Holistic science for living well

An introduction

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And here's the deal:
Forget that this task of planet-saving
is not possible in the time required.
Don't be put off by people
who know what is not possible.
Do what needs to be done,
and check to see if it was impossible
only after you are done.
Paul Hawken[1]

1 Hawken, 2009

Introduction

We can't solve problems
by using the same kind of thinking
we used when we created them.
Albert Einstein

How can we think
of solving a problem
when the problem is
the way we think?
Clive Hamilton[2]

This book is an introduction, an invitation to explore holistic science as a new way to understand ourselves as humans within the complexity of life on Earth and to participate in it for its flourishing. It explores new proposals within the social and scientific circles of our current world. It is about nothing more or less than changing our way of thinking and appreciating life, in order to amend the critical errors we have made for having a limited vision of what life is. The book helps to understand the concepts on which this proposed change of mentality is based.

What is the motivation for presenting a study on holistic science?

The main reason is the situation of the Earth in the face of the serious environmental, social and economic crises we are facing at the beginning of the 21st century. We are in an accelerated race to destroy the basis of

2 Hamilton, 2012: 9

our survival on Earth, and beyond that, to destroy the basis of a great part of life in general. We human beings are the driving force behind the sixth mass extinction of plants and animals in Earth's history.

In the study *Planetary Boundaries: Exploring the safe operating space for humanity*, Rockström et al. (2009a) show the anthropogenic pressure on the Earth system. The authors indicate that human activity has reached a scale at which abrupt global environmental change can no longer be excluded. They identify nine planetary boundaries: climate change, ocean acidification, stratospheric ozone depletion, biogeochemical cycles of nitrogen and phosphorus, global freshwater use, land use change, rate of biodiversity loss, atmospheric aerosol load, and chemical pollution (figure 1). The potential consequences of transgressing one or more of the planetary boundaries range from deleterious to catastrophic, due to the risk of crossing thresholds that may trigger non-linear and abrupt environmental changes. Rockström et al. (2009a, b) estimate that humanity has already transgressed three planetary limits: that of climate change, the rate of biodiversity loss and changes in the nitrogen cycle (see also Barnosky et al., 2012; Martens & Obenland, 2012; Steffen et al., 2004).

American journalist Dianne Dumanoski (2009) classifies the dangers into two categories: *slow death* and *surprises*. The threats that cause *slow death* are the known problems: such as species extinction, land erosion, degraded soils, freshwater depletion and pollution, forest loss, pervasive contamination of food chains, and the cumulative burden of human activities on natural systems. Apart from the threats – which in themselves are of great concern to us – there is another danger of immense magnitude, *surprises*: abrupt and unpredictable changes that threaten the fundamental processes of the planet. The best known disruption is climate change, which disrupts the carbon cycle, but on top of that we are disrupting the nitrogen, phosphorus and sulphur cycles on a planetary scale (Dumanoski, 2009). These changes can distort the functioning of the Earth system with unpredictable consequences.

The environmental perspectives are intertwined with economic and social crises. We are faced with exponential growth in human population; structural violence characterized by growing inequality in access to power, education, health and justice; cultural homogenization and loss of cultural diversity; the economy of waste and destruction; the financial crisis, to name but a few.

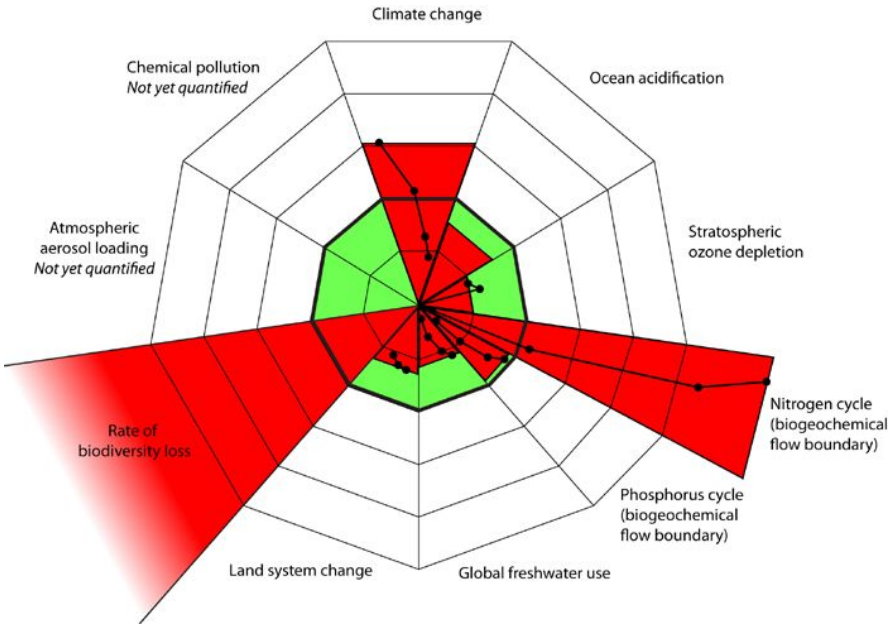

Figure 1: Beyond the boundary. The green shading inside represents the proposed safe operating space for nine planetary systems. The red wedges represent an estimate of the current position of each variable. The limits in three systems (rate of biodiversity loss, climate change and human interference with the nitrogen cycle) have already been exceeded (Rockström et al., 2009a: 22).

The sum of the damage we are causing at the planetary level show up as climate change. For many years, the eminent scientists James Hansen and James Lovelock have been warning of the approaching catastrophic climate change for the 21st century if we continue on the business as usual path of development (Hansen et al., 2008; Hansen, 2009; Lovelock, 2006, 2009). Many new studies confirm the serious warnings of Hansen and Lovelock (Anderson, 2012; PwC, 2012; World Bank, 2012). The outlook is apocalyptic: if we keep on emitting greenhouse gases as we currently do, **the average Earth temperature could increase by 4 °C by 2060.**

In short: *Homo economicus* has evolved from being part of the community of life to being a planetary force "pushing the Earth System well outside of its normal operating range" (Steffen et al., 2004: 81). Do we really want to continue to destroy the basis of our life on Earth? Do we want to leave our children and grandchildren a world that is unrecognizable and unimaginable? And finally, do we want to enter the history of the Earth as the generation that destroyed the future of its children and of life in general?

How did we get into this mess?

The situation that our home, Earth, is facing is critical. This reality did not appear suddenly at the beginning of the 21st century; it is the results of an historical process. More than 300 years ago in Europe, the Enlightenment and the scientific revolution opened the way to transforming our view of the world from animated and alive, to that of a world as a machine. Physicist and philosopher Danah Zohar describes it as follows:

> Classical physics transmuted the living cosmos of Greek and medieval times, a cosmos filled with purpose and intelligence driven by the love of God for the benefit of humans, into a dead, clockwork machine. [...] Human beings, and their struggles, the

> whole of consciousness, and life itself were irrelevant to the workings of the vast universal machine (Zohar, 1990, cited by Wheatley, 2006: 31).

