



Eyecatchers
* From design to art *

Eyecatchers
* From design to art *

IGUANA
1994/1999
DESIGN PLUS
iF
Top 10
Design
Award
Winner
2000

AWAKE THE ARTIST

OXYGEN

The OXYGEN
radiator

TOP PERFORMERS

WWW.
THE RADIATOR FACTORY
.COM

DREAM A FUTURE

Eyecatchers
* From design to art *

LIVING TOMORROW
Where visions meet

jagaHybridHeating

The OXY

TOP PERFORMERS

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INNOVATE OR DIE

**THE UNIVERSAL SURVIVAL
PHILOSOPHY OF
JAN KRIEKELS**



**LANNOO
CAMPUS**



JAGA VALUE TOTEM

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- MESSAGE
OUT OF THE FUTURE -



ABOUT

JAN KRIEKELS

AN ECCENTRIC, A REBEL, A DREAMER. That is how I often get described in interviews. But that is putting it a bit simply perhaps ... although it is not entirely incorrect. The path that I have chosen to take throughout my life has been anything but straight-forward. There have been a lot of twists and turns along the way, and I have taken a few side roads too. And above all, I've gone off the beaten track many a time.

The moment I first set eyes on a map of the world is one I will remember forever. A four-year-old boy suddenly discovered that there was more to the world than the Diepenbeek market square ... that was a revelation. And I soon felt that it was an insult to our planet to ignore all those different, interesting countries out there; I could not understand those who had no desire to discover the world outside their village. The first time I heard the word 'Fiji' was a turning point: I wanted to see the world and not just hear others talking about it. This urge to explore would know no bounds, something that could have been predicted even then. Working, eating and sleeping ... that would never be enough for me. There is much more to life than that.

The two role models in my early childhood – my father and my mother – showed me you can choose from a number of different directions in life. My father was the embodiment of the hard worker's ethic. He was an ingenious engineer. Giving up was simply not a part of his vocabulary. And he wanted to pass these qualities onto me. He always set me to work; sitting still was not an option. He would be welding with my uncle in the workshop behind our house, day in, day out. They had a company that installed central heating, and later convectors: Gebroeders Kriekels ('Kriekels Brothers'). They later changed the name to Jaga, using the first two letters of their respective names: Jan and Gaston. In those early years, I would sometimes help out and I did it with enthusiasm and an entrepreneurial spirit. At the age of 11, I was already carrying out heating trials in the garage.

My mother's family provided me with quite different insights. Speech and discourse were the greatest goods according to that side of the family. I got my creativity from my mother, as well as the urge to keep looking for the ideal, to fight for the things that seemed impossible to achieve. Her brother was the polar opposite of my father in every respect. He played the guitar and would sit around musing all day, writing books and philosophising about the cosmos, the Muses and the meaning of life. This showed me that you could do things differently ... The economic and technical ideas on the one hand, the artistic and philosophical way of life on the other. These elements continued to recur in my circle of friends later in life. And in the end, it was precisely that juxtaposition which made me who I am.



Although I would go on to travel the world in my adult life, my first trip as a child was one of the most memorable. When I was four years old, I hid in my father's van before dawn. In the morning, the van set off for a construction site in Brussels. He let me help out the whole day, but when we came home late at night, the house was in uproar. My mother was furious; she had raised the alarm all over the neighbourhood. This first form of escapism was the harbinger of my rebellious youth.

During my teens, I got bored quickly. My urge to explore the world was immense. I started backpacking in my holidays. I would travel by plane to a far-flung destination and start exploring on arrival. I planned everything myself and hitch-hiked from one place to the next. I had to work for a long time to be able to buy a plane ticket, but once I had arrived at my destination, life was cheap. I didn't need luxury and comfort. I didn't sleep in hotels, but would rather lose myself in nature. I wanted to discover real life and immerse myself in new cultures.

My travelling was made all the more special by a sense of timelessness. This feeling would envelope me wherever I went. The intriguing contact with other cultures and my lack of a plan meant I completely lost all sense of time. That feeling was unique and I still cherish it. The fact that nobody really knew where I was also made my travel experiences all the more extraordinary. I often had no contact with family or friends for months on end. This further intensified the feeling of freedom.

Since my childhood, I have been driven by a wide-ranging curiosity. When the time came to start studying, I didn't limit myself to one discipline. I took psychology, engineering, anthropology, philosophy, design and economics. But I also wanted to continue discovering how different other cultures are, with my own eyes. I travelled all over the world: from Mongolia and Indonesia to South America, Mexico and the United States. The things I experienced were to determine my vision for the future.

For example, in the region around Wamema in Papua (known as Irian Jaya at the time) on the island of New Guinea, I got to know a population that explicitly identified itself with nature. I observed the people of the small villages in the Maoke Mountains and took part in their daily life and rituals. I didn't need to speak the language to communicate. I showed humility by offering food to the mothers. They divided that among the families and gave me cooked food in return. It was always a risk to make myself so dependent on them, but this created trust, which allowed me a glimpse of their traditions and customs.

One day I took a long road back to the spot where a pilot had dropped me off a few weeks earlier and would pick me up and take me back to Biak. Until then, my courage

had known no bounds, but a new feeling came over me on that road: fear. On an island where headhunters who had been expelled from the villages laid down the law, I was walking in the dark through the woods. My senses had never been so sharp. I ended up making that journey four times. It was only on the fourth day that the plane came to collect me.

