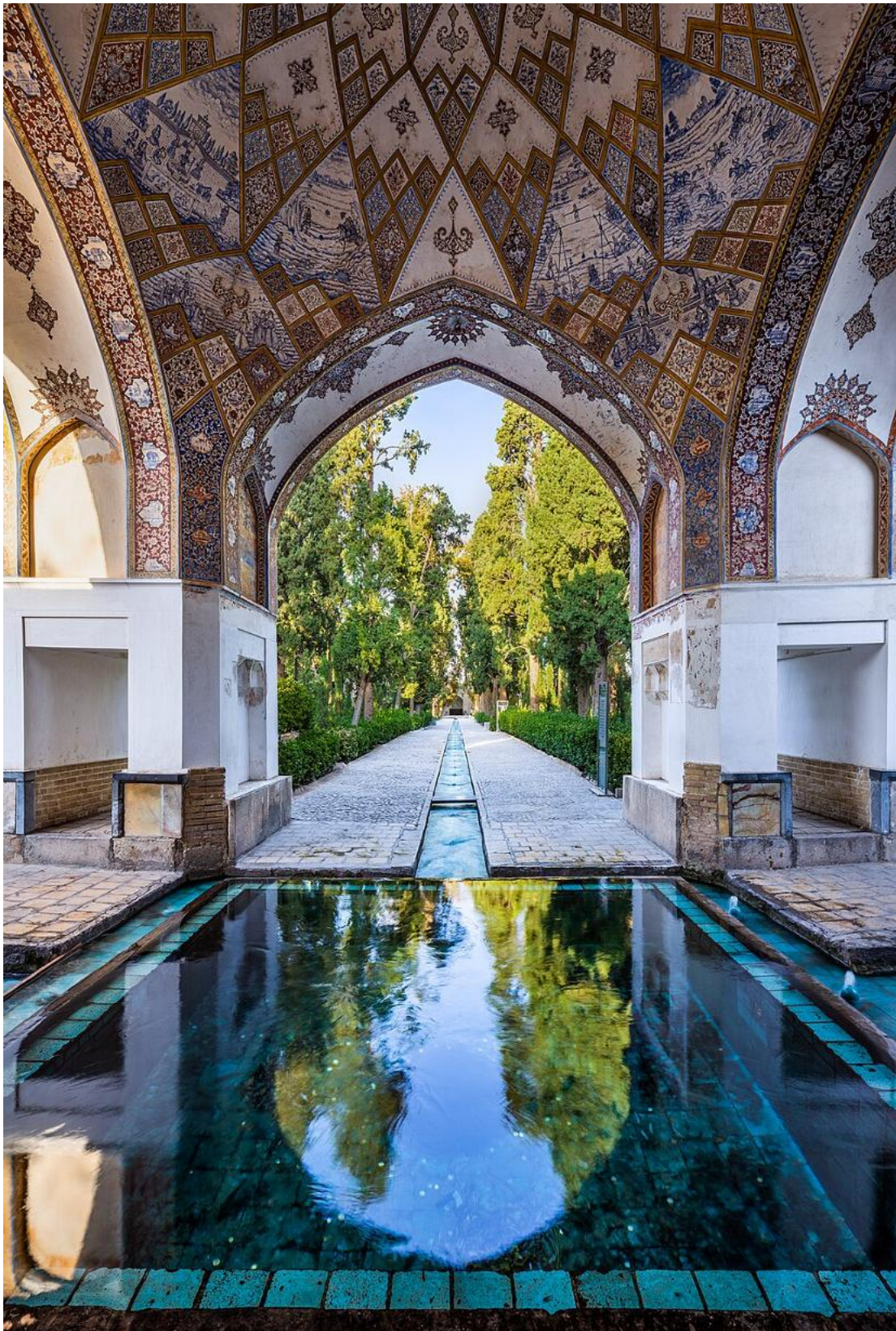
¹² Ibid.

¹³ UNESCO World Heritage Convention. “World Heritage List”

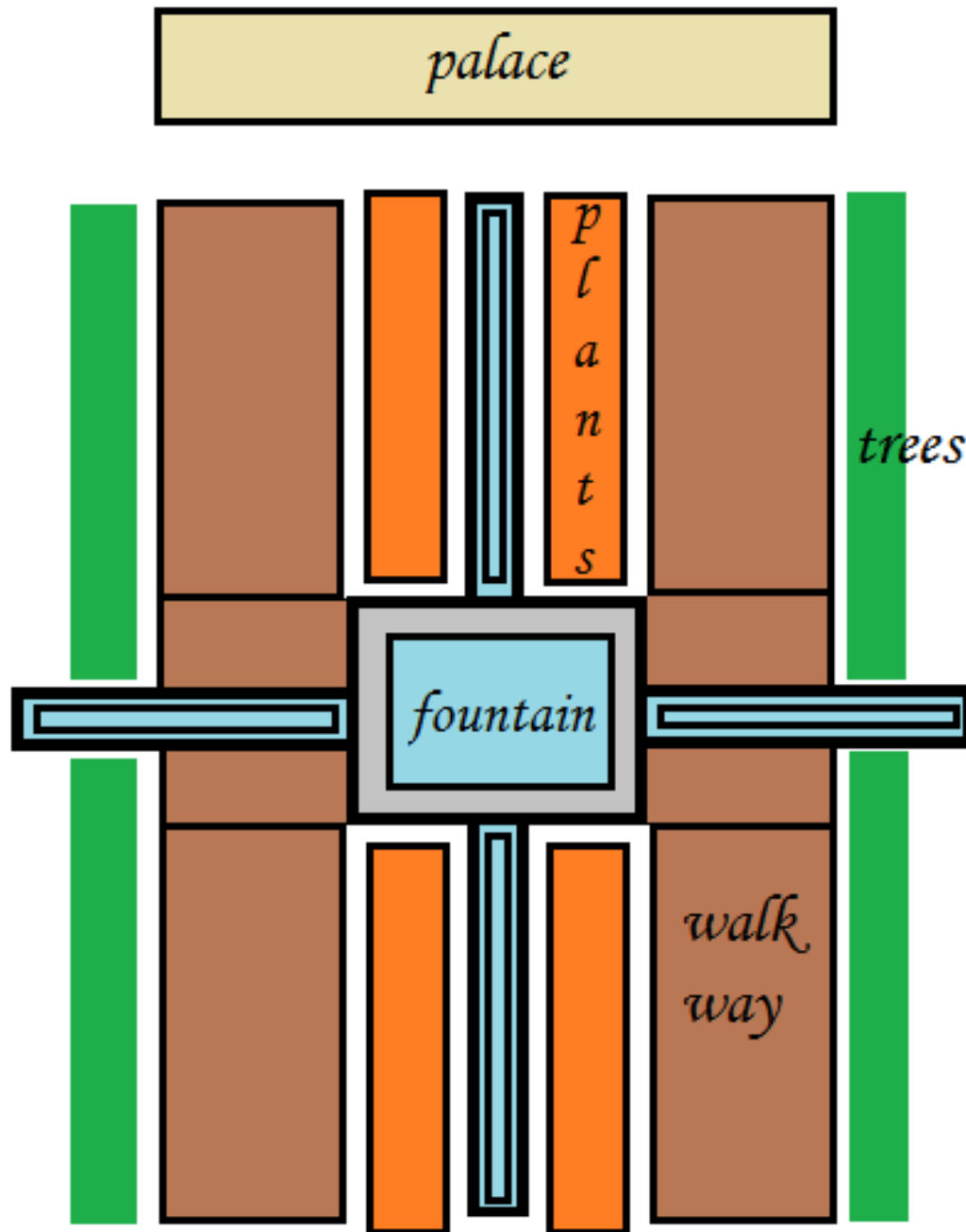
¹⁴ Abbas, Mohamed Yusoff, Nazanin Nafisi, and Sara Nafisi. “Persian Garden, Cultural Sustainability and Environmental Design: Case Study Shazdeh Garden.” *Procedia – Social and Behavioral Sciences* 222 (2016): 510–17. <https://doi.org/10.1016/j.sbspro.2016.05.142>.

¹⁵ The fourfold ordering of space reappears in the Hebrew bible as in the Qu’ran. In the biblical account of the Garden of Eden, a single river flows out of the garden and divides into four rivers (Genesis 2:10–14) and in the Qu’ran, everyone who stands in awe before his Lord is promised two gardens, each with two flowing springs.

¹⁶ Remini, Boualem, R. Kechad, and Bachir Achour. “The Collecting of Groundwater by the Qanats: A Millennium Technique Decaying.” *LARHYSS Journal* 20 (2014): 259–77. <https://larhyss.net/ojs/index.php/larhyss/article/view/246>.



Iran Kushak pavilion, Fin Garden (Bagh-e Fin), Kashan, Iran (UNESCO ID 1372-004). Amir Pashaei, 2019, Wikimedia Commons



Persian Garden Plan / Charbagh principle. Dr. Persi, Wikimedia Commons



Garden Carpet, second half 18th century, made in Iran, Kurdistan. The James F. Ballard Collection, Gift of James F. Ballard, 1922



Xenophon in front of the Viennese Parliament, 2025

East Asian gardens

Chinese

"When the first descriptions of Chinese gardens reached Europe in the eighteenth century, they started a revolution in taste. Until then, ever since the Egyptians first laid out pleasure gardens on the banks of the Nile, the gardens of the West had been based on straight lines and rectangles. From Spain to Mogul India rich and cultivated men planted their decorative trees and flowers in formal patterns, bringing order and symmetry to nature, while from salons all over Europe the local Princes looked down over meticulous arrangements that mirrored the organising mind of man." ¹⁷

The Garden of Perfect Brightness

One of these descriptions originates from a letter, written in 1743, by Father Attiret to a friend in Paris. Attiret was one of several Jesuits whom the then reigning Qianlong Emperor had employed as painters to his court in Beijing. Attiret had left for China towards the end of 1737.¹⁸ In his letter he gives a short description of the journey, reporting that he did not see much of the country, as they travelled either by boat or in a cage-like litter with no view outside. He also had the feeling that there was not much to see. But when he comes to Peking and sees the Emperor's Palace and the imperial garden landscapes, his description becomes full of admiration.¹⁹ He praises the beauty, symmetry, and order of the Palace, but his greatest fascination is the imperial garden – the *Yuanmingyuan*, or Garden of Perfect Brightness.

"That what they are to represent there, is a natural and wild View of the Country; a rural Retirement. I admire the Art, with which all this Irregularity is conducted. All is in good taste; and so managed, that it's Beauties appear gradually, one after another. To enjoy them as one ought, you should view every Piece by itself; and you would find enough to amuse you for a long while, and to satisfy all your Curiosity." ²⁰

The Qianlong Emperor was a fervent garden builder. Maggie Keswick describes his passion for landscaping as verging on the maniac.

"No sooner was one lay-out finished than he would start another, and gradually several older Imperial gardens, as well as uncultivated and agricultural land, were absorbed into his domain. The result was a vast complex of lakes and palaces collectively known as the 'Garden of Perfect Brightness', or Yuan Ming Yuan. It was one of the most fantastic pleasure gardens ever built on earth." ²¹

Attiret's position as court painter gave him privileged insights into the imperial world that were granted to very few people, and even fewer foreigners. His descriptions of the imperial garden differ significantly from the garden styles that Europeans were accustomed to at the time. Raised hills and digged valleys, lakes and meandering streams, well-disposed buildings, walks with various turnings and windings, aligned by "Pieces of Rock, some of

¹⁷ Keswick, Maggie, with contributions and conclusions by Charles Jencks. *The Chinese Garden: History, Art and Architecture*. New York: Rizzoli, 1980, 9.

¹⁸ Amiot, Joseph-Marie. Extract from a Letter Dated 1 March 1769, from Peking, Praising Brother Attiret and a Detailed Account of the State of Chinese Painting. *Journal des Savants*, June 1771, 406–20.
<https://www.battle-of-qurman.com.cn/literature/JournalScaves1771-txt-en.pdf>.

¹⁹ Attiret, Jean-Denis, S. J. "A Letter to M. d'Assaut in Paris, 1 November 1743." Translated by Joseph Spence [Sir Harry Beaumont]. In *A Particular Account of the Emperor of China's Gardens Near Peking*, edited by François Louis. Faculty of Bard College, 2004, 28. <https://faculty.bard.edu/~louis/gardens/attiretaccount.html>. (Original French published in: *Lettres édifiantes et curieuses écrites des missions étrangères par quelques missionnaires de la Compagnie de Jésus*, 27:1–61. Paris: Guérin, 1749; English translation, London, 1752.)

²⁰ Ibid.

²¹ Keswick, *The Chinese Garden*

which jut out, and others recede inwards; and are placed with so much Art, that would take it to be the Work of Nature."²²

In 1744 the emperor commissioned two Chinese artists to capture the garden impressions in a set of 40 paintings. One might think at first glance that the garden landscapes represent natural sceneries but they were planned, designed, and constructed. Some were intended to mimic sites from parts of China celebrated by China's famous writers, poets, and painters.

The garden landscape was covering around 350 hectares. It seems like a miniature version of a country, encompassing agricultural land, administrative buildings, several libraries and sites to admire the landscape. There was also a scenography of a small town with a market street.

There, the eunuchs were to enact the hustle and bustle of a real town several times a year. At the appointed times, each Eunuch slipped into a role that was assigned to him, selling or transporting goods, serving at coffee-houses or being involved in a quarrel or fight. To make the bustle more active, even theft is enacted in the course of a fair that is only for the entertainment of the emperor, the empress and his mistresses.

Father Attiret remarked in his letter that the Emperors of China are obliged to live in a strange sort of solitude. When they pass a real town all the doors and windows are shut and nobody is allowed to pass through any street. They compensate for this loss of public diversions, in which they can not participate due to their high status, by other means or inventions.²³

Attiret also describes scenes of agriculture in an area with fields, meadows, farm-houses, and little scattered cottages. There the eunuchs would imitate every thing that is done in the countryside to express a rural simplicity and the customs of country life – they go with oxen and ploughs, sow wheat, rice, and other sorts of grain, and they harvest their crops.²⁴

The *Apricot Blossom Spring Villa*²⁵ stages such a rural setting with vegetable gardens and rustic dwellings in a village. Qianlong liked to come here when the flowers were in bloom, and in a poem he writes of drinking wine during a rainy night at the pavilion near the peak of the hill.²⁶

The Emperor was the only adult male resident in the Yuanmingyuan. It looks like he has lived in his own scenography – actor and audience of a permanent performance. Close to the end of his letter Padre Attiret writes: "There is but one Man here; and that is the Emperor. All Pleasures are made for him alone. This charming Place is scarce ever seen by anybody but himself, his Women, and his Eunuchs."²⁷

Qianlong reigned for 49 years, from 1736 to 1795, spending about a third of each year living at the Yuanmingyuan.²⁸ The last emperor to reside at the estate fled with most of his court to his summer palace when European troops approached Beijing. They sought revenge after the Chinese took members of a negotiating delegation hostage, some of whom were tortured and executed. In retaliation for the torture and execution, and to pressure the ruling emperor Xianfeng into signing a peace treaty, *Yuanmingyuan's* wooden pavilions were set on fire, the

²² Attiret, "Letter to M. d'Assaut," 1 November 1743, trans. Spence, online text ed. Louis.

²³ Ibid.

²⁴ Ibid.

²⁵ See image at the end of the chapter "East Asian gardens"

²⁶ Li, Li-Ming. "The Garden of Perfect Brightness I." *Visualizing Cultures*, Massachusetts Institute of Technology, 2012. https://visualizingcultures.mit.edu/garden_perfect_brightness/ymy1_essay.pdf.

²⁷ Attiret, "Letter to M. d'Assaut," 1 November 1743, trans. Spence, online text ed. Louis.

²⁸ Li, "Garden of Perfect Brightness I."

stone and marble structures were left in ruins. Countless valuable works of art were plundered and meandered into major Western collections of "Oriental" art. The destruction of *Yuanmingyuan* remains a powerful symbol of China's national humiliation by apparently uncultured foreign powers in the 19th century.²⁹

The wish for immortality and a stone lover

Qianlong was not the only Chinese emperor who was passionate about landscaping. Two others are also worth mentioning. One is Emperor Han Wu-ti (156–87 BC), one of the most famous rulers of ancient China, and the other Emperor Hui-tsung (1082–1135), who was an ardent lover of stones.

Although Han Wu-ti was a proponent of Confucianism and a successful military and administrative leader, he developed an obsession that overshadowed his legacy: the relentless pursuit of immortality and the phantasms associated with it. He wanted to attract the immortals in order to elicit the secret of longevity from them. The immortals were not quite gods, but were believed to possess magical powers and the secret of eternal life. Han Wu-ti had the idea that he could attract them by constructing a replica of their home within his palace grounds. He ordered the construction of a lake with three artificial islands, representing the three mythical islands of Penglai, Fangzhang and Yingzhou that are supposed to be the home of the immortals.³⁰

The emperor died at sixty-nine, after a reign of fifty-four years. But the tradition of creating symbolic replicas of the Isles of the Immortals – using symbolic and imaginary elements to form an idealised nature – endured, inspiring countless later gardens and palaces.

The other emperor, Huizong (1082–1135), the eighth ruler of the Song dynasty was a devoted Daoist, great patron of the arts, excellent painter, elegant calligrapher and passionate garden maker.³¹ In particular, he was a lover of stones, "a petromaniac of the first order", as Keswick has called him.³² The emperor commissioned the construction of a gigantic artificial mountain landscape in the northeast of the city, its location determined by a geomancer. Fantastically shaped rocks were piled into dramatic formations. Other unusually shaped stones were placed throughout the garden – some of them were even given names, which were engraved in gold on the most special specimens.³³

Huizong had stones, plants, and animals collected from all over the country and transported to his imperial park. Completed in 1122, Genyue was a representation of the empire in miniature. But the transport logistics for all the treasures gathered for the park was immense and interrupted the normal transport of food and raw materials. On the whole, the project exhausted the empire's resources. Absorbed in his garden and the arts, Huizong neglected economic policy and military defense. Only four years after Genyue's completion, Juchen invaders destroyed it, and the emperor ended his days in captivity.³⁴

Even the pursuit of beauty can lead astray.

²⁹ The Opium Wars." *Yuanmingyuan – Europe*, 2023. <https://www.yuanmingyuan.eu/en/opium-wars/>.

³⁰ Keswick, *The Chinese Garden*, 40

³¹ "Huizong." In: *Encyclopaedia Britannica*. The Editors of Encyclopaedia Britannica, 1 January 2025. <https://www.britannica.com/biography/Huizong>.

³² Keswick, *The Chinese Garden*, 53.

³³ *Ibid.*, 54.

³⁴ "Huizong," *Encyclopaedia Britannica*; Keswick, *The Chinese Garden*, 53-56.

Private gardens

Gardens were not just for Emperors. In addition to the manifestations of imperial garden fantasies, private gardens of a different style appeared during the Han era (202 BC to 220 AD), often belonging to members of a new class of government officials that had emerged during the dynasty.

Maggie Keswick describes two distinct opposing tendencies in Chinese private gardens that were present from the beginning: one tended towards an elaborate display of wealth inspired by imperial parks, the other to a simple 'scholars retreat' inspired by rural simplicity and utility. The educated classes preferred a simpler style of garden design, thereby expressing a certain cultural identity. It is largely out of this tradition that the Chinese private garden, with all its richness of meaning, has developed.³⁵

When Daoism and Buddhism entered Chinese culture, private gardens reflected the influence of changing values. A subtle fusion developed between the arts of gardening, painting, poetry and calligraphy – a feature that accompanies the history of Chinese garden culture.³⁶

Gardens were sites for the experience and expression of Daoist philosophy. Scholars, tired of official duties, dreamed of living in seclusion, in search of intellectual and spiritual insights, far away from worldly concerns and troubles. Many Chinese poets and painters draw their inspiration from Daoist philosophy: "with-draw-from-society," "return to nature," and "reclusive life" have become conventional themes of Chinese poetry, painting, and calligraphy.³⁷

The poet Tao Yuanming, one of China's most celebrated poets, lived from AD 365–427, is such an example. He was a government official, unwilling to follow contemporary mores and disgusted with political strife and the corrupt government. Yuanming chose to resign from the civil service and to live in solitude on his farm, not far away from a Buddhist temple. He farmed the land and wrote poems.

The more ostentatious garden style in private gardens gained momentum in the late Ming period (1572-1644/1368–1644), when a new merchant class, the *nouveau riche*, emerged due to the economic boom of trade in the southern reaches of the Yangtze River. This led to an ideological confrontation between the gardening tastes of the gentry and those of the merchants and turned the garden into a sociological issue.³⁸

Wen Zhenheng, a 17th-century writer and garden designer from a scholar-gentry family was no advocate of the pompous style. Around 1622, he compiled the *Zhangwuzhi* (长物志: *Treatise on Superfluous Things*), a garden philosophy, in which he complains about the vulgarity of such gardens, viewing them as a threat to the refined, intellectual garden tradition cultivated by the literati. He criticised not only the lavish garden style but also the commercialised social atmosphere associated with it.³⁹

³⁵ Keswick, *The Chinese Garden*, 41

³⁶ *Ibid.*, 73

³⁷ Li, Xueyang, Joseph P. Miller, and Tian Ruan. "Exploring Taoist Educational Philosophies in a Classical Suzhou Garden." In *Taoism, Teaching, and Learning: A Nature-Based Approach to Education*, 3–19. Toronto: University of Toronto Press, 2022. <https://doi.org/10.3138/j.ctv333ksts.5>.

³⁸ Yun, Jiayan, and Joonhyun Kim. "Sociocultural Factors of the Late Ming and Early Qing Chinese Garden Landscape, Based on Philosophies Seen in *Yuanye*, *Zhangwuzhi*, and *Xianqingouji*." *Landscape Research* 43, no. 2 (2018): 187–200. <https://doi.org/10.1080/01426397.2018.1428290>.

³⁹ *Ibid.*

A garden book and a principle

A similar reluctance against the hedonistic vogue of the time was expressed by Ji Cheng 計成 (1582 – c. 1642), a garden designer from a commoner's background. He first gained a reputation as a landscape painter and over time developed into an experienced garden designer and created gardens for both literati and merchants.⁴⁰ Ji is the author of a manual of landscape gardening, the *Yuanye* (園冶), translated as *The Garden Treatise* or *The Craft of Gardens*. It was written in 1631, its last English publication dates from 2012. Obviously a book with a long lasting relevance.

Most of the *Yuanye* is focussed on architectural features. The final chapter of the third and last volume of it introduces to the concept of borrowed scenery, *jièjǐng* 借景, a concept of garden design that modernist architects have adopted and revived in the course of the 1960s. *Jièjǐng* describes a principle in which background elements surrounding the garden are incorporated into the scenery of the garden, allowing the garden to extend beyond its boundaries.⁴¹

Kuitert writes that borrowing scenery is “not a single design idea but the essence of a landscape design philosophy in its entirety.”⁴² To be able to make a garden, the garden maker has to become receptive to the constantly changing moods and appearances of a landscape.

At the beginning of the *jièjǐng* Cheng notes that “there are no fixed rules in garden creation; it all depends on what the landscape lends,”⁴³ and paragraphs later: “There is no strategy in borrowing, it is simply following what touches you emotionally.”⁴⁴ In the passages between these statements, Cheng poetically describes various situations that can be experienced in a landscape as it changes with the seasons – situations experienced bodily, through all the senses. Gentle breeze, fragrance of orchids, Osmanthus, and lotus, sound of bamboo hit by rain, the gloomy ringing of the crickets, wild geese in flight uttering cries in the fading morning moon.

Here two excerpts from the *jièjǐng*:

‘The mood matches the pure and the remote,
the hills and valleys convey such feelings.
Thoughts beyond the vulgar world suddenly arise,
as if one enters a painting to travel inside it.’

‘It is delightful to meet the Fairy of the Flowers
among their pretty red and voluptuous violet.
Enjoying wine while professing to be a Sage,
one may equal the Prime Minister of the Mountain.’⁴⁵

It is a conversation between sentiment and scenery dissolving the division between subject and object. As Kuitert writes, “the reader moves towards a conclusion: landscape and garden maker are both object and subject and are interchangeable.”⁴⁶

⁴⁰ Ibid.

⁴¹ Kuitert, Wybe. “Borrowing Scenery and the Landscape That Lends – The Final Chapter of *Yuanye*.” *Journal of Landscape Architecture* 10, no. 2 (2015): 32–43. <https://doi.org/10.1080/18626033.2015.1058570>

⁴² Ibid., 32.

⁴³ Ibid., 35.

⁴⁴ Ibid., 39

⁴⁵ Ji Cheng, *Yuanye* (園冶, *The Craft of Gardens*), quoted in Wybe Kuitert, “Borrowing Scenery and the Landscape That Lends – The Final Chapter of *Yuanye*,” *Journal of Landscape Architecture* 10, no. 2 (2015): 38, <https://doi.org/10.1080/18626033.2015.1058570>.

⁴⁶ Ibid.

Japanese

The Japanese garden culture has a principle similar to the *jiējīng*. In Japanese it is called *shakkei* and has the same character: 借景 as in Chinese. The principle of ‘borrowed scenery’ entered Japanese garden design in the 17th century. In its original version, the concept appealed to all the senses, but then gradually drifted towards visual dominance. The contemporary architecture community’s interest in *shakkei* focuses primarily on the visual aspects; the idea of a Gesamtkunstwerk, with bird sounds, the perfume of flowers, gentle breezes and seasonal variations, as described in the *Yuanye*, has frequently faded into the background.

Shakkei creates a connection through which scenes from the surrounding landscape become part of the garden and in the same way, the garden is returned to the landscape and embedded in it, elucidates Kaji Kenji, a Shinto high priest in Tokyo, asked about the motifs and guiding principles of Japanese garden design.⁴⁷

As another influence on Japanese garden design Kenji mentions Buddhism. At the end of the 12th century Buddhism imprinted the Japanese garden with a distinctly philosophical flavour in which inner reflection was an important motif. This spiritual tendency developed into the style of stone gardens in Zen Buddhist garden landscapes. Both contemplating the garden and raking the gravel are considered meditative practices.

Kenji’s interview is one of several interviews in a book edited by Carola Platzek. She interviewed Japanese gardeners, academics and priests to learn how they are influenced by traditional and modern concepts, referring to the *Sakuteiki* – an 11th-century Japanese gardening manual and most likely the oldest published book on garden design in the world.⁴⁸

In one of the interviews, Amakasi Hiromasa, a garden historian and gardener in Tokyo, considers the most important message of *Sakuteiki* to learn from nature. One learns best how to portray it by observing it closely and paying attention to one’s own perception. Those experiences should then be expressed in the garden. For him, the design process simply means observing nature and absorbing it. On this basis, the knowledge of what to do arises quite naturally. But he also questions whether this ‘simplicity’ is easy to achieve.⁴⁹

The *Sakuteiki* contains rules, rules that according to Hiromasa are not to be followed strictly but should be adapted to the conditions of the space. The most important thing is not the rules but the inner attitude with which you approach garden design. Dividing the world into categories and thereby standardising things is too simplistic, because in reality everything is intertwined. This intertwining is what constitutes reality.

Hiromasa also describes a principle called *omoiau*, which literally means ‘thinking of each other’. It concerns the relationship between different elements in the garden. Placing a stone solely for its beauty is pointless if that stone and others around it do not harmonise.⁵⁰ He also emphasised the importance of a particular oral tradition known as *kuden*. *Kuden* means being in the same place, experiencing the same situation, and arriving at the same insights and decisions, and thus goes beyond the usual meaning of oral tradition.⁵¹

⁴⁷ Platzek, Carola, ed. *Teachings of the Garden: Conversations in Japan*. Vienna: Schlebrügge. Editor, 2020. Interview with Kaji Kenji, 15

⁴⁸ Takei, Jirō, and Marc P. Keane. *Sakuteiki: Visions of the Japanese Garden: A Modern Translation of Japan’s Gardening Classic*. Boston: Tuttle, 2001, 3n1.

⁴⁹ Platzek, Carola, ed. *Teachings of the Garden: Conversations in Japan*. Vienna: Schlebrügge. Editor, 2020. Interview with Amakasi Hiromasa, 21

⁵⁰ Ibid., 22

⁵¹ Ibid., 23

Another interviewee, Yagasaki Zentarō, an architectural historian from Kyoto, talks about *roji*, tea gardens, and the tea ceremony *cha-dō*. In the 15th century, tea drinking developed into an art form that turned towards aesthetic modesty in the 19th century. Beauty was not discovered in obvious splendour, but by that which was not fully accessible, somewhat hidden, even unfinished. This principle is known as *wabi*. The tea garden is a garden of movement, a path that ends at the hidden tea house and prepares visitors for the tea ceremony. The tea ceremony takes place in silence, so that mutual attention to the sounds attunes the ritual.

These are just brief glimpses into Chinese and Japanese garden culture. Nevertheless, I hope that I have been able to convey an impression of the many facets that the garden had and continues to have in these cultures; of its profound meanings, philosophical and spiritual aspects, its aesthetics and the methods and practices connected with it.

But in spite of all the poetics, aesthetics and the aspect of self-cultivation, I am missing a bit of wilderness. A bit of *laissez faire*, where the garden can do what it wants. A bit of mess, more of *wabi*. Maggie Keswick describes the Japanese garden as almost too perfect to be inhabited.

“with its exquisite arrangements of stone and moss. Its manicured pines and dry streams, and above all, its sense of being so perfect in itself that (as Mishima wrote) the visitor feels even the intrusion of his own sense onto the garden constitutes a violation.”⁵²

And she contrasts the Chinese garden that is

“confusing and dense, dominated by huge rock-piles and a great number of buildings all squeezed into innumerable, often very small spaces, for many foreigners the characteristic Chinese garden is so unlike anything else as to be incomprehensible and even in parts grotesque.”⁵³

What I miss in both garden cultures is an ecological understanding that complements the philosophical, symbolic, and aesthetic aspects.

You may object that there has been a lot of attention here on imperial and ornamental gardens – and you may ask: what about subsistence gardens, vegetable gardens, allotment gardens, and home gardens where vegetables, berry bushes, and fruit trees grow? I can answer that my interest lay in the worldviews and cultural settings that underlie specific garden designs, and subsistence gardens left fewer traces in historical literature.