The transformation in thinking had some deep implications in the relation between men and nature. The new worldview, grounded in a reductionist, linear and mechanistic thinking, expanded and took over the entire planet. The scientific revolution is one of the origins of the current thinking and situation (see chapter one, *The scientific revolution and the reductionist paradigm*).

As we saw in the first section, today's world – dominated by the Western worldview – is flawed with unsustainability. In view of the prospects for the coming decades we must understand the following: ***change is not an option, it is a necessity***. Are we prepared for the challenges to come? In order to find solutions, we must change our way of thinking. This book is an introduction to a new way of looking at life and participating in it in a sustainable way.

What alternatives do we have?

Fortunately, the Western reader's view of the world is not the only one. There exist other ways of seeing, understanding, doing science and participating in life on Earth. Ways that suggest a change in the mentality of humanity and that can be much more satisfactory for the preservation of life on Earth. The book introduces basic concepts and tries to incite the curiosity about holistic science so that the reader reconsiders his way of living on the planet and finds a first entry door to the magic world that it implies.

The anthropological and cultural roots of Latin-American peoples are much closer to the understanding of the new holistic vision of life and the world. Therefore, the book highlights some similarities between the

new scientific concept that currently opens hopeful space in the world of science and of intellectuality, and the worldview of a good part of the indigenous peoples of the planet (see the chapter *The indigenous worldview*). In this book, the expression indigenous worldview is used in a generic way, just as, for example, the Western worldview. This is not meant to imply, in any way, that there is a single indigenous worldview.

Every day, we encounter diffuse, deceptive or irrelevant information on concepts such as sustainability, ecology, climate change, etc. It has also become fashionable to use the terms holism or holistic, system or systemic, in various combinations. Even though many people use these terms frequently, few really understand their meaning and, in many cases, the use of these terms distorts their meaning. They are often used to attract the attention, but the text that accompanies the term makes no reference to them, or even worse, they are used in an incorrect way. The book introduces holistic science and systemic thinking, and enumerates the basic principles required for an action or process to be ecologically sustainable (see chapter two *Holistic science*). It also provides practical tools so that the reader can find out how to go deeper into these issues in a serious way and how to apply holism and systems thinking in everyday life (see chapter three *Holistic paradigms and education*).

One of the great obstacles to the dissemination of holistic science in Latin America is the scarcity of literature in Spanish with this content. This book aims to be a contribution to the Latin American reality. It quotes great works of this scientific current, reinforcing the need to translate them into Spanish. It is worth the effort to bring these avant-garde topics to a population that can make enormous contributions in the construction of this new paradigm.

The initiative *Transiciones*

The platform *Transiciones*[3] [Transitions] promotes changes and transformations focused on alternatives to the contemporary development for South America. It was officially launched at the international seminar *Territorial Development and Extractivism* in November 2011 in Cusco, Peru. The platform serves as valuable means to promote learning, debate and action on alternatives to development in the region.

Eduardo Gudynas, one of the initiators, defines transitions as follows: "Transitions comprise a process that brings together different ideas, actions and proposals to abandon the current style of development and move towards alternatives that are focused on a good life for people and on protecting Nature" (Gudynas, 2012: 15).

The initiative *Transiciones* was initiated by the *Centro Latinoamericano de Ecología Social* (CLAES) in Uruguay and counts with institutions from several countries: *Asociación Argentina de Abogados Ambientalistas* (AAdeAA), *Liga de Defensa del Medio Ambiente* (LIDEMA), *Centro de Documentación e Información Bolivia* (CEDIB), *Centro de Documentación y Desarrollo Andino* (CENDA) and *Colectivo CASA* de Bolivia, *Centro Ecuatoriano de Derecho Ambiental* (CEDA)[4] in Ecuador, *Red Peruana por una Globalización con Equidad* (RedGE), *Derecho Ambiente y Recursos Naturales* (DAR) and *Programa Democracia y Transformación Global* (PDTG) in Peru.

The discussion of the initiative started in Peru and led in 2011 to the publication of the book *Transiciones: Post extractivismo y alternativas al extractivismo en el Perú* [Transitions: Post Extractivism and Alternatives to Extractivism in Peru] (Alayza & Gudynas, 2011). In 2012, three new books were published: a basic guide on transitions titled *Hay alternativas al extractivismo: Transiciones para salir del Viejo Desarrollo* [Alternatives to Extractivism: Transitions out of Old Development] (Gudynas, 2012),

3 http://www.transiciones.org/
4 The NGO CEDA ceased to exist in 2015.

and two books on transitions in the Andean region, the annals of the international seminar *Desarrollo Territorial y Extractivismo* [Territorial Development and Extractivism] (Velardi & Zeisser, 2012), and *Transiciones y alternativas al extractivismo en la región andina: Una mirada desde Bolivia, Ecuador y Perú* [Transitions and Alternatives to Extractivism in the Andean Region: A View from Bolivia, Ecuador and Peru] (Alayza & Gudynas, 2012).

The present book deepens some ideas presented in two articles of the initiative (Elbers, 2012a; Elbers & Muñoz, 2012). The article *Economía, energía y cambio climático: una propuesta para fomentar la visión holística en Transiciones* [Economics, Energy and Climate Change: A Proposal to Foster a Holistic Vision in Transitions] (Elbers, 2012a) examines the economy, energy and climate change under a holistic approach. It shows that these are three complex, interconnected and interdependent systems that are at the same time subsystems of the Earth system. The present study is particularly devoted to deepening readers' understanding of holistic science and the holistic paradigm, highlighting their significance in the search for alternatives to development.

Description of the parts of the study

A better understanding of holistic science and its value for a new path in the 21st century requires a brief retrospective of the history of science. The first chapter, *The scientific revolution and the reductionist paradigm*, describes the birth of the modern science and worldview. The second chapter, *Holistic science*, explores some principles of quantum physics and of systemic thinking; the chapter closes with a comparison between reductionist science and holistic science. The third chapter, *Holistic paradigms and education*, introduces us to indigenous worldview, holistic paradigm and holistic education. The chapter ends by looking at the relation between the concept of Living well (*buen vivir*) and the holistic

paradigm. The last chapter, *Proposals for action*, presents some suggestions for the dissemination of holistic concepts.