I built my first house – in the United States – all thanks to a certain coincidence. I was hitch-hiking when a Jaguar suddenly pulled up. The lady behind the wheel agreed to give me a ride but along the way her car broke down. I managed to repair it and she offered me a job on the spot: to build a house. And so I built a huge villa for her – right in the middle of an earthquake region – along with 35 other people, mainly Mexican day labourers. That project taught me a lot.

At one point while travelling in South America, I had been sitting on top of a moving truck full of worn cobblestones for several hours. It was about 45 degrees Celsius and I was in a semi-trance because of the constant swaying of the truck. After four hours I turned around and was just able to duck in time as we drove under a bridge. That's when I realised that man has a kind of super-sensory basic consciousness, which only awakes in the most extreme conditions.

In Mongolia, I spent three gruelling weeks at the other extreme, in temperatures of –20 degrees Celsius. It was only then that I fully realised that heat is a vital necessity and a beautiful gift, because quality of life is simply impossible without it. You only realise that when it is no longer there. Back home after X months away, I joined the family business with a new attitude and a different perspective. I had been searching for a purpose ... and in that extreme cold, I found it.

I started working for Jaga in the beginning of the eighties – and the oil crisis. High energy prices almost spelled the end for the company and led to a turning point. In retrospect, this was the ideal time for me to start because people are more open to innovation in times of crisis. And radical innovation in all areas was just what I wanted; innovation was my driving force. I had to make products that didn't exist yet. Conservatism was – and still is – my biggest enemy; I will never repeat myself.

At Jaga, I got to know all of the departments up close, but it soon became clear that product development was my hobby-horse. My father and I started with the production of ecological heat pumps. Oil was expensive, so we decided to make heat from the ambient air. Jaga devoted ever more attention to energy efficiency and the design of less polluting products. As a result Jaga was successful, despite times of economic difficulty. The small company that had once started as Gebroeders Kriekels was now a

market leader in heat pumps. Jaga would go on to permanently replace the polluting central heating boiler.

At the end of the eighties, I began to realise that Jaga was not offering enough special products to really stand out. Our technology was excellent, but we weren't as good at design. This meant that Jaga remained a local company with increasingly narrower margins. With each day, it became harder to keep our heads above water. We needed a different approach. The decision that my father and I made was unique and daring at that time: customised products. Jaga started making heating products for specific target groups such as hospitals. We did away with the serial production of the early years and the proven methods used by our competitors. Jaga let the customers make their own choices, opted for *prosumption* and differentiation, and started selling niche products.

To me, innovation doesn't just mean developing new products. It also means international expansion. I started presenting the Jaga catalogue abroad with the help of interpreters. We went to Germany, Estonia, the former Czechoslovakia and Russia. These had been unexplored areas within our industry. At the same time I started looking for new marketing techniques and opted for *experience branding*. I wanted customers to experience our brand. We needed more emphasis on creativity and emotion, rather than promoting purely commercial factors. I didn't want to sell customers a radiator, but rather a feeling. The underlying theory was that Jaga warms your soul, as well as your house. This move to out-of-the-box thinking heralded a drastic change. Since then, the company has taken its own path, without looking at what competitors are doing. And our success has come naturally. Jaga developed the fastest, most efficient radiators in the world and won countless awards. We installed heating systems in the Federation Towers in Moscow, the residential accommodation of Russian President Vladimir Putin, the headquarters of Telefónica in Madrid and thousands of other buildings. Sales rose steadily, exports went through the roof. In 2003, Jaga was awarded the 'Export Lion' award.¹

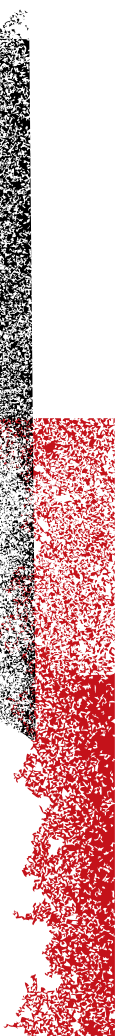
Managing a company turned out to be much easier than surviving in nature. During my world travels, I constantly had to be innovative. It was often a matter of innovate or die. I had to let go of the situation and quickly think of a solution, or I would have had it. I have taken all those memories and experiences with me along the way. They have made me the person I am today. I have been able to translate them into my work for the company, and now they constitute the very heart of the company's philosophy and of Jaga's products. The company's mission and vision include the same elements

¹ Annual prize awarded by Flanders Investment & Trade to Flemish companies.

as my personal philosophies. There is room for nature, emotions, design, spirituality, cooperation and dreams. Sometimes these different facets collide with each other, but that is always enriching. I have learned to let go too. At the point when I know something through and through, I start to learn about something new. This helps me stay young and alert, and it means that Jaga is constantly reinventing itself.

I am both a teacher and a student. The path I have taken to making my dreams come true has rendered me wiser and more fulfilled. In this book, I describe five values derived from my outlook on life, my travel experiences and my business philosophies. To me, they form the absolute basis of a better, more sustainable future.

An eccentric? A rebel? A dreamer? Maybe. But if I were able to write my introduction in interviews myself from now on, I would choose: a creative economist. Or better still: an innovator.





INNOVATE OR DIE

INNOVATION. *The word of the twenty-first century.* There has never been as much innovation going on as there is now. And there has never been as much demand for it. A bizarre paradox. So are we innovating in the most effective way?

Life on our planet is changing dramatically. Sooner rather than later, we need to look for new ways to survive. Innovation today should serve just one goal: the quest for a universal survival model. This is the only way that our future can be guaranteed.