But I don't want to omit them. For a perspective that combines subsistence gardening with insights into worldviews, I invite you to South America, to the Amazonian rainforest, to encounter another way of gardening.

⁵² Keswick, *The Chinese Garden*, 7

⁵³ *Ibid.*, 23



Market Street at "Sitting Rocks and Winding Stream." Shen Yuan, Tangdai, Wang Youdun, 1744

A multifunctional place where the emperor frequently dined, theater plays were performed, and famous scholars practiced calligraphy and composed poems. It was also the site of a famous market street with shops where the court ladies could pretend to be ordinary people out shopping, and where the eunuchs – in the role of commoners – reenacted everyday life.



Apricot Blossom Spring Villa. Shen Yuan and Tangdai, 1744



The Qianlong Emperor (1736). Giuseppe Castiglione



Portrait of the Qianlong Emperor in Court Dress (1791). Unidentified painter, Hanging scroll, colour on silk, Palace Museum, Beijing



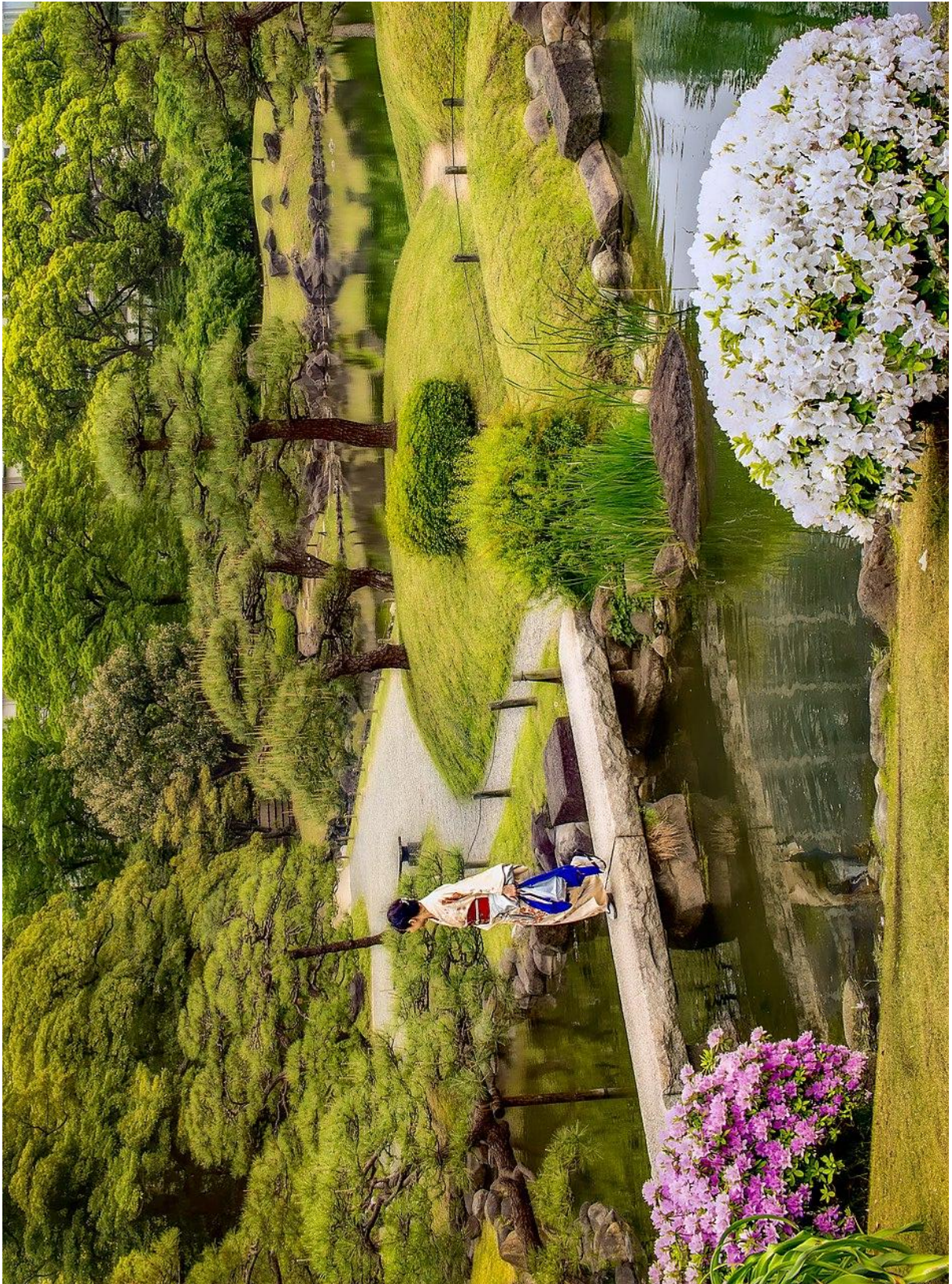
Emperor Wu of Han (157 - 87 BCE) with two of his attendants



Auspicious Dragon Rock, Emperor Huizong of the Song dynasty, China
Northern Song period (960-1127). Handscroll, ink and color on silk



Chinese Garden, 2014. Wikimedia Commons



Kyu Shiba Rikyu Garden, Tokyo. Wikimedia Commons

Amazonian garden landscapes

Carvajal's Chronicle

The path we take to reach the Amazonian garden leads, as the other garden stories, through history. For a long time, the Amazonian lowlands were considered as a sparsely populated and largely untouched rainforest area in which no major civilisations could have developed. However, an ancient chronicle by Gaspar de Carvajal,⁵⁴ a 16th-century Dominican friar who accompanied the expedition led by the Spanish explorer Francisco de Orellana from the Andes to the Amazon in 1541, suggests a different reality. Orellana's group was part of a greater endeavour initiated by Gonzalo Pizarro, described as one of the most corrupt, brutal and ruthless conquistadors of the New World,⁵⁵ who had set out in search of the rumored Land of Cinnamon.

Carvajal's chronicle tells of numerous settlements along the riverbanks, about villages and towns, some of them fortified.⁵⁶ Throughout the chronicle, he reports about encounters with indigenous peoples, some peaceful, but also many that ended in armed confrontations. Carvajal also mentions one encounter with the Amazons. He describes these women as fair-skinned and tall, with braided long hair, muscular and naked, armed with bows and arrows, and capable of piercing the Spanish brigantines, making them look like porcupines.⁵⁷ A passage that contributed to the association of the region with the classical myth and ultimately to the naming of the river; a name that has since shaped European imaginaries of a vast, unexplored wilderness with exotic people and other wondrous beings.

"[...] in 1541, Friar Gaspar Carvajal, the priest who accompanied and chronicled Orellana's expedition, the first to descend the river, located them [the Amazons], once and for all, in the vast, unexplored wilderness of tropical America, just where so many of Europe's other legendary races, dwarves, giants, cyclops, and other monstrous beings were turning up."

writes the anthropologist Michael Heckenberger in his book "The Ecology of Power."⁵⁸

No traces left

However, when naturalists and anthropologists arrived 200 years later in the Amazon, in the 18th century, they encountered very few people, only small societies scattered along the headwaters of the tributaries of the Amazon.⁵⁹ "By the time the first scientists arrived in most areas, circa 1750–1850, the juggernaut of European colonialism had already swept across the Americas," states Heckenberger.⁶⁰

As no remains of a denser population or complex society were visible, it was concluded that the Amazon had always supported only low population densities and that the environmental

⁵⁴ Carvajal, Gaspar de. *Descubrimiento del río de las Amazonas: Relación de Fray Gaspar de Carvajal*. Edited by José Toribio Medina. Seville: E. Rasco, 1894. <https://archive.org/details/descubrimiento00carvgooq>.

⁵⁵ "Gonzalo Pizarro." *Wikipedia, The Free Encyclopedia*. Accessed February 16, 2026. https://en.wikipedia.org/wiki/Gonzalo_Pizarro.

⁵⁶ Margolis, Mac. "Lost Cities in the Amazon: How Science Is Revealing Ancient Garden Towns Hidden in the Rainforest." *Pulitzer Center on Crisis Reporting*, accessed March 16, 2026.

<https://pulitzercenter.org/stories/lost-cities-amazon-how-science-revealing-ancient-garden-towns-hidden-rainforest>; Carvajal, *Descubrimiento del río de las Amazonas*, ed. Medina, 30ff.

⁵⁷ Carvajal, *Descubrimiento del río de las Amazonas*, ed. Medina, 60.

⁵⁸ Heckenberger, Michael J. *The Ecology of Power: Culture, Place, and Personhood in the Southern Amazon, AD 1000–2000*. New York: Routledge, 2005, 8.

⁵⁹ Palace, M. W., C. N. H. McMichael, B. H. Braswell, S. C. Hagen, M. B. Bush, E. Neves, E. Tamanaha, C. Herrick, and S. Frohling. 2017. Ancient Amazonian populations left lasting impacts on forest structure. *Ecosphere* 8(12):e02035. <https://doi.org/10.1002/ecs2.2035>. <https://esajournals.onlinelibrary.wiley.com/doi/full/10.1002/ecs2.2035>

⁶⁰ Heckenberger, *Ecology of Power*, 9.

conditions limited social complexity.⁶¹ Carvajal's chronicle, which had remained largely unknown for centuries in a library in Lima, did not inform their view and when it was published in the late 19th century it was dismissed as a work of fiction.⁶²

Until the end of the 20th century, the paradigm prevailed that the soil was too poor to support larger populations that could have allowed the development of complex societies.⁶³ But step by step it becomes increasingly plausible that Carvajal's accounts may, in large part, have been true. There is growing evidence that, prior to European invasion in Amazonia, there existed interconnected settlements and urban-like clusters, surrounded by agroforestry and agricultural land. Discoveries of altered plant compositions around archaeological sites,⁶⁴ and fertile areas of dark, anthropogenic soil (terra preta)⁶⁵ suggest that tropical forests were actively managed and thus could sustain more people than previously assumed.⁶⁶ Yet how many people lived there and whether ancient Amazonia was highly influenced by human impact or only modestly, and how far ancient anthropogenic influences shape present forest ecosystems, is still under debate.⁶⁷

What is relatively undebated is, that the European invasion brought depopulation, exploitation, and slavery to Amazonia and the reason small-scale foraging communities remain the sole Indigenous occupants of the Amazon Basin, is due to disease (such as smallpox, influenza, and measles), genocide, and slavery commencing with the arrival of European colonial powers in the Americas. The most accessible sites were abandoned, partly as a consequence of population collapse and partly to avoid further unpleasant interaction with Europeans.⁶⁸ The forest quickly swallowed the settlements and cultivated lands they left behind. Thus, 200 years later, the exploring naturalists that came to the Amazon could find no trace of them.

A new technology

A new technology called lidar (light detection and ranging) enables the researchers now to make them visible. Lidar uses infrared lasers and sends rays in a high density from an aerial vehicle to the ground. Most of the rays are reflected from the canopy, but some from the ground underneath. The forest canopy can be mathematically filtered out so that landscape features on the forest floor become detectable. A digital deforestation. This methodology has already brought to light vast urban networks in Southeast Asia as well as previously unknown urban settlements under the canopy of the Honduran rainforest in Central America⁶⁹ and the latest in the Bolivian Amazon and in the Upano Valley of Amazonian Ecuador.⁷⁰

⁶¹ Neves, Eduardo. "Many Features of the Amazon Are Man-Made": Q&A with Archaeologist Eduardo Neves." Interview by Peter Speetjens. *Mongabay*, May 2, 2023.

<https://news.mongabay.com/2023/05/many-features-of-the-amazon-are-man-made-qa-with-archaeologist-eduardo-neves/>.

⁶² Ibid.

⁶³ Roberts, Patrick. *Tropical Forests in Prehistory, History, and Modernity*. Oxford: Oxford University Press, 2019, 7.

https://api.pageplace.de/preview/DT0400.9780192550552_A35792084/preview-9780192550552_A35792084.pdf.

⁶⁴ Levis, C., et al. "Persistent Effects of Pre-Columbian Plant Domestication on Amazonian Forest Composition." *Science* 355 (2017): 925–31. Oliver, J. J. "The Archaeology of Agriculture in Ancient Amazonia." In *The Handbook of South American Archaeology*, edited by Helaine Silverman and William H. Isbell, 198–99. New York: Springer, 2008.

https://doi.org/10.1007/978-0-387-74907-5_12.

⁶⁵ Schmidt, Morgan J., et al. "Intentional Creation of Carbon-Rich Dark Earth Soils in the Amazon." *Science Advances* 9, no. 38 (2023): eadh8499. <https://doi.org/10.1126/sciadv.adh8499>

⁶⁶ Heckenberger, *Ecology of Power*.

⁶⁷ Palace, Michael W., et al. "Ancient Amazonian Populations Left Lasting Impacts on Forest Structure." *Ecosphere* 8, no. 12 (2017): e02035. <https://doi.org/10.1002/ecs2.2035>.

⁶⁸ Ibid.; Roberts, *Tropical Forests*, 2019.

⁶⁹ Roberts, *Tropical Forests*, 2019, 16.

⁷⁰ Rostain, Stéphen, et al. "Two Thousand Years of Garden Urbanism in the Upper Amazon." *Science* 383 (2024): 183–89. <https://doi.org/10.1126/science.adi6317>.

One of those making intensive use of the technology is a team of experts led by Vinícius Peripato, from the Brazilian National Institute for Space Research. He says that the findings so far suggest that the ancestors of the Amazonian inhabitants had large urban-like centers and engineered their habitat into food-yielding landscapes, “sustainably run systems, which could offer lessons for modern cities.”⁷¹

Already before the invention of LiDAR there was a study by anthropologist Michael Heckenberger that gave an example of pre-colonial urbanism in the Amazonian rainforest.

“Michael Heckenberger[’s ...] three decades of excavations [...] revealed a surprisingly intricate network of “low-density garden cities,” dating from at least 1,500 years ago, replete with homes and gardens, broad roads, central plazas, a palatial dwelling fit for a chief, with a log palisade and defensive ditches surrounding it, as well as orchards and managed forest on the outside. Each city may have harboured thousands of residents.”⁷²

A biocultural heritage

Heckenberger’s research began in 1993, when he came to the upper Xingu region of the Brazilian Amazon. The region was once among the least accessible regions of the land.⁷³ Today, vast soybean fields are creeping towards the forest in which a large reserve has been set aside for the use of native tribes. It is a rare example of cultural continuity, a place with an unwritten history that has inscribed itself into the present.⁷⁴ In the Amazon, history is not preserved in written records but written in “the skin of the land.”⁷⁵ The patterns inscribed in the land tell of ecological knowledge but also of relations of power and trade, of rituals and mythological beliefs. “Archaeology in the Amazon is pretty unique, as we not only work with the past, but also with the present and the future,” says Neves, professor of archaeology at the University of São Paulo, Brazil who has worked for more than 30 years in the central and southwest Amazon.⁷⁶

Heckenberger spent a year living in an indigenous village where he worked with the people and unearthed their history.⁷⁷ What they found were networks of settlements, galactic clusters, connected by a system of roads, bridges and canals, all situated in a large managed landscape of agroforestry, fields and fish farms.⁷⁸ A huge garden landscape that resembles Ebenezer Howard’s vision of the ‘Garden Cities of Tomorrow’ (1902), a book first published in 1898 as *To-morrow: A Peaceful Path to Real Reform*, in which he proposes a model of sustainable urban development as an alternative to industrial urbanism. In the Amazonian rainforest he might have found his vision already realised.

“These agricultural populations did not denude the landscape of trees, as commonly practiced in modern developmental practices, but instead created patchy (spatially and seasonally) mosaic patterns of land-use. Like today, these would have incorporated diverse forest and wetland management strategies, including sequential multi-cropping in long-term rotational cycles of agriculture and arboriculture, large-scale wetland management, and patchy land-use and forest “connectivity” through habitat corridors.”⁷⁹

⁷¹ Peripato, Vinícius. Mentioned in Margolis, “Lost Cities of the Amazon”.

⁷² Rostain “Two Thousand Years of Garden Urbanism.”

⁷³ Mertens, Richard. “Can’t See the Forest for the Trees.” *University of Chicago Magazine*, September–October 2008. https://magazine.uchicago.edu/0810/features/the_forest.shtm.

⁷⁴ Heckenberger, Michael J., et al. “Amazonia 1492: Pristine Forest or Cultural Parkland?” *Science* 301 (2003): 1710–14. <https://doi.org/10.1126/science.1086112>.

⁷⁵ Heckenberger, *Ecology of Power*, 188.

⁷⁶ Neves, “Many Features of the Amazon”

⁷⁷ Mertens, “Can’t See the Forest for the Trees;” Margolis, “Lost Cities of the Amazon”.

⁷⁸ Heckenberger, *Ecology of Power*, 78

⁷⁹ Heckenberger, Michael. “Tropical Garden Cities: Cultural Values and Sustainability in the Amazon’s ‘Arc of Deforestation.’” In *World Sustainability Forum* 2012, 984. <https://doi.org/10.3390/wsf2-00984>.

wrote Heckenberger in a paper that examines the history of coupled human-nature systems. An investigation he sees as serving not only to learn about the past, but also to address issues of sustainability, cultural heritage, and rights in the face of the rapid destruction of landscapes that bear witness to a history of sustainable relationships between humans and nature.⁸⁰

Eduardo Neves, a professor of archaeology at the University of São Paulo, Brazil, said in an interview:

“What an archaeological survey of the Amazon teaches us is that man and nature were fully intertwined and impossible to untangle. Which leads us to perhaps the most important paradigm shift of all: the Amazon Rainforest is not so much, or not only a natural heritage, but a biocultural heritage.”⁸¹

By chopping down the rainforest, humanity risks this heritage and the knowledge about sophisticated indigenous land management strategies that offer potential solutions to sustainable development issues.⁸²

Contemporary Amazonian peoples who live on pre-Columbian settlements make use of the legacy of the land. They have inherited indigenous knowledge and management practices and adapted them. Sites of fertile, anthropogenic terra preta, found throughout the Amazon basin, are often used as gardens by contemporary inhabitants and the food-yielding landscapes created by their ancestors are maintained. They use techniques that range from the removal of non-useful and the protection of useful plants, to the selection of phenotypes, fire management, and soil improvement. Those practices have transformed plant species abundance and composition and created diverse forest patches rich in edible perennial plants.⁸³

Levis et al.⁸⁴ call these land management systems social–ecological systems that generate multiple co-benefits to nature and human societies. In January 2023 a traditional agroforestry system of the indigenous peoples of the Ecuadorian Amazon, called *chakra*, was officially recognised as a Globally Important Agricultural Heritage System (GIAHS) by FAO.⁸⁵

The *chakra*

The *chakra* is a family or community space that combines the cultivation of staple foods, timber trees, fruit trees, and ornamental and medicinal plants, in spatial patterns and temporal cycles which mimic the natural processes of succession or restoration of forests. They adapt those patterns and cycles to the diverse microclimatic conditions and ecological niches of the terrain.⁸⁶

⁸⁰ Ibid.

⁸¹ Neves, “Many Features of the Amazon”

⁸² Levis, Carolina, Bárbara M. Flores, José V. Campos-Silva, et al. “Contributions of Human Cultures to Biodiversity and Ecosystem Conservation.” *Nature Ecology & Evolution* 8 (2024): 866–79. <https://doi.org/10.1038/s41559-024-02356-1>

⁸³ Levis, Carolina, et al. “How People Domesticated Amazonian Forests.” *Frontiers in Ecology and Evolution* 5 (2018): 171. <https://doi.org/10.3389/fevo.2017.00171>.

⁸⁴ Levis et al., “Contributions of Human Cultures to Biodiversity and Ecosystem Conservation.”

⁸⁵ Food and Agriculture Organization of the United Nations (FAO). “The Amazonian Chakra, a Traditional Agroforestry System Managed by Indigenous Communities in Napo Province, Ecuador.” *FAO Agroforestry*, 12 February 2024. <https://www.fao.org/agroforestry/activities/faos-work/article-detail/the-amazonian-chakra--a-traditional-agroforestry-system-managed-by-indigenous-communities-in-napo-province--ecuador/en>.

⁸⁶ Corporation of Associations of the Amazonian Chakra. *Proposal: The Amazonian Chakra, a Traditional Agroforestry System Managed by Indigenous Communities in Napo Province – Ecuador*. January 2023. FAO Open Knowledge Repository. <https://openknowledge.fao.org/server/api/core/bitstreams/4e98fa6d-37b1-4200-a88a-067ee63ff2b4/content>.

In today's rural Amazon, most households maintain a cleared area around their homes, growing crops such as vegetables, spices, and medicinal plants, as well as plants for ritual or spiritual purposes. This area typically transitions into an adjacent agro-forest with palm and fruit trees, and other perennial species; plant communities that have developed there through historical and current land management. These different intensities of management lead to a shifting mosaic pattern, a patchwork landscape succession, a diversified landscape blurring the boundaries between gardens and forests and what is natural and cultural.⁸⁷

The garden as an open air laboratory

Barboza et al. suggest to see those home gardens as “open-air” laboratories – as open sites of continuous empirical experimentation and collaboration. The collaboration, as specified by the authors, encompasses the activities of both “human and non-human species – including soil microbes, weeds, pests, fungi and bacteria.” The authors propose to broaden the perspective on what can be considered a laboratory and suggest that the garden can serve as a model for a site of “experimentation and co-laboring among many different kinds of organisms and beings.”⁸⁸

“Through the conceptual intervention of the “open air laboratory,” we thus aim to disrupt popular Western scientific imaginings of laboratories as closed, sterile, and regulated sites of investigation, dominated by pipettes and test tubes.”⁸⁹

The experimentation began long before. The small-scale societies that inhabited Amazonia around 11,000 years ago, practiced foraging and casual horticulture. With their activities around villages and camp sites, along trails and in fallow fields, they substantially altered forest composition. While not intensively on-site, their use and management of forest resources exceeded a wide geographical reach; a landscape domestication that included plant domestication in varying degrees.⁹⁰

Cosmo-vision

These practices are rooted in an ontology that differs significantly from the one that developed in Western societies. In the Amazonian cosmo-vision, humans live in parity with nature – a relationship that does not preclude the existence of hierarchies or categories, but as this is a relational world in which all beings are interconnected, the hierarchies are fluid.⁹¹ Eduardo Kohn describes this relatedness to the many kinds of beings – be they alive or spirits – in which roles constantly have to be negotiated as a “shifting ecology of selves”. The diverse nonhuman others – plants, animals, and spirits – are conceived as persons endowed with agency. As they share the same ecosphere humans must negotiate with them.⁹² Compared to Western ways of understanding the world this leads to very different relationships with nature. It results in an ethic that imposes limits on the human uses of the forest, because every action may be subject to a counteraction.⁹³

⁸⁷ Barboza, Myrian S. Leitão-Barboza, et al. “Open-Air Laboratories: Amazonian Home Gardens as Sites of Experimentation, Collaboration, and Negotiation across Time.” *Journal of Anthropological Archaeology* 62 (2021): 101302. <https://doi.org/10.1016/j.jaa.2021.101302>.

⁸⁸ Ibid.

⁸⁹ Ibid.

⁹⁰ Clement, Charles R., et al. “The Rain Forest is a Human Creation.” *World Nutrition* 6, no. 9–10 (September–October 2015): 694–703. <https://www.alice.cnptia.embrapa.br/alice/bitstream/doc/1090276/1/2015216.pdf>.

⁹¹ Heckenberger, *Ecology of Power*, 338–39.

⁹² Kohn, Eduardo. *How Forests Think: Toward an Anthropology beyond the Human*. Berkeley: University of California Press, 2013, 192ff

⁹³ Clement, Charles R., et al. “Naturalness Is in the Eye of the Beholder.” *Frontiers in Forests and Global Change* 4 (2021): 800294. <https://doi.org/10.3389/ffgc.2021.800294>.

In the worldview of Amazonian peoples, the separation between humans and animals did not arise because humans evolved away from animals, as the “evolutionist ‘scientific’ mythology” suggests. For these societies, the original shared condition of humans and animals lies in their humanity, not in their animality. Animals were once humans whose humanity has become concealed; therefore many species are understood to possess a spiritual component that qualifies them as “people”.⁹⁴

In contrast, Western scientific worldviews are founded on a nature–culture dichotomy that treats non-human beings as resources for human use. As stated by Levis et al. this perspective leads in practice to “highly productive social-ecological systems” such as large-scale monocultures with decreased diversity and with often little resilience, whereas indigenous ontologies lead to practices that support diversified socio-ecological systems, a diversity which generally accumulates over time.⁹⁵

Building on the semiotic theory of Charles Sanders Peirce, Eduardo Kohn explored how Amazonians interact with the many creatures that cohabit the ecosystem. He spent four years of fieldwork among the Runa of Ecuador’s Upper Amazon. In his book *How Forests Think* he argues that forests are full of signs. The relations through which humans, animals, and even plants interpret and respond to one another through semiotic processes, structure the tropical ecosystem. In Kohn’s perspective all life is semiotic and also the “‘self,’ at its most basic level, is a product of semiosis.”⁹⁶ Selves “are outcomes of semiosis as well as the starting points for new sign interpretation whose outcome will be a future self.”⁹⁷ Therefore we and all other living beings are always with one foot in the future.

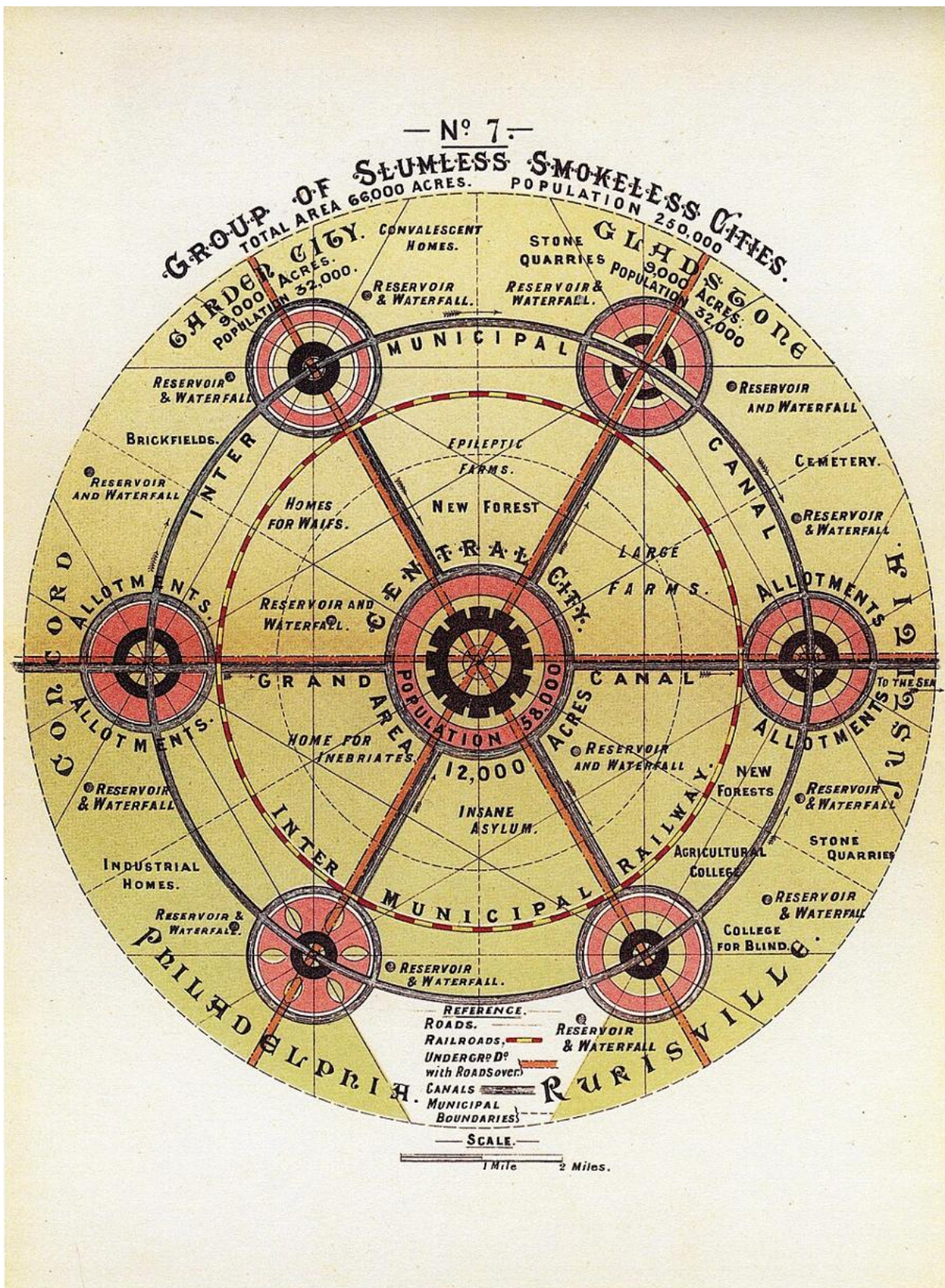
Before we turn to the future, let us return to the present.

⁹⁴ Viveiros de Castro, Eduardo. “Exchanging Perspectives: The Transformation of Objects into Subjects in Amerindian Ontologies.” *Common Knowledge* 10, no. 3 (2004): 464–65 <https://doi.org/10.1215/0961754X-10-3-463>.

⁹⁵ Levis, Carolina, Bárbara M. Flores, José V. Campos-Silva, et al. “Contributions of Human Cultures to Biodiversity and Ecosystem Conservation.” *Nature Ecology & Evolution* 8 (2024): 866–79. <https://doi.org/10.1038/s41559-024-02356-1>.

⁹⁶ Kohn, *How Forests Think*, 16

⁹⁷ *Ibid.*, 206



Howard, Ebenezer, To-morrow: A Peaceful Path to Real Reform, London: Swan Sonnenschein & Co., Ltd., 1898.
Wikimedia Commons



Song Dong. Doing Nothing Garden, 2010-12. Gerd Eichmann, 2012. Wikimedia Commons

Gardens in contemporary art, as a metaphor and utopia

Returning to the present, I invite you on a brief excursion into gardens in contemporary art. Artists of the past saw nature as their master. In the 20th century, art separated from nature and turned to abstraction. Now again there are works of art that deal with nature, only this time with living organisms, with landscapes, and gardens.⁹⁸

Contemporary art

Time Landscape

The idea that gardens could function as independent works of art – not in the sense of garden art or as motifs for paintings – emerged in the 1960s and 1970s. In 1965, land artist Alan Sonfist proposed planting an abandoned lot in lower Manhattan with plants that were native to the New York City area in pre-colonial times, creating one of the first intentional "art gardens": an ecological monument amidst a concrete jungle, titled *Time Landscape*.⁹⁹

Ecokathedraal

In the 1970s, Louis Guillaume Le Roy (1924-2012), self-proclaimed 'ecotect', became known for the idea of the wild garden. He rejected the monotony of controlled, functionalist urban development and advocated for a creative interaction between plants, animals and humans.¹⁰⁰ Ordinary citizens could be responsible for their own environment and not master plans of people who neither live at the place nor have practical experience with the material used in constructions.