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1 The scientific revolution and the reductionist paradigm

> For fragmentation is now very widespread,
> not only throughout society, but also in each individual;
> and this is leading to a kind of general confusion of the mind,
> which creates an endless series of problems
> and interferes with our clarity of perception so seriously
> as to prevent us from being able to solve most of them. […]
> The notion that all these fragments are
> separately existent is evidently an illusion,
> and this illusion cannot do other than
> lead to endless conflict and confusion.
> *David Bohm*[5]

This chapter first describes the dominant world view, based on Western reductionist thinking. It is followed by a brief review of the scientific revolution that is one of the origins of current thinking. It then examines the vision of a mechanistic world, the domination of nature and of women, and makes a brief analysis of the dominant power.

The intention of this chapter is not to negate the achievements of reductionist science, but to analyse the causes of the global situation in which we now are (see chapter *Introduction*). Holistic science does not pretend to replace or withdraw reductionist science. Reductionist science remains in force and has its own importance. But holistic science transcends and includes reductionist science. In fact, the big difference is

5 Bohm 1980: 1, 2

that holism is inclusive, it does not reduce itself to reason and ensures the well-being of the whole of creation (see chapter *Holistic science*).

The cosmology of domination

In their book *The Tao of Liberation* (2009, 2012), Canadian adult educator Mark Hathaway and Brazilian theologian Leonardo Boff discuss the difficulties of describing the characteristics of the worldview that each of us has. We absorb a number of basic beliefs from our cultural environment, we take the view of reality as given and natural, much of the cosmology is received in an unconscious manner. Hathaway and Boff deduct that "we usually adopt a cosmology through a process that more closely resembles osmosis than it does formal learning" (2009: 141). Philip Smith and Manfred Max-Neef argue that what is described as "paradigms" is often referred to as

> the *set of beliefs* that (practically speaking) all members of a given (sub)culture have in common. A paradigm is not experienced existentially as something *you believe to be true*, but as something that simply *is true* (Smith & Max-Neef, 2011: 58).

To face the current crisis in the world, Hathaway and Boff (2009) urge on deconstructing the dominant modern cosmology and describing it in the clearest way as possible. But what characterizes the cosmology that predominates today in the modern industrialized societies cannot be expressed by a single term; it includes principles of materialism, reductionism, objectivism, dualism and determinism – without pretending that the list is complete. Hathaway and Boff (2009: 142), rightly, call it the "cosmology of domination", because this vision grants carte blanche to subjugate the Earth, to exploit and plunder the planet (Hathaway & Boff, 2009). Based on the works of Theodore Roszak and David Toolan,

Hathaway and Boff provide a synopsis of the key features of this worldview:

- There is an objective reality that exists outside of one's own mind. Other people also have their own unique centers of consciousness.
- Mind and matter, including mind and body, are separate entities.
- The universe is composed of matter, a dead, lifeless substance composed of tiny, normally indivisible, atoms and even smaller, changeless, elementary particles.
- All true phenomena can be perceived by the senses, often assisted by instruments. Anything that cannot be perceived in such a way – save perhaps the mind itself – is considered illusory, or at best subjective. Spirit and soul are therefore dismissed, ignored, or marginalized to the personal or emotional realm. The real world is reduced to the world of the material, and this world can be measured and quantified. In Galileo's words, "the book of nature is written in the language of mathematics."
- The mode of thought preferred is discursive and analytical in nature – that is, an approach that categorizes, divides into pieces, and then delineates. Reality is most accurately studied by rigorous, objective observation and the application of logic. The more detached the observer, the more accurate will be the observation.
- Nature and the cosmos are understood in mechanistic terms. The universe itself resembles a giant clockwork machine exemplified by the movement of the planets and stars.
- Since the nature of reality is mechanistic, we can gain a complete knowledge of the whole by breaking it into – or reducing it to – its component parts and studying them one by one. (This approach is often called "reductionalism.")
- There is no purpose to nature or to the cosmos. There are, though, fixed, external laws that have governed and ordered

all things for all of time. Given the same initial conditions, then, an experiment will always yield the same results.

- Time moves forward like a straight line, with cause always preceding effect. Each effect has a definite cause or set of causes, and the flow of causality is strictly unidirectional.
- The cosmos is essentially deterministic, based on mechanical causes. If one could ever have a complete knowledge of the current state of all matter, it would be possible to predict the future with certainty. True novelty is essentially impossible.
- All life on Earth is involved in a never-ending competition for survival. Evolution is driven by dominance, the "survival of the fittest." Change, when it occurs at all (and always within the bounds fixed by determinism), is change driven by competition, or even violence (Hathaway & Boff, 2009: 142-143).

If we look at these postulates with critical eyes, it is difficult to think that theses ideas are unquestionable truths. But if we look at how most people in modern industrialized societies **act**, then they do seem to describe the fundamentals of how life works on Earth. The Western world has relied on these axioms during the last centuries and continues today to accept and apply many of these concepts without any critical consciousness (Hathaway & Boff, 2009). In chapter two we will discuss these postulates of the cosmology of domination based on the knowledge that emerged with quantum physics in the early 20th century.

To continue, we explore the following questions: what is the origin of the predominant reductionist and mechanistic western thinking? How did we get to our actual way of thinking? When did we take this path?

The scientific revolution

The scientific revolution flourished in Europe from the end of the Renaissance in the 16th century and continued in the Enlightenment era in the 17th century. One of its characteristics is the separation of Western culture from nature. The early practitioners and defenders of modern science, among them Galileo, Bacon and Descartes, were convinced that the foundation of truth is reason. They discarded the belief in established religious dogmas that they saw as superstitious beliefs of ordinary people (Harding, 2006).

At the beginning of the 16th century, the Polish astronomer Nicolas Copernicus (1473-1543) proposed the heliocentric model according to which the Earth and the other planets revolve around the Sun, eliminating the idea of the Earth as the centre of the universe. Copernicus, considered the father of modern astronomy, believed that the entire universe was composed of numerical relationships, concluding that what is true in mathematics must be true in the real, objective world. Some 100 years later, in the early 17th century, Johannes Kepler (1571-1630), a German astronomer and mathematician, founded Copernicus' ideas by providing a mathematical theory of the motion of the planets in their orbit around the Sun (Hathaway & Boff, 2009).

In the same era, Italian astronomer, mathematician and physicist Galileo Galilei (1564-1642) improves the telescope invented a little earlier and used it to observe planets and stars, thus confirming the theories of Copernicus and Kepler. Like them, he has a mathematical vision of the cosmos, postulating an order of the universe governed by immutable laws outside nature. Galileo argued that subjective sensory experiences must be overlooked if we are to learn anything useful about the world, and he believed that "that which cannot be measured and reduced to numbers is not real" (quoted by Hathaway & Boff, 2009: 146). English ecologist Stephan Harding summarizes this as follows:

> Primary qualities – those which were rightly attributed to the objective, real world – were those aspects of things, and only those, that were amenable to quantitative measurement. Galileo believed that reliable knowledge resides in quantities, so nature had to be reduced to numbers if she was to yield her secrets and submit to the controlling influence of the human mind. For scientists, mathematics became the language for understanding and controlling nature (Harding, 2006: 26).