FIVE BASIC VALUES

For me, true innovation is contained in ancient principles. I created my survival philosophy based on five key values that I gleaned from my experiences, education and business philosophies. We all know these values, but we have to dig deep in our consciousness these days to discover their origins. And yet these basic principles contain the renewal that we – and our planet – so crave. By reactivating these basic values, we are laying down a new, more sustainable path to the future. These five values are our new foundation:

VALUE 1 RESPECT NATURE
VALUE 2 AWAKE THE ARTIST
VALUE 3 DREAM A FUTURE

VALUE 4 CREATE EMOTION
VALUE 5 BUILD BRIDGES

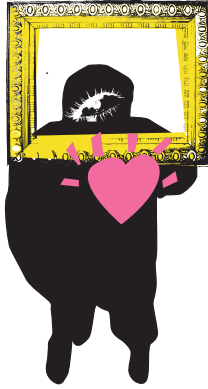
INTELLIGENCE, EMOTION AND SPIRITUALITY

The five values are based on three components, which are present in everyone: intelligence, emotion and spirituality. The first three values – *Respect Nature*, *Awake the Artist* and *Dream a Future* – are the simplest for Westerners to adopt. We mainly use the left-hand side of our brain for these – the same side as logic, reason, facts, and evidence. The other two are a throwback to the emotional and spiritual person within. To fully understand them and to realise their importance, we must appeal to the right-hand side of our brain. We have to open ourselves up to something that we may not be able to grasp immediately.

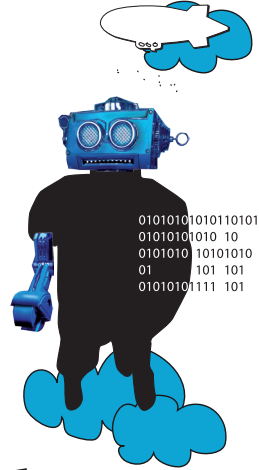
At this moment, man is being confronted with the terrible consequences of something he himself has caused. His negative impact on the planet is becoming more evident every day. Now he must prove his worth – and he can't do that just with the mathematical mind that has dominated thinking in modern times. We need more creativity, emotion and a collective dream. And above all, we need a sense of belonging that makes committed collaboration possible, so that we can realise our dream for the future.



**RESPECT
NATURE**



**AWAKE
THE ARTIST**



**DREAM
A FUTURE**



**CREATE
EMOTION**



**BUILD
BRIDGES**

FIVE ARCHETYPES

I link one archetype to each basic value, making five archetypes in total. These archetypes are present in every society and, to a certain extent, in every human being. My thinking has been inspired by the principles of the ancient tribes, because the combination of various characteristics enabled these tribes to survive. A monoculture died out. Even today, these five archetypes need to be represented in every layer of society. This means that every company needs to have them too, to really innovate. By allowing these different characters to work together openly and critically, we are laying the foundations for sustainable results and future-oriented decisions.

VALUE 1

Respect Nature – the Green Engineer
He respects nature and the circle of life.

VALUE 2

Awake the Artist – the Artist
He awakes the artist within us.

VALUE 3

Dream a Future – the Visionary
He dreams about our future and builds the sustainable path to achieving it.

VALUE 4

Create Emotion – the Motivator
He creates emotion and inspires us to cooperate.

VALUE 5

Build Bridges – the Navigator
He builds bridges between our spirits.

A SUSTAINABLE ALTERNATIVE

In this book, I present an alternative to every outmoded way of thinking and every tried and tested method. Right now, we have one foot in the old world and the other in the new. The transition is already in full flow. That's why there is both a hard and a soft copy of my book; it acts as a bridge between what we know and where we want to go.

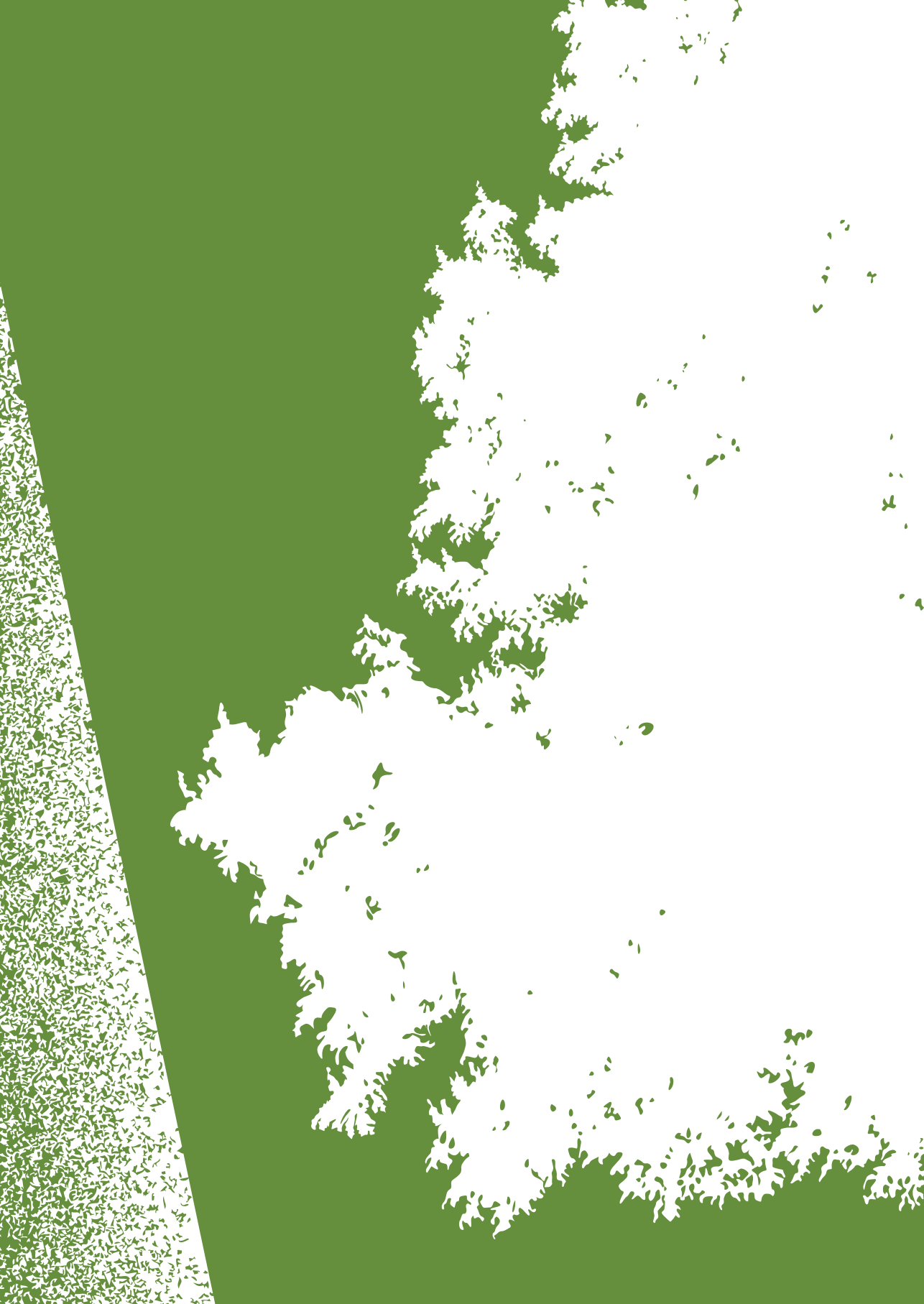
I want to use this book to contribute to a better way of living and a more sustainable way of doing business. I want to use my alternative path for each value to show that innovation is feasible. I want to show that things can be done differently – no, *have* to be done differently. We are the last generation that can still make a difference. Innovation is no longer a choice but an absolute necessity. It is up to us: innovate or die ...