Le Roy's most prominent project, Ecokathedraal (eco-cathedral), expresses his theory of design processes, processes that require time and physical commitment and aim to promote the diversity of ecosystems. The landscape architect Julian Raxworthy, who had the Ecokathedraal as a case study for his doctoral research, wrote in a 2016 essay that "the appearance of the Ecokathedraal is that of a ruin or an archaeological site set in a forest."¹⁰¹

In 1966 Le Roy had bought a plot of land at Mildam and dumped a large amount of rubble from a demolished prison nearby across the ground. From the late 1970s, the site gradually developed into the *Ecokathedraal*.¹⁰² In the early 1980s he persuaded the municipality to supply him with bricks and stones from demolition work and started to build stone sculptures he called 'tables' from the delivered material.¹⁰³ Those artefacts arising from a practice of putting brick by brick create microclimates that foster spontaneous vegetation. He used no mortar, leaving unsealed gaps between the bricks that were both literal and metaphorical. As metaphor the gap represented space that was out of society's control, economically of no value, but creating a wealth of biodiversity. Le Roy understood the Ecokathedraal's beauty, both conceptually and aesthetically, as a collaboration between humans and nature.¹⁰⁴

⁹⁸ Burckhardt, Lucius. "Natura Maestra." In *Kunstforum*, vol. 145, "Künstler als Gärtner," 1999, 188.

⁹⁹ "How Avant-Garde Artists Have Embraced Gardens." *Art Fund – Explore, Get Inspired*. 2024.
<https://www.artfund.org/explore/get-inspired/features/gardens-and-the-avant-garde>.

¹⁰⁰ "The Eco-Cathedral: Louis Le Roy, Wild Garden Ideologist." *Het Nieuwe Instituut – Ontwerp van het Sociale*. 2021.
<https://nieuweinstituut.nl/en/projects/ontwerp-van-het-sociale/de-ecokathedraal-louis-le-roy-ideoloog-van-de-wilde-tuin>

¹⁰¹ Raxworthy, Julian. "Building a Wilderness with Louis Le Roy." In *The Slow Reader: A Resource for Design Thinking and Practice*, edited by C. F. Strauss and A. P. Pais, 98–109. Amsterdam: Valiz, 2016.
<https://julianraxworthy.com/2016-LeRoyBuildWild-Essay.html>.

¹⁰² "The Eco-Cathedral, Netherlands." *Twentieth Century Society – Building of the Month*.
<https://c20society.org.uk/building-of-the-month/ecokathedraal-netherlands#menu/about>.

¹⁰³ Raxworthy, "Building a Wilderness"

¹⁰⁴ Raxworthy, "Building a Wilderness"

Künstlergärten Weimar

In 1998, a symposium titled *Modern Nature: Künstler als Gärtner* was held in Linz. The quarterly art magazine *Kunstforum* dedicated its 145th issue to the theme 'Artists as Gardeners' and included several contributions from the symposium. In this issue, Barbara Nemitz presents her project *Künstlergärten Weimar* (Artists' Gardens Weimar).¹⁰⁵ It is a project on which she worked from 1993 to 2009.

Nemitz's idea was to create a garden in Weimar consisting of works by visual artists made from vegetation. As the Dr. Georg Haar Foundation granted permission to create vegetal artworks on its private property, a suitable location was designated. A variety of stakeholders participated in the conception and implementation of a flexible framework and management structure. They conducted their own planting experiments on the ground, researched artists working with plants, and began inviting them. Until 1999, there were only a few artists; then, according to Barbara Nemitz, the use of vegetation in works of fine art became established.

For her, it was important that the artist is confronted with something living when working with vegetation. When one engages with living beings, the forms of the work are determined both by the artist's intention and the growth and characteristics of the plants, including their environments.¹⁰⁶

dOCUMENTA (13)

Another contributor to *Kunstforum* issue 145 is André Schmid. This is how he characterised the garden (own translation): 'The garden is a symbol of process, of constant change, a structure that defies easy definition, balancing between certainties, between distant poles. Time plays an essential role within it; plants grow and change their appearance, and the changing seasons evoke a wide range of moods. Its final state is unpredictable, even if the garden designer has the clearest vision of the whole.' The article closes by predicting that a flourishing time lies ahead for the garden.¹⁰⁷

A look at the documenta in 2012 shows that Schmid may have been right, at least regarding the context of art. The garden has entered the stage of big international art shows.

dOCUMENTA (13) director Carolyn Christov-Bakargiev chose to respond to our "permanent crisis" with numerous gardens.

"[...] the show was overgrown with experimental planters and creatively landscaped areas, relating variously to agriculture, farming, and natural life forms, which made the 2012 iteration of the international mega-exhibition that occurs every five years in central Germany the most 'eco' yet."

describes T.J. Demos the documenta of 2012.¹⁰⁸

To give a few examples: Trees, this time only two and not oaks as at documenta 7, but apple trees were planted in memoriam Korbinian Aigner – a Bavarian priest and gardener who bred four apple varieties at Dachau concentration camp, naming them KZ-1 to -4 (Jimmie Durham); varieties of colorful chard were cultivated on floating barges in cooperation with the Department of Organic Agricultural Sciences at the University of Kassel ("Swiss Chard

¹⁰⁵ Nemitz, Barbara. "Der Garten ist ein Ort der Handlung." In *Kunstforum*, vol. 145 (1999), *Künstler als Gärtner*, 207–12.

¹⁰⁶ Nemitz, Barbara. "Die KünstlerGärten Weimar im Park der Villa Haar." *Stiftung Haar – Villa Haar / Park*. 2025. <https://www.stiftunghaar.de/wp-content/uploads/2025/06/Nemitz.pdf>.

¹⁰⁷ Schmid, André. "Schritte in seismographischer Aufmerksamkeit." In *Kunstforum International*, vol. 145 (1999), *Künstler als Gärtner*, 166.

¹⁰⁸ Demos, T. J. "Gardens Beyond Eden: Bio-aesthetics, Eco-Futurism, and Dystopia at dOCUMENTA (13)." *The Brooklyn Rail*, October 2012. <https://brooklynrail.org/2012/10/art/gardens-beyond-eden-bio-aesthetics-eco-futurism-and-dystopia-at-documenta-13/>.

Ferry,” Christian Philipp Müller); psychedelic plants sprouted on a compost hill (“Untilled,” Pierre Huyghe); butterflies found a flowering meadow habitat before Kassel’s Staatstheater (“The Lover,” Kristina Buch); vertical vegetable gardens on the grounds of the Natural History Museum suggested self-sufficient urban food production (Claire Pentecost); AND AND AND sold regional products in garden kiosks while growing some on-site to promote political ecology; and Song Dong’s “Doing Nothing Garden” featured a six-meter-high mound consisting of biological waste and rubble, overgrown with grass and flowers and ornamented with neon signs on it reading ‘Doing’ and ‘Nothing.’¹⁰⁹

Donna Haraway has contributed one of the “100 notebook” publications that conceptualised the documenta: *SF: Speculative Fabulation and String Figures*. According to Demos,¹¹⁰ Haraway’s conceptual presence was discernible in “a rhizomatic display geography” and in the “conceptual diffusion”, meaning that no identifiable central theme existed, but rather a becoming-through the other – or through each other – perspective was at work. In Demos’ view, her “postmodern aesthetic of eco-feminist science-fiction”, inhabited by techno-biological cyborgs, contrasted with the political ecology expressed by another “notebook” author, the Indian eco-activist Vandana Shiva. Shiva criticizes the uncritical embrace of technology and the appropriation of indigenous knowledge of plants by multinational pharmaceutical and agribusiness corporations. For her, living organisms, unlike machines, cannot simply be programmed and patented; they organise themselves.¹¹¹

Metaphor

The European Nomadic Biennial Manifesta 12 in Palermo in 2018 had “The Planetary Garden. Cultivating Coexistence.” as a motto.¹¹² In the curatorial concept the authors refer to the French landscape architect, theoretician and gardener Gilles Clément who suggested in the 1990s to see the world as a “planetary garden” with humanity in charge of being its gardener. He defines “planetary gardening” as a method of living in harmony with nature, appreciating the ecosystem in all its diversity, and acting as a caring gardener and steward within it. Clément sees the garden as the key for understanding the earth and the primary goal of planetary gardening to make use of diversity without destroying it.¹¹³

Although the curators of Manifesta 12 describe the world today driven “by invisible informational networks, transnational private interests, algorithmic intelligence, environmental processes and ever-increasing inequalities,” they consider “the metaphor of the planet as a manageable garden” to be still relevant and appealing. However, they understand the garden “not as a space for humans to take control, but rather as a site where ‘gardeners’ recognise their dependency on other species, and respond to climate, time, or an array of social factors, in a shared responsibility.”¹¹⁴

One year after Manifesta 12 Judith Elisabeth Weiss wrote in *Kunstforum* Vol. 258 (Kunstnatur/Naturkunst) about the relevance of the garden as a metaphor and artistic field of activity (“Zur Aktualität des Gartens als Metapher und künstlerisches Wirkungsfeld”).¹¹⁵ She writes that in times of ecological crisis, fundamentalism, and the increasingly lamented

¹⁰⁹ dOCUMENTA (13): *Das Begleitbuch / The Guidebook* (Catalog 3/3). Hatje Cantz, 2012.

¹¹⁰ Demos, “Gardens Beyond Eden”

¹¹¹ Ibid.

¹¹² Manifesta 12. “The Planetary Garden: Cultivating Coexistence.” 2018. <https://m12.manifesta.org/planetary-garden/index.html>

¹¹³ Clément, Gilles. “Der planetarische Garten.” In *Garden Futures: Designing with Nature*, edited by Mateo Kries, 164. Weil am Rhein: Vitra Design Museum, 2023.

¹¹⁴ Manifesta 12, “Planetary Garden,” 2018.

¹¹⁵ Weiss, Judith Elisabeth. “Guerrilla-Gardening, Paradiesgärtlein und planetarischer Garten.” In *Kunstforum International*, vol. 258: *Kunstnatur/Naturkunst*.

brutalisation of society, the symbiotic forces within the plant kingdom make the garden metaphor so appealing today. Weiss refers to a number of exhibitions from recent years as examples; among them the already mentioned Manifesta in Palermo and Alexander Kluge's show *Gärten der Kooperation* (Gardens of Cooperation) at the Württembergische Kunstverein Stuttgart in 2017/18.

I have seen Kluge's exhibition. The two central points of the exhibition revolve around cooperation and emancipation, both fundamental themes in Kluge's work. As far as I remember there was not a single plant but many videos. Kluge sees emancipation as an "enduring, nonlinear process" and as "a collective work that requires many decentrally organised platforms or 'gardens'," can be read in the press information.¹¹⁶ The garden is definitely metaphorical in this case. Gardens of Cooperation – a poetic metaphor that evokes pleasant associations.

To me, the idea of the planetary garden seems less like a metaphor and more like a worldview – a kind of map that provides orientation for our own and society's actions. I see it closely linked to the Gaia hypothesis, a theory developed in the 1970s by chemist James Lovelock and microbiologist Lynn Margulis. Course material on climate from Harvard University's School of Engineering provides this description:

"The **Gaia hypothesis**, also known as **Gaia theory** or **Gaia principle**, proposes that all organisms and their inorganic surroundings on Earth are closely integrated to form a single and self-regulating complex system, maintaining the conditions for life on the planet."¹¹⁷

The theory was initially largely ignored and later ridiculed by some scientists, "derided as some kind of neo-Pagan New Age religion."¹¹⁸ I remember my biology professor presenting the Gaia hypothesis almost shyly in the 1980s.

Some criticised the theory as teleological, since it seems to imply that everything follows a predetermined purpose. Stephen Jay Gould argued that the theory was merely a metaphorical description of Earth's processes and offered no new mechanisms to explain this self-regulating homeostasis.¹¹⁹ David Abram states that Gould overlooked the fact that by using the term "mechanism," he himself employed a metaphor – a metaphor that decisively shaped modern science.¹²⁰

What would happen if we changed the metaphor?

Daily language does not use the garden itself so much as a metaphor but processes that are connected to the garden, like: preparing the soil for things to thrive, providing fertile ground for ideas, spreading seeds as germs for future developments, harvesting the fruits or work, growing roots when becoming settled, composting unpleasant experiences – all processes.

"'Excellently observed,' answered Candide; 'but let us take care of our garden.'"¹²¹ This is how Voltaire's satire *Candide, ou l'Optimisme* ended after having studied all the problems

¹¹⁶ Württembergischer Kunstverein Stuttgart. "Press Information: Alexander Kluge – Gardens of Cooperation." 2017. https://www.wkv-stuttgart.de/uploads/media/01_reader_kluge_de_fin.pdf.

¹¹⁷ "Gaia Hypothesis." 2012. Harvard University School of Engineering and Applied Sciences, course EPS281r, *Climate*. <https://courses.seas.harvard.edu/climate/eli/Courses/EPS281r/Sources/Gaia/Gaia-hypothesis-wikipedia.pdf>.

¹¹⁸ Ibid.

¹¹⁹ Gould, Stephen Jay. "Kropotkin Was No Crackpot." *Natural History* 106 (June 1997): 12–21. <http://libcom.org/library/kropotkin-was-no-crackpot>.

¹²⁰ Abram, David. "The Mechanical and the Organic: Epistemological Consequences of the Gaia Hypothesis." In *Gaia and Evolution: Proceedings of the Second Annual Camelford Conference on the Implications of the Gaia Thesis*, edited by J. E. Lovelock, 1988.

¹²¹ Voltaire. *Candide*, chapter 30, "Conclusion." In *Candide*. Wikisource, The Free Online Library. https://en.wikisource.org/wiki/Candide/Chapter_30.

and sufferings of the world. This remark had, although it is mainly read metaphorically, a solid material basis.¹²² He cultivated and farmed the land on his estate in Ferney, a small village near the Republic of Geneva, and produced so much that he sold his garden produce in Geneva. In his letters to his Parisian friends, he liked to refer to himself as a 'farmer' or 'rural philosopher' and emphasised that he plowed the fields himself.¹²³ Voltaire obviously had experience in horticulture and even derived economic benefit from it. His specific garden experience shaped his idea about cultivation and of what a garden is and therefore also the association to the metaphor.

When I look at today's private gardens, many make me wonder if they can truly be called gardens: clean, with no places to hide, no wild parts, no growth without permission – deserted places inhabited by just a few species that survive the conditions and are accepted by the gardener. My impression is that many such gardens exist, in varying degrees of sterility. If these gardens mirror the gardeners' aesthetic and understanding of nature, I fear that a change of metaphor would not change much. Only if the guiding principle of the gardener is to stimulate biodiversity through her work and to use it without reducing it, as Clément suggested, will we perhaps begin to understand the poetry of nature.

From this perspective, the garden is more an attitude than a metaphor, a compass for individual and social action. At the same time, and in practical terms, it also serves as a site for experimentation, a laboratory, a model for testing practices. I have learned that in the transcientistic society the garden definitely has all those functions. Transcientists see themselves as gardeners – in a practical as well as in a metaphorical sense.

In societies shaped by Jewish/Christian or Islamic traditions, the strongest garden symbol is probably the Garden of Eden (or Paradise). I prefer to call it a symbol rather than a metaphor. A place "where the first man and woman lived in harmony with nature and God," as Giesecke and Jacobs have put it.¹²⁴ A place where lambs lie relaxed beside lions, an image of peacefulness, a target for nostalgic longing.

Utopia

Giesecke and Jacobs began a paragraph in their publication *Earth Perfect? Nature, Utopia, and the Garden* with: "The links between gardening and utopian dreaming are ancient and deep."¹²⁵ And indeed, when the term 'utopia' was coined the author Thomas More described the towns of the fictional island 'Utopia', located somewhere in the New world, as garden towns. The utopian houses all have a garden in the backyard, and the people are enthusiastic and dedicated gardeners.

"They cultivate their gardens with great care, so that they have both vines, fruits, herbs, and flowers in them; and all is so well ordered and so finely kept that I never saw gardens anywhere that were both so fruitful and so beautiful as theirs."¹²⁶

Ebenezer Howard's already mentioned vision of the *Garden Cities of Tomorrow* did not remain entirely in the realm of utopia. During his lifetime two garden cities were founded,

¹²² The sentence is interpreted in two ways: firstly, as a call not to concern oneself with major world events, but with the things one can directly influence, the immediate surroundings and one's own inner self; and secondly, as a call to engage practically with the world and not be satisfied with simply erecting sophisticated theoretical constructions.

¹²³ Mayault, Isabelle. "In Voltaire's Garden." *London Review of Books Blog*, August 23, 2018. <https://www.lrb.co.uk/blog/2018/august/in-voltaire-s-garden>.

¹²⁴ Giesecke, Annette, and Naomi Jacobs, eds. *Earth Perfect? Nature, Utopia, and the Garden*. London: Black Dog Publishing, 2012, 7.

¹²⁵ Ibid.

¹²⁶ More, Thomas. *Utopia*. Translated by Gilbert Burnet. 1516. Project Gutenberg, 2021. <https://www.gutenberg.org/cache/epub/2130/pg2130-images.html#chap03>.

both in Hertfordshire: Letchworth (1903) and Welwyn Garden City (1920). They lacked the contiguous zone of farmland as an essential feature but still could fulfill Ebenezer's aim to reduce the alienation of human society from nature.¹²⁷

A contemporary of Ebenezer was William Morris, who also described a society structured around the garden. In his *News from Nowhere*, published in 1890, he describes a post-revolutionary England as a garden consisting of gardens, where democracy, humanity, and solidarity have become a reality.¹²⁸

Around a hundred years later, in 1975, Ernest Callenbach wrote the novel "Ecotopia". In it, he describes a completely decarbonised, propertyless, self-determined society of free people who have created a garden state in post-secessionist California and Oregon.¹²⁹

We already encountered Gilles Clément's vision of the 'planetary garden', a garden without borders, in which humans, as gardeners, are in constant dialogue with its diversity. Clément asks which model we want to choose in order to be able to use diversity without minimising it, despite a growing population. A diversity on which our survival ultimately depends. He urges us not to view destructive violence as inevitable, but to cultivate a mental landscape, a garden of optimism in every imaginable area.¹³⁰

¹²⁷ Britannica Editors (2026). Sir Ebenezer Howard. Retrieved on March 8, 2026 from <https://www.britannica.com/biography/Ebenezer-Howard>

¹²⁸ Thumfart, Anna. "Der Garten als gesellschaftspolitische Utopie: William Morris, Ernest Callenbach, Samuel Alexander." In *Gärten. Von der Naturbeherrschung zur gesellschaftlichen Utopie*, edited by Anna Thumfart, Birgit Hollstein, and Susanne Tänzer, 123–42. Göttingen: Wallstein, 2021, 13.

¹²⁹ Ibid.

¹³⁰ Clément, Gilles. "Der planetarische Garten." In *Garden Futures: Designing with Nature*, edited by Mateo Kries, 166–67. Weil am Rhein: Vitra Design Museum, 2023.

A look at the findings

Résumé

The garden Eden has familiarised us with the paradox of the connection between knowledge and sin and with the possibility of different readings of this Bible passage. We crossed the bridge from the Garden of Eden to Paradise and arrived at the Persian Gardens, the celestial paradises on earth. We learned about the *Chahar Bagh* principle, the four-part garden with its far reaching influence on later garden designs, about irrigation systems contributing to the blossoming of the landscape, about the mutual fertilisation of garden and culture.

Padre Attiret, the 18th-century Jesuit priest and court painter, brought us to China and the gardens of Chinese Emperors, who constructed their own fairy-tale lands and in some cases ruined their Empire. In the private gardens of Chinese scholars we encountered a “return to nature” movement inspired by Daoist philosophy and the synthesis that evolved between the arts of gardening, painting, poetry and calligraphy. We have heard about a book written in 1631 that was last published in 2012: the *Yuanye* (園冶), translated as *The Garden Treatise* or *The Craft of Gardens*.

The *Yuanye* has introduced us to the principle of “borrowed landscape” (*jièjǐng* 借景); a principle that views the garden as part of the landscape and the gardener’s work as an immersion into the landscape where the borders between subject and object become fluid. In its origins, it was a practice that engaged all the senses and encompassed all the seasons: a multisensory experience.

We learned that the Chinese *jièjǐng* has a counterpart in Japanese culture called *shakkei*, where the scenery of the surrounding landscape becomes part of the garden, and the garden is reintegrated into, and embedded within, that landscape. In Japanese culture we also found the *Sakuteiki*, an eleventh-century Japanese gardening manual which is most likely the oldest published garden design book in the world. According to a contemporary Japanese gardener, the *Sakuteiki*’s most important message is to learn from nature through careful observation, so that the knowledge of what to do arises naturally. A sort of self education in dialogue with nature.

We have heard of abstract Zen Buddhist garden landscapes that invite contemplation when viewed and maintained, and we encountered the principle of “thinking of each other” (*omoiau*) and the transfer of knowledge through sharing the same impressions (*kuden*). I also want to bring to mind the Japanese tea garden and the tea ceremony performed there.

In South America we got to know a concealed domesticated landscape, a biocultural heritage in which historical human activities account for a large part of the diversity found today. We heard about sophisticated indigenous land management strategies and fertile soils of anthropogenic origin, from which the current inhabitants still benefit. We were introduced to the idea of the garden as an “open-air” laboratory, a site of “experimentation and co-laboring” among many different kinds of organisms and beings.¹³¹

A look into the Amazonian cosmovision showed us how non-human beings – plants, animals, and spirits – are conceived as persons with agency, with whom humans must negotiate in order to coexist in the same ecosystem. Finally, we encountered the forest and the “self” as a product of semiotics; as a permanent exchange, a constant transmission and interpretation of signs.

¹³¹ Barboza and Leitão-Barboza et al., “Open-Air Laboratories”

We have heard of the garden and gardening as an artistic expression that has entered the stage of the major art events. The garden appeared to us as an ecological monument, as a gap outside of social control, creating a wealth of biodiversity, as a process of negotiation with the living, that has its own dynamics. We heard about the garden as a remedy of crisis, its use as a metaphor and of planetary gardening as a compass on the way to nowhere.

We now have a compass, but what about the fish? In all of the mentioned 'garden' cultures water is involved, so at least the possibility for fish to exist. Let's have a look if we find some.

Getting to the fish

Fish in cultivated waters, Persia

First about the element, the medium fish live in. In Persian culture (Zoroastrian and pre-Zoroastrian), water is one of the primordial creations, close to the origin of the cosmos. It is not a neutral substance but emanated from the divine. Water has its own deity, *Anāhitā*, goddess of all waters, fertility, health, healing, and wisdom. She is mentioned in the *Avesta*, the sacred scripture of Zoroastrianism, though her origins lie in pre-Zoroastrian times.¹³²

Water is the central design element in the Persian garden. Besides its irrigation function, and microclimatic effects it features prominently for decorative aspects – jets, fountains, pools, channels, and waterfalls.¹³³ Fish may have been present in these waters, as suggested by depictions on garden carpets, but aspects of microclimatic refreshment and visual and acoustic aesthetics seem to have been more central to garden design than aquatic life.

Fekete and Haidari describe the special aspects of water use in Persian Gardens:

“Tanks or channels with fountains are eye-catching and lure the ears; besides spray action, the drops hitting the water surface provide pleasing sounds and rippling movements. The water's constantly changing behaviour offers contrast to the fixed elements of the garden: walls, footpaths, and statues. As water keeps moving, its circulation affects the air, cooling and moistening it. Playing in the sunlight, the falling water drops add a light-splitting dimension. The sound of falling or moving water alters other sounds, blocking or transforming them. Still water offers a distinct silence.”¹³⁴

Fish appear abundantly as motifs on stone engravings, reliefs, millennia-old pottery, metal bowls, pins, and axes – and of course on carpets, where they also take abstract form in the *Herāti* pattern: two leaves resembling fish circling a central petal.¹³⁵

Fish in cultivated waters, China

In Chinese garden culture, water plays an equally significant role. However, it is treated quite differently. In a Chinese garden, water is meant to flow as if naturally. Rectangular channels and fountains do not fit into the aesthetic of the Chinese garden. And in Chinese gardens we find reports of real fish. Father Attiret, whom we encountered as court painter to the Quianlong Emperor, describes a scene that he considers to be the most beautiful part of the whole pleasure ground. A lake almost eight kilometers in circumference, with an island in the middle. Attiret details the topography, shores, and buildings and also mentions vegetation and wildlife, ... and fish.

¹³² Mark, Joshua J. “Anahita.” *World History Encyclopedia*, 4 February 2020. <https://www.worldhistory.org/Anahita/>.

¹³³ Fekete, Albert and Haidari, Reza. “Special Aspects of Water Use in Persian Gardens.” *Acta Universitatis Sapientiae: Agriculture and Environment* 7 (2015): 77–90. <https://doi.org/10.1515/ausae-2015-0007>.

¹³⁴ Ibid.

¹³⁵ Moradi, Zohreh. “Fish Imagery in Iranian Artwork.” *Iranian Journal of Ichthyology* 2 (2015): 244–61. https://www.researchgate.net/publication/289539037_Fish_Imagery_in_Iranian_artwork.

“There are also on the Banks of this Lake, a great Number of Network-houses, and Pavilions; half on the Land, and half running into the Lake, for all sorts of Water-fowl: as farther on upon the Shore, you meet frequently with Menageries for different sorts of Creatures; and even little Parks, for the Chace. But of all this sort of Things, the Chinese are most particularly fond of a kind of Fish, the greater Part of which are of a Colour as brilliant as Gold; others, of a Silver Colour; and others of different Shades or Red, Green, Blue, Purple, and Black: and some, of all Sorts of Colours mixt together. There are several Reservoirs for these Fish, in all Parts of the Garden; but the most considerable of them all is at this Lake. It takes up a very large Space; and is all surrounded with a Lattice-work of Brass-wire: in which the Openings are so very fine and small, as to prevent the fish from wandering into the main waters.”¹³⁶

Fish also play a role in Chinese mythology. Since early times, depictions of fish have adorned bronze vessels and ceramics and are the subject of numerous paintings. In Chinese, the word for "fish" (yú 魚) is phonetically similar to "abundance" (yú 餘), making fish a common symbol of wealth and prosperity.¹³⁷ Goldfish and carp played a particularly important role.

Goldfish were a significant part of Chinese life: appreciated as food, raised in ponds, and a household accessory for people of all walks of life. They developed into a commercial commodity, were sold on street markets, and kept in glass bowls that magnified their appearance. Goldfish appeared in prints serving as a symbol for prosperity and wealth, and were given as a wedding gift symbolising a harmonious marriage that can be compared to ‘the pleasures of fish in water’.¹³⁸

The most important carp image is associated with the Dragon’s Gate. In this legend, carps swimming upstream that manage to leap the gate are transformed into dragons. This became a metaphor for passing the scholar examinations and the subsequent success in life, with honour and wealth.¹³⁹ In Chinese thought, the dragon is associated with the element of water. The *Huainanzi*, an important Chinese classic written in the 2nd century BC under the patronage of the Han dynasty prince Liú Ān, contains a passage in which water is described almost as a living being with personal traits, a dragon: weak yet boundless, gentle yet powerful, nourishing all things while yielding to everything.

In a translation by Cranmer-Byng, it sounds like this:

“There is nothing in the world so weak as water; yet its experience is such that it has no bounds, its depth such that cannot be fathomed. In length it is without limit, in distance it has no shores; in its flows and ebbs, its increase and decrease, it is measureless. When it rises to Heaven, it produces rain and dew; when it falls upon the earth, it gives richness and moisture; there is no creature in the world to whom it does not impart life, and nothing that it does not bring to completion. It holds all things in its wide embrace with perfect impartiality, its graciousness extends even to creeping things and tiny insects, without any expectation of reward.”¹⁴⁰

¹³⁶ Attiret, Jean-Denis. “Letter to M. d’Assaut, 1 November 1743.” Translated by Joseph Spence [Sir Harry Beaumont]. <https://faculty.bard.edu/~louis/gardens/attiretaccount.html>.

¹³⁷ Laing, Ellen Johnston. “Carp and Goldfish as Auspicious Symbols and their Representation in Chinese Popular Prints.” *Arts asiatiques* 72 (2017): 97–109, 98.

¹³⁸ Laing, “Carp and Goldfish,” 102 ff; Eberhard, Wolfram. *A Dictionary of Chinese Symbols: Hidden Symbols in Chinese Life and Thought*. London: Routledge & Kegan Paul, 1986., 124

¹³⁹ Laing, “Carp and Goldfish,” 99

¹⁴⁰ Cranmer-Byng, Lionel. *A Feast of Lanterns*. London: John Lane, The Bodley Head, 1916. “Introduction: Dragons.” In *Sacred Texts Archive*. <https://sacred-texts.com/cfu/fo/fo06.htm>.

Fish in wild and cultivated waters, Amazon

This image of a boundless water dragon leads us to the fish diversity of one of the most expansive river systems on Earth, the Amazon and its vast basin. It is home to around 2,500 different fish species, many found nowhere else.¹⁴¹ They represent roughly 15% of the world's freshwater fishes described so far.¹⁴² Fish have traditionally been an important protein source in the Amazon Basin, though the region is relatively poor in fisheries production. They are caught using traps, weirs, nets, poison, bow and arrow, lances, and water management.¹⁴³ Archaeological findings of ancient settlements in the Xingu region indicate fish farming.¹⁴⁴

Fish and the garden

In the garden cultures presented, fish appeared both as a source of protein and as a symbol and metaphor. The symbolic and metaphoric aspects of fish nourish my speculations on the meaning of "a garden for a fish," but the most satisfactory hint I can draw from the lessons learned so far, suggesting a resolution to the riddle, is the association of the garden with a laboratory. Since zebrafish (*Danio rerio*) are involved in the project and they are model organisms typically studied in laboratory settings, I speculate that "a garden for a fish" describes a laboratory guided by gardening principles. But let us see which insights we gain from **BOOK II: FISH**.