This new mathematical way of thinking promised a solid and incontrovertible foundation to build on science a new era of social stability based on the "application of pure reason to every aspect of life" (Harding, 2006: 26).

Like Galileo, Francis Bacon (1561-1626), English philosopher, politician and author, was one of the important founders of the scientific revolution, often considered the father of scientific methodology. Bacon proclaimed a new revolutionary doctrine: "knowledge is power"; and by that he did not refer to intellectual power but to physical power (Dumanoski, 2009). His wish was to recreate nature through mechanical inventions to serve human needs and desires. In his book *The Masculine Birth of Time*, Bacon writes "I am come in very truth leading to you nature with all her children to bind her to your service and make her your slave" (quoted by Hathaway & Boff, 2009: 151-152). According to Bacon, nature, once enslaved, "takes orders from man and works under his authority" (quoted by Harding, 2006: 26).

The new science received a big push in the 17th century when French philosopher, mathematician and physicist René Descartes (1596-1650) had the vision of the material world as that of a large machine. He declared that the world was nothing more that a dead machine without feelings – free of mind and spirit – that we could tame and control by exercising our rational intellect. Determined that any entity could be fully understood by studying the functioning of its isolated parts, he laid the

foundation for the reductionist methodology. For Hathaway and Boff (2009) it was Descartes who could have proposed the first true *mechanistic cosmology*. For him, the transcendent mind elevates the human being above matter. His doctrine "I think, therefore I am" is based on the ability to think and differentiates it from all others. Descartes considered emotions as belonging to the realm of the body and as contaminants of the mind which was the pure field of rationality. Through the application of mathematics one can understand the physical world governed by immutable laws dictated by God (Harding, 2006; Hathaway & Boff, 2009).

Hathaway and Boff analyse Descartes' worldview and its consequences for the relations between man and nature in the following way:

> For Descartes, all of reality – outside the transcendent realm of mind (which for Descartes included God) – is basically mechanical in nature. Everything is simply dead matter. Even animals are "automata" that only *appear* to be lifelike – they are really just complex machines. Since they have no souls, they cannot really experience pain or happiness, and thus humans can use them as they will.
> […]
> It is also hard to imagine a worldview more ruthlessly anthropocentric than that put forward by Descartes. Humans – particularly human minds – belong to a realm completely distinct from other creatures and from the entire material realm. They have totally free reign to exercise power over the Earth and all it contains, even if it means destroying other organisms (who are only "automata," not really living) in the process. At the same time, the preference given to "rational" – or, more precisely, discursive – ways of knowing along with a devaluation of both the emotions and the body seems to reinforce patriarchy, particularly because women were traditionally identified more closely with the emotional sphere and with nature itself. (Hathaway & Boff, 2009: 147-148).

In the second half of the 17th century, Sir Isaac Newton (1642-1727), the great English physicist, astronomer and mathematician, validated this emerging mechanistic view of the world. He formulated mechanical laws of motion and gravitation that could be verified by experimentation and observation: with these, he seemed to confirm that the world was nothing more that a big machine whose behaviour could be accurately predicted. The success of Newton's theories opened to way to the widespread acceptance of this mechanistic vision (Harding, 2006; Hathaway & Boff, 2009). As psychologist Deborah Du Naan Winter points out:

> Newton's work still provides the basis of our modern worldview: mater is seen as inherently inert; it is made up of objects that move only because outside forces move them, like billiard balls whose direction and motion can be successfully predicted. Although Newton agreed with Descartes that only God could have created such an exquisitely ordered universe, Newton helped pave the way for our modern secular worldview by demonstrating how orderly and precisely predictable the movement of objects is (Winter, 1996, quoted by Hathaway & Boff, 2009: 148).

Dianne Dumanoski summarizes the change caused by the scientific revolution in the following words:

> The revolutionary change that launched the modern era's radical cultural experiment involved two distinct steps: first, the demotion of Nature into mindless mechanism; second, the bold elevation of humanity vis-à-vis the larger world. Bacon reflects this immodest view of humans when he begins his *Refutation of Philosophies* with the declaration: "We are agreed, my sons, that you are men. That means, as I think, that you are not animals on hind legs, but mortal gods" (Dumanoski, 2009: 227).

The world as a machine

The scientific revolution replaced the ancient vision of an organic, living cosmos with the vision of a mechanistic world. This change has had profound consequences on our understanding of reality. The living, mystical planet was transformed into a clockwork machine: a tangible, palpable machine that can be dismantled and reassembled, and – very important – that obeys to the absolute control of men (Hathaway & Boff, 2009). The Irish priest Diarmuid O'Murchu illustrated some of the main characteristics of this vision of the world with the example of the operation of a television:

> First, cause and effect take place in a simple, straightforward, and linear way. If I push a button, the TV goes on. Something happens because something else causes it to happen. Similarly, there are no souls directing the growth of the oak tree, just straightforward biological processes directed by chemicals called genes.
> Second, the universe is predictable and deterministic. If I push the button, the TV will always come on unless, of course, there is a malfunction or no electricity at the moment. Pushing the "on" button will not, for example, result in a channel change sometimes and cause the color of the picture to change at others. Things work in a predictable, predetermined fashion. In the same way, a scientific experiment should always yield consistent, repeatable results.
> Finally, every whole is comprised of smaller parts. If something is wrong with the TV, it suffices to find the faulty part or parts and replace them and all will work once again. Using the same logic, we can understand how a TV functions by studying the function of each of its parts, then seeing how each relates to the others. So, too, with anything else in the cosmos: We break something complex into simpler components to understand it (O'Murchu, quoted by Hathaway & Boff, 2009: 149).

The example of the television explains well the postulates of the reductionist paradigm supported by conventional science. First, the world is understood in a linear way, there is always a cause-effect relationship that is simple and direct. Second, since the universe is a gigantic machine, everything is predictable and deterministic. Third, the machine is made up of parts that differ from one another and that are separable and replaceable. If I understand how the parts work, I will automatically understand how the whole machine works. According to "I think, therefore I am", the doctrine of Descartes, we, humans, are the only creatures that have the ability to understand and control this universal machine called Earth, and furthermore we have the obligation to subdue and dominate it. Dumanoski describes this human control over nature in the following way:

> The image of the world as a machine meshed well with Bacon's program to regain Eden by extending human control over nature. Transforming animals, plants, and natural systems into automata did more than banish bothersome scruples and reverence; it made the enterprise of science and the dream of human control seem possible. Machines, after all, are human creations and are by design under human control. Unlike a living nature, machines do not change in unpredictable ways. If the world is imagined as a giant clock, that suggests it is simple, orderly, predictable, fully comprehensible, and open to manipulation. By taking a machine apart, it is possible to understand fully how it works (Dumanoski, 2009: 228).