VALUE 1



RESPECT
NATURE





.....

Up until now, energy consumption has always been carried out at nature's expense. Break with traditional thinking by investing in the development of innovative products that consume less energy, and therefore less fuel. Choosing the most ecologically sound and sustainable path shouldn't be a matter of choice any more: it should be automatic.

.....

THE BEATEN PATH



RESPECT
NATURE



FIRE = EVOLUTION?

The source of human civilisation as we know it is fire. Fire determined the strength of the human being. Fire is the engine of everything; fire and burning have catapulted man from zero to hero. A life without fuel is unthinkable these days ...

Nevertheless, of the four basic elements, fire has also proven to be the most devastating. Our water, our air and our earth feel its impact every day.

The question of whether fire has enabled human evolution is therefore central in this first section, because my first value – *Respect Nature* – demands respect for all four natural elements: earth, water, air and fire, and it is technology that connects them all.

Going way back in time is part of my quest for answers: to the foundations of Western civilisation. According to Greek mythology, man was given fire by Prometheus, who stole it from the gods of Olympus. It soon emerged that his gift was not all that it seemed ...

THE MYTH OF FIRE: PROMETHEUS' STOLEN GIFT

Fire was invaluable to the Greek gods. When Prometheus stole a lighted torch from Olympus, the consequences were far-reaching. Prometheus gave fire from the gods to mankind because he saw that man was unhappy. This act meant he incurred the wrath of the almighty Zeus, who punished him by chaining him up on a mountain. An eagle came every day to feast on his liver, but as Zeus made it grow back each night, the eagle would simply return the following day.

The Olympic flame The Olympic flame originated from this myth: the Romans kept the flame in the temple of Zeus burning throughout the games to keep the memory of the theft alive. The tradition of carrying the flame is still an integral part of every Olympic Games.

Fire in human hands Thanks to his act of thievery, Prometheus played a key role in the history of mankind, because humans went on to make good use of that stolen gift. Fire was the basis of a true transformation: man evolved from a low, insignificant creature to an almost divine creation. The ability to deal with fire in a responsible way meant a drastic change in human ways of living. People were able to warm themselves. They were better equipped to keep wildlife at a distance, as animals appeared to have a primal fear of fire. They could also use flames to sharpen spears, which made hunting easier. They roasted meat and were able to eat a more varied diet, which allowed them to ingest nutrients more quickly. Human health and life expectancy thus





FIRE IS EVOLUTION

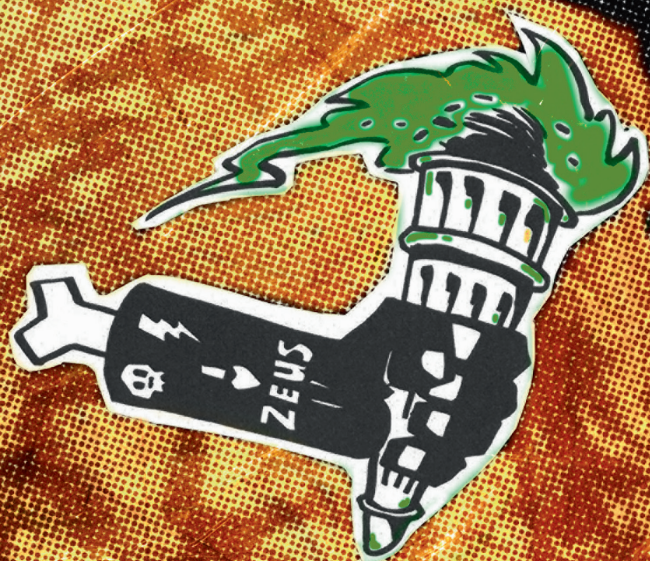
also improved significantly. Improved living conditions and more free time meant the human brain could develop.