¹⁴¹ Jézéquel, C., P. A. Tedesco, R. Bigorne, et al. "A Database of Freshwater Fish Species of the Amazon Basin." *Scientific Data* 7 (2020): 96. <https://doi.org/10.1038/s41597-020-0436-4>.

¹⁴² Currently there are 18,898 recognised **freshwater** fishes. IUCN/SSC Freshwater Fish Specialist Group. "About Freshwater Fishes." 2026. <https://freshwaterfish.org/about-freshwater-fishes/>.

¹⁴³ Heckenberger, Michael J. *The Ecology of Power: Culture, Place, and Personhood in the Southern Amazon, AD 1000–2000*. London: Routledge, 2005, 200.

¹⁴⁴ Heckenberger, Michael J., B. Franchetto, Morgan J. Schmidt, and Carlos Fausto. "Pre-Columbian Urbanism, Anthropogenic Landscapes, and the Future of the Amazon." *Science* (2008). <https://doi.org/10.1126/science.1159769>, 1217.

I asked Else what she thinks of these speculations. She said nothing. Yet I believe I caught a subtle smile on her face.

BOOK II

FISH



a fish?

A fish is an underwater creature; it breathes water and has neither legs nor arms, but fins. A fish is flexible and moves in a three-dimensional space. Gravity feels light. It is nice if one can float in space. You can not fall.

You don't have to be a fish to float in water, some mammals can do that too, including us humans, though we're not very good at it. The master divers among mammals are the Cuvier's beaked whales; one was recorded diving for 132 minutes underwater.¹

The world champion in static apnea (breath-holding) is Stéphane Mifsud, a French free diver born in 1971. His lung capacity was measured at 10.5 litres, and on 8 June 2009, he stayed underwater for 11 minutes and 35 seconds.²

Losing track, you wanted to talk about fish.

True, but I think these considerations serve imagination. Water as a surrounding medium would kill every human in half an hour, while most fish species would die within the same time if taken out of water. They live, one could say, on islands in a sea of air.

Speaking of fish species: there are around 35,000 fish species recorded on Earth,³ far more than there are mammals. The database *Mammal Species of the World* lists only 5,416 mammalian species.⁴

Fish can differ from one another as much as, or even more than, a Mongolian gerbil, an elephant, a human, a bat, and a dolphin differ from each other. A fish can be many different kinds of creature.

¹ Quick, Nicola J., et al. "Extreme Diving in Mammals: First Estimates of Behavioural Aerobic Dive Limits in Cuvier's Beaked Whales." *Journal of Experimental Biology* 223, no. 18 (2020).
<https://journals.biologists.com/jeb/article/223/18/jeb222109/225819/Extreme-diving-in-mammals-first-estimates-of>

² Wikipedia. "Stéphane Mifsud." 2026. https://en.wikipedia.org/wiki/St%C3%A9phane_Mifsud.

³ Froese, Rainer, and Daniel Pauly, eds. "FishBase: A Global Information System on Fishes." Accessed 14 April 2026.
<https://www.fishbase.org/home.php>

⁴ Matthews, Robert W., and Janice R. Matthews. "Preface." *The Natural History of the Third Mariner Station Woodlot*. Bucknell University Department of Biology. <https://www.departments.bucknell.edu/biology/resources/msw3/preface.html>

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in the zoo shop

Personal experiences

The arrival

In early 2019, I set up a standard 54-liter all-inclusive aquarium and planted it with some robust aquatic plants. According to the literature, a tank reaches a stable biological equilibrium after about two weeks, once beneficial bacteria have established, converting organic waste into nutrients. On January 18, I purchased 5 zebrafish from a local zoo shop. In nature zebrafish live in shoals so it is advised to keep them at least in a group of five. Five fish traveled in a plastic bag to my home - enveloped in newspaper – as it was winter and zebrafish are tropical fish.



five fish arrive in a plastic bag in my home on 18 Jan 2019

Acquiring aquarium-keeping experience

As I had almost no experience as an aquarist, I simply released the fish into their new home of 0.054 cubic meters and, for months, I did nothing but feed them and observe them and the development of the underwater vegetation. Step by step, I added more fish, among them three colorless mutants and one so-called leopard mutant, in which the stripes have turned into spots. This variation has led to scientific investigations into which genes are responsible for the change in pattern.¹ By November 2019 the aquarium was inhabited by 13 fish in total. I fed them with ordinary flake food and sometimes frozen mosquito larvae or living *Daphnia*, little water fleas. The vegetation changed slowly over time; some plants thrived, others disappeared, and I tried new ones, but overall the system seemed to remain stable.



fish tank in Aug. 18th 2019

¹ Watanabe, M., Iwashita, M., Ishii, M. *et al.* Spot pattern of *leopard Danio* is caused by mutation in the zebrafish *connexin41.8* gene. *EMBO Rep* 7, 893–897 (2006). <https://doi.org/10.1038/sj.embor.7400757>

Becoming familiar with the fish

To become familiar with the fish, I followed them with a camera and took hundreds of pictures hoping some would be focused enough and the fish in the right position to identify differences in the stripe pattern. With the mutants, the 4 mentioned and one longfin variant not yet mentioned, identification was easy. With the others it seemed almost impossible at first glance. But they differ slightly in size and body shape and in their stripe patterns – sometimes easier, sometimes harder to detect. Once you start to know them, you also begin to recognise differences in their temperament. Through a mixture of subliminal perceptions, casual and structured observations, one becomes aware of their individual characteristics.

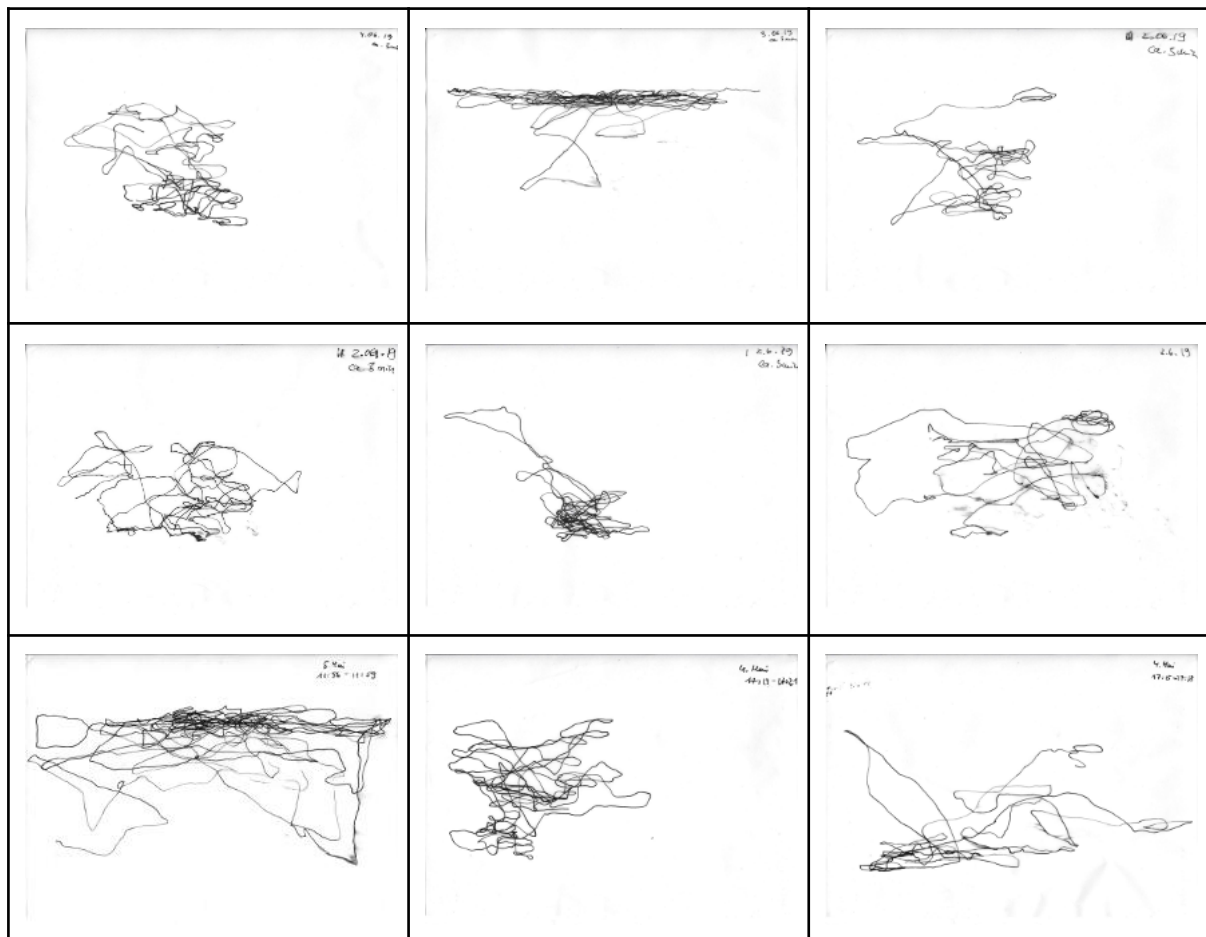


photos for identification at the wall in my living room



Tracking

Another method I used to familiarise myself with the fish was to track their movements with a pencil on paper. Below you see the first outcomes of this practice.



exercises to trace a fish ~3 min, pencil on paper, May/June 2019

Experiments

In November 2019, once I had fully realised that keeping fish was not just about my own enjoyment but about deciphering the meaning of “a garden for a fish”, I began conducting a few experiments.

I thought that to deserve to be called a garden, a 54-liter aquarium seemed too small, even though zebrafish don't grow particularly large, usually between two and four centimeters. A garden would need more diversity and a bigger water volume. I didn't want to achieve this with one large tank, which is difficult to move, but rather with several interconnected ones. A certain degree of mobility in the garden structure seemed essential to me; it should be modifiable and adaptable to different conditions with minimal effort. Therefore, a modular construction seemed appropriate.

The modules would need to be connectable. My idea was that this could be done by tubes through which the fish could swim, so I wanted to test whether they would actually do so.

I started with a short tube, 10 cm long. The fish swam through it, as you can see on the image, but only after I placed a few frozen mosquito larvae inside as an incentive. They didn't do it just for fun or curiosity. It also turned out that some swam through with less hesitation, while others preferred to wait outside until the more daring ones had pushed a few larvae out by swimming through.

The fish that entered the tube first were not necessarily the boldest. A female who was always first at feeding was among the first to enter, but along with her were the colorless mutants and the leopard variant – fish that usually behaved rather shyly.

I tried longer tubes and some other variants, only realising too late that I was on the wrong track.



Experiment: do fish swim through a tube? Vienna, Nov 19, 2019

Things start to go wrong

In January 2020 things started to go wrong. First the *leopard* variant disappeared. It had always been one of the thinnest and tiniest. I had taken it for a male, but when he got fat from his fearless reach for the mosquito larvae, I doubted his gender. However, s/he had vanished. The vegetation in the aquarium was quite dense at the time, and I thought s/he'd hidden herself. I searched for her but couldn't find her – not even when, a few days later, I thinned out the plants. There was a lot of hornwort growing in the tank, which I had harvested from the Old Danube the previous summer, where it grows in abundance. I assume *Leopard's* obesity was a sign of illness. S/he had probably hidden herself to die, as most animals do, and after a few days had already decomposed so much that I could no longer find any remains of her.

A few days later, one of the colourless mutants got sick; I had called him *Little Pale*. I think it was a male. He swam slowly, stopped eating, and was dead a day later. I checked the water parameters with a test strip and found nothing alarming. But I observed that the upper leaves of one plant species had turned reddish, and that the water fern, which had struggled before, was now thriving. An obvious sign that something had changed in the water chemistry, even though the test strip showed no indication.

I noted this in my laboratory notebook on 20 January 2020:

Little Pale is dead. He died on January 19, 2020 and was one of the insatiable fish that often entered the tube loaded with mosquito larvae. I was sad and felt guilty. He was probably overeating and I suspect that the colorless zebrafish mutants are more susceptible than the wild forms. In order to show him my last respect and not to treat him as an object, I built this sort of mausoleum.



January 19, 2020

Death of the eager eaters and a new menace

A few days later, the next colorless mutant died and *Oszilla* got sick. She was breathing rapidly, staying close to the surface most of the time, and not eating. I had named her *Oszilla* because the lowest stripe near her belly resembled an oscillogram. She was clearly a female and one of the braver fish – courted by the males even when she was unwell.

I had raised the tank temperature on an aquarist's advice, changed a filter element, and bought new plants, hoping to improve water quality even though there were no obvious signs of a poor water quality – except that the fish were not doing well.

Oszilla recovered but never fully. The last colorless mutant, whom I called *White*, also behaved strangely and barely ate. *White* died on March 21, 2020; *Oszilla* on April 1, 2020. All the eager mosquito larvae eaters had perished. Being first at the banquet is not always an advantage.

And a new menace appeared: blue-green algae – which, strictly speaking, are not actually algae but photosynthetic bacteria lacking a cell nucleus (cyanobacteria, or cyanophyceae). They overgrew everything with bluish slime. I had already read that cyanobacteria can take over an aquarium and are nearly impossible to eliminate except by darkening the entire tank for over a week.



Plant overgrown with cyanobacteria

Countermeasures

I tried several measures: lowering the temperature, changing the water flow, meticulously cleaning the aquarium, freeing the plants from the slimy bluish layer that hindered their photosynthesis, changing the water, and upgrading the filter system. I had also set up a second aquarium as an evacuation option if needed.

At the end of May I used this option.

The fish were temporarily housed in a glass bowl, filled with water mixed from both tanks to ease the transition. Some turned completely pale with fright.

The infested tank remained. I wanted to observe its further development and test different strategies to control the cyanobacteria: light conditions, temperature, water movement, and a product called Blue-Exit containing salicylic acid as its active ingredient. It had a limiting effect, but cyanobacteria are tough and fascinating. They are said to have been the first oxygen producers on Earth.



Vienna, 20/05/2020, pale fish in a glass bowl, waiting to be transferred in new waters

Feeling guilty

A miserable gardener – that's how I felt. I should have realised that a fish might not know when it has eaten enough. It seemed the whole system had fallen out of balance. But of course, that made me learn about the dynamics and fragility of this small man-made indoor fish habitat. I developed a sensitivity for the system and the fish, learning to read also the subtler signs. And it definitely confronted me with ethical questions. I felt stupid and guilty, and still do. But I can't undo it.

During the years, more fish died, mainly from age, some from sickness or a combination of both. When a fish became sick, I had to ask myself at a certain point whether it wouldn't be more empathetic to euthanise it. One method recommended in the practical protocols of the International Zebrafish and Medaka Course (IZMC)² is to immerse the fish in ice water until no further movement of the operculum that covers the gills is noticeable. I considered this necessary twice. The first time, my hands were shaking. I was astonished by my reaction. It only took a few seconds until the fish in the ice water seemed stunned and stopped moving. Gill movement stopped after a few minutes.



euthanised fish, Dez. 12, 2022

² International Zebrafish/Medaka Course (IZMC). Practical Protocols. Protocol 8, 18. A course offered by the European Zebrafish Resource Centre (EZRC) at the Karlsruhe Institute of Technology (KIT), providing training on the keeping and handling of zebrafish and medaka – including exam and certificate.

In scientific fish facilities, fish are kept for a maximum of two years, after which they are automatically euthanised. “Old fish past the reproductive stage frequently act as sinks for pathogens and should be removed following the procedures described in chapter 7,” writes Thomas Dickmeis in the theory book for the IZM course.³ Chapter 7 covers “Anaesthesia, analgesia and euthanasia in fish.”

Twice I bought 3–4 new fish. I had to get acquainted with them anew, and the fish with each other too.

The end of fish keeping

At the end of 2022, I decided to stop acquiring new fish. Keeping fish requires constant presence and implies responsibility, which I bore for over four years. This also meant finding reliable fish sitters whenever I was away. I also moved twice and had to find and train new caretakers each time. Sometimes the fish were overfed. I no longer wanted to keep fish under these unstable conditions. The remaining fish should be allowed to die of old age, and not be replaced by new ones.

When there were only two fish left, I named them *Eve* and *Adam*. *Eve* died on the night of February 17–18, 2025; *Adam* three months later, on May 10, between 5 and 10 p.m. From time to time I imagined that the two remaining fish might mate, produce offspring, and start a dynasty. But if that imagination had come true, it would have created a problem: a never-ending responsibility for their care. I could only get involved with such matters if the conditions were reasonably secure and stable.

When Adam had died, at first, the absence felt strange. Until then, I had always been considerate in the living room (later the ‘fish garden laboratory’): dimmed lights, darkened aquarium, minimal noise. I had to adjust to the fact that this wasn’t necessary anymore. My first stop upon returning home – or entering the “fish garden laboratory,” as I’d called it since the last move – was always to check on the fish. An aquarium remains interesting even without them, but it no longer draws your attention so automatically.

I felt sad and relieved at the same time.

That was the story of my fish-keeping experience in brief. There's much more to tell, but I won't bore you with the millions of small observations I made. Instead, I will report on some practices and habits that developed over time in the fish garden laboratory and defined the fishes' environment.

³ Dickmeis, Thomas. Husbandry, breeding and feeding. Zebrafish. International Zebrafish/Medaka Course, 47

Environmental conditions and dependencies

I had found high-quality fish food (containing fish and fish by-products, cereals, crustaceans, vegetable by-products, yeast, and minerals) that the fish liked and which seemed to enhance their well-being. I never fed mosquito larvae again; when available, I fed them live daphnia, which I also tried to breed, with mediocre success. In the end, I managed to keep one population of those little crustaceans alive for over a year. The fish enjoyed hunting them.

There were no fixed feeding times. On November 28, 2020, I started noting the date and time of each feeding, a habit I maintained until the end. Feeding times followed my own rhythms to which the fish had to adapt, and they also marked when someone else was caring for them. I fed them once or twice a day. Sometimes they had a fasting day, as recommended in the literature.

The lighting was controlled by a timer: 12 hours day, 12 hours night.



1541 feeding days

Drawings

From time to time, I tracked the fish – a good exercise in concentration. Each individual seemed to have its own preferred area of residence. These preferences changed with illness, age, or the arrival of new companions.

A narrow chamber was separated from the rest of the aquarium by a Plexiglas plate with openings for passage. It became a favored refuge for some fish, while others rarely entered or were immediately chased away. Some of these behaviors can be traced in the drawings.

After Eva's death, I followed Adam's movements almost daily, sometimes several times a day. I watched how he responded to sounds and whether his swimming pattern changed. He lived for another three months, and his gradual loss of vitality is visible in the drawings.

Occasionally, playing a kalimba pressed against the aquarium glass seemed to lift his spirits.

I learned that tracing the movement of a fish with a pencil on paper also conveys something of the fish's mood, as your hand imitates its motion. If the movement is quick and hasty, your hand becomes quick and hasty; if the fish is sick and moves only slightly, your hand remains more or less in place and does little; if the fish has lost its sense of equilibrium and sways like a drunken sailor, your hand follows that same unsteady path. A camera and software, as used in scientific research to track a fish, may provide a more precise record of the movements, but they lack the capacity to transmit that bodily, embodied feeling.



smaller section of the aquarium separated by a plexiglass partition with openings



the other side

Other biota

The vegetation in the aquarium was constantly changing. I experimented with new plants time and again – some collected from local natural waters, others purchased. As I learned, aquariums with lush vegetation usually rely on CO₂ diffusers and fertilisers to stimulate plant growth. That approach was out of the question for me. To gain experience in underwater gardening, I was content with continuous observation.

Over time, additional aquariums and larger glass containers joined the one with the fish, and new underwater worlds began to develop within them.

In addition to the fish, other aquatic organisms also found their way into the fish tank and the other containers. In most cases, they arrived accidentally with the plants that were placed in the tanks. Among those visible to the naked eye were primarily snails – welcome guests, since they consumed leftover fish food. Less welcome were planarians. At times, there were many of them: small, flat, wormlike creatures no longer than 10 mm, with distinctive eye spots that gave them a rather endearing appearance. They are hermaphrodites.

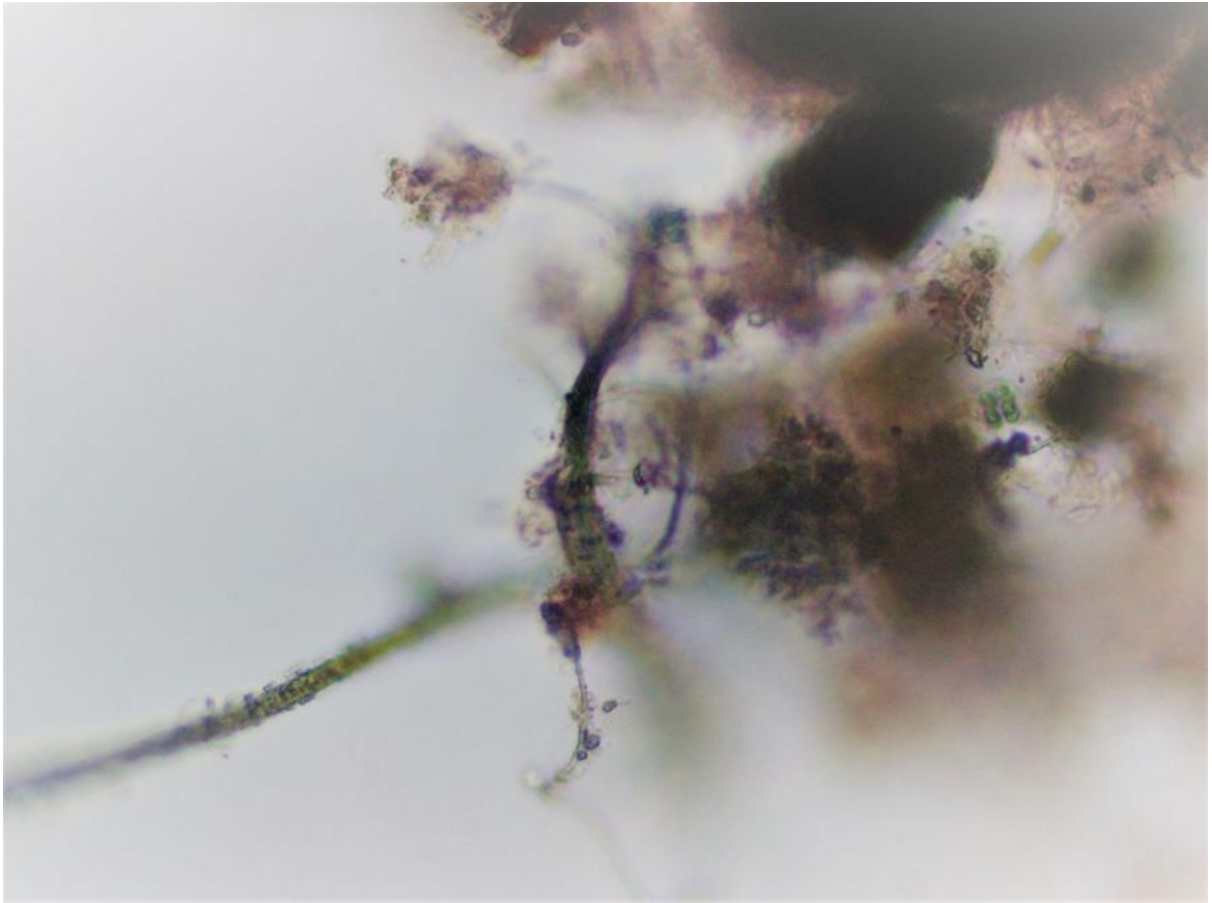
I don't want to broaden these descriptions; I only wish to point out that there is plenty to observe and to marvel at in such underwater worlds. This is even more true when one dives into the microworld: a single drop of water can contain an entire universe of its own.



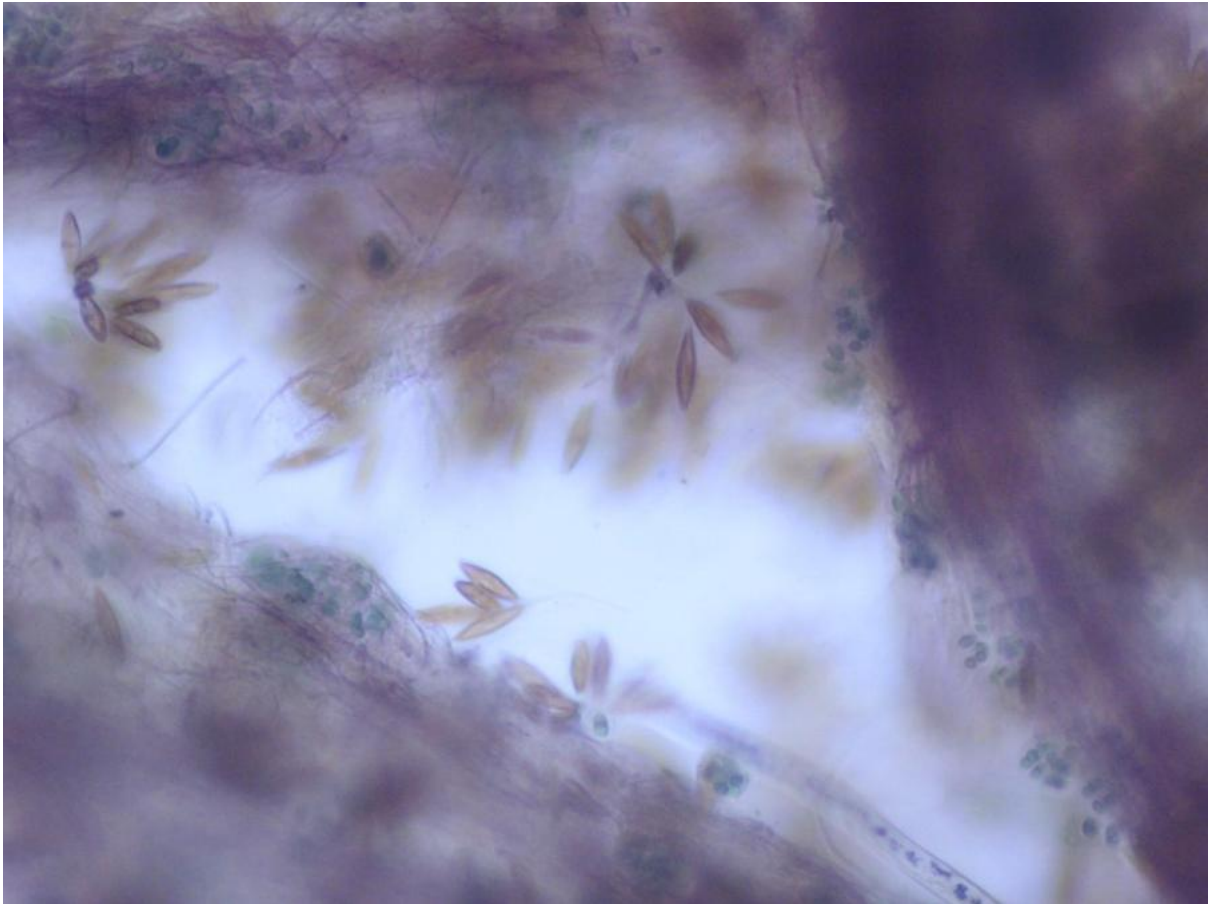
Mating ramshorns (*Planorbis corneus*)



planaria (x10)



microscopic image from worlds within a world (x 100)



microscopic image from worlds within a world (x 100)



microscopic image from worlds within a world (x 100)



microscopic image from a shrinking world (x 400)



a single cyanobacteria

Fish and humans

Although we are relatives – sharing a common ancestor that lived around 400 million years ago – fish seem alien to us. They have no recognisable facial expressions, a body language that is mostly incomprehensible to humans, and they seem to be mute. They are mainly something you catch and eat, or, like the zebrafish, something used as a research tool in scientific research.

The Food and Agriculture Organization of the United Nations (FAO) counts the amount of fish caught in tons. The global wild fish catch in 2022 was 87.99 million t = 87 990 000 000 kg.⁴ If we estimate the average fish weight to be just under one kilogram, this corresponds to roughly 88–90 billion individual fish being hauled ashore in that year.

Zebrafish in science

From nature to the lab

Zebrafish are not intended for consumption. These golden-black striped fish, with a maximum length of 5 cm, originate from slow-flowing or stagnant waters in the Ganges and Brahmaputra river basins of north-eastern India, Bangladesh, and Nepal,⁵ and have made a career as aquarium fish. They were introduced into scientific research in the 1970s and 1980s by American molecular biologist George Streisinger and his colleagues at the University of Oregon. In the following years, their habitat expanded to laboratories and fish facilities in numerous countries around the world.

They have become research tools for investigating a wide range of questions. Publications involving zebrafish originate from 103 countries, with a focus on Europe, the US and Canada, China, Japan and a few other Asian countries.⁶

Zebrafish are not counted in tonnes. The exact number of zebrafish used in research each year is uncertain. Lidster et al. estimate that it could exceed five million.⁷

Fishkeeping in science

Zebrafish facilities range from small labs with a few hundred to a few thousand adult fish to large centers housing tens of thousands or more, operating as increasingly automated

⁴ Food and Agriculture Organization of the United Nations (FAO), via World Bank. 2025. Processed by Our World in Data.

⁵ Spence, Rowena, et al. "The Behaviour and Ecology of the Zebrafish, *Danio rerio*." *Biological Reviews* 83, no. 1 (2008): 13–34.

⁶ Kint, Priyamvadah, Gopalakrishnan Mahesh, and Yatish Panwar. "Mapping of Zebrafish Research: A Global Outlook." *Zebrafish* 10, no. 4 (2013): 510–17.

⁷ Lidster, K., G. D. Readman, M. J. Prescott, and S. F. Owen. "International Survey on the Use and Welfare of Zebrafish *Danio rerio* in Research." *Journal of Fish Biology* 90 (2017): 1891–1905. <https://doi.org/10.1111/jfb.13278>.

service facilities. Adults are generally kept in tanks on racks of 3.0 to 10.0 L at a density of about 10 fish per liter;⁸ tanks usually have no substrate and are devoid of decoration or vegetation, often containing only the fish, though sometimes snails such as the great ramshorn (*Planorbis corneus*) are added to help remove food residues and algae.