The domination of nature and women

The domination of nature and women are two crucial points in Western cosmology. Indian philosopher and physicist Vandana Shiva characterizes it as fundamentally reductionist not only for dividing everything into parts but also for understanding as exclusive "the capacity of humans to know nature", for excluding "other knowers and other ways of knowing"

from the generation of knowledge, and for reducing "the capacity of nature to creatively regenerate and renew itself by manipulating it as inert and fragmented matter" (Shiva, 1989, quoted by Hathaway & Boff, 2009: 143-144). Shiva notes that:

> The mechanistic metaphors of reductionalism have socially reconstituted nature and society. In contrast to organic metaphors, in which concepts of order and power were based on interconnectedness and reciprocity, the metaphor of nature as machine was based on the assumption of separability and manipulability. ... [The domination of both nature and women] is inherently violent, understood here as the violation of integrity. Reductionalist science is a source of violence against nature and women because it subjugates and dispossesses them of their full productivity, power, and potential (Shiva, 1989, quoted by Hathaway & Boff, 2009: 144).

This vision of the Western world is also based on progress. Progress is synonymous with economic growth and is based on a linear order of power (compare with chapter *A brief analysis of power*) that puts women and nature in a subordinate position. Deborah Du Nann Winter describes this in accurate words:

> Progress, through land ownership or economic wealth, is a fundamental feature of our worldview. The perception that human life is perched in *linear time* marked by progress toward something better is mirrored by the Greek and Christian view that we are perched in a *linear power order* as well. In the traditional Western view of the cosmos, God reigns over men, who rule over women, children, plants, and inorganic matter, in that order (Winter, 1996, quoted by Hathaway & Boff, 2009: 162).

The worldview of domination has replaced an older worldview, animism, that contemplated the word, and even the entire cosmos, as an organism full of life and purpose (on animism, see Abram, 1997, 2010; Harding, 2006). The scientific revolution replaced the image of a living organism

with a gigantic machine made of dead and inert matter. To humanity, normally conceived as "the man", it corresponds to dominate this gigantic machine – the nature – and to form it according to its purposes (Hathaway & Boff, 2009). Hathaway and Boff pick up the words of Theodore Roszak who analyses the meaning of a dead universe; he considers that

> the idea of a dead universe leads to "the rape of nature" and that rape, in this case, is emphatically *not* a mere metaphor. Rape is rooted in "a mentality that licenses domination" and "a lust for power that is anything but metaphorical.... Rape stems from a distinct state of mind that is the same whether the victim is a woman or a rainforest. Rape begins by denying the victim her dignity, autonomy, and feeling. Psychologists now call this 'objectifying' the victim'" (Roszak, 1999, quoted by Hathaway & Boff, 2009: 163).

Until today, no evidence was found that reductionist and mechanistic cosmology constitutes a proven scientific fact based on the laws of the universe (Sheldrake, 2012). On the contrary, the reductionist and mechanistic cosmology is a social construct to justify the domination of Man (masculine) over everything else.

A brief analysis of power

> It really boils down to this: that all life is interrelated.
> We are all caught in an inescapable network of mutuality,
> tied into a single garment of destiny.
> Whatever affects one directly,
> affects all indirectly [...]
> We aren't going to have peace on Earth
> until we recognize this basic fact
> of the interrelated structure of all reality.
> *Martin Luther King, Jr.*[6]

A substantial element that sustains the mechanistic and reductionist paradigm is the dominant and exploitative power exercised by patriarchy. This power undermines the ecological and social systems that sustain life. However, the word power has different meanings; for most people, the dominated and exploited, it has a negative connotation. But the root of the word in Latin is *posse* and means "to be able." Contrarily to coercive and destructive power, this form of power allows to be productive and creative (Hathaway & Boff, 2009).

According to the French philosopher Michel Foucault, power is not static, nor can it be possessed by anyone. Foucault describes power more as something that flows through a network of relationships, as threads that connect beings: "Individuals are the vehicles of power, not its point of application" (Foucault, 1980, quoted by Hathaway & Boff, 2009: 81). A characteristic of power in patriarchal societies is that it is *possessed* by a group or an individual at the expense of the rest of society. The great challenge is to change asymmetric power relations from active over

6 Quoted by Sweeney (2008: 14)

passive, oppressor over oppressed and exploiter over exploited, towards new relations based on mutuality and creativity (Hathaway & Boff, 2009).

US American ecofeminist Starhawk describes power by outlining three basic types: *power-over*, *power-from-within* and *power-with* (quoted by Hathaway & Boff, 2009: 81). This concept was originally developed by the US American social worker Mary Parker Follett (1868-1933) who worked on a world view of cocreative power (see the excellent description of her work in Briskin et al., 2009: 90-98).

Most of us have grown under *power-over*, an old concept of power that restraints and controls. This concept, typical of today's patriarchal societies, constructs reality out of discrete and separate entities. Hierarchical systems are distinguished by power-over: they are reigned by authority and domination, which are often accompanied by fear – it is an essentially negative concept of repression. The power-over is a zero-sum game: "if you win, I lose". It also promotes the idea of *invulnerability*, in other words, to maintain power requires strong defence, armour and rigidity. From a systemic point of view, this notion is incorrect and dysfunctional to the larger system because it hinders diversity and feedback. The processes of life are intrinsically self-organized (Briskin et al., 2009; Hathaway & Boff, 2009; Macy, 1995; Macy & Brown, 2010, 2014). By analysing the power-over exercised by the modern industrial societies, Macy and Brown reached a bleak conclusion: "Any system that removes feedback and blocks its perception of the outcome of its behaviour commits suicide" (Macy & Brown, 2010: 62).

Power-from-within is the contrary of the power-over; it represents creativity, healing and love, the power that sustains all of life. This power is always found in places where people act in common to oppose the power over, it is the key element to what we call *empowerment* (Hathaway & Boff, 2009).

The third form is *power-with*, that can also be called *power of influence*, or *power as process*. This form of power originates from the willingness to

listen to the ideas of others, enabling them to act together and to form truly participatory organizations. Power-with is based on the qualities of the systems of life which evolve with flexibility and group intelligence. Contrary to power-over that desperately searches for invulnerability through coercion and control, the power-with requires openness, vulnerability and willingness to change. Systemic scientists call this organic capacity to operate "from below" *synergy* (Hathaway & Boff, 2009; Macy, 1995; Macy & Brown, 2010, 2014).