Pandora's Box: all the sins of the world Zeus didn't just punish Prometheus for his betrayal; he also punished man. He sent Pandora to bring disaster on them. Pandora was given many good gifts by the gods: Athena gave her intelligence and talent and Aphrodite gave her the beauty of a goddess. Hermes, however, gave her the gift of speech, a deceitful nature and shameless thoughts. She also had a characteristic that was to have terrible consequences: curiosity. Zeus gave Pandora to Prometheus' brother along with a box that contained all the misfortune of the world. The curious Pandora opened the box and brought disease and disaster to the earth. She tried to close the lid quickly, but the only thing still left inside the box was hope.

Fire as a symbol Prometheus means *the forward-thinking one*. Fire could therefore be a symbol for inspiration and intelligence because, thanks to altered living conditions, humans suddenly had the ability to think about more than simply surviving. There was now room for deeper thoughts and ideas. Thanks to the advances brought about by fire, humans developed far more swiftly than other living beings on earth. In *The Secret Doctrine*, HP Blavatsky refers to the myth of Prometheus as 'the allegory of the pilgrimage of man, in which thought is the hero who overcomes evil forces and eventually regains a state of wisdom and freedom'.

Evolution? The crucial question is whether man has really used that wisdom to improve his lot. And whether he has seized his new freedom as an opportunity to create a better future ... I don't think the answer is a definite 'no' just yet – although I do think that moment is getting closer. It is clear that humans have not dealt with Prometheus' gift in the most efficient way. Yet we now need to carry on with the hope that remained in Pandora's Box, because that will be imperative to ensuring our ability to survive.





FROM MYTH TO REALITY: THE EARTH IS SUFFERING

I believe respecting nature starts with one crucial insight, which is that the earth did create a perfect equilibrium once upon a time. This was a balanced system that made millions of life forms possible. For a long time, man was just one of many small components. Then, one day, he disturbed that unique equilibrium and irreversibly affected all ecosystems designed so carefully by the earth. Man's decisions formed the basis of a profound change for nature: global warming and a drastic change in the habitat of all life forms. In short, this wasn't just climate change but a profound modification of our biotope.

Climate change and a system thrown off balance

AN AGE-OLD PHENOMENON Climate change has been an issue at various stages throughout the history of the earth. Average temperatures rise and fall, air currents and water cycles change... the climate and weather are constantly changing. During the ice ages, it was significantly colder on earth than it is today, but there have also been periods when the average temperature was a lot higher. Some changes in climate came about gradually, whereas others came about more quickly and had a major impact on the earth, although this was not as high everywhere.

Changing weather conditions has different causes. For example, a change in solar activity can temporarily affect temperatures. The 'Little Ice Age' in Europe – between 1600 and 1800 – was caused by this. Even volcanic eruptions affect the weather. The ash and sulphur released during an eruption block the sun's rays and cause a slightly lower temperature for a number of years. Changes in ocean currents and air currents also influence the weather. For example, the El Niño phenomenon, in which sea water along the equator in the eastern Pacific Ocean warms up, is directly related to local rainfall.

THE BALANCE: THE GREENHOUSE EFFECT AND PHOTOSYNTHESIS The temperature on earth – and therefore the weather – is closely related to two natural processes: global warming and photosynthesis. Our planet uses both to maintain a balance in nature.

GREENHOUSE EFFECT: THE EARTH UNDER A BELL JAR The interplay between the sun, atmosphere and earth determines the temperature on the planet. The sun gives off rays to the earth, which in turn sends the heat from the sun's rays back into the atmosphere. Some of these leave the atmosphere immediately; the others are absorbed by the earth, which re-radiates the energy in the form of infrared radiation or heat. It is this radiation that is partially absorbed by gases which occur naturally in the atmosphere. This creates the effect of a conservatory or greenhouse: the heat is retained, so the temperature rises. Carbon dioxide (CO₂) and methane (CH₄) – the most important of the so-called greenhouse gases – play an important role in this effect. Thanks

to the greenhouse effect, the average temperature on earth is about 15 degrees Celsius, rather than -18 . In other words, this process makes life possible.

PHOTOSYNTHESIS: CO₂ TURNS INTO OXYGEN Nature maintains its own balance by controlling the amount of carbon dioxide in the atmosphere by way of photosynthesis. Plants use light energy to absorb CO₂ and to turn it into oxygen. They also form carbohydrates from the CO₂ and water. This means that the flora on earth is crucial to life. Forests and seas are carbon dioxide warehouses and they act as the lungs of our earth. They reduce the amount of CO₂ in the air, which means the atmosphere does not warm up too much. In short, they keep the planet cool and ensure that the system remains stable.

The greenhouse effect and photosynthesis are, in other words, two natural processes which together keep temperatures on earth under control and optimise the composition of our air – or rather, that's what happens if they are able to carry out their work as normal. Throughout the centuries, other natural processes have had an impact on this balanced cooperation, but nature has always managed to repair itself. Until now.

THE DIFFERENCE TODAY: ANTHROPOGENIC CHANGE

The current climate change is unlike any previous one. Scientists have thought long and hard about this for decades, as twentieth century climate change could not be fully explained by natural processes. The conclusion was rather obvious: human activity was the basis of the change. This conclusion launched a period of contention and discussion between scientists, industrialists and policymakers, given the enormity of its economic, ecological and political consequences.

.....