The largest experimental fish facility in Europe, the European Zebrafish Resource Center at KIT in Karlsruhe, has a capacity of more than 300,000 fish.⁹ Even larger is the University of Pittsburgh School of Medicine's fish facility, which describes itself as one of the largest aquatics research facilities in the world and can maintain up to 500,000 adult zebrafish in 11,000 tanks.¹⁰ By comparison, the 20,000 zebrafish that can be accommodated in the Zebrafish Core Facility of the Miami College of Arts and Sciences seem modest.¹¹

Model organisms

"The classification of a particular organism as a model organism is based on scientific principles, but is also relevant to the funding and visibility of the laboratories that work with them. Model organisms are the subject of debate."¹²

Zebrafish are model organisms. What does that mean? Model organisms are non-human species that are studied in the expectation that insights gained from them can be extrapolated to other organisms and eventually generalised. It is difficult to determine when the term was first introduced, but it became widespread during the Human Genome Project, when large-scale genomic sequencing techniques were developed.¹³

The assumption that insights gained from studying one organism can be applied to others is rooted in evolutionary theory, which holds that all life forms are related through a common evolutionary history. It follows that, depending on their degree of kinship, organisms share more or less of their genetic material and thus biological processes; some of which are considered universal.

The US National Institutes of Health lists the mouse and rat as examples of mammalian model organisms, and budding yeast, social amoebae, nematodes, fruit flies, zebrafish, frogs, and thale cress as non-mammalian ones.¹⁴ When a species attains the status of a model organism, it is typically accompanied by an established research community, shared resources, and platforms for collaboration and funding applications. By contrast, working with a species that is not recognised as a model organism often means lacking such

⁸ Lawrence, C., et al. "The Husbandry of Zebrafish (*Danio rerio*): A Review." *Zebrafish* 12, no. 2 (2015): 87–95. <https://pmc.ncbi.nlm.nih.gov/articles/PMC4521404/>.

⁹ European Zebrafish Resource Center (EZRC). "About." Karlsruhe Institute of Technology (KIT). Accessed 11 April 2022. <https://www.ezrc.kit.edu/24.php>.

¹⁰ Center for Integrative Organ Systems (cenIOS). "Research Facilities." University of Pittsburgh. Accessed 11 April 2022. <https://www.cenios.pitt.edu/research/facilities>.

¹¹ University of Miami, College of Arts and Sciences. "Zebrafish Core Facility." Accessed 11 April 2022. <https://www.as.miami.edu/faculty-and-staff/zebrafish-core-facility/index.html>.

¹² Gilbert, Scott F. "The Adequacy of Model Systems for Evo-Devo: Modeling the Formation of Organisms/Modeling the Formation of Society." In *Mapping the Future of Biology: Evolving Concepts and Theories*, edited by Anouk Barberousse, Michel Morange, and Thomas Pradeu, 57–68. Dordrecht: Springer, 2009. https://doi.org/10.1007/978-1-4020-9636-5_5.

¹³ Ankeny, Rachel A., and Leonelli, Sabina. *Model Organisms*. Elements in the Philosophy of Biology. Cambridge: Cambridge University Press, 2020. <https://www.cambridge.org/core/elements/model-organisms/F895B26EAC0373BCA5A138835AC73AEA>

¹⁴ National Institutes of Health (NIH). "Sharing Policies: Model Organisms—Definitions of Model Organisms and Related Resources." Accessed 11 April 2026. <https://grants.nih.gov/policy-and-compliance/policy-topics/sharing-policies/other/model-organism#definitions-of-model-organisms-and-related-resources>.

infrastructure. As a result, scientists have an interest in establishing the species they study as model organisms within the scientific community.¹⁵

Databases and publications

The zebrafish research community is large and growing. According to the Zebrafish Information Network (ZFIN) database, publications involving zebrafish reached 4,504 in 2025 – compared to just 560 records listed for 2000.¹⁶ ZFIN is a comprehensive database containing nearly everything related to zebrafish research: publications, gene databases, lab manuals, laboratories, meetings, researchers, and more.

Browsing through publication titles turns out to be surprisingly intriguing. A quick look at this year's papers yields examples like: *Synergistic Effect of Glyphosate and Polyethylene Microplastics on Culturable Gut Microbiota Alterations in Zebrafish*, *AIE Fluorescent Bio-Probe for Recognition of Exogenous and Endogenous H₂S Signaling Molecules*, and *Targeted Detection of Nonalcoholic Fatty Liver*, or *Lipidomic Remodeling of the Brain and Muscle in a Zebrafish Model of Depression* (published in the *Journal of Affective Disorders*). These are still reasonably understandable if you focus a little. Less so is one from the *Chinese Medical Journal*: *Inhibitory Effect of Blestriarene C on Triple-Negative Breast Cancer: Inducing Ferroptosis and Mitophagy via SESN2/AKT/FOXO4 Axis*.

Microplastics and microbiota, nonalcoholic fatty liver and depression, breast cancer and mitophagy. Keyword searches tell stories: “ayahuasca” yields 2 publications (2018 and 2023); “depression” returns 75, from 2002 to the latest in 2026; “senescence” produces 86 hits. “Environment” generates 672 results, though many appear in journals like *Environmental Research* or *Environmental Toxicology and Chemistry*, making such hits inevitable. The more specific “environmental enrichment” yields 32 hits, with the most recent in 2022. A vast, multi-purpose playground.

Science in practice

I wanted to see a fish facility and speak with people working with zebrafish. Several emails to researchers and public relation departments requesting a visit went unanswered, and a phone call dead-ended at the secretary. In my hometown of Tübingen, there is also a zebrafish facility, belonging to the working group of Nobel laureate Christiane Nüsslein-Volhard.

I went there, met someone from the facility, and learned that to gain access or any permission, I needed to contact the head: Christiane Nüsslein-Volhard.

Which I did. I wrote her a letter and even ordered a specially self-designed stamp featuring a zebrafish from the Austrian Post to pique her curiosity. Again, a dead end at the secretary, as I realised during another visit, for which I had specially designed a business card. There, during the lunch break, I met one of the scientists working in the facility and spoke with him about his research and daily work. He recounted some *Eulenspiegel*-like antics around legal issues – well-intentioned regulations that ultimately had the opposite effect – and an ingenious solution for fish in the lab that weren't officially declared as research animals. These were companion fish meant to ease the shyness of others, hoping their presence would help. During a routine lab inspection, this was criticised, as undeclared animals aren't

¹⁵ Ankeny and Leonelli, *Model Organisms*.

¹⁶ Zebrafish Information Network (ZFIN). "Publication Search." University of Oregon. Accessed 11 April 2026. <https://zfin.org/action/publication/search>.

allowed in research facilities. They resolved it by simply labeling the aquarium “ornamental fish.”



Fish facility building in Tübingen

As gaining entry to a fish laboratory or facility through private initiative seemed difficult, if not impossible, I decided to attend the International Zebrafish and Medaka Course offered by the European Zebrafish Resource Centre (EZRC) at the Karlsruhe Institute of Technology (KIT).

The course includes theory and practice. The theoretical part covers topics such as the ethics of animal experimentation, legal regulations, biology, analgesia and euthanasia, health monitoring, and statistics. The practical part took place in the laboratory, where the staff demonstrated their fish keeping, breeding and feeding practices. We learnt to distinguish male from female fish, to pierce a fish egg under the microscope (imitating a DNA injection), and to euthanise a fish. The course concludes with a multiple-choice examination. Participants who pass successfully receive “a certificate confirming their specific knowledge of zebrafish and medaka as well as their skills to work with these animals in compliance with legal requirements.”¹⁷

I was the first to finish, and the only one to pass without a single mistake.

I now comply with Directive 2010/63/EU of the European Parliament and of the Council, which requires that anyone performing animal experimentation be adequately trained.

¹⁷ Karlsruhe Institute of Technology (KIT). "International Zebrafish and Medaka Course (IZMC)." European Zebrafish Resource Center (EZRC). Accessed 12 April 2026. <https://izmc.ezrc.kit.edu/english/index.php>.

Felasa Certificate ID: F059/17-IZMC.2023.09.002
(Unique student reference)

CERTIFICATE

Margit Busch

has completed with success the FELASA Accredited Course F059/17

International Zebrafish and Medaka Course

25. bis 28. September 2023

Prof. Nicholas S. Foulkes, Dr. Daniela Vallone, Dr. Christine Blattner,
Almut Köhler, Ph. D. (vet. med.)
Karlsruhe Institute of Technology (KIT), Germany

for persons carrying out procedures on animals (**Function A**), taking care of animals
(**Function C**), euthanasia (**Function D**)

It covered the species zebrafish (*Danio rerio*) and medaka (*Oryzias latipes*) and
included the additional task specific module N° 20 "Anaesthesia for minor procedure"
and N° 23 "Advanced Animal Husbandry, Care and Enrichment Practices"

The FELASA accredited course F059/17 covered according to the Directive
2010/63/EU and the related EC Guidelines (EC, 2014¹) the following:

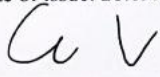
Modules:

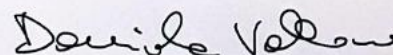
Core Modules (required for all functions)	N° 1, 2, 3.1, 4, 5, 6.1
Function Modules	N° 3.2, 7, 8, 6.2
Additional Task Modules	N° 20, 23
Other Additional Tasks Modules	N/A

Use of Live Animals for:

Handling teaching (ref. Mod. 3.2)	Zebrafish (<i>Danio rerio</i>), Medaka (<i>Oryzias latipes</i>)
Minor Invasive Procedures teaching (ref. Mod 8)	Zebrafish (<i>Danio rerio</i>), Medaka (<i>Oryzias latipes</i>)
Humane methods of killing (ref. Mod. 6.2)	Zebrafish (<i>Danio rerio</i>), Medaka (<i>Oryzias latipes</i>)

Date of issue: 28.09.2023


Signature
Dr. Christine Blattner
Authorised Person from the Institution


Signature
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Course Organizer
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Ethical considerations

Long ago I saw a piece of art in an exhibition in Berlin involving a fish – I think it was a sea bass – fresh from the fishmonger's, lying on a chopping board and occasionally flapping its tail fin. I liked the work.

*Quäle nie ein Tier zum Scherz,
denn es fühlt wie du den Schmerz.*
Never harm an animal for fun,
as it feels the pain as you do.

This German saying opens a field of ethical considerations in dealing with animals, whether in art or science. At its core, it reasons by analogy, pointing to a shared capacity for feeling between animals and humans. Yet it also implies that, under certain conditions, causing pain or discomfort might be ethically justifiable if a valid reason exists. The sentence appears to offer guidance – but does it truly, when our behavior toward animals is so ambivalent?

If we read *Scherz* as "just for fun" or "without acceptable reason," we must then ask: What counts as acceptable? When does "harming" even occur? Is it acceptable to genetically modify fish, making them suffer, to develop treatments for human diseases? Is it acceptable to eat meat produced under conditions we would, if being confronted with them directly, call unacceptable? What does it do to us when we treat living beings as mere objects, and under what circumstances is this justifiable?

Clearly, our moral frameworks are relative, and there is often a gap between what we profess or believe and how we actually act. In short, it depends. To make this more concrete and imaginable, let us focus on a few examples – primarily artworks involving fish. These examples may help to sketch, at least in broad terms, a moral landscape.

Fish and ethics in the arts

I will start with a work by Marco Evaristti, a Chilean artist based in Denmark who is, according to Wikipedia, best known for his work *Helena & El Pescador* (2000). Ten blenders (Moulinex Optiblend 2000) were placed on display at Trapholt Museum in Kolding, Denmark. Each was filled with water and contained a goldfish. The blenders were visibly plugged in and thus ready to use.¹⁸

The second example is the film *Der Todeskampf einer Äsche* (1986) by Swiss film director Peter Aschwanden. It was in November 1986 when 1,350 tons of chemicals burned in a storage hall of the Sandoz chemical company. The extinguishing water spilled into the Rhine, killing millions of living creatures, including fish, along a 400 km stretch downstream. As a contribution to a Swiss television discussion panel on the Basel chemical disaster, Aschwanden filmed a grayling in its death agony after poisoning it with a few millilitres of rose fertiliser containing the neurotoxin endosulfan.¹⁹

The third example is *Initial Attempts at Embryonic Transplant Surgery* by bioartist Adam Zaretsky. He tried "to cut the head off one growing zebrafish embryo and transplant (paste) that head onto another 'whole' zebrafish embryo."²⁰ He did not succeed, but that was not his goal. He wrote: "By learning standard microsurgical skills as an art productive process, I am

¹⁸ Bomsdorf, Clemens. "Goldfish in a Blender? Marco Evaristti Calls It Art." *The Wall Street Journal*, 28 August 2013. Accessed 30 September 2021. <https://www.wsj.com/articles/BL-SEB-76634>.

¹⁹ O.A. "Kleine Fische." *Der Spiegel*, no. 44 (1988). Accessed 29 September 2021. <https://www.spiegel.de/politik/kleine-fische-a-db73f054-0002-0001-0000-000013532075>.

²⁰ Zaretsky, Adam. "Initial Attempts at Embryonic Transplant Surgery." Accessed 20 September 2021. <https://emutagen.com/embryo.html>; Zwijnenberg, Robert. "A Two-Headed Zebrafish." *ArtScience Forum*, 2012. Accessed 20 September 2021. <https://www.artscienceforum.nl/contributions/a-two-headed-zebrafish>.

attempting to focus on the liminal relationships that are formed at the border between the creation and the destruction of living beings. This is an attempt at waking the sleeping dreams of personal beauty. Therefore, I am not shielded by the rhetoric of moral sanctity implicit in the public face of scientific rationalization."²¹

What Zaretsky failed to do, science accomplished – albeit unintentionally. Taiwanese scientists accidentally created a two-headed zebrafish when they micro-injected over 200 zebrafish embryos with a gene causing muscle cell death, aiming to develop a drug for muscular dystrophy. The researchers were inspired by the incident to study how these conjoined creatures form, with the rationale that the research could eventually help develop treatments against conjoined babies.²²

The fourth example is about sonifications of fish movements; the translation of fish locomotion into musical syntax. These are performed either to create novel electronic music control – allowing, for example, club-goers new experiences²³ – or in science communication settings, such as science centers, zoos, and aquaria, to make science tangible and open new perceptual pathways.²⁴ The simplest version of the sonification of fish movements is *Quintetto*, an installation by the Italian artist collective Quiet Ensemble. Five goldfish swim in separate vertical tanks; their movements are captured by camera and translated into digital sound signals. A French design magazine describes it: "Le résultat est un véritable concert de cinq instruments, effet garanti !!"²⁵

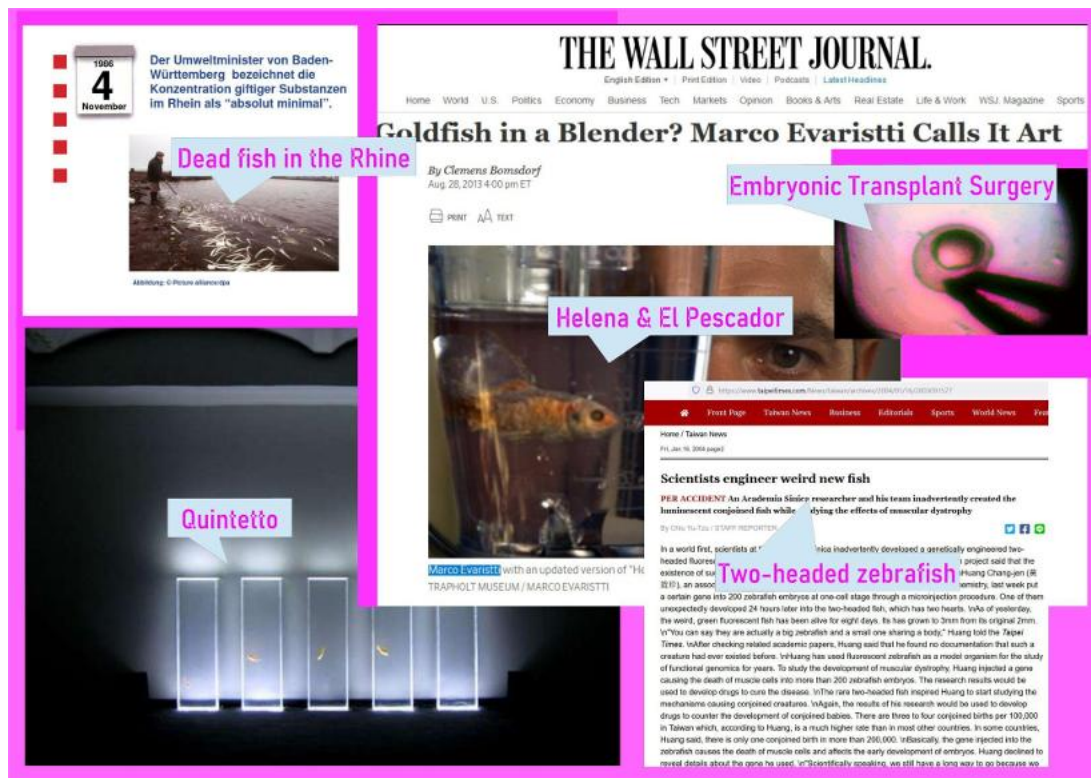
²¹ Zaretsky, Adam. "Initial Attempts at Embryonic Transplant Surgery."

²² Chiu, Yu-Tzu. "Scientists Engineer Weird New Fish." *Taipei Times*, 16 January 2004, 2. Accessed 20 September 2021. <https://www.taipeitimes.com/News/taiwan/archives/2004/01/16/2003091577>.

²³ Eloul, Shaltiel, et al. "Motion Tracking of a Fish as a Novel Way to Control Electronic Music Performance." *Leonardo* 49, no. 3 (2016): 203–10.

²⁴ Walker, Bruce N., et al. "Aquarium Sonification: Soundscapes for Accessible Dynamic Informal Learning Environments." In *Proceedings of the 12th International Conference on Auditory Display*, 238–41. London, UK, 20–23 June 2006; Baldan, Stefano, et al. "'Musica Sull'Acqua': A Motion Tracking Based Sonification of an Aquarium in Real Time." In *Proceedings of the 9th Sound and Music Computing Conference*, 69–74. Copenhagen: Aalborg University, 11–14 July 2012.

²⁵ *Le Journal du Design*. "Installation musicale Quintetto par Quiet Ensemble." 9 September 2011. Accessed 20 September 2021. <https://www.journal-du-design.fr/art/installation-musicale-quintetto-par-quiet-ensemble-19114/>.



Fish in art, collage

Fish and ethics in science

The first chapter of the theory book for the International Zebrafish and Medaka Course covers the history and ethics of animal experimentation.²⁶ It outlines attitudes ranging from absolute anthropocentrism, which considers only humans (as rational beings) worthy of ethical concern, to "radical biocentrism," which welcomes all creatures into the moral community. The author advocates moderate biocentrism as a practicable moral theory: all creatures possess intrinsic value, though a hierarchy exists among organisms. A fish's suffering thus weighs more than a fly's but less than that of a human or dog.

The core ethical framework for laboratory animal research and testing is the "3Rs": Replace, Reduce, Refine – developed by Russell and Burch in 1959 and now embedded in laws like EU Directive 2010/63/EU. Replace means using non-sentient alternatives like cell cultures wherever possible instead of sentient animals; reduce means designing experiments to require fewer animals while achieving statistically valid results; refine means minimising pain, distress, and suffering through, e.g., better housing, environmental enrichment, social grouping, and improved anaesthesia or analgesia.²⁷

²⁶ Hilbert, Lennart (n.d.). History of Ethics of Animal Experimentation. Zebrafish. International Zebrafish/Medaka Course, 5

²⁷ Hubrecht, Robert C., and Elizabeth Carter. "The 3Rs and Humane Experimental Technique: Implementing Change." *Animals* 9, no. 10 (2019): 754. <https://doi.org/10.3390/ani9100754>.



Fish as metaphor and symbol

Fish appear frequently in metaphorical language: "like a fish out of water" or, in the better case, "like a fish to water"; "a small fish in a big pond" or "a big fish in a small pond."²⁸

As a symbol, most people in Western cultures have encountered the ichthys (ἰχθύς), the ancient Christian fish symbol (from Greek ἰχθύς = fish). It is the simplest way to draw something that reminds of a fish and is often seen as a simple outline on car bumpers. I won't delve into Christian fish symbolism, but Matthew 4:19 merits mention, where Jesus says: "Follow me, and I will make you fishers of men." A remarkable sentence.

On spiritual-themed websites – often brimming with advertising – fish are linked to emotions and the depths of the unconscious. As we learned in the **GARDEN**, in Chinese the word for "fish" (yú 魚) sounds like "abundance" (yú 餘), making fish a common symbol of wealth and prosperity.²⁹ We also learned about carps that manage to leap the Dragon's Gate and are transformed into dragons.³⁰

The most compelling association – symbolic or metaphorical? – comes from Alexander Kluge:

"There is a saying that 'lakes are islands for fish.' When we fish get into new waters, we change. Evolution goes on. The soul is an underwater creature. It is fluid and changes constantly."³¹



²⁸ Lang, Matthew. "Metaphors for Fish." Accessed 11 April 2026. <https://langfaq.com/metaphors-for-fish/>.

²⁹ Laing, Ellen Johnston. "Carp and Goldfish as Auspicious Symbols and their Representation in Chinese Popular Prints." *Arts asiatiques* 72 (2017): 97–109, 98.

³⁰ Ibid., 99

³¹ Kluge, Alexander. *Pluriverse*. Leipzig: Spector Books, 2018, 63

A look at the findings

Résumé

We began by asking: What is a fish? I then reflected on my experiences of keeping fish – how I became familiar with them by identifying subtle differences in stripe patterns, body shape, and behaviour. You heard about the experience of a fish's mood being transmitted to one's hand when tracking its movements, and about my shaking hands as I euthanised a sick fish. I spoke about experiments with unfortunate consequences, in which I tried to find out whether the fish would swim through a tube, and about the lesson that being first at the banquet is not always an advantage. I described feelings of guilt and stupidity, as well as the end of my fishkeeping after six years; I experienced both loss and relief as the last fish died. I also touched on the fish's environmental conditions shaped by my habits and gave a minimal impression of the diversity and wonders contained within those small underwater worlds.

In the end, I hope to have conveyed an impression of a complex system in which feelings, physico-chemical parameters, microorganisms, social aspects, and attitudes intermingle and shape reality – a reality full of wonders.

We then turned to the relationship between humans and fish. You learned about the role of the zebrafish as a research organism used to investigate a wide range of questions, and about the facilities in which they are bred and kept. We explored the concept of the model organism, which is based on the assumption that insights gained from studying one organism can be applied to others, grounded in evolutionary theory.

I reported on the Zebrafish Information Network (ZFIN) database as a vast, multi-purpose resource, and on my attempts to gain access to the practical world of scientific research. I also mentioned receiving a certificate confirming that I comply with Directive 2010/63/EU of the European Parliament and of the Council, which requires that anyone performing animal experimentation be adequately trained.

After these experiences, I invited you into a landscape of ethical considerations, reflecting on the German saying: *Quäle nie ein Tier zum Scherz, denn es fühlt wie du den Schmerz* ("never harm an animal for fun, for it feels pain as you do"). I presented examples from the arts involving fish that can foster discussion and help to sketch a moral landscape.

Within the scientific context, we encountered a range of ethical positions – from absolute anthropocentrism, which considers only humans worthy of moral concern, to "radical biocentrism," which includes all living beings in the moral community. We also became familiar with the "3Rs" – Replace, Reduce, Refine – the core principles of the ethical framework for laboratory animal research and testing.

In the final section, I reflected on the metaphorical and symbolic dimensions of fish, ending with Alexander Kluge: The soul is an underwater creature. It is fluid and changes constantly.

Conclusions

The concept of model organisms rests on the assumption that insights gained from studying one organism can be applied to others. If we transfer this concept to a *garden for a fish*, we arrive at the notion of a model system – a system consisting of fish, garden, and gardener. Combining this with the metaphorical association of the fish with the soul, this leads to the image of a garden for the soul.

Taking this one step further, I return to the question: what does it do to us when we treat living beings as mere objects? A lesson I take from *How Forests Think* by Eduardo Kohn (mentioned in the **GARDEN**) is that, in objectifying others, we risk becoming objectified ourselves.

To Replace, Reduce, Refine, I would like to add a fourth principle: Redefine. By this I mean rethinking our goals. If we adopt an ontology that understands the self as a product of relations, the central aim would be to cultivate meaningful and rewarding relationships.

I suggest that the first step in this direction is to begin to wonder about the connections that constitute the beauty of nature – an idea presented by Gregory Bateson, which will resurface in the next book: **TIME TRAVEL**

BOOK III

TIME TRAVEL

CONTENT

The futures

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- Futures studies

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- Nature as an object
- Relational ways of understanding the world

The Biologische Versuchsanstalt

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A look at the findings

The futures

The future's tendencies

Today's future appears to be drifting toward dystopian landscapes: accelerating climate change, collapsing biodiversity, expanding wars and conflicts, economic crises, mass migration, rising authoritarian regimes, and shifting social constellations and global power relations.

One might get the impression that humanity cannot respond to these crises with life-affirming intelligence and creativity, and that the best response would be to adopt a stoic attitude and wait for the insanity to consume itself. But what if, drawing on the gardening attitude we encountered in **BOOK I**, we are called to cultivate the garden and prepare the soil for better times precisely because of the world's present condition?

What about the possibilities for different futures? Ones that are not dystopian – ones with a friendlier face. A future in which humanity can rightly call itself *Homo sapiens*; wise human beings. I think it is highest time to invest more energy and research in their invention.

The warning

United Nations High Commissioner for Human Rights Volker Türk stated on 09 Sep 2024 at a session of the Human Rights Council in Geneva:

"It seems we are at a fork in the road. We can continue on our current path, a treacherous new normal, and sleepwalk into a dystopian future, or we can wake up and turn things around for the better, for humanity and the planet."¹

He highlighted tendencies toward wars, conflicts, injustices, inequalities, and misinformation, emphasising that such a world cannot be the "new normal"; it cannot be our common goal.

"We can and must make a different choice: reconnect with our common humanity, nature and our planet."² Türk speaks, as Commissioner for Human Rights, not only of reconnecting with our shared humanity, but also with nature and our planet. A message that points to a connection between these elements. What does that mean: "reconnecting"? And how do we do that?

A warning call in view of the negative trends toward disasters, but also a hopeful appeal that it is possible to direct the paths toward a more desirable future, comes from future studies:

"Despite the potential for catastrophe suggested by current trends, we are also in the best position ever to reverse negative trends. As a species, we have never been more conscious, globally connected, or capable of radical positive change. With instantaneous communications, millions can be mobilised instantly for good causes, if understanding, passion, and will are engaged."³

Futures studies

People, organisations, and trends

The quote above originates from a book by Jennifer M. Gidley, *The Future: A Very Short Introduction*. Its cover blurb presents Gidley as a "renowned futurist, innovative educator, and postformal psychologist." When *The Future* was published in 2017, Gidley was president of the World Futures Studies Federation (WFSF), one of the major global

¹ United Nations High Commissioner for Human Rights Volker Türk. 2024. *Statement at the Human Rights Council, Geneva*. United Nations Web TV, 14:40–15:04. <https://webtv.un.org/en/asset/k1c/k1chdvvn6>

² Ibid., 16:48–16:59.

³ Gidley, Jennifer M. 2017. *The Future: A Very Short Introduction*. Oxford: Oxford University Press, 2.

communities representing the discipline.⁴ On the WFSF website it is described as "a forum for stimulation, exploration and exchange of ideas, visions, and plans for alternative futures, through long-term, big-picture thinking and radical change."⁵

Gidley talks in her book about the changing views of the future throughout human history and emphasises the idea of multiple possible futures rather than a single, predestined one. She contrasts technological and human-centred visions, and stresses the need for imagination, ethics, and foresight to face today's global challenges instead of keeping our heads in the sand. She defines futures studies as "the art and science of taking responsibility for the long-term consequences of our decisions and our actions today."⁶

Something to chew on. But do we agree on the long-term consequences of our decisions and actions today? And what does it mean to take responsibility? A techno-optimist would say that we will find a technological solution for everything: we will suck the CO₂ from the atmosphere,⁷ invent artificial photosynthesis,⁸ gain energy from nuclear fusion,⁹ or deep-freeze our bodies by Alcor until humans and machines become one and immortal, as former Google engineer Ray Kurzweil portrays the future.¹⁰ One side of the bandwidth within futures studies.

Futures studies became an academic discipline by the 1960s. The political, social and technological transformations of that time significantly increased interest in the field worldwide. Special institutes for futures studies were established in several countries and undergraduate and postgraduate programmes were launched.¹¹ The transformations we are experiencing today seem to be of greater scope than back then. What do futures studies have to offer nowadays?

Futures studies is a broad field. Different societies, institutes, and companies connected to futures studies all claim their importance. They have different ontologies, ideologies, teleologies, and epistemologies, and they either focus on helping us better prepare for what is to come or on broadening the perspective to a multiplicity of possible futures. One, of course, does not exclude the other.

Sohail Inayatullah, holder of a UNESCO Chair in Futures Studies and co-founder of the educational think tank Metafuture, summarises futures studies as "the systematic study of possible, probable and preferable futures including the worldviews and myths that underlie each future."¹² Inayatullah sees a shift in the study of the future, moving "from predicting the future to mapping alternative futures to shaping desired futures."¹³ The motto of the 2025 Expo in Japan, "Designing Future Society for Our Lives," supports his observation. Although

⁴ Kristóf, T. "Development Tendencies and Turning Points of Futures Studies." *European Journal of Futures Research* 12, no. 9 (2024). <https://doi.org/10.1186/s40309-024-00231-7>; Motti, V. V. "Futures Studies." In *The Palgrave Encyclopedia of the Possible*, edited by Ugo Brentari and Erica Borgna, Cham: Palgrave Macmillan, 2022. https://doi.org/10.1007/978-3-319-98390-5_269-1.

⁵ World Futures Studies Federation. "About WFSF." <https://wfsf.org/>.