Power-with is often mixed and confused with power-over; German philosopher Hannah Arendt studied this relationship in depth. Arendt compared *violence*, the most extreme form of power-over, with the power to act together, which corresponds to the power-with of Mary Parker Follett:

> Power [power-with] and violence [power-over], though they are distinct phenomena, usually appear together. Wherever they are combined, power, we have found, is the primary and dominant factor. The situation, however, is entirely different when we deal with them in their pure states. ... Violence can always destroy power; out of the barrel of a gun grows the most effective command, resulting in the most instant and perfect obedience. What never can grow out of it is power….
> Politically speaking, it is insufficient to say that power and violence are not the same. Power and violence are opposites; when the one rules absolutely, the other is absent. Violence appears where power is in jeopardy, but left to its own course it ends in power's disappearance. Violence can destroy power; it is utterly incapable of creating it (Arendt, 1970, quoted by Hathaway & Boff, 2009: 83).

The relationship between power-with and power-from-within is clearer. The empowerment of people grows in the groups in which the opinion of everyone is heard and valued. It is a mutual relationship: if power-from-within grows, power-with also grows, and vice-versa (Hathaway & Boff, 2009).

Hathaway and Boff visualized the relationships between the three forms of power based on the illustration of the web of relations proposed by Michel Foucault (see figure 2). The power-from-within is illustrated as the solid nodes within the web, while the lines that interconnect and interrelate the nodes represent the power-with. Finally, the power-over is visualized by thick lines that symbolize barriers. These thick lines block the relations of the power-with and suffocate the development of the power-from-within (Hathaway & Boff, 2009).

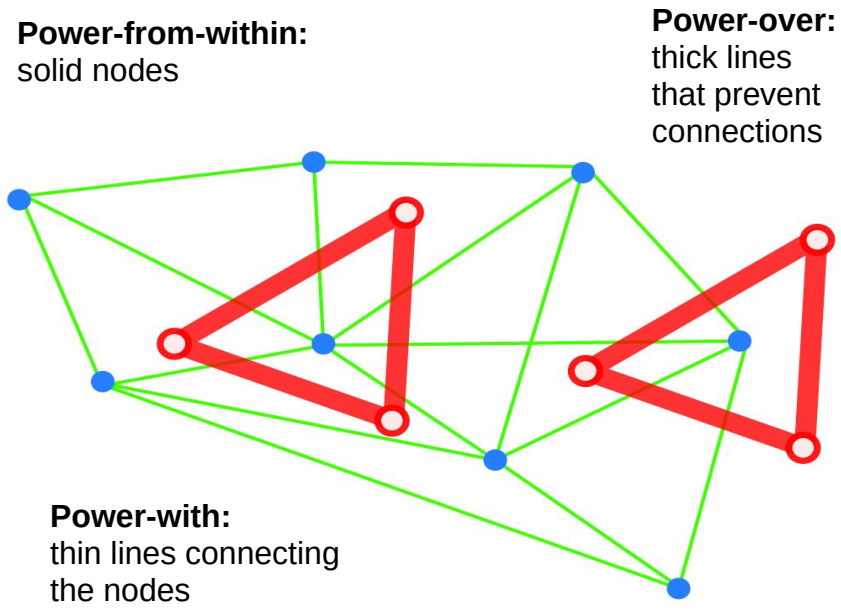

Figure 2: Visualising the exercise of power. *Power-over* represents coercion, control and invulnerability, *power-from-within* creativity, healing and love, and *power-with* openness, vulnerability and willingness to change (adapted from Hathaway & Boff, 2009: 84).

To deepen the knowledge about the scientific revolution, the reductionist paradigm, its relationship with the state of the Earth and the global crisis at the beginning of the 21st century I recommend the books of Dumanoski (2009), Harding (2006), Hathaway & Boff (2009, 2012) and Sheldrake (2012). In chapter two I present an introduction to the concepts of holistic science including a comparison of holism with reductionism.

I wish to close this chapter with an excerpt from the new book of English biologist Rupert Sheldrake, *Science Set Free*, which insightfully analyses ten fundamental beliefs of modern science. At the end of chapter one, *Is Nature Mechanical?*, Sheldrake poses some questions for materialists:

> Is the mechanistic worldview a testable scientific theory, or a metaphor?
>
> If it is a metaphor, why is the machine metaphor better in every respect than the organism metaphor? If it is a scientific theory, how could it be tested or refuted?
>
> Do you think that yourself are nothing but a complex machine?
>
> Have you been programmed to believe in materialism?
> (Sheldrake, 2012: 55).

2 Holistic science

The trouble [...] is that we are
terrifyingly ignorant.
The most learned of us
are ignorant. [...]
The acquisition of knowledge
always involves
the revelation of ignorance –
almost *is* the revelation of ignorance.
Our knowledge of the world
instructs us first of all
that the world is greater
than our knowledge of it.
Wendell Berry[7]

In the previous chapter, the scientific revolution and the reductionist paradigm were reviewed in a critical and brief form. As we saw in the introduction, today we are facing multiple environmental, social and economical crises. These are not isolated phenomena; on the contrary, all crises are interconnected and interdependent (Elbers, 2012a). They result from a life regulated by the principles of a reductionist worldview at a global level.

In their astute analysis of the global economic system, *Economics Unmasked*, Philip Smith and Manfred Max-Neef state the following about reductionism:

> Reductionism is thus specifically and ideally suited to the study of (classes of) objects with limited interaction with other (classes of)

7 Quoted by Meadows (2008: 86)

> objects, but, more importantly, studies where living – possibly irrational – beings, are excluded (Smith & Max-Neef, 2011: 63).

This mechanistic view of the world we live in, exposed in the previous chapter, contrasts sharply with holistic science. Stephan Harding characterizes holistic science with the following words:

> Holistic science weaves together the empirical and the archetypical aspects of the mind so that they work together as equal partners in a quest that aims not at a complete understanding and mastery of nature, but rather that strives for genuine participation with nature (Harding, 2006: 29).

With the empirical aspects, Harding refers to the reductionist scientific dominance that handles facts, models and predictions through empirical research. The archetypal aspects of the mind refer to an animistic, ancient and primordial perception, which understands the human organism as inherently predisposed to see nature as something alive and full of soul (Harding, 2006). In this chapter, we want to illustrate the words of Stephan Harding. The introduction to holistic science begins with quantum physics that revolutionized the scientific world in the early 20th century.