Man has unbalanced the system. Humans have caused climate change.

.....

The first step towards recognising the problem has been taken. No one would really dare to openly doubt its existence: climate change is a fact and man has caused it. However, although the period for discussions and expressing doubt may well be a thing of the past, effective measures to tackle the problem have still not been forthcoming from our world leaders and policymakers, despite the fact that the time for action is now! I can only hope that humanity and nature don't have to wait too much longer for us to finally sit up and take note, and that we don't have to wake up one day and realise that it's too late to resolve the situation.

The turning point: the Industrial Revolution It didn't take scientists long to establish the point at which the system of global warming and photosynthesis was disturbed: the end of the eighteenth century. The Industrial Revolution thus became not only a turning point in the history of man, but also in that of nature.



GAS

Carbon dioxide (CO₂)

EMISSION FROM

- Combustion of fossil fuels for electricity and heat
- Forest fires
- Burning agricultural waste
- Transport
- Thawing of permafrost

Methane (CH₄)

- Livestock farming
- Rice cultivation
- Gas leakages in the coal, oil and gas industry
- Thawing of permafrost

Black carbon
(soot or particulate matter)

- Burning forests and grasslands
- Burning agricultural waste and firewood
- Transport with diesel engines without emission filters

Halogenated alkanes

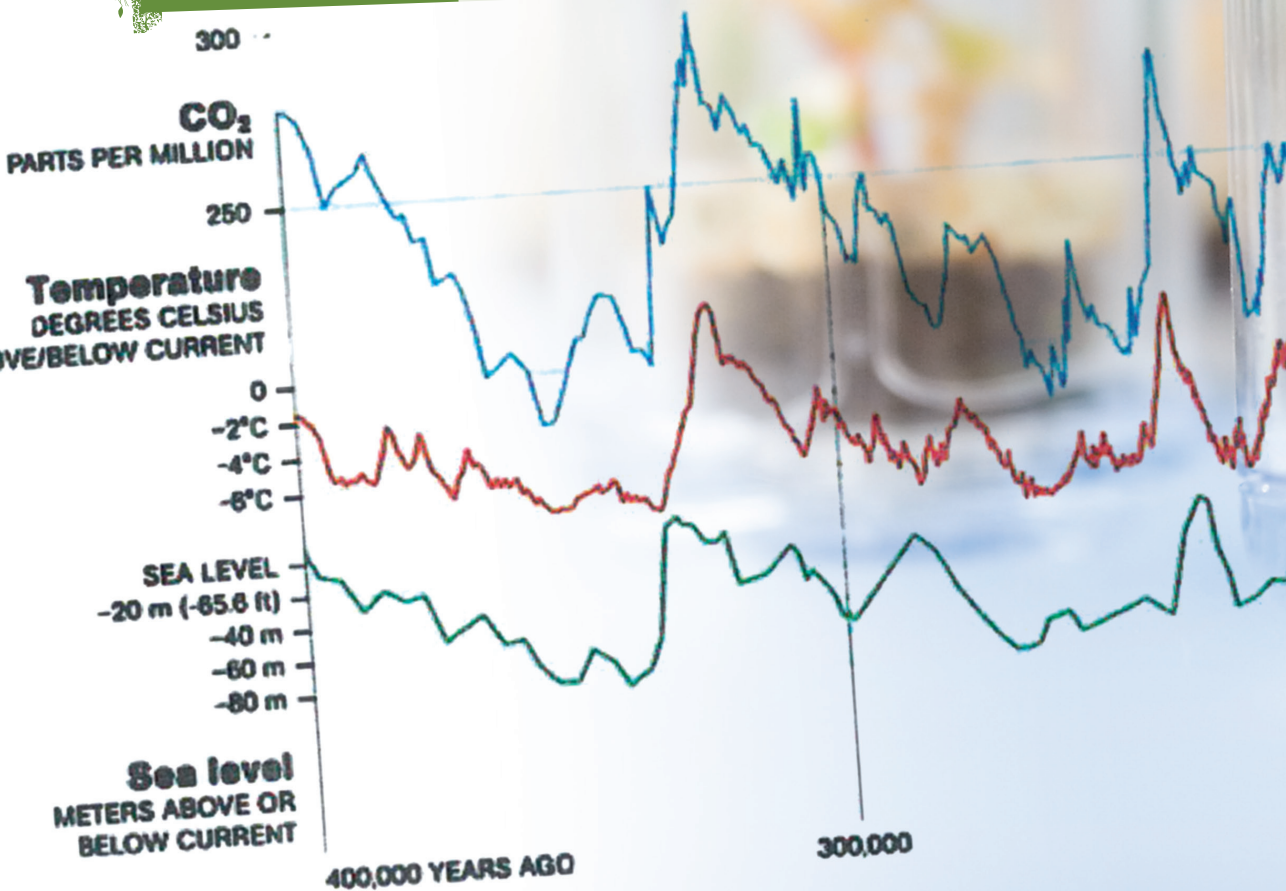
- Industry

Carbon monoxide (CO)
and volatile organic
hydrocarbons

- Combustion of biomass
- Industry
- Cars and trucks (especially in the US)

Nitrogen oxide (N₂O)

- Fertilisers in agriculture





384 PPM
2007 GLOBAL AVERAGE

280 PPM
PRE-INDUSTRIAL
REVOLUTION

350
PARTS
PER
MILLION

300

250

0
-2°C

-4°C

-6°C

SEA
LEVEL

-20 m

-40 m

-60 m

-80 m

Last interglacial:
sea level four or more
meters (13 feet)
higher than today

Peak of last
ice age

PRESENT

200,000

100,000

A DIFFERENT LIFE FOR MAN AND FOR NATURE The Industrial Revolution affected nearly every aspect of daily life in the Western World in particular. The transition from manual labour to production by machines running on fuel had an enormous impact on how things were done. The invention of the steam engine meant objects could suddenly be produced quickly and in large quantities; coal mining gave an additional boost to steel production; factories and cities started sprouting up everywhere and forests had to make room for more factories; and steam engines running on wood and coal worked at full speed, meaning production capacity increased significantly.