⁶ Gidley, *The Future*, 136.

⁷ IEA. "CO₂ Transport and Storage."

<https://www.iea.org/energy-system/carbon-capture-utilisation-and-storage/co2-transport-and-storage>.

⁸ World Economic Forum. "Could artificial photosynthesis solve domestic and global challenges?" 2025.

<https://www.weforum.org/stories/2025/10/could-artificial-photosynthesis-solve-domestic-and-global-challenges/>.

⁹ Association. "Nuclear Fusion Power."

<https://world-nuclear.org/information-library/current-and-future-generation/nuclear-fusion-power>.

¹⁰ Britannica. "Raymond Kurzweil." <https://www.britannica.com/biography/Raymond-Kurzweil>; Futura-Sciences. "Ex-Google employee Ray Kurzweil"; NBC News. "Company will freeze your dead body."

¹¹ World Futures Studies Federation. "About Futures Studies." 2025. <https://wfsf.org/about-futures-studies/>; Institute for Futures Studies. "About Futures Studies." 2025. <https://www.iffs.se/en/about-us/about-futures-studies/>.

¹² Inayatullah, Sohail. "Futures Studies: Theories and Methods." In *There's a Future: Visions for a Better World*, 36–66, 2013.

¹³ Ibid.

somewhat awkwardly phrased, ‘designing’ expresses the idea that people have a certain degree of agency over the future.

The pluralisation of *futures* is a major focus of the WFSF and is also stressed by the UNESCO Futures Literacy Laboratories initiative.¹⁴ A perspective of a multitude of futures opens up the space to imagine alternative and desirable visions, and to eventually realise them.

One of the WFSF’s present representatives is Victor V. Motti. In addition to his role as director there, he is president of an institute with a futuristic acronym and name: Ap-Fi, the Alternative Planetary Futures Institute. The Ap-Fi website introduces the institute as one that, “founded in the year 53 A.E. (After Earthrise), conducts open-access horizon-scanning, foresight research, and advocacy centered on planetary consciousness.”¹⁵

Ap-Fi’s recommended reading spans from Sri Aurobindo and Nobel laureate Albert Szent-Györgyi (whose book *The Crazy Ape* appears on the list) to Dipesh Chakrabarty (*One Planet, Many Worlds: The Climate Parallax*), Yuk Hui (*Machine and Sovereignty*), and Christopher E. Mason (*The Next 500 Years: Engineering Life to Reach New Worlds*), among others. This broad bandwidth of works engages philosophical, spiritual, mythic, and cosmological perspectives alongside more technical or systems-oriented approaches. In sum, these texts reveal a preference for speculative, visionary, and holistic modes of futuring over strictly empirical, data-driven methodologies or purely technological visions.

By contrast, the “Top Introductory Foresight Books”¹⁶ recommended by futurist John M. Smart¹⁷ and colleagues – curated on *The Foresight Guide* – demonstrates a pronounced orientation toward evidence-based reasoning, predictive modeling, technological trajectories, and strategies for adaptation to accelerating change. *The Foresight Guide* is advertised as “the most comprehensive intro to general futures thinking and professional foresight practice available on the web” and aims to “be the best Big Picture Guide to 21st Century Foresight,” explicitly championing “exponential, evo-devo, and evidence-based thinking.”¹⁸ Superlatives and self-promotion are not rare in the domain of futures studies.

The same site also maintains a list of “700 foresight leaders,”¹⁹ which includes Jennifer Gidley and Sohail Inayatullah, as well as Bill Gates, Al Gore, Elon Musk, Ray Kurzweil, and the influential podcaster Joe Rogan.

Ross Dawson is another name among the 700 listed on *The Foresight Guide*. I came across him by chance while searching the internet for researchers of the future. He is an impassioned self-promoter who portrays himself as an influential futurist and “world-renowned keynote speaker, strategy advisor, and entrepreneur.”²⁰ His website lists illustrious companies among his clients, such as American Express, Coca-Cola, Google, Microsoft, Oracle, and Visa, and promises to inspire audiences “with powerful, practical insights into the future and how to seize today’s opportunities.”²¹ As stated before, futures

¹⁴ UNESCO. “Futures Literacy & Foresight.” <https://www.unesco.org/en/futures-literacy>; World Futures Studies Federation. “About Futures Studies.” <https://wfsf.org/about-futures-studies/>.

¹⁵ Alternative Planetary Futures Institute. “About Us.” <https://www.apfi.us/about-us>.

¹⁶ Foresight Guide. “Top Foresight Books.” <https://foresightguide.com/top-foresight-books/>.

¹⁷ John M. Smart is a global futurist, foresight consultant, and entrepreneur. He is CEO of Foresight University and founder of the Acceleration Studies Foundation, a nonprofit focused on understanding and describing human adaptiveness in a world of accelerating technological change. <https://www.johnmsmart.com/>.

¹⁸ Foresight Guide. <https://foresightguide.com/>.

¹⁹ Foresight Guide. “Leaders Table of Contents.” <https://foresightguide.com/leaders-table-of-contents/>.

²⁰ Dawson, Ross. *Ross Dawson*. <https://rossdawson.com>.

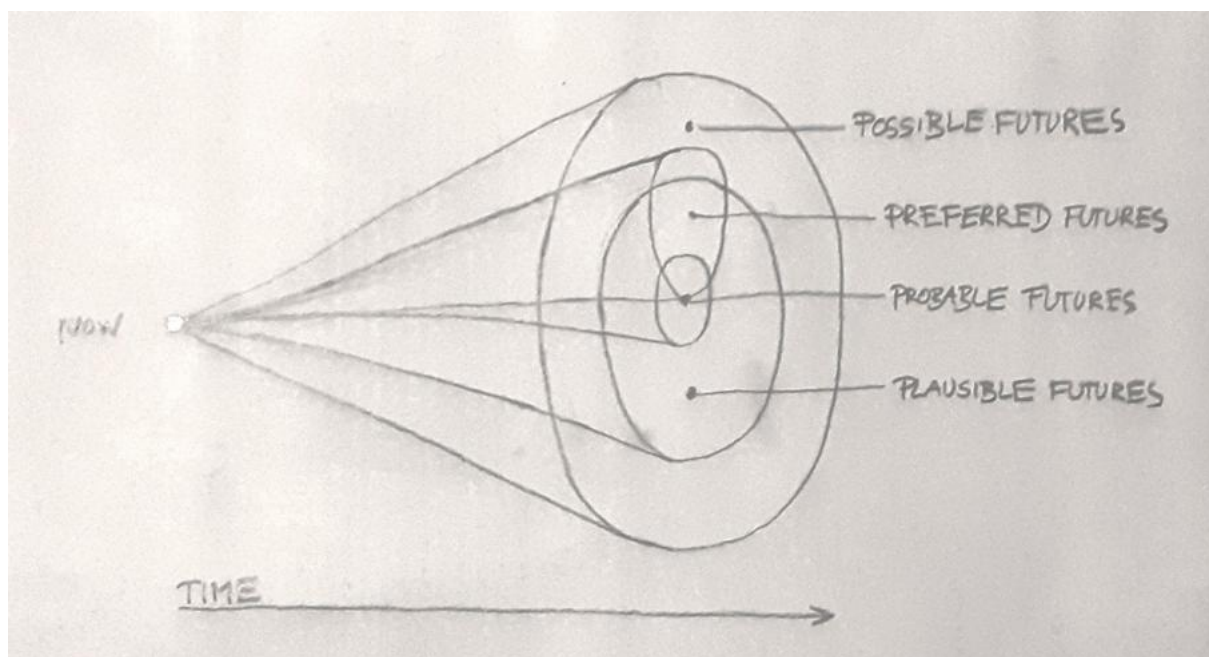
²¹ Dawson, Ross. “About.” <https://rossdawson.com/about/>.

studies is a broad and heterogeneous field, and its representatives are not shy about using superlatives.

Multiple futures and their visualisation

In spite of differences in focus, there seems to be a consensus that the future is not absolutely determined by preceding actions and that it can be altered. If the future is not determined, it follows that multiple futures are possible, each with varying likelihoods. This shifts attention away from prediction toward identifying alternative futures and using them strategically.²²

A widely used visual model in futures studies is the *futures cone*. Since its introduction in the early 1990s, it has been repeatedly criticised, modified, and refined, yet it continues to be valued as a depiction of key concepts in futurology.²³ The version shown here is a simplified adaptation of the futures cone as presented by Joseph Voros.²⁴



“Futures Cone” adapted from: Joseph Voros

A *possible* future is one that we think could happen given certain developments in knowledge and technology; a *plausible* future is one that appears credible based on current knowledge; a *probable* future follows from observable trends; a *preferred* future is one we would like to happen and inhabit.²⁵

One modification, proposed by Epaminondas Christophilopoulos, transfers a concept from physics – the light cone – into this model. The light cone is a double cone, with one part extending into the past and the other into the future. It represents all possible paths that light can take through spacetime and defines the range of possible causal connections, invariant across observers. Christophilopoulos’ future cone adopts this structure: the past cone

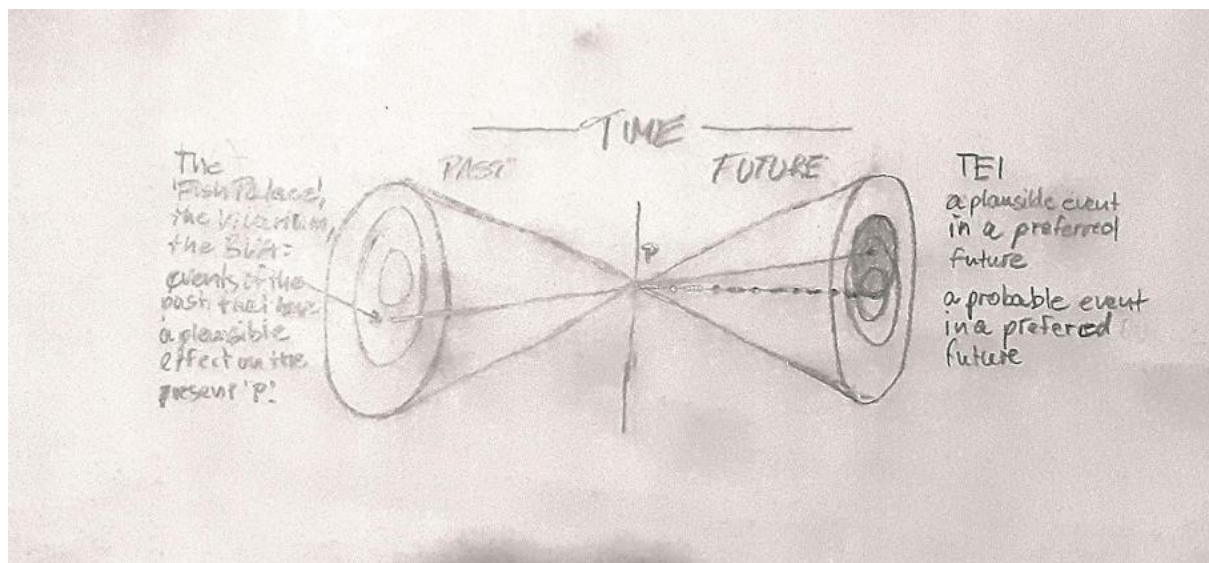
²² Gall, T., Vallet, F. and Yannou, B. “How to Visualise Futures Studies Concepts: Revision of the Futures Cone.” *Futures* 143 (2022). <https://www.sciencedirect.com/science/article/abs/pii/S0016328722001240#preview-section-introduction>.

²³ Ibid.

²⁴ Voros, Joseph. “The Futures Cone, Use and History.” *The Voroscope*, 24 February 2017. <https://thevoroscope.com/2017/02/24/the-futures-cone-use-and-history/>

²⁵ Boldrini, N. “Futures Cone: What It Is and Its Uses.” *Tech4Future, Futures4Business* (2023). <https://tech4future.info/en/futures-cone/>.

contains all events that could have causally affected the present moment (P), while the future cone contains all events that can be influenced from it. He refers to this expanded model as the “Cones of Everything.”²⁶



Sketch of the “cone of everything” and an example of how the present (P) acts as a lens that filters the ripples of a past event and directs them into the field of a preferable and probable future.

A thought experiment: the fact that you are reading these lines at this moment is the outcome of a chain of past events that generated the present. Yet this outcome could not have been predicted. Although natural laws and intentions are involved, their trajectories unfold within complex environments and are continuously refigured by circumstances. The present moment is the result of the convergence of many events from different times and places. It is causally grounded, yet practically unpredictable.

What is happening now, in turn, spreads out and encounters the ripples set in motion by other moments across time and space, constantly creating a new ‘now.’ Each ‘now’ is a moment in which trajectories change, and with them the probabilities of particular futures. Each ‘now’ offers the possibility of directing a preferred future toward higher probability.

I would like to recall Sohail Inayatullah’s definition of futures studies: “futures studies is the systematic study of possible, probable and preferable futures including the worldviews and myths that underlie each future.”²⁷ Worldviews and myths do not only shape our visions of the future but evidently also the present and the path we are taking on the way into the future. They don’t change the range of possible futures, but they influence how we move within that field – making some outcomes more likely than others.

Therefore, I suggest we take a closer look at world views.

²⁶ Christofilopoulos, E. “Special Relativity Theory Expands the Futures Cone’s Conceptualisation of the Futures and the Pasts.” *Journal of Futures Studies* 26, no. 1 (2021): 83–90.
<https://jfsdigital.org/articles-and-essays/vol-26-no-1-september-2021/special-relativity-theory-expands-the-futures-cones-conceptualisation-of-the-futures-and-the-pasts/>.

²⁷Inayatullah. “Futures Studies: Theories and Methods.”

World views

Nature as an object?

In dominant contemporary Western scientific understanding, nature appears as a text to be deciphered by the code of mathematics, physics and biochemistry. We behave like observers looking at nature from the outside, as subjects confronting nature as object. This subject–object divide shapes how knowledge is produced and limits what it can grasp.

German philosopher, theologian and educator Georg Picht argued in a lecture series of the 1960s that this division leads to a culture of knowledge incapable of halting destruction. Knowledge that treats nature as an external object, he insisted, cannot truly understand it. As the sphere of life we inhabit and co-constitute, nature cannot be grasped from the outside. In this sense, the natural sciences, at least in this form, cannot provide the kind of knowledge needed to prevent the destruction of nature.²⁸

Relational ways of understanding the world

Let us assume that Picht's analysis points to something fundamental – that the separation of subject and object impedes us from understanding the deeper connections in nature – then relational ways of understanding the world should move to the centre of attention.

One such relational approach we have already encountered in the Amazonian rainforest, where the anthropologist Eduardo Kohn describes the tropical ecosystem as structured through relations in which humans, animals, and even plants interpret and respond to one another via semiotic processes. In his perspective, all life is semiotic, and even the “self,” at its most basic level, is a product of semiosis.²⁹ The self is constantly being reconstructed through interpreting signs and being interpreted by others, and knowing becomes a matter of navigating a living semiotic field. There are no pre-existing, self-contained individuals, but rather a web of living sign processes that constitute the world.

The physicist and feminist theorist Karen Barad extends Kohn's biosemiotic universe into a fully material one not limited to life, in which matter and meaning co-constitute each other. She calls into question familiar dualisms – such as nature/culture or subject/object – by emphasising that reality is not composed of independent entities, but emerges through what she calls *intra-actions*.

She writes that “[...] in contrast to the usual ‘interaction,’ which assumes that there are separate individual agencies that precede their interaction, the notion of intra-action recognizes that distinct agencies do not precede, but rather emerge through, their intra-action,” and emphasises that the “*notion of intra-action constitutes a radical reworking of the traditional notion of causality*.”³⁰ (italic in the original)

From this follows a far-reaching shift in perspective: how we act and judge which actions are rightful, how we understand existence – our very worldview – and how we come to know are inseparably linked. Barad names this an *ethico-onto-epistemology*: ethics, ontology, and epistemology cannot be kept apart, but are woven into the very fabric of reality.³¹

²⁸ Picht, Georg. *Der Begriff der Natur und seine Geschichte*, Einführung Carl Friedrich von Weizsäcker, [1989], 4. Aufl. 1998. Baier, K. “Nature and Natural Science as Philosophical Problems: Georg Picht and C. F. v. Weizsäcker.” Lecture notes, Winter Semester 2000/2001.

²⁹ Kohn, Eduardo. *How Forests Think: Toward an Anthropology beyond the Human*. Berkeley: University of California Press, 2013. 16.

³⁰ Barad, K. *Meeting the Universe Halfway: Quantum Physics and the Entanglement of Matter and Meaning*. Durham–London: Duke University Press, 2007, 33.

³¹ *Ibid.*, 90.

Another thinker who understood the world as constituted by relationships is the English anthropologist and cyberneticist Gregory Bateson (1904–1980). His daughter Nora Bateson portrayed him in a film, titled *An Ecology of Mind*,³² from which I have selected the following perspectives which bring aesthetics into play:

Bateson posed the question of what obscures our perception to such an extent that we fail to recognise the delicate interdependencies in ecological systems that give them their integrity. Because we do not see these relations, we easily damage them. This misunderstanding we all live with can ultimately only be corrected by recognising the connections that constitute the beauty of nature. Every kind of aesthetic response is a reaction to relationships. It means looking at the patterns, the redundancies and similarities but recognising that they are always themed with variation. The combination of theme and variation immediately points to something behind it. If you give the patterns of connection room to wiggle, they perpetually self-correct.

All this points toward a transcientistic perspective.

But before turning to such perspectives and the future, I would like to invite you on a journey into the past, to the beginning of the 20th century. There we encounter a biological institute, the Biologische Versuchsanstalt (BVA), whose history offers a lesson in the entanglement of ideology, ontology, and epistemology. It demonstrates how the scientific consensus and practice of an era are shaped not only by 'mere facts,' but also by the social, political, and intellectual climate – and by the worldview that accompanies them.

³² *An Ecology of Mind* is a film portrait of Gregory Bateson, anthropologist, philosopher, author, naturalist, systems theorist, and filmmaker, produced and directed by his daughter, Nora Bateson.

The Biologische Versuchsanstalt

Praterbude Nr. 1: the History of a Location

We travel to the Viennese Prater, a former imperial hunting ground opened to the public by Joseph II on April 7, 1766. The opening was announced in an *Avertissement* published in the *Wienerisches Diarium* and read, in essence, as follows: His Imperial Majesty, out of gracious concern for the public, has decreed that from now on everyone, without distinction, may freely walk, ride, and drive in the Prater and the Stadtgut at all times of the year and day. This applies not only to the main avenue but also to side paths, meadows, and open spaces (with the exception of more remote areas and dense woods). People are also permitted to enjoy themselves there with games and other appropriate amusements. However, it is expected that no one will misuse this freedom or engage in improper behavior.³³

The public embraced the offer immediately and poured into the Prater. Soon afterwards, small food and amusement stalls appeared, entertaining the crowds and providing refreshments, thereby laying the foundations for what would later become the Wurstelprater amusement park.

We move forward roughly a hundred years to 1873, the year of the Vienna World Exposition. Walking along the Prater Hauptallee – a straight avenue approximately 4.4 kilometres long, running from west to east – we encounter on the right a neo-Renaissance building: Praterbude Nr. 1.³⁴ It houses a show aquarium, advertised as “Europe’s largest,” and is stormed by visitors immediately after its opening. Newspapers dub it the Viennese “fish palace.”³⁵

The promising start did not protect the enterprise from the dark clouds surrounding the World Fair. The cholera epidemic and the Black Friday at the Vienna Stock Exchange also cast their shadows on the aquarium. The following years saw changing owners and shifting concepts, as the enterprise constantly had to compete with the attractions of the amusement park while seeking a compromise between scientific education and entertainment.

Having been known as the “Aquarium” for fifteen years, the building at the Prater Hauptallee was renamed in 1888. The new name – *Vivarium* – was written in golden letters above the entrance, signaling that its concept included more than just fish. The *Vivarium* expanded and was eventually incorporated into a zoo, at times featuring questionable attractions. Ultimately, none of these models proved sustainable. In 1901, the Vienna Zoo Society went bankrupt and the Vivarium, with its four characteristic corner towers, stood empty, its future use uncertain.³⁶

In 1902, three Viennese biologists from the Jewish bourgeoisie – committed to research and financially independent – acquired the building: the 28-year-old zoologist Hans Leo Przibram, supported by his brother Karl, together with the botanists Wilhelm Figdor and Leopold von Portheim. They transformed it into a research institute and named it the *Biologische Versuchsanstalt* (BVA).

By the time the institute opened in 1903, the building had already lived through a turbulent history.

³³ *Avertissement*. In: *Wiener Zeitung*, 9. April 1766, S. 8 (online bei [ANNO](https://de-academic.com/dic.nsf/dewiki/173403)).

³⁴ <https://de-academic.com/dic.nsf/dewiki/173403>

³⁵ Taschwer, K. “From the Aquarium to the Zoo to the Lab: Preludes to the Biologische Versuchsanstalt in the Viennese Wurstelprater.” In *Vivarium: Experimental, Quantitative, and Theoretical Biology at Vienna's Biologische Versuchsanstalt*, edited by G. B. Müller, 38. Cambridge, MA: MIT Press, 2017. <https://doi.org/10.2307/j.ctt1w0db5x>.

³⁶ *Ibid.*, 41 ff.

The social and cultural conditions at the turn of the century

We are in the year 1903. Walking along the Prater Hauptallee, we again encounter the neo-Renaissance building. Turning around, we see the Vienna Giant Ferris Wheel, which was not present during our first visit in 1873 – it was constructed in 1897. The former *Vivarium* is now equipped with state-of-the-art facilities for experimental biological research. The three young biologists who had purchased the building transformed it into a modern research institute. In what kind of milieu did the motivation for such a project arise?

We find ourselves in an environment that provides fertile ground for significant developments in art and science: the Secession movement, the foundations of psychology and psychoanalysis, major achievements in physics and mathematics, the philosophy of the Vienna Circle, and much more. Extensive social interactions, such as those taking place in the influential ‘salons’ of the Viennese haute bourgeoisie, promote the mutual exchange of ideas. Karl Lueger (1844–1910) serves as mayor of Vienna. He is credited with transforming Vienna into a modern city, but is also criticised for his populist and antisemitic policies.

The end of the 19th century is marked, both in Europe and the United States, by an impressive boom in science and technology, driven by the development and application of experimental methods across many disciplines.³⁷ Eduard Suess, president of the Academy of Sciences in Vienna, remarked on the impact of the natural sciences in this period: they have “penetrated every area of human life and work; they influence and change our social relations, our philosophical views, economic policy, the power of the states, everything.”³⁸

How much more true is this today?

General Biology

At the turn of the 20th century, alongside these developments, the idea of “general biology” began to take shape. Fields such as zoology, botany, anatomy, and physiology already existed; however, they were typically studied as separate domains without a unifying framework. The shared characteristics of living organisms called for a broader theoretical and philosophical perspective. General biology emerged in response to this need, aiming to provide guiding principles for research and teaching.³⁹

Its development was influenced both by efforts to establish biology as an autonomous discipline and by debates in theoretical biology, as well as discussions surrounding medical education and preclinical training. In German-speaking countries in particular, general biology was also linked to attempts to reach audiences beyond the scientific community.⁴⁰

Key debates defining the field took place during the academic year 1901/02, when the Philosophical Society at the University of Vienna hosted a lecture series addressing what was widely described as the “crisis of Darwinism.” Central to these debate were questions about the adequacy of Darwin’s theory of natural selection, particularly in relation to neo-Lamarckian ideas suggesting that acquired characteristics could be inherited and that organisms actively adapt to environmental conditions.⁴¹

³⁷ Taschwer, Klaus. “From the Aquarium to the Zoo to the Lab: Preludes to the Biologische Versuchsanstalt in the Viennese Wurstelprater.” In *Vivarium: Experimental, Quantitative, and Theoretical Biology at Vienna’s Biologische Versuchsanstalt*, edited by G. B. Müller, 44. Cambridge, MA: MIT Press, 2017. <https://doi.org/10.2307/j.ctt1w0db5x>.

³⁸ Suess, Eduard. *Erinnerungen*. 1916. iv. Cited in Taschwer, “From the Aquarium to the Zoo to the Lab,” 44.

³⁹ Laubichler, Manfred D. “Emergence of Theoretical and General Biology: The Broader Scientific Context for the Biologische Versuchsanstalt.” In *Vivarium: Experimental, Quantitative, and Theoretical Biology at Vienna’s Biologische Versuchsanstalt*, edited by G. B. Müller, 95. Cambridge, MA: MIT Press, 2017.

⁴⁰ *Ibid.*, 106.

⁴¹ Barr, Z. 2021. *Wissen, um zu leben: Popularization as Epistemic Practice in Austrian Natural Science, 1865–1916*. PhD diss., University of Chicago, 13; Taschwer, “From the Aquarium to the Zoo to the Lab,” 47.

In *On the Origin of Species* (1859), Charles Darwin introduced the theory of evolution driven primarily by natural selection. Herbert Spencer later popularised the idea as “the survival of the fittest,” although Darwin himself did not initially use that phrase. Several decades earlier, Jean-Baptiste Lamarck had proposed a different principle: that organisms could pass on characteristics acquired during their lifetimes to their offspring.

The following passage from Lamarck's *Philosophie zoologique* illustrates this idea:

“Regular use of an organ encourages its development, strengthens it and even extends it, while prolonged underuse impairs its development, destroys it, gradually reduces its size and ultimately – if this lack of use persists over a long period of time – causes it to disappear in subsequent generations. One can thus imagine that a change in circumstances would force individuals of an animal species to change their habits. The less-used organs would gradually atrophy, while the more-used organs would develop better and attain a strength and size proportional to the use that these individuals usually make of them.”⁴²

Lamarck thus argued that the effects of use and disuse of organs could themselves be inherited.

The motivation for founding the BVA

To understand the motivations behind the establishment of the BVA and its pioneering role in experimental biology, it is helpful to recall the paradigm shift in biology around 1900. Science was moving away from primarily descriptive and comparative approaches and increasingly focused on causal explanations – in biology especially with regard to evolution, development, and inheritance. Only through experimentation could the underlying causes of observed phenomena be uncovered.⁴³

The scientific programme of the institute's founders followed an approach advocated in the 1890s by the German embryologist Wilhelm Roux (1850–1924). Roux termed this approach *Entwicklungsmechanik* (developmental mechanics) and defined it as the “Lehre von den Ursachen der organischen Gestaltungen” – the study of the causes of the formation of organic forms.⁴⁴ *Entwicklungsmechanik* aimed to identify the factors and mechanisms regulating the development of organisms. Roux is credited with providing a decisive impulse for the founders of the BVA to pursue this field systematically.⁴⁵

⁴² Lamarck de, Jean-Baptiste. *Philosophie zoologique, ou Exposition des considérations relatives à l'histoire naturelle des animaux*. 2 vols. Paris: Dentu, 1809. 1:v–vi. <https://www.digitale-sammlungen.de/de/view/bsb10928650?page=14,15>.

Translation by the author.

⁴³ Laubichler, *Emergence of Theoretical and General Biology*, 104.

⁴⁴ Roux, W. G. “Einleitung.” *Archiv für Entwicklungsmechanik der Organismen*, 1. Leipzig: Wilhelm Engelmann, 1894. <https://repositorium.meduniwien.ac.at/obvumwoa/download/pdf/11552016>.

⁴⁵ Müller, G. B. “Substance of Form: Hans Przibram's Quest for Biological Experiment, Quantification, and Theory.” In *Vivarium: Experimental, Quantitative, and Theoretical Biology at Vienna's Biologische Versuchsanstalt*, edited by G. B. Müller, 138. Cambridge, MA: MIT Press, 2017. <https://doi.org/10.2307/j.ctt1w0db5x>.

As biology shifted from description and classification toward experimentation and quantification, theory, measurement, and mathematical analysis were to guide the work of the BVA. The aim was to place biology on a solid theoretical, methodological, and empirical foundation, comparable to that of physics and chemistry.

This required an institution specifically devoted to experimental biology, equipped with the infrastructure necessary to address fundamental questions. Universities at the time could provide neither the organisational framework nor the technical facilities for such work.⁴⁶

The BVA's pioneering role

Beyond questions of development and growth, researchers at the BVA sought to understand how environmental parameters influence organismal processes, in line with the institute's broader interest in the mechanisms of evolution. The entire facility was equipped to control and manipulate environmental conditions such as temperature and humidity, as well as electrical and magnetic influences, mechanical factors, and gravity, several of which were regulated by automated devices.⁴⁷

The BVA was the first biological research station to create artificial environments for species under investigation on this scale. It hosted an extensive range of species. In 1908, Paul Kammerer, a zoological assistant at the BVA and a gifted terrarian, listed a total of 738 species from all classes of animals kept at the institute; a diversity that was, and remains, unique for an institute of experimental biology.⁴⁸ Kammerer was one of the most prominent figures associated with the BVA. His expertise in animal care played a crucial role in developing methods for maintaining organisms over extended periods.⁴⁹

Hans Leo Przibram, one of the founders of the BVA and its driving force, emphasised the importance of successful animal husbandry in a 1908/09 report.⁵⁰ He contrasted earlier biological research – largely focused on description and anatomical comparison – with the institute's experimental orientation and argued that, while experimentation in biology required appropriate technical means, its success did not primarily depend on complex apparatus. Rather, it relied on the development of practical skills in maintaining living organisms, a basic prerequisite for successful biological experimentation.⁵¹

Przibram envisaged the BVA as an institution not only devoted to experimental biology but also committed to overcoming disciplinary boundaries. He was convinced that similar patterns existed in animals and plants and that these patterns had to be discovered through experimental investigation.⁵² Accordingly, the BVA brought together biological research from the fields of botany, zoology, physiology, and related areas such as chemistry under one roof and equipped them with state-of-the-art facilities and instruments.⁵³

⁴⁶ Reiter, W. L. "Zerstört und vergessen: Die Biologische Versuchsanstalt und ihre Wissenschaftler/innen." *Österreichische Zeitschrift für Geschichtswissenschaften* 10, no. 4 (1999): 585–614, 592. <https://doi.org/10.25365/oezg-1999-10-4-7>.

⁴⁷ Müller, "Substance of Form," 144.