Quantum physics

At the beginning of the 20th century a revolution occurred in the world of physics, which radically changed the view of the world: quantum theory. This new branch of science made it possible to look at old controversies of physics under a new light and announced the end of the hegemony of Newtonian thought. The new theory is so unfamiliar that we find it difficult to take it as the basis for understanding the world – and ourselves. This difficulty is not surprising because our patterns of thought, behaviour, and perceptions are marked by the classical worldview that developed with the scientific revolution since the 17th century. Galileo, Descartes, and Newton provided us with true enlightenment, reliable knowledge, and sure predictions, and with that the perspective of the unlimited domination of nature (Dürr, 2009; Wheatley, 2006).

Calling quantum mechanics a branch of science is not entirely correct, because quantum mechanics is the foundation of all modern natural sciences. Equations explain the behaviour of very small objects of the size of atoms, and even smaller. The development of the most important branches of technique, modern chemistry, nuclear technology, model information technology, molecular biology, would not have been possible without it. The English physicist John Gribbin calls quantum theory the greatest scientific advance and even describes it as more transcendent and of greater practical use than the theory of relativity (Dürr, 2009, 2011; Gribbin, 1987).

The classic world view is mechanistic: its contents are perceivable and palpable, manageable with our rational thinking, symbolically describable by terms, and interpretable. Nature is considered material and we can decompose it without losing its material characteristics. Consequently, scientists, and more specifically physicists, made an effort to break the world into its smallest parts in order to find the "pure matter", it was the

search of the "indivisible", of the "atom". When they found this tiniest particle that makes up all chemical elements, they called it an atom. Atoms seemed to be the indivisible particles of pure matter, leading to the conclusion that matter comes first, and that it can be broken down to a point where it finally becomes indivisible (atomic). Atoms were attributed immutability in time. In this way, the continuity of the world is guaranteed from the continuity of matter through time. From this point of view, changes that we observe in the world result from the reorganization of the smallest particles. It is a world of isolated particles that remain identical and are related only to their closest neighbours. In this model, the forces obey simple laws that permit precise changes through targeted interventions (Dürr, 2009). But this model has an inconvenient; Hans-Peter Dürr, a German physicist and Alternative Nobel Prize winner, explains it accurately with the following words:

> Of course, this is valid only if we as human beings do not see ourselves as part of this strictly determined mechanism of "nature", but stand, so to speak, as the image of God outside of creation and are thus elevated above nature: man as co-creator, as manipulator and sovereign over a mechanically enslaved nature (Dürr, 2009:86).

According to the classical concept of nature, first there is the substance, i.e. the matter, which remains unchanged, while the form, or the aspect, is in second place. Form is only born by the interaction of matter and changes continuously over time (Dürr, 2009).

Quantum physics has inverted this structure of thought; Hans-Peter Dürr illustrates it with eloquent words:

> Modern physics now reaches a surprising conclusion: *Matter is not made of matter!* If we take matter further and further apart in the hope of finding the smallest, shapeless, pure matter, nothing remains at the end that reminds us of matter. In the end, there is no substance, only form, aspect, symmetry, relation. This

> conclusion was and still is very confusing. If matter is not made up of matter, it means that the primacy of matter and form turns around: The primary is relationship, the substance is the secondary. According to the new physics, matter is a phenomenon that only appears at a certain coarsened view. Matter/substance is coagulated form. Perhaps we could also say: at the end of all the matter fragmentation, there remains something that resembles more like the spirit – holistic, open, alive: the potentiality, the optional possibility of a realization. Matter is the slag of this spirit – removable, detachable, determined: reality (Dürr, 2009:86).

The new physics is not created to be explained with our language, hence it is difficult to express it in words. Box 1 explains the nature of quantum physics in words, images and metaphors to ensure simplicity in complexity. The German physicist Werner Heisenberg, one of the fathers of quantum physics, wrote the autobiographical book *Der Teil und das Ganze* [The part and the whole] (1969) in which he compiled conversations about the new physics. In one of these conversations with Danish physicist Niels Bohr, another father of quantum physics, the latter expressed the peculiarity of the difficulty of explaining the new physics in words: "Quantum theory is a wonderful example of the fact that you can understand a situation in complete clarity and yet know that you can only speak of it in images and parables" (Bohr, quoted by Heisenberg, 1969: 246). The colloquial language does not come close to describing the novelty even though one has "understood" everything. Werner Heisenberg explained it in the following way:

> For in it [quantum theory] we can formulate uniform orders over a very wide range in an abstract mathematical language; but at the same time we realize that if we want to describe the effects of these orders in natural language, we have to rely on parables, on complementary approaches that take into account paradoxes and apparent contradictions (Heisenberg, 1969: 252).

Box 1: The extraordinary nature of quantum physics in words, images and metaphors

If one is not initially shocked by quantum theory, it is impossible to have understood it.

Niels Bohr, Danish physicist

What we observe is not nature herself, but nature exposed to our method of questioning.

Werner Heisenberg, German physicist

[The quantum world is] a vast porridge of being where nothing is fixed or measurable ... somewhat ghostly and just beyond our grasp.

Danah Zohar, US American physicist

[The quantum world are] dynamic patterns continually changing into one another – the continuous dance of energy.

Fritjof Capra, Austrian physicist

The cosmos is a whole, because this quantum code [of the information field] has no limit. There is only the One, just as a lake is much more than a collection of water drops, since the individual drop only exists outside of the lake. When it becomes part of the lake, the term "drop" loses its meaning.

Hans-Peter Dürr, German physicist

The universe begins to look more like a great thought than like a great machine.

James Jeans, British astronomer

What we call "living" matter is not another matter than the usual one, the "dead" matter. Living matter is basically the same "matter" – which is actually not matter.

Hans-Peter Dürr, German physicist

Hans-Peter Dürr continues with the metaphorical explanation of quantum physics:

> The original elements of quantum physics are *relationships of the structure of form*. They are not matter. When this non-matter coagulates to a certain extent, becomes slag, then it becomes something "material." Or to express it in a riskier form: *Basically, there is only spirit*. But that spirit "calcifies", and when it calcifies, it becomes matter. And in our classical conception we take lime, because it is "tangible", more serious than what was there before, the not-yet-calcified, the spiritually alive. Consequently, there is nothing being, nothing that exists. There is only change, transformation, operations, processes. We misjudge the change in its primary meaning when we describe it ontologically as: A has changed into B over time. For there is basically neither A nor B nor time, but only the change of form, only the metamorphosis. Such shape changes cannot be isolated in principle, because they are open relationship structures. There is therefore only one single form and this is the "world", the potential "reality". There is only the one. And this one cannot in principle be divided into existing parts, it is the non-dual. Because dividing has something to do with our material view and with our idea that parts have similar properties to the whole or at least can be described with the same terms. The world thus presents itself as something non-separable, as something holistic (Dürr, 2009: 95).