OPTING FOR MORE TIME OR MORE PRODUCTION

During the Industrial Revolution man made an important decision. The speed and efficiency of machine production gave him the opportunity to invest the time he had regained in other things, such as personal development and keeping in touch with friends and family. Instead he chose to produce more, and it was this mass production that would eventually put natural processes under pressure.

Man has changed the composition of the atmosphere: the balance has been disturbed.

A BALANCED SYSTEM BECOMES OUT OF KILTER Since the Industrial Revolution, humans have been emitting increasing amounts of greenhouse gases into the air – in particular carbon dioxide (CO_2), which is primarily emitted by burning fossil fuels for energy, heat and transport. Massive deforestation in recent centuries means we have fewer green areas to fulfil the purifying function of photosynthesis. This is how more and more carbon dioxide is emitted into the air. Humans have changed the composition of the atmosphere dramatically over the past two centuries.

MORE AND MORE GREENHOUSE GASES It is this increase of the amount of greenhouse gases in the atmosphere that causes global warming. The gases work like a kind of braking system, which prevents the earth from getting rid of the sun's heat as easily as it used to. This means that our thin atmosphere becomes increasingly thicker and retains more infrared rays. This in turn warms up the lower atmospheric layers while the highest atmospheric layers get less heat.

The best known of the greenhouse gases is carbon dioxide. Discussions about addressing climate change are therefore usually about how to reduce CO_2 emissions. Yet carbon dioxide is not the only greenhouse gas that causes damage. The increased amount of methane (CH_4) – which holds twenty times more heat than carbon dioxide – is also problematic. Methane is mainly emitted by livestock. Population growth



means meat production has increased and the amount of methane in the air continues to rise. Other greenhouse gases with a heavy impact on nature's balance include black carbon, halogenated alkanes, nitrogen oxide, carbon monoxide and volatile organic hydrocarbons.

The production of electricity and heat is responsible for a quarter of greenhouse gas emissions. Deforestation ranks second at 18 per cent. Transport, industry and agriculture also contribute to pollution – each is responsible for about 14 per cent of emissions.

REDUCED LUNG CAPACITY OF THE EARTH The earth's surface consists of about four billion hectares of forest: that is about one third of the total land area. Deforestation has been going on for centuries, but it has been taking place ever more frequently in recent decades. This creates a twofold problem: more carbon dioxide and fewer purifying trees.

The destruction of forests is responsible for around one fifth of annual carbon dioxide emissions. Forests are burned for agricultural purposes, like establishing plantations and livestock farming. Brazil and Indonesia in particular are engaging in deforestation on a large scale. In Indonesia, this is done in order to establish palm oil plantations. More forest is felled and the land is drained by setting fire to the peat. The palm oil is used for the food industry and for the production of biodiesel, although this last usage is coming increasingly under fire. This is because a life cycle analysis spanning several years showed that the entire process for the production of this biofuel emits more carbon dioxide into the air than the plantations can extract from it.

Deforestation thus contributes to global warming in two ways. On the one hand, trees that are destroyed emit carbon dioxide and this goes into the atmosphere. On the other hand, there are fewer trees to extract carbon dioxide from the air and turn it into oxygen. In short, just when the earth needs a good set of lungs more than ever, it has to deal with a reduced lung capacity.

CONSTANTLY ON THE LOOKOUT FOR MORE ENERGY Where do we get the fossil fuels that pollute our earth? Well, paradoxically, from the earth itself. The earth's crust was formed during the Precambrian era, which began 4.56 billion years ago. There was a lot of volcanic activity and a lot of meteorites and comets hit the earth. At the beginning of this period, the atmosphere consisted mainly of carbon dioxide, methane and ammonia. At a later stage, the atmosphere cooled down rapidly since almost all of the methane had disappeared from it. In recent centuries, humans started to mine the oil and gas supplies, hidden in the depths of the earth, which originated during this period. They opened up Pandora's Box ...



The amount of fossil fuels that we need today to meet our basic needs is increasing all the time. We now need more energy to achieve the same effect, simply because our energy fields are further and further away. The result is entropy, a drastic depreciation. We used up the resources in our immediate vicinity – such as the wood of the forests we lived in – quite quickly. This meant we had to get energy out of the ground: lignite, coal, oil, gas. We had to look ever deeper to find these fossil fuels. We made it more and more difficult for ourselves and so we also needed more complex technology. The scarcer the resources became, the more risks we took, all for the sake of comfort and lifestyle and to be able to keep up with population growth. The result is an increasingly large ecological footprint and an ever-growing water footprint (*see box, page 48 & 54*).

Our climate: from stable to variable Greenhouse gas levels and global temperatures have fluctuated since the planet came into existence. Scientists established this by examining the isotope ratio of oxygen in sludge from the ocean floor. Their research produced data on evaporation and precipitation, and therefore on temperature. The fluctuation of the carbon dioxide concentration in the atmosphere was investigated by analysing air bubbles in ancient ice formations. The Belgian Princess Elisabeth polar station in Antarctica plays an important role in this type of research on glaciers and the climate.