⁴⁸ Taschwer, K. "From the Aquarium to the Zoo to the Lab: Preludes to the Biologische Versuchsanstalt in the Viennese Wurstelprater." In *Vivarium: Experimental, Quantitative, and Theoretical Biology at Vienna's Biologische Versuchsanstalt*, edited by G. B. Müller, 37. Cambridge, MA: MIT Press, 2017. <https://doi.org/10.2307/j.ctt1w0db5x>.

⁴⁹ Taschwer, Klaus. "Experimentalbiologie im Prater. Zur Geschichte der Biologischen Versuchsanstalt 1902 bis 1945." Ausstellung in der Aula der ÖAW, 2015.

⁵⁰ Przibram, Hans. "Die Biologische Versuchsanstalt in Wien. Zweck, Einrichtung und Tätigkeit während der ersten fünf Jahre ihres Bestandes (1902–1907). Bericht der zoologischen, botanischen und physikalisch-chemischen Abteilung." *Zeitschrift für biologische Technik und Methodik* 1 (1908/09): 234–64, 235.

⁵¹ Ibid.

⁵² Nickelsen, Kärin. "Growth, Development, and Regeneration: Plant Biology in Vienna around 1900." In *Vivarium: Experimental, Quantitative, and Theoretical Biology at Vienna's Biologische Versuchsanstalt*, edited by G. B. Müller, 171. Cambridge, MA: MIT Press, 2017. <https://doi.org/10.2307/j.ctt1w0db5x>.

⁵³ Taschwer, "From the Aquarium to the Zoo to the Lab," 38.

This interdisciplinary approach and novel research direction demanded not only architectural and technical adaptations of the building and the construction of animal facilities, but also the invention of new instruments, methods, and protocols. The experience gained was shared through numerous publications and through personal exchanges with similar facilities established elsewhere. Former members, employees, and international visitors contributed to disseminating the ideas and expertise developed at the BVA to other institutions and countries.⁵⁴

A comparatively large number of women worked at the BVA. Hans Przibram is credited with actively supporting the participation of female scientists.⁵⁵ An often-cited example is Leonore Brecher, whose dissertation was supervised by Przibram and who later collaborated with him. She held no permanent position and supported herself through a small private foundation and by teaching biology courses at the Volksheim Ottakring.⁵⁶

Some of the BVA's protagonists

Leonore Brecher's research focused primarily on whether and how color changes in animals – mainly butterfly pupae – are caused by environmental influences and can be inherited. She conducted research, published her findings, and met all academic requirements for a habilitation, the qualification needed to teach at the University of Vienna. Her application was first put on hold and ultimately refused, likely influenced by anti-Semitic motives. The committee argued that she was not suited to exercising the authority required of a lecturer towards students.⁵⁷

Thanks to scholarships for research stays in Berlin, Kiel, Cambridge, and Rostock, Brecher was able to continue her research activities. In 1933, after losing her laboratory in Kiel and having her final funding application rejected, she returned to Vienna and the BVA.⁵⁸

Hans Leo Przibram's main area of expertise was regeneration. As head of the zoological department, he made regeneration the central focus of early experimental work at the institute. His doctoral thesis in 1899 already dealt with regeneration in crustaceans, and the topic remained his primary research interest throughout his career. The studies involved the removal of body appendages – limbs, wings, antennae, eyes, or even entire body parts – to determine whether and to what extent they could regenerate.⁵⁹

⁵⁴ Müller, G. B. "Biologische Versuchsanstalt: An Experiment in the Experimental Sciences." In *Vivarium: Experimental, Quantitative, and Theoretical Biology at Vienna's Biologische Versuchsanstalt*, edited by G. B. Müller, 16. Cambridge, MA: MIT Press, 2017. <https://doi.org/10.2307/j.ctt1w0db5x>; Taschwer, "Experimentalbiologie im Prater."

⁵⁵ Müller, "Biologische Versuchsanstalt," 13–14.

⁵⁶ ÖAW. "Gedenkbuch für die Opfer des Nationalsozialismus an der Österreichischen Akademie der Wissenschaften: Leonore Brecher." <https://www.oeaw.ac.at/gedenkbuch/personen/a-h/leonore-rachelle-brecher/>. 2025.

⁵⁷ Taschwer, "Experimentalbiologie im Prater."

⁵⁸ ÖAW, "Gedenkbuch ... Leonore Brecher."

⁵⁹ Müller, "Substance of Form," 140.

His preferred organism for these investigations was the praying mantis. In several articles, he described the partial or complete removal of antennae, legs, eyes, and other body parts, recording and measuring the corresponding regeneration processes.⁶⁰ Somewhat ironically, praying mantises are famed for biting off the heads of males (as they do with their normal prey).

Przibram was not only a passionate biologist but also a talented, self-taught illustrator. His drawings were so well received that he was invited to participate in the Secession's winter exhibitions in 1899/1900 and 1900/1901. His skill in drawing also served him well in the scientific context, as he contributed illustrations to numerous BVA publications.⁶¹

Another figure of the BVA with artistic leanings was Paul Kammerer, long-time assistant at the BVA and a prolific publicist. Kammerer was a music lover. He studied biology, but also spent the year 1900–1901 at the Conservatory of the Society of Music Friends in Vienna and at one point considered a career as a composer. He played the piano, wrote music reviews, and, in competition with Alban Berg, composed songs for solo voice, aiming to gain the favor of the rising young singer Helene Nahowska.⁶² He was a great admirer of Gustav Mahler and an even greater admirer of Mahler's wife, Alma.⁶³

The case of Paul Kammerer⁶⁴ will occupy us for a while, as it provides an example of how science, ideology, worldviews, and politics are intertwined.

The case of Paul Kammerer I

Kammerer pursued a specific research programme at the BVA. He aimed to find evidence that acquired characteristics could be transmitted to subsequent generations. As already mentioned, Kammerer was an exceptionally skilled animal caretaker, a prerequisite for his work. He began conducting breeding experiments on amphibians in the climate chambers set up at the institute. Amphibians, including frogs, toads, newts, and salamanders, were his major research animals.⁶⁵

By altering their environmental conditions, he reported that he succeeded in inducing the development of rudimentary eyes in blind cave olms, causing salamanders to change colour, and making toads develop nuptial pads, a trait that midwife toads – the species studied – do not normally possess. According to Kammerer's reports, all these new characteristics left their traits in the next generation.⁶⁶

One would call him today an advocate of citizen science. He was an engaged member of the Viennese aquarist club Lotus and an active proponent of public education, keen to bring biological knowledge to a broader audience.⁶⁷ Kammerer knew how to captivate audiences beyond scientific circles with inspiring lectures, which earned him considerable popularity. In his book on general biology, written at the beginning of the First World War, he argued that

⁶⁰ Przibram, H. "Aufzucht, Farbwechsel und Regeneration der Gottesanbeterinnen (Mantidae). III. Temperatur- und Vererbungsversuche." *Archiv für Entwicklungsmechanik der Organismen* (1909). https://ia800607.us.archive.org/view_archive.php?archive=/8/items/crossref-pre-1923-scholarly-works/10.1007%252Fb02161671.zip&file=10.1007%252Fb02162074.pdf#page=46.

⁶¹ Taschwer, "Experimentalbiologie im Prater."

⁶² Simms, B. R. "Paul Kammerer and Alban Berg: Rivals in Song." *Music & Letters* 98, no. 1 (2017): 104–27. <https://doi.org/10.1093/ml/gcx002>.

⁶³ Rex, Eva. "Der Fall Paul Kammerer." *Sezession* 117 (2023), <https://sezession.de/68511/der-fall-paul-kammerer>.

⁶⁴ *Der Fall Paul Kammerer* (The case of Paul Kammerer), is also the title of a book written by the journalist and author K. Taschwer who also wrote several articles about the BVA. Taschwer, Klaus. *Der Fall Paul Kammerer: Das abenteuerliche Leben des umstrittensten Biologen seiner Zeit*. Munich: Carl Hanser Verlag, 2016.

⁶⁵ Reiter, "Zerstört und vergessen," 599; Rex, "Der Fall Paul Kammerer."

⁶⁶ Klos, Sandra. "Kammerer, Paul." In *Neue Deutsche Biographie*, published 1 March 2024. <https://www.deutsche-biographie.de/gnd116036028.html#dbcontent>.

⁶⁷ Taschwer, "From the Aquarium to the Zoo to the Lab," 48–49.

scientifically interested laypeople, with their unbiased judgement and often astonishing open-mindedness, had an advantage in understanding the subject matter.⁶⁸

His research and the conclusions he drew brought him great popularity but were also the subject of vigorous controversy. The intellectual debate between supporters of Lamarck's ideas and advocates of a selection theory that ruled out the inheritance of acquired characteristics was conducted with great passion at the time.

Kammerer writes in *The Inheritance of Acquired Characteristics*, published in New York in 1924:

"The assumption of the inheritance of acquired characteristics necessitates a much more difficult process of relative thinking. It demands that we look at the living being, and the cycle of its life from the conception to ultimate development and back, in relation to the exterior world."⁶⁹

The chapter 'Where Does Evolution Stand?' concludes with:

"It is not unmerciful selection that shapes and perfects the machinery of life; not disconsolate struggle for life alone governs the world, but rather out of its own strength every creature strives upward towards light and the joy in life, burying only what is useless in the graves of selection."⁷⁰

These passages reveal not merely a prosaic researcher, but one with profound passion. His enthusiasm and public performances earned him both admiration and criticism within the scientific community. The *Österreichisches Biographisches Lexikon* states that Kammerer affirmed the inheritance of acquired characteristics for ideological reasons;⁷¹ I am tempted to say that he affirmed it for idealistic reasons.

⁶⁸Kammerer, P. 1915. *Allgemeine Biologie*. Stuttgart: Deutsche Verlags-Anstalt, xii.
https://www.academia.edu/25836881/1915a_Allgemeine_Biologie.

⁶⁹ Kammerer, P. 1924. *The Inheritance of Acquired Characteristics*. New York: Boni and Liveright, 16.

⁷⁰ Ibid., 258

⁷¹ ÖBL. "Kammerer, Paul (1880–1926)." *Österreichisches Biographisches Lexikon 1815–1950* 3 (1963): 209–10.
https://www.biographien.ac.at/oeb1/oeb1_K/Kammerer_Paul_1880_1926.xml. "Im Mittelpunkt seiner Arbeiten stand die Frage der Vererbung erworbener Eigenschaften, die K. aus weltanschaulichen Gründen bejahte."

Evolutionary theory, ideology, and politics

Debates over evolution were repeatedly entangled with broader ideological concerns, whether theological, philosophical, or political. In the 1860s, Darwin's *Origin of Species* faced strong resistance from religious authorities and defenders of traditional worldviews. For some proponents, such as the English sociologist and philosopher Herbert Spencer, evolutionary theory offered justification for laissez-faire economics and a minimal state, since unfettered competition between individuals would supposedly lead to the gradual improvement of society. Spencer summarised this idea with the term "survival of the fittest," which he introduced in *Principles of Biology* (1864).⁷²

The polymath Sir Francis Galton (1822–1911), a cousin of Charles Darwin, was also stimulated by the *Origin of Species* and began to speculate about heredity, particularly the inheritance of intelligence and talent. He introduced the term "eugenics" in his 1883 publication *Inquiries into Human Faculty and Its Development*.⁷³ Galton linked eugenics to the Greek *eugenes*, meaning "well-born" or "good in stock", a concept he applied to humans, animals, and plants alike. He defined eugenics as "the science of improving stock," encompassing, especially in the case of humans, all factors that might help "in however remote a degree to give to the more suitable races or strains of blood a better chance of prevailing speedily over the less suitable." He suggested eugenics as a concise and general term for this proposed science.⁷⁴

By the 1880s, questioning Darwin's principles was considered almost unscientific.⁷⁵ Once evolution itself gained wider acceptance, however, the controversy shifted to the mechanisms underlying evolutionary change. From around 1880 to well into the 1930s, many theories competed for recognition. The most controversial topic was the role of natural selection, which many biologists considered overestimated. During this period, later framed as "the eclipse of Darwinism," alternative concepts to natural selection were developed and explored.⁷⁶

"Mendelians contradicted the neo-Lamarckians, mutationists fought with Weismannians who were also fighting with the neo-Lamarckians, experimental embryologists opposed the classical recapitulatory theories of development, and the followers of newer disciplines, like genetics, considered the zoologists who clung to Darwinism to be antiquated naturalists rather than true scientists," summarises Mark Largent the debate, drawing on a description by evolutionary biologist Julian Huxley (1887–1975).⁷⁷

One scientist who disagreed with the idea of acquired characteristics was the German evolutionary biologist August Weismann (1834–1914), who is considered a pioneer of neo-Darwinism. Wondering how "the characteristic peculiarities of structure continued unchanged through long series of generations" and how "the individual is able to transmit its structural features to its offspring with such precision,"⁷⁸ he developed the theory of the 'Continuity of the Germ-plasm'.⁷⁹ This became a paradigm in biology known as the

⁷² R. M. Dennis. "Social Darwinism, Scientific Racism, and the Metaphysics of Race," *The Journal of Negro Education* 64, no. 3 (1996), 244.

⁷³ Galton, Francis. *Inquiries into Human Faculty and Its Development*. London: Macmillan, 1883, 24.

⁷⁴ Galton, *Inquiries into Human Faculty*, 24

⁷⁵ Hirschmüller, Albrecht. "Paul Kammerer und die Vererbung erworbener Eigenschaften," *Medizinhistorisches Journal* 26, no. 1/2 (1991): 26, <http://www.jstor.org/stable/25804032>.

⁷⁶ Largent, Mark A. "So-Called Eclipse of Darwinism." In *Descended from Darwin: Insights into the History of Evolutionary Studies, 1900–1970*, [page range]. Philadelphia: American Philosophical Society, 2009. <http://www.jstor.org/stable/25804032>.

⁷⁷ Largent, "So-Called Eclipse of Darwinism," 3–4.

⁷⁸ Weismann, A. "The Continuity of the Germ-Plasm as the Foundation of a Theory of Heredity." In *Essays upon Heredity and Kindred Biological Problems*, vol. 1, chap. 4, pt. 1 (Oxford: Clarendon Press, 1889), 165.

⁷⁹ Weismann, *The Continuity of the Germ-Plasm*, 168.

Weismann barrier: information cannot pass from somatic cells to germ cells, so acquired traits cannot be inherited. Germ cells produce somatic cells, but are not influenced by what the somatic cells experience or by abilities acquired during an individual's life.

In 1885, Weismann wrote, still carefully:

"I believe and I have shown that the hypothesis of the transmission of acquired characters—up to that time generally accepted—is, to say the least, very far from being proved, and that entire class of facts which have been interpreted under this hypothesis may be quite as well interpreted otherwise, while in many cases they must be explained differently."⁸⁰

One of his experiments involved cutting off mice's tails to show that the trait was not passed to offspring. This was in response to widespread anecdotes, such as a bull that lost its tail in an accident reportedly siring only tailless calves, or a cow with a broken horn producing offspring with drooping horns.⁸¹ By 1893, Weismann declared that the "conception of the germ-plasm as the hereditary substance in the germ cells has been fully established [...]"⁸²

And indeed, three decades later Paul Kammerer observed that "the most widely read of the present-day textbooks dealing with the Science of Inheritance [...] more or less strongly oppose the theory of the Inheritance of Acquired Characteristics," noting the same trend at the conferences of the German Society for Genetics in Vienna in 1922 and Munich in 1923. For Kammerer, the shift was not purely scientific; he also saw it as reflecting the political zeitgeist.⁸³

It seems that the development of evolutionary theory oscillates between two poles. On one side we find the narrative of merciless selection and struggle, where only those with the best traits survive; on the other, a perspective that foregrounds the agency of living beings – their ability to actively engage with and respond to the outside world, and to pass something of that engagement on to the next generation.

The attribution of political or social significance to biological theories often turned the debate into a political issue. But the simple picture that social-welfare advocates were inspired by neo-Lamarckian ideas and therefore sought to improve living conditions for a better future, and social Darwinists and eugenicists moving toward racial ideology, as suggested by Rex,⁸⁴ does not fully capture the complexity of the perspectives.

Positions that combined humanism and eugenics were not uncommon in social democratic circles. At the beginning of the 20th century, socialists on both sides of the English Channel were interested in eugenics, the science of good heredity, and its German counterpart, *Rassenhygiene*.⁸⁵

Otto Neurath, for example, one of the most important figures in the social democratic education and social policy of Red Vienna, translated, together with his first wife Anna Schapire-Neurath, Galton's book *Hereditary Genius*, German: *Genie und Vererbung*.⁸⁶ In the introduction, the Neuraths express their sympathy with Galton's idea of improving the race. They write that anyone who tries to foresee the future with an open mind will see that the

⁸⁰ Weismann, *The Continuity of the Germ-Plasm*, 168, 169.

⁸¹ Kammerer, Paul. *The Inheritance of Acquired Characteristics* (New York: Boni & Liveright, 1924), 15, <https://archive.org/details/inheritanceofacq0000paul/page/14>.

⁸² Weismann, A. *The Germ-Plasm: A Theory of Heredity*. New York: Charles Scribner's Sons, 1893, 37.

⁸³ Kammerer, *Inheritance of Acquired Characteristics*, 13, 14.

⁸⁴ Rex, "Der Fall Paul Kammerer"

⁸⁵ Lulay, Britta. *Eugenik und Sozialismus: Biowissenschaftliche Diskurse in den sozialistischen Bewegungen Deutschlands und Großbritanniens um 1900*. Stuttgart: Franz Steiner Verlag, 2021, 10-12, https://api.pageplace.de/preview/DT0400.9783515130431_A42230365/preview-9783515130431_A42230365.pdf.

⁸⁶ Galton, F. 1892. *Hereditary Genius: An Inquiry into Its Laws and Consequences*. London: Macmillan.

greatest problems increasingly concerning humanity are the improvement of the social order and the improvement of our race. They credit Galton and his eugenics with having decisively initiated the movement for the systematic improvement of the race.⁸⁷

“Wer mit offenem Auge die Entwicklung der Zukunft vorzuschauen versucht, sieht als die größten Probleme, welche die Menschheit in immer stärkerer Weise bewegen werden, die Verbesserung der sozialen Ordnung und die Verbesserung unserer Rasse, zwei Ziele, die eng miteinander zusammenhängen. Der Ruhm aber, in entscheidendem Maße die Bewegung für die systematische Verbesserung der Rasse in unserem Zeitalter eingeleitet zu haben, gebührt Francis Galton und seiner Eugenik.”⁸⁸

Another example is Julius Tandler, who was City Councillor for Health and Welfare in Red Vienna from 1919-34, a period during which the Social Democratic Workers' Party of Austria (SDAP) was in power in Vienna. As a proponent of neo-Lamarckism, he reorganised Vienna's social welfare system accordingly.⁸⁹ The establishment of maternity homes, kindergartens, after-school care centres, youth welfare offices, dental clinics, counselling centres for motherhood and marriage, and the promotion of Vienna's gardens were his means of achieving a better society. But despite his belief in the effect of improving environmental conditions, he partially adopted ideas from eugenics and human economics. In a 1923 lecture published in 1924, he discussed the costs incurred by the state in caring for the poor, the elderly, and the mentally ill – expenses that states must bear for lives that are completely unworthy of living – and concluded that, despite ethical and humanitarian obstacles, there is a slowly growing recognition in public perception that lives of no value are to be sacrificed in order to preserve those worth living.⁹⁰

One should note that at the beginning of his text, he stated that the conviction that every human being has the right to a dignified existence is becoming increasingly accepted in public opinion. Consequently, the eugenic measures he initiated were limited to public education and the areas of marriage counselling and family planning, though the latter also earned him criticism from those affected.

Tandler was inspired by the sociologist Rudolf Goldscheid, a private scholar known for his theory of human economy (German: *Menschenökonomie*). Goldscheid drew analogies from the production of goods to the production of humans - both can be optimised - and introduced the theory of human economy in his book *Höherentwicklung und Menschenökonomie*.⁹¹ As Goldscheid was also a neo-Lamarckist, he saw the main means to improve the human condition as the improvement of individual and collective living conditions. Social Darwinism in the sense of National Socialists' biopolitics he regarded as economically useless, as the suppressed are not eradicated but prepare the soil for new miseries.⁹²

Around 1930, German eugenicists who were connected to – or members of – the NSDAP significantly escalated the racist aspects of eugenics, developing their own racial doctrine

⁸⁷ Neurath, Otto, and Anna Schapire-Neurath. “Introduction.” In *Genie und Vererbung*, by Francis Galton, vi–vii. Leipzig: Klinkhardt, 1910.

⁸⁸ Ibid.

⁸⁹ Sieder, Reinhard. *Biopolitik und Alltagsleben im Roten Wien: Experimentierfelder der Hohen Moderne*. Bielefeld: transcript Verlag, 2025, 61, <https://doi.org/10.1515/9783839410875>.

⁹⁰ Tandler, Julius. “Ehe und Bevölkerungspolitik.” *Wiener Medizinische Wochenschrift*, no. 6 (1924): 305-6, <https://anno.onb.ac.at/cgi-content/anno-plus?aid=wmw&datum=1924&page=162>.

⁹¹ Goldscheid, Rudolf. *Höherentwicklung und Menschenökonomie*. Leipzig : Werner Klinkhardt, 1911, 568.

⁹² Goldscheid, *Höherentwicklung und Menschenökonomie*, 576.

and combining it with anti-Semitic and anti-Slavic racial policies.⁹³ All the while, *Red Vienna* was increasingly being contested by the Heimwehr and other paramilitary political associations and came to an abrupt end during the February riots of 1934.⁹⁴

Tandler's career in Vienna also ended in 1934. After his dismissal, he went to China and the Soviet Union as a health advisor, where he consulted on the establishment of a welfare system in Moscow based on the Viennese model.⁹⁵

The case of Paul Kammerer II

During the First World War, maintaining the infrastructure necessary for animal care became a major challenge; many of Kammerer's protégés lost their lives. Like Leonore Brecher, Kammerer was denied the title of associate professor, making a university career unattainable. The reason given was his recently published work *Das Gesetz der Serie* (The Law of Series). In it, Kammerer collects coincidences in the literal sense and suspects a seriality in them – a speculation whose scientific validity was considered questionable and therefore called Kammerer's academic suitability into question. However, it can be assumed that the committee members had other reasons for rejecting his professorship. Anti-Semitic resentment and his pacifist and socialist views most likely played a role.⁹⁶

In 1923 Kammerer quit the BVA and travelled to the US and UK to continue lecturing and writing. His visit to Britain was also linked to hopes of resolving a controversy between him and the leading Cambridge geneticist William Bateson.⁹⁷ Bateson had visited the BVA and Paul Kammerer in 1910 and developed doubts about Kammerer's credibility.⁹⁸

Kammerer brought with him, as proof of an inherited acquired trait, a preserved specimen of a midwife toad (*Alytes obstetricans*) that had survived the turbulence of war. It was a specimen remaining from experiments in which he had forced the toads to change their habits by making the terrestrial environment inhospitable for them. The species, which normally mated on land, was forced to mate in water. As one of the consequences, males of future generations developed nuptial pads – rough, blackish swellings that help males grip the slippery backs of females when mating in water.⁹⁹

None of the renowned biologists who examined Kammerer's specimen noticed anything suspicious, and his lectures at Cambridge and to the Linnean Society were well received,¹⁰⁰ although Bateson remained sceptical.¹⁰¹ However, when Gladwyn Kingsley Noble (1894–1940) from the American Museum of Natural History visited Vienna in early 1926 to examine the specimen, he found no nuptial pads, only blackened areas caused by the injection of ink. Despite the support of the institute director Hans Przibram, the existence of alternative explanations for the forgery that would convey Kammerer's innocence, and a future prospect – namely an open invitation from Moscow to found an experimental institute there – Kammerer shot himself about six months after Noble's visit.¹⁰²

⁹³ Sieder, *Biopolitik und Alltagsleben im Roten Wien*, 55, 56

⁹⁴ https://www.geschichtewiki.wien.gv.at/Rotes_Wien#Politische_Auseinandersetzung.

⁹⁵ Sieder, *Biopolitik und Alltagsleben im Roten Wien*, 63

⁹⁶ Klos, "Kammerer, Paul"; Taschwer, "Biologische Versuchsanstalt"; Reiter, "Zerstört und vergessen," 592, 600.

⁹⁷ William Bateson is the father of Gregory Bateson of whom we heard in "Relational ways of understanding the world"

⁹⁸ Oxford Reference. "Paul Kammerer." In *A Dictionary of Scientists*. Oxford: Oxford University Press, 2025.

<https://www.oxfordreference.com/display/10.1093/oi/authority.20110803100029369>

⁹⁹ "Paul Kammerer's Experiments on the Midwife Toad (1905–1910)." *Embryo Project Encyclopedia*. Arizona State University. <https://embryo.asu.edu/pages/paul-kammerers-experiments-midwife-toad-1905-1910>.

¹⁰⁰ Oxford Reference, "Paul Kammerer."

¹⁰¹ Reiter, Walter L. "Zerstört und vergessen," 601.

¹⁰² Taschwer, Klaus. "Experimentalbiologie im Prater."

The downfall of the BVA

“Here stood the Institute for Experimental Biology (Vivarium), one of the world’s first research facilities for experimental biology. Established in 1902 and financed by Hans Przibram (1874–1944), Leopold von Portheim (1869–1947) and Wilhelm Figdor (1866–1938), it was donated to the Academy of Sciences in 1914. Its directors Przibram and Portheim were persecuted on ‚racial‘ grounds after the ‚Anschluss‘ with Nazi Germany in 1938. Hans Przibram died in the Theresienstadt concentration camp.”¹⁰³

This is written on a memorial plaque attached to a fence at Prater Hauptallee. Behind it: a low-rise building surrounded by a fenced bicycle training ground for children.

To ensure the BVA’s continued existence, the three founders had donated their exceptional institution to the Academy of Sciences in 1914. The donation was accompanied by additional capital of 300,000 crowns – a sum equivalent to over two million euros today – intended to fund the institute’s scientific operations and serve as reserve capital for renovations or new buildings.¹⁰⁴

Their generosity and commitment were poorly rewarded. The already mentioned antisemitism, spreading after 1918, manifested itself in dwindling support and ultimately led to the founders being expelled from the institution they had established. Immediately after the "Anschluss" (annexation of Austria by Nazi Germany) in spring 1938 the locks were changed overnight to prevent the "racially" undesirable scientists from entering their institution.

In April 1938, the new president of the Academy, Heinrich Ritter von Srbik, and Professor Fritz Knoll, chairman of the board of trustees of the BVA, wrote a document stating that the Biological Research Institute will be closed for 14 days for urgent cleaning work and will reopen for those employees who have applied for and received an access permit.¹⁰⁵ All Jewish employees (15 out of 22) were dismissed, and the institution's assets were "Aryanized." This was the end of serious research activities at the BVA. As the memory plaque says: Przibram died in Theresienstadt concentration camp, as did his wife Elisabeth; Leonore Brecher died in 1942 in Auschwitz.¹⁰⁶

The building was destroyed in the Prater fire during the final days of the war in 1945 and was never rebuilt.¹⁰⁷ Today, the site accommodates a bicycle training area for children. The memorial plaque with the inscription quoted above is attached to the fence surrounding the site.

It was dedicated on 12 June 2015 during a commemorative event of the ÖAW, 70 years after the end of the Second World War, in memory of all those who fell victim to Nazi terror. Due to its high number of victims (seven of the approximately 30 employees lost their lives in concentration camps), the BVA was at the centre of the commemoration. An exhibition titled *Experimental Biology in the Prater: On the History of the Biological Research Institute 1902–1945* gave an impression of the BVA's research, and the lives and fates of its

¹⁰³ Inscription on BVA memorial plaque, Prater Hauptallee, Vienna.

¹⁰⁴ Reiter, W. L. "Mäzenatentum und Institutsgründungen: das Institut für Radiumforschung und die Biologische Versuchsanstalt – innovative Grundlagenforschung außerhalb der Universitäten." In *Organisationsformen der Erkenntnisgewinnung*, ed. R. Pichler and T. Heinze. Wiesbaden: Springer VS, 2024. https://doi.org/10.1007/978-3-658-44331-3_7.

¹⁰⁵ Reiter, Walter L. "Zerstört und vergessen," 601.

¹⁰⁶ Wien Geschichte Wiki. "Vivarium." 2026. <https://www.geschichtewiki.wien.gv.at/Vivarium>.

¹⁰⁷ Wien Geschichte Wiki, "Vivarium."

scientists. The ÖAW sees the commemoration of the Biological Research Institute as one of the milestones in the process of coming to terms with its own role during the Nazi era.¹⁰⁸

After the exhibition opening, Eva Jablonka, evolutionary theorist, geneticist, and professor at Tel Aviv University, gave a keynote speech titled "Back to the Vivarium: Plasticity and Inheritance Then and Now," highlighting the BVA research's current relevance.¹⁰⁹

Which brings us to the now.

The biological debate today

Developments of evolutionary theory

Eva Jablonka is part of an interdisciplinary group that developed a modified theory of evolution known as the Extended Evolutionary Synthesis (EES). In a 2014 *Nature* article "Does evolutionary theory need a rethink?", proponents of this approach are directly contrasted with their critics.¹¹⁰

EES maintains in essence that evolution is not driven by genes alone, but by dynamic interactions between organisms, development, and environments and that these processes must be incorporated into the framework of evolutionary theory. Critics, however, contend that the phenomena that proponents of EES describe as key evolutionary processes "are already firmly established in evolutionary biology," and offer no new insights.¹¹¹

The theory of evolution has developed further and integrated many findings of advanced biology in its framework, since Paul Kammerer reported that the inheritance of acquired characteristics was being rejected in textbooks and at conferences; however, this rejection has persisted. From around 1930 onward, the development of evolutionary theory is commonly described as a series of overlapping phases, beginning with the emergence of the Modern Synthesis (MS). MS integrated Darwinian natural selection with Mendelian and population genetics and firmly rejected the inheritance of acquired characteristics. Within its framework, evolution is understood as changes in gene frequencies within populations, driven by mutation, selection, genetic drift, migration, and chance – processes that can be mathematically modelled.¹¹²

When the double-helix structure of DNA was uncovered in 1953, it provided a molecular explanation for heredity and variation, strengthened the MS, and contributed to a shift toward a more gene-centred and mechanistic understanding of biological processes.¹¹³ At its core, the Modern Synthesis has remained central to evolutionary biology for nearly a century and has been described by Huneman and Walsh as "one of the best corroborated theories ever devised."¹¹⁴ Yet today, it is increasingly challenged by new concepts and findings.

Also, the most recent forms of the MS are seen by Laland et al. as largely retaining the same core assumption: "random genetic variation [...] winnowed through different environmental sieves"¹¹⁵ is the process by which organisms evolve and adapt to their environments. The proponents of EES, argue that, within this framework, the environment appears merely as a

¹⁰⁸ ÖAW. "Gegen das Vergessen." 2015. <https://www.oeaw.ac.at/detail/news/gegen-das-vergessen/>.

¹⁰⁹ ÖAW. "Den Pionieren der experimentellen Biologie zu Ehren." 2015.

<https://www.oeaw.ac.at/detail/veranstaltung/den-pionieren-der-experimentellen-biologie-zu-ehren>.

¹¹⁰ Laland, K. et al. "Does Evolutionary Theory Need a Rethink?" *Nature* 514 (2014): 161–64.

¹¹¹ Wray, Gregory A., Hopi E. Hoekstra and colleagues. In Laland et al., "Does Evolutionary Theory Need a Rethink?"

¹¹² Plutynski, "Modern Synthesis." *Routledge Encyclopedia of Philosophy*, 2009. <https://philsci-archive.pitt.edu/15335/>; Laland et al., "Does Evolutionary Theory Need a Rethink?"

¹¹³ Wray, Gregory A., Hopi E. Hoekstra and colleagues. In Laland et al., "Does Evolutionary Theory Need a Rethink?"

¹¹⁴ Huneman, Philippe, and Denis M. Walsh. *Challenging the Modern Synthesis: Adaptation, Development, and Inheritance*. Oxford: Oxford University Press, 2017

¹¹⁵ Laland. "Does Evolutionary Theory Need a Rethink?"

'background condition' that selects, but with which no real interaction takes place. They note that the evidence supporting their position is becoming increasingly compelling and that evolutionary biology needs to be revised to incorporate these findings.¹¹⁶

Gerd Müller summarises the difference between Modern Synthesis (MS) and Extended Evolutionary Synthesis (ESS) as follows:

"Whereas the MS theory and its various amendments concentrate on genetic and adaptive variation in populations, the extended framework emphasizes the role of constructive processes, ecological interactions and systems dynamics in the evolution of organismal complexity as well as its social and cultural conditions."¹¹⁷

According to him the resulting theoretical frameworks differ from each other in their core logic and predictive capacities.

Veigl et al. note that it is no coincidence that the call for a revision of evolutionary theory emerged after the completion of the Human Genome Project (HGP). This 13 years lasting mega project has tied up substantial research funding and resources that were not available to other approaches, which consequently could not be pursued to the same extent. But HGP had not delivered the expected simple explanations for health and disease, which led to a certain disillusionment with genetic research,¹¹⁸ and an openness to other approaches.

Veigl and colleagues are Science and Technology Studies (STS) researchers. They explored the EES as a scientific-intellectual movement (SIM) – a term describing "dissenting groups within science that seek to change the status quo in a field and to redistribute power, recognition, and resources."¹¹⁹ The STS researchers investigated the development, narratives and communication strategies of the EES proponents, arguing that ESS, as a scientific-intellectual movement, is "an important topic of study for STS researchers in the current political moment."¹²⁰

One reason the authors claim its importance is that from the very beginning, evolutionary theory was intertwined with religion, philosophy, society, culture, and economics. Darwin's theory was inspired by economist Thomas Malthus's ideas, and *On the Origin of Species* in turn inspired Herbert Spencer's concept of "survival of the fittest." As a discipline that has set out to explain how life came into being and developed to its diversity including the origin of man, it challenged religion and power distribution and influenced philosophy and schools of thought in society and economics and therefore has also been the subject of heated debate.¹²¹

We have learned something about those debates and consequences in the example of the Biological Research Institute and its era. In today's "post-truth" climate, the authors argue, science and politics are entangled in new and more fragile ways: debates about scientifically supported ideas, such as the ESS, are framed as "post-truth" or politically motivated, a rhetoric suited to shut down critical discussion, silence certain voices, and lump scientific controversy together with overt anti-science movements.¹²²

¹¹⁶ Laland. "Does Evolutionary Theory Need a Rethink?"

¹¹⁷ Gerd B. Müller; Why an extended evolutionary synthesis is necessary. *Interface Focus* 6 October 2017; 7 (5): 20170015. <https://doi.org/10.1098/rsfs.2017.0015>

¹¹⁸ Veigl, S. J., Z. Vasilyeva, and R. Müller. "Scientific-Intellectual Movements in the Post-Truth Age: The Case of the Extended Evolutionary Synthesis." *Social Studies of Science* 56, no. 1 (2026): 142–67.

¹¹⁹ Ibid.

¹²⁰ Ibid.

¹²¹ Ibid.

¹²² Ibid.

At the same time, they observe that scientists on both sides of the EES dispute also use political-style strategies, such as accusing opponents of being dogmatic or careerist, which further blurs the line between science and politics in contemporary scientific life. This creates, according to the authors, an atmosphere that makes it difficult to disentangle genuine scientific disagreement from questions of power, institutional authority, and who is allowed to reshape mainstream theory.¹²³

Veigl et al. describe the politicised climate but they do not map the debate onto a simple left-right spectrum or assigning EES or the standard view to a particular political camp. A look at the terminology used in the EES sphere reveals a core logic that is close to the broader relational, eco-socialist or post-humanist spectrum of thought in the humanities.

A joint meeting of the Royal Society and the British Academy in 2016, organised by EES supporters, addressed the fact that the questions of evolution are not just a scientific issue but touch on conceptual and cultural questions central to the humanities and social sciences, especially philosophy of science. The meeting was titled "New Trends in Evolutionary Biology: Biological, Philosophical and Social Science Perspectives" and aimed to encourage cross-disciplinary discussion, involving the humanities and social sciences "in order to provide further analytical perspectives and explore the social and philosophical implications."¹²⁴

The organisers state that it was difficult to invite prominent proponents of the MS to the meeting, and the reactions were accordingly. In one letter, the EES meeting was said to be 'similar to the Society allowing advocates of homeopathy to organize a meeting'; other reactions pointed to 'increasing post-truth tendencies within science'; and moderate sceptics argued there was nothing new.¹²⁵

One could assume that by challenging genetic-determinist and hyper-individualist worldviews, EES undercuts the biological justification for strongly market-driven and extreme individualistic models of society. Instead, it supports relational and ecological policies.

A biological discipline that has even more intersection with the humanities is biosemiotics. In the **GARDEN** we already heard about Eduardo Kohn's perspective that all life is semiotic and also the "'self,' at its most basic level, is a product of semiosis."¹²⁶ Biosemiotics has less visibility than the debates around ESS and mainstream evolutionary theory but its claims are even more radical. Biosemiotics considers "that *evolution is semiosis*, a process of continuous interpretation and re-interpretation of hereditary signs alongside other signs that originate in the environment or the body."¹²⁷

In August, 2025 I went to the Twenty-fifth Annual International Gathering in Biosemiotics.

¹²³ Ibid.

¹²⁴ Royal Society. "Evolutionary Biology Meeting." 2016.

<https://royalsociety.org/pastevent/?requestedPath=%2Fscience-events-and-lectures%2F2016%2F11%2Fevolutionary-biology%2F/>.

¹²⁵ Veigl et al., "Scientific-Intellectual Movements."

¹²⁶ Kohn, *How Forests Think*, 16.

¹²⁷ Sharov, A., T. Maran, and M. Tønnessen. "Comprehending the Semiosis of Evolution." *Biosemiotics* 9, no. 1 (2016): 1–6. <https://doi.org/10.1007/s12304-016-9262-7>.

Biosemiotics

life and meaning

“Biosemiotics is an interdisciplinary research agenda investigating the myriad forms of communication and signification found in and between living systems. It is thus the study of representation, meaning, sense, and the biological significance of codes and sign processes, from genetic code sequences to intercellular signaling processes to animal display behavior to human semiotic artifacts such as language and abstract symbolic thought.”¹²⁸

That is how biosemiotics is defined on the website of the International Society of Biosemiotic Studies (ISBS), which organises those annual gatherings. The philosopher Lukáš Zámečník describes biosemiotics as a “pluralistic cross-discipline,”¹²⁹ an intersection of biological sciences and the humanities. He calls it a cross-discipline as it changes the ontology – something multi- or trans-disciplines don’t necessarily do.

“Living” and “meaning” are central concepts in biosemiotics. Both terms are somewhat vague and not as concrete as quantities that the natural sciences usually measure, such as temperature, salinity, pH value, conductivity, weight, or wavelengths. Nonetheless, despite their vagueness, let's try to get a clearer picture of life and meaning.

“Life is a self-sustaining chemical system capable of Darwinian evolution.”¹³⁰

A rather dry definition for all the miracles life has to offer. What does this NASA-quoted definition actually tell us? A chemical system could be inorganic; so the deciding aspect for life must be Darwinian evolution. Is that enough to explain life?

For biosemioticians, it is semiosis – the production and interpretation of signs – that marks the line between living organisms and inanimate objects, as Kalevi Kull notes in quoting Thomas A. Sebeok.¹³¹ This capacity for sign use underlies the very phenomenon of life and is its main common characteristic. Sign production and interpretation are distinguished from mere physical or chemical interactions by their meaningfulness: unlike purely mechanical processes, communication involves the transmission of a message that goes beyond the material carrier and refers to something else.

The discipline of biosemiotics seeks to understand this meaning-making in living systems. From the perspective of semiotics, “meaning is neither a thing nor a process, but a relation.”¹³² Meaning emerges through interpretation – it is not built into the sign, but is defined by the interpretant, by the individual act of making sense of a sign. This process is never fully deterministic; interpretation is, by definition, open-ended and situated. Meaning is always contextual, part of a larger relational whole. An organ, for example, has meaning only in relation to the organism it supports; an organelle gains significance within the cell; and a species acquires its meaning in relation to the ecological community in which it lives.¹³³

Biosemioticians propose that the driver of evolution is not natural selection alone, but meaning-making and semiotic fitting. From the standpoint of semiosis, being “fit” is less important than fitting into the context. To live is to take part in ongoing conversations – perceiving and being perceived, interpreting and getting interpreted, forming alliances and

¹²⁸ International Society for Biosemiotic Studies. 2026. <https://biosemiotics.org/>.

¹²⁹ Zámečník, Lukáš. “What Is It Like to Be a Biosemiotician.” In *Approaches to Biosemiotics*, ed. Juan R. Coca et al., 12, 15. 2023. <https://doi.org/10.24197/eduva.475>.

¹³⁰ NASA. “About Life Detection.” 2025. <https://astrobiology.nasa.gov/research/life-detection/about/>.

¹³¹ Kull, Kalevi. “On the Concept of Meaning in Biology.” In *Evolution “On Purpose”: Teleonomy in Living Systems*, ed. Peter A. Corning et al., 162. Cambridge, MA: MIT Press, 2023.

¹³² Ibid.

¹³³ Ibid.

continually negotiating the shifting boundaries of conflict and cooperation with fellow creatures, rivals, predators, and others who share the same space.¹³⁴

This is definitely a different ontology than the one connected to the definition of life proposed by NASA.

the gathering

The peer-reviewed journal *Biosemiotics*, affiliated with the International Society for Biosemiotic Studies (ISBS), sees biosemiotics as a bridge between biology, philosophy, linguistics, and communication sciences.¹³⁵ The biosemiotics community is unquestionably highly diverse. The people who assembled at the gathering came from different disciplines, age groups, and intellectual approaches. I have rarely attended a scientific meeting with such a variety of characters, all sharing a common concern: the study of meaning.

Beyond those who explicitly identify as biosemioticians, participants represented fields such as philosophy of technology, systems theory and non-linear dynamics, and molecular biology, to name just a few. A selection of presentation titles gives an impression of the range of approaches and topics: *The World as a Semiotic Database: With Cassirer from Stardust via Biomolecules to ChatGPT and Beyond*; *The Symphony of (the) Living*; *Embodied Storying: Perception Nests in Ecological Relations*; *Reduced to Codes: Lost Behind the Metaphors*; *Reconsidering Ayahuasca-Induced Shamanic Visions from Ecossemiotic Perspectives*; *Herring Gulls, Vocal Semiotics, and the Emergence of Mind in Urban Ecology*; *Research Centres as Living Systems*; *Japanese Gardens and Biosemiotics: Lessons for Commercial Organizations*. This list offers only a glimpse of the diversity.

In his presentation *Japanese Gardens and Biosemiotics*, Daniel Olivier Kamp argued that the design principles of the Japanese garden act as a catalyst that dissolves subject–object dualism and creates an experience of relating. He suggested that companies should foster environments of relation by orienting themselves toward these principles of garden design.¹³⁶

Despite the diversity, there was a strong sense of community. I quickly felt at home. Even though the presentations covered a wide range of topics and approaches, I was often able to grasp the essentials, even if many of the details remained beyond my understanding.

In a previous part of this text, I reflected on relational ways of understanding the world and mentioned Nora Bateson, who made a film about her father, Gregory Bateson. She is a prominent figure at these gatherings and, together with her colleagues, introduced Warm Data practices – practices that “transform complexity science into an experiential approach of profound mutual learning and relationship building,”¹³⁷ as the Warm Data website describes.

¹³⁴ Maran, Timo, and Karel Kleisner. “Towards an Evolutionary Biosemiotics: Semiotic Selection and Semiotic Co-option.” *Biosemiotics* 3 (2010): 189–200. <https://doi.org/10.1007/s12304-010-9087-8>.

¹³⁵ *Biosemiotics*. Springer. <https://link.springer.com/journal/12304>.

¹³⁶ Kull, Kalevi, et al. *Gathering in Biosemiotics 2025 Abstract Book (Semiotic Space, Etc.). The Twenty-Fifth Annual International Gathering in Biosemiotics: Program and Abstracts*, 2025.

¹³⁷ Warm Data. “Warm Data Theory & Practice.” 2026. <https://www.warmdata.life/warmdata>.

A look at the findings

Résumé

In light of the dystopian outlooks that characterise the present, we took an excursion into futures studies. This field maintains that there is not just one future, but many possible futures – each with different degrees of probability and desirability. However, futurists do not agree on what is desirable. Their visions range from radical techno-optimism to philosophical, spiritual, mythic, and cosmological perspectives.

What is considered desirable depends to a large extent on one's worldview. I presented the Western scientific understanding of nature as a cultural perspective in which nature is conceived as an object. In reference to the philosopher of religion Georg Picht, I drew on the thesis that a natural science which treats nature as an object cannot truly understand it – and therefore cannot know how to act sustainably within it.

This led to a search for relational ontologies. Along the way, we encountered the anthropologist Eduardo Kohn, whose ontology holds that there are no pre-existing, self-contained individuals, but rather a web of living sign processes that constitute the world.

We then turned to the physicist and feminist theorist Karen Barad, in whose framework matter and meaning co-constitute each other, and conventional dualisms – such as nature/culture or subject/object – dissolve. In her view, reality is not composed of independent entities, but emerges through what she calls “intra-actions.” From this standpoint, ethics, ontology, and epistemology cannot be considered separately, but are woven into the very fabric of reality.

The reflection on worldviews ended with an encounter with the English anthropologist and cyberneticist Gregory Bateson, who asked what obscures our perception to such an extent that we fail to recognise the delicate interdependencies within ecological systems that give them their integrity. He argued that our blindness to these relationships leads us to destroy them – and that this can only change if we begin to recognise the connections that constitute the beauty of nature.

Then we traveled to the past and learned about a privately founded biological research institute, the BVA, set up in a building that was once a fish-palace. We heard about its protagonists and their research interests and methods. We have got an impression of entanglements between ideological, political, cultural and scientific forces that shape an era. The stories and history connected to the BVA have offered us lessons about science, ontologies and epistemologies, about society and politics. Lessons that shed light on the present and might help to calibrate our compass for the future.

We learned about the further developments of evolutionary theory and about the present debate between supporters of mainstream Modern Synthesis and supporters of Extended Evolutionary Synthesis. The first treats evolution as changes in gene frequencies in populations under selection, mutation, and drift, whereas for the second evolution is not only about gene-frequency change but also about how development, ecology, and behavior shape and constrain evolutionary trajectories.

Finally we arrived at biosemiotics. A cross-discipline of biological sciences and the humanities, which sees all life including evolution as semiosis. Semiosis – the production and interpretation of signs – for them, marks the line between living organisms and inanimate objects.

Here we are now. We have explored gardens, learned about fish, evolutionary theory and its debates, and – through the example of a biological research institute – seen how science is inevitably entangled with the worldviews of its time. Along the way, we found small hints and tentative claims about what ‘a garden for a fish’ might mean, together with rich material for speculation.

Therefore, I invite you to follow me as I develop my speculations and conclusions in the **EPILOGUE**.

EPILOGUE

CONTENT

18/04/2026

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18/04/2026

Slowly and unavoidably, I have to come to an end. The containers are full, and I thought it would be easy to reach a conclusion. This turned out to be an illusion. Strolling through my cultivated jungles, I discover many things I have only touched upon – or not touched at all, but wanted to touch. Not all fruits are ripe; not all vegetables are ready to be harvested. May they stay for another market day. The boat is leaving, so I have to wrap up and deliver my most important conclusions about what a garden for a fish might mean.

I propose that a garden for a fish can be read as a model, a metaphor, a memorial and honouring service, and a seed. In these final pages, I will explain what led me to these conclusions – or speculations.

Model?

The term “model” is used naturally in everyday language, but it carries a range of meanings depending on the context. Often, a model is a simplified representation of something – whether in the form of an object, diagram, or conceptual construct – that helps us identify relationships, understand how a system works, or make predictions. In model building, such as architectural mock-ups or model railways, the model is a physical miniature of something real. These scaled-down versions can be used to plan, demonstrate, or simply enjoy.

Models can serve varied purposes: they can explain, clarify, predict, provide guidance, or offer a basis for experiments to test theories and practices. Not every model is representational: a role model, for instance, is not a representation but a template for how one wishes to behave and present oneself – an example worth following, a model of ‘how to act’.

A model can be a diagram, plan, or sketch; a mock-up; a type, version, or variant of a product; an archetype or prototype; a template, blueprint, or simulation. It can be a conceptual model or paradigm; a schema, structure, configuration, or algorithm. It can be a model organism or a role model worthy of imitation.

We have heard about model organisms in scientific experimentation, studied in the expectation that insights gained can be extrapolated to other organisms. Transferring this to a garden for a fish, I conclude that lessons from cultivating a garden for a model organism should yield insights into the workings of other systems.

I see a *garden for a fish* as a system comprising garden, fish, and gardener – a model system that helps us identify relationships and not only understand but *experience* how a system works. It is also a physical miniature that stands for something more general: a miniature that demonstrates and brings joy. It is a prototype, a conceptual model, and an example worth following.

I imagine that a *garden for a fish* can be understood as a model for a transcientistic research laboratory – a laboratory guided by a gardening mindset, in which the relationships that make up reality are examined and the connections that constitute the beauty of nature are explored and made visible to others. I regard it as a model system for conditions that can be described as positively utopian, and thus as a model that offers experiences providing orientation on how to act.

Models can be composed of metaphors and analogies; they often contain symbols and can therefore be seen as symbolic constructs. A model reflects our deeper ontological and epistemological commitments.

Metaphor?

Enlightenment brought not only modern science but also the metaphor of mechanism: the idea that the world functions according to fixed laws and rules and is, in principle, entirely predictable. An all-knowing intelligence could tell the story of the universe from beginning to end; the book has already been written. Ironically, taken to its logical conclusion, such a view leaves no room for manoeuvre, since in a predetermined universe everything must happen exactly as it does.

I already asked in the **GARDEN** what would happen if we change the metaphor. Metaphors are shaped by, but also shape, our conceptual system – the model by which we try to explain and understand the world and, ultimately, act in it. Metaphors bring a host of associations. A mechanism associates functioning, repeatability, and reliability; it suggests that things can be governed and controlled. The associations that come along with “organism” are different. They point to something that organises itself, has agency, and is therefore neither entirely predictable nor controllable.

In **TIME TRAVEL** we learned that biosemioticians see the capacity of sign use as the main characteristic of living beings. Unlike mechanical processes, semiotic processes usually allow some degree of freedom – some room for interpretation or “room to wiggle”, as Gregory Bateson phrased it. A world viewed as constructed by sign processes differs from one assumed to be a mechanism.

I asked two AIs, Perplexity and ChatGPT, whether signs have meaning for them. Both replied: “Short answer: not in the way they do for you.” They went on to explain the differences. Asked for one sentence describing these, ChatGPT gave the shorter answer: “You *experience* meaning in signs, while I only *process patterns* that correspond to meaning without experiencing it.” (*italics in the original*)

Back to the metaphor: the Garden of Eden is not a metaphor; I would call it a symbol, a symbol for being in harmony with oneself, nature and with God. Being in harmony is a feeling, an experience.

You might remember Gilles Clément’s vision of a planetary garden, which the curators of Manifesta 12 saw as a relevant and appealing metaphor, and Elisabeth Weiss, who stressed the symbiotic forces within the plant kingdom that make the garden metaphorically so attractive.

I suggest it is not the garden as such that serves as a metaphor, but the activities – the things that happen in a garden, the way of gardening, and the attitude behind it. A garden expresses the gardener’s understanding of, and relationship to, nature. Accordingly, the associations a garden carries depend very much on what it means to an individual.

Before I present my ideas on the attitudes and ways of gardening that the transcientists have adopted, I would like to examine what metaphor “garden” and “fish” produce when brought together.

“Zhuangzi and Huizi were rambling on the bridge over the Hao River. Zhuangzi said, ‘Out swim the [fish], so free and easy. That’s the happiness of fish’. Huizi said, ‘You are not a fish. Whence do you know about the happiness of fish?’ Zhuangzi replied, ‘You are not me. Whence do you know that I don’t know about the happiness of fish?’ Huizi answered, ‘I am not you, so I surely don’t know about you. You are surely not a fish, so for the same reason, you don’t know about the happiness of fish’. Zhuangzi said, ‘Let’s get back to the starting point. When you said, ‘Whence do you know about the happiness of fish?’, you already knew that I knew. I know it from here, above the Hao River.”¹

If we look at fish as organisms more intimately connected to the medium in which they live than humans are, then the most important lesson we can learn from them is that the well-being of an individual depends, to a large extent, on the well-being of the world it inhabits. However different the associations connected to the garden might be, I argue that they are rarely negative. Therefore, a garden for a fish sounds like something enjoyable for the fish, if not paradisiacal. Recalling Alexander Kluge's metaphor of the soul as an underwater creature and combining it with Voltaire's *Il faut cultiver notre jardin*, we arrive at a garden that we need to cultivate for our souls to find a home in it.

I think that is a possible reading of the riddle.

Else seemed to like this idea.

Transcientists as gardeners

We understood that what it means to cultivate a garden can vary widely. Therefore, I want to share my assumptions about which elements from the different garden cultures presented in the **GARDEN** section have trickled into transcientistic culture. They are as follows:

From the Garden of Eden, the *transcientists* read the mandate to take responsibility and care for the earth as a garden. From the Persian garden, they adopted irrigation principles to establish blossoming oases in arid areas, gradually spreading across the landscape – together with sensitivity to the acoustic dimensions of water and the integration of gardens with the arts.

From the Chinese garden, they incorporated elements of Daoist philosophy into the transcientistic worldview, as well as a Chinese way of fusing garden with artistic practice. They also cultivated receptiveness to the poetics of nature and nurtured states of empathy that dissolve the boundaries between subject and object.

Similarly, the Japanese gardening approach shaped transcientistic practices aimed at reaching a state in which knowledge of what to do arises naturally. The principle of “thinking of each other” (*omoiau*) – as a relational concept – is deeply embedded in transcientistic culture, as is the transmission of knowledge through shared impressions (*kuden*). A ritualised form of tea drinking also likely forms part of their cosmos.

In some respects, the Amazonian garden comes closest to the transcientistic mindset. It supports the notion of a planetary garden and the idea that human existence should serve biodiversity rather than diminish it. A culture of negotiation – as a practice of shaping and

¹ Lee, Ting-mien. “‘Angry Fish’ and ‘Dying Fish’ Matter in <i>the Zhuangzi</i> Too: Political Analogies in the ‘Happy Fish’ Dialogue.” *Asian Philosophy*, 2024. doi:10.1080/09552367.2024.2348350.

learning – and the conception of the garden as a laboratory are inextricably linked to transcientistic knowledge culture. The view that non-human beings should be regarded as agents in their own right, who cannot simply be dominated but with whom relationships must be negotiated, is a common transcientistic perspective. For transcientists, the self is continuously reconfigured in its encounters with the environment, and semiotic perspectives play a crucial role in how they decipher and intervene in the world.

I take it for granted that transcientists see themselves as planetary gardeners: as gardeners who allow wild growth and welcome coincidences, who have developed the sensitivity to listen to the polyphony of life and gently tune into it.

Honoring the fish

Animals serve us in many ways: we eat them, love them, find them cute or fascinating, ride them, and use them as experimental animals. To use them in experiments, they must be cared for, fed, and kept in environmental conditions suited to their needs; we thereby build a relationship. There is a mutual dependency between research animals and researchers.

In a 2000 proclamation, the American Association for Laboratory Animal Science (AALAS) declared their gratitude to and respect for the laboratory animals they use, and promised to “continue to be at the forefront of improving the humane care and use of laboratory animals.”² They acknowledged their responsibility to balance “potential benefits and the ethical costs implicit in research conducted with animals.”³

It is unclear whether they proclaimed this in view of growing public criticism of animal experimentation or if they were motivated by their own moral concerns.

What is clear is that, in laboratory research, you must in most cases make the animal an object. Science demands objectivity. This can cause feelings of conflict, resolved by detachment and reducing individuals to numbers. Large fish facilities like KIT offer ready-to-go fish mutants, which you select from a catalogue and collect in a shopping cart.⁴ Furthermore, there is a tendency for caretaking and experimenting to become ever more separated.

In a publication reflecting on this conflict, the author, Susan A. Iliff proposes adding a fourth “R” to the 3Rs (Reduce, Replace, Refine) plus Remembering the Animals. She describes various rituals and lists institutions that hold annual memorial services, many in South-East Asia (e.g., the Primate Research Institute at Kyoto University and the National Institute of Toxicological Research in Seoul, Korea), but also the School of Medicine at the University of Washington and the Merck Research Laboratories in Rahway, NJ.⁵

The most remarkable service in Iliff’s list is one honouring the memory of insect “victims” of agrochemicals, held by the Society of Agricultural Chemical Industry in Tokyo, Japan.⁶

I propose that *a garden for a fish*, beside its aspects as model and metaphor, also has a memorial service function. Not only for the fish.

Remembering the future

I argue that the history of the BVA deserves more than a memorial service and a plaque. It is a story worth retelling and reflecting upon. I therefore propose an institution that takes up the

² AALAS Proclamation, quoted in Iliff, Susan A. “An Additional ‘R’: Remembering the Animals.” *ILAR Journal* 43, no. 1 (2002): 38–47. <https://doi.org/10.1093/ilar.43.1.38>.

³ Ibid.

⁴ European Zebrafish Resource Center (EZRC). “Search Fish Lines.” Karlsruhe Institute of Technology (KIT). Accessed 21 April 2026. <https://www.ezrc.kit.edu/catalog.php>.

⁵ Ibid.

⁶ Ibid.

threads cut by the Nazi regime and develops them further in a future context. I imagine it as a place where insights from the natural sciences and humanities converge and weave into an artistic tapestry. Two major figures from the BVA had artistic leanings that might have flourished in such an environment. This institution would carry key elements of the BVA into the present.

What would its main research fields and guiding questions be? What might its organisational structure look like? Who would its researchers be? How would it engage a broader public, and how would it position itself internationally? What would it be called? How would it be funded? Where would it be located? What principles would guide it?

In the following passage, I will address these questions.

TEI – Transcientistic Experimental Institute

I'll start with the name; not because it is the most important aspect, but because it simplifies the language. Instead of repeatedly referring to "the institute I imagine," I call it TEI (Transcientistic Experimental Institute). The full name is a bit heavy, but the abbreviation works well. In IPA (International Phonetic Alphabet), TEI is written as /ti: i: aɪ/ – "tee ee eye"; BVA as /bi: vi: eɪ/ – "bee vee ay".

TEI leans toward relational ways of thinking. From that follows a research approach that tries to explore and develop a sensitivity to the "delicate interdependencies in ecological systems that give them their integrity" – as Bateson has phrased it – and to make these visible to others. It is a research that focuses on how to cultivate meaningful and rewarding relationships.

As a successor to the BVA, TEI centres on biological questions. Biosemiotics, as a field in which the humanities and life sciences converge, provides an appropriate framework. One area of focus is biomimetics: learning from nature to address complex human problems. This also involves careful observation and attention to one's own perception, as emphasised by Amakasu Hiromasa in his reading of the *Sakuteiki*.

TEI has a modular and adaptable structure, able to grow and shift in response to changing interests and conditions. Its core element is a "garden for a fish," around which other projects develop. Possible areas are bioacoustics, mycology, or the study of insect-induced galls – where insects "persuade" plants to form protective structures for their larvae. Departments emerge and transform depending on the interests of researchers. TEI offers residencies and maintains connections with similar institutions. It is open to people from different backgrounds; school classes come for regular visits and project work.

TEI offers excursions and workshops, and organises screenings, performances, and theatre. Located in the Prater (though not precisely defined), it sits between natural and urban environments. It has the amusement park in its neighbourhood and offers amusement of another kind: encouraging attention to the connections that shape the complexity and beauty of living systems.

TEI is funded mainly by public grants, with a smaller proportion coming from private donations and revenue from events.

VIVARIUM is written in golden letters above the entrance. At the entrance door, a plaque reads: *Transcientistic Experimental Institute (TEI) – In memory of the Biologische Versuchsanstalt, whose scattered seeds have grown into this institute.*

If utopia is a place that does not exist, then surely (as Lao Tzu would say) the way to get there is by the way that is not a way. And in the same vein, the nature of the utopia I am trying to describe is such that if it is to come, it must exist already.

Ursula K. Le Guin. A Non-Euclidean View of California as a Cold Place to Be