The conclusions of these scientific studies are striking. Over the past 3,000 years, the level of greenhouse gases in the atmosphere has remained fairly stable, as has the average temperature. This biological balance has allowed human civilisation to make such a huge leap forwards. It is only since we began burning fossil fuels *en masse* and emitting greenhouse gases into the atmosphere in many other ways, that we started seeing significant changes.

INSEPARABLE: CO₂, TEMPERATURE AND SEA LEVELS The relationship between carbon dioxide levels, temperature and sea levels is unmistakable: they rise and fall together. It is common knowledge that CO₂ emissions started increasing dramatically from the Industrial Revolution onwards, yet current statistics are staggering. We emit around thirty billion tonnes of carbon dioxide into the atmosphere every year. Nature absorbs half of this and the other half is what causes the increased concentration of CO₂ in the atmosphere.

Our climate has remained fairly constant since the last ice age, which took place some 11,000 years ago. Carbon dioxide levels have never risen above 300 ppm during the past 650,000 years. [Ppm stands for ‘parts per million’, the number of particles of carbon dioxide in each million of other particles.] Almost two and a half centuries ago, things started to change: we went from 280 ppm in the middle of the eighteenth cen-

tury to 385 ppm, where we are now. This means that the amount of carbon dioxide in the atmosphere has risen by more than a third since the Industrial Revolution. As well as this, annual global greenhouse gas emissions have increased by up to six billion tonnes since the start of the nineties – a growth of more than 20 per cent!

The average temperature has already risen by about 0.8 degrees Celsius. A study by the UN Environment Programme shows that the period from 2000 to 2009 saw the highest ever greenhouse gas emissions, and this decade was also the warmest ever. The results of the Intergovernmental Panel on Climate Change (IPCC) show an average temperature rise of 0.15 to 0.20 degrees Celsius in each decade. The sea level also increased as rising temperatures melted the ice on glaciers and ice caps. The impact that humans have had on the planet in recent decades is bigger than ever. During the years to come this will not only affect nature and our biotope, but every living creature on this planet.

A temperature increase with serious consequences

It is already clear that global warming affects all parts of the world. We come across headlines about devastating hurricanes, severe floods, disastrous droughts and fires when reading our newspapers at breakfast. Climate change has serious consequences for the health of our ecosystems and the conservation of our flora and fauna. The impact grows with each degree that the temperature rises (*see box, page 57*).

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*Humans and nature will
 feel the impact of global
 warming all over the world.*

RIISING SEA LEVELS The rise in sea levels due to the melting of glaciers and ice caps will have consequences for the world of the future: coasts will become uninhabitable, large parts of the civilised world will be flooded. The effects of climate change are already a painful reality for the people of Kiribati, a volcanic island group in the Pacific Ocean. The islands are just a few centimetres above sea level, which makes increased rainfall, more frequent storms and rising sea levels a constant threat to their survival. Groundwater is salinated, causing difficulties in growing crops. The islanders have already had to move some of their villages.

MORE EXTREME WEATHER The weather is set to become even more extreme and unpredictable. This is because the temperature of the oceans is increasing. In the foreseeable future, strongly rising convection currents and higher wind speeds will start to form above warm water, causing severe storms, hurricanes and tornadoes. Increased evaporation also means more rainfall. In the last two decades of the twentieth century, we saw an increase of 230 per cent of the number of disasters caused by floods. Droughts follow periods of intense rainfall. This creates more forest fires,





THERE IS NO PLANET B

which brings everything that is harmful to the earth's surface. The result is more carbon dioxide in the atmosphere.

SCARCITY OF DRINKING WATER Climate change has also had an impact on our drinking water supply. Humans only drink fresh water, which comes mainly from melting glaciers. Just 2.75 per cent of all water on earth is fresh and just over 2 per cent of that comes from glaciers. An ice cap acts like a mirror for the sun: it reflects 90 per cent of the rays; thus these are not converted into heat. The sea does, however, absorb a lot of heat. The consequences are obvious: the less ice there is, the faster the temperature rises and the faster the ice disappears. The glaciers are melting away at an alarming rate.

Our water supplies are dwindling. The depletion of water resources has tripled in the past fifty years. Nowadays, 80 per cent of the population lives in an area with a high risk of water shortage. It is becoming increasingly difficult to supply people all over the world with drinking water. By 2050, more than 600 million people will no longer have access to clean water. Water shortages are expected to be particularly acute in the Middle East and Australia.

ECOSYSTEMS ARE AT RISK, BIODIVERSITY IS DECREASING Climate zones are shifting and entire ecosystems are thus being undermined: the habitat of certain plants and animals is either disappearing or changing radically. Rivers are drying up, forests are withering away. Some life forms are threatened with extinction because they cannot adapt quickly enough. Increasing pollution exacerbates this precarious situation. The Living Planet Report 2012 by the WWF contains shocking figures. The Living Planet Index – which shows the health of our ecosystems and is based on 8,000 groups of 2,500 vertebrate species – shows that biodiversity in the tropics has decreased by 60 per cent since the seventies, and that the natural habitat of many species has also shrunk since the eighties. One fifth of vertebrate species is at risk of extinction. The rhinoceros, orang-utan, gorilla and tiger are among those on the list of endangered (or critically endangered) species.

The situation is no less disturbing in the oceans. Oceans absorb carbon dioxide, which affects biological systems as CO₂ uptake increases the acidity of the oceans. Some marine animals, such as shellfish and corals, suffer the painful consequences of this. The condition of coral reefs has declined by 38 per cent during the past thirty years. Extensive pollution means the cod and river dolphin are now also endangered species.