The development of the concepts has shown with full clarity that quantum physics surpasses the limits of Newton's classic mechanics. Familiar concepts, such as Ernest Rutherford's atomic model of 1911, according to which electrons orbit around the nucleus of the atom, are obsolete in the face of the knowledge of the new physics. John Gribbin describes it in clear words: "It is not only that the atom of Bohr with its 'orbits' of electrons gives a wrong image – *all* images are wrong – and there is no physical analogy that makes us understand what happens in atoms, and that's it" (Gribbin, 1987: 106).

In 1927, Werner Heisenberg stated the relation of indeterminacy or uncertainty principle, according to which it is impossible to measure simultaneously the position and the impulse of an electron with arbitrary precision. In other words, the more certain you are about the position of a particle, the less you know about its velocity or amount of linear motion. At this point, quantum theory splits from classical physics and determinism. For Newton it would have been possible to predict the entire course of the future if we knew the place and momentum of every particle in the universe. For the modern physicist this concept of a perfect prediction is absurd because we cannot even know exactly the place and momentum of *one* particle. In the same year 1927, Niels Bohr and Werner Heisenberg formulated the "Copenhagen Interpretation", the first complete and consistent interpretation in itself, of the mathematical foundations of quantum theory (Gribbin, 1987).

More than 80 years have passed since these findings profoundly changed the scientific paradigm, but this revolutionary revelation has hardly been understood philosophically and epistemologically in society and the sciences (Dürr, 2009). That's to say, mainstream science and the vast majority of people remain firmly anchored in reductionist thinking. And this is not a minor detail; it is the main reason behind the way we treat the Earth and behind the situation in which we are today.

The knowledge of quantum physics provides us with raw material to reflect on our path to the future. We need a new way of thinking to address the challenges of the 21st century. Hathaway and Boff express the virtue of the new science versus the classical concepts with the following words:

> Perhaps determinism is a comfort for those who wish to see things continue as they are at present; but if we want to fundamentally change the way that humans live on Earth, then the paradoxical, surprising nature of the cosmos as revealed in

> quantum physics should in fact be taken as a sign of hope (Hathaway & Boff, 2009: 194).

Hans-Peter Dürr is also encouraging an optimistic outlook when he talks about the enormous potential that the knowledge of quantum physics has to offer:

> So quantum physics tells us that reality is a great spiritual relationship and our world is full of possibilities. There is an enormous amount of encouragement and optimism in this. We live in a much bigger world than we generally assume. And we can shape this world! Our Western consumer culture, our life-despising economic race represents only a tiny niche within our possibilities. Yet many people believe that economic constraints are laws of nature. No, they are man-made constraints (Dürr, 2011: 32).

The multiple crises we are confronted with today are a deep reflection of the spiritual crisis in the relationship between man and the animate world. And this is directly related to our denial to accept the new scientific worldview, not only formally and for the benefits for the technological developments, but with *all* the consequences. Dürr remarks that to accept this new worldview would force us to be humble with respect to the knowable in principle: "If the new physics teaches us by principle that the future cannot be predicted and that nature is not a machine, this means that we have to question all the social and economic structures that are based on this outdated worldview" (Dürr, 2009: 166).

I would now like to refer to two parables, *The parable of the ichthyologist* and *The world – a poem*. Both illustrate the consequences of our way of thinking that dismantles and fragments everything and that recognizes only the economic as a value.

The parable of the ichthyologist

In 1939, English astrophysicist Arthur Eddington wrote the parable of the ichthyologist in his *Philosophy of Physical Science*:

> A natural scientist – an ichthyologist, a fish expert – who investigates marine life and captures only fishes for that purpose, finds a fundamental law of ichthyology after years of fishing: "All fish are larger than five centimetres." Because there has never been a fish less than five centimetres in any one catch. On the way home, he meets his best friend, the metaphysician, and tells him about his finding. But the later says: "My dear, this is not a fundamental law. If you had measured the mesh size of your net, you would have found that you couldn't catch smaller fish at all." However, the ichthyologist is not impressed by this rejoinder and replies: "Excuse me, you don't understand anything about science. You are not a fisherman, not an ichthyologist. In ichthyology, a fish is defined as something you can catch with nets. What I cannot catch is not a fish. By the way, if you see the catchable as a limitation, I have to tell you: I don't see it as a limitation. I catch fishes to bring them to the market. No one has ever asked me for a fish I can't catch" (see figure 3) (Eddington, quoted by Dürr, 2009: 119).

In this parable, the metaphor of the net makes visible the insufficiency of the experimental measurement methodology of science that reduces and fragments the whole and leads us to think that what we see is reality. According to this way of seeing, what counts are the things that can be "captured", the "real," palpable things. But another important aspect of the parable is the definition of the fish in terms of the market: a fish is what I can sell in the market, and that's it. In other words, it is not worth wasting a second thinking about a fish that has no economic value. In this world of the "catchable", there is no room for the *transcendent*. Aspects such as kindness, beauty, vitality, are not recognized, they do not count, in the literal sense of the word (Dürr, 2009).

Whatever it is that we do, we need nets to fish. These are the reference systems and the thinking schemes to which our brain is accustomed to classifying what we experiment. Many scientists that were formed in the school of fragmented and reductionist thinking act in the same way as our ichthyologist. In addition to fragmenting everything, this action often has a doubtful and frankly detestable facet: what is not susceptible to be caught in the nets, what is outside the linear and reductionist thinking system is qualified as inexistent or irrelevant. It is generally not

Figure 3: "What I can't catch is not a fish." For everything we do and perceive we need reference systems without which we cannot classify the newly experienced. We cannot describe reality without these conceptual "nets". This is what makes demonstrable knowledge possible, but at the same time defines the fundamental limits of this knowledge. Everything that escapes through the meshes of the net does not "exist" (adapted from Dürr, 2009: 120).

discussed in circles considered as "serious" and consequently it is not recognized as a value (Dürr, 2009).

Galileo and Descartes made believe as an axiom that the natural sciences are *objective*, and despite the findings and advances of quantum physics that have shown that it is not the case, this "law" of the sciences is still widely accepted. The English philosopher Mary Midgley analyses the problems that the natural sciences have with the terms subjectivity and consciousness (Midgley, 2005), and speaking of consciousness, she describes this methodological approach with simple but acute words:

> Only what science studies is real,
> Science cannot study consciousness,
> So: Consciousness is not real.
> (Midgley, 2005: 334)

The world – a poem

Hans-Peter Dürr imagined a beautiful parable to reveal the difference between the holistic and reductionist worldview and illustrated it with the example of poetry. A poem is composed of various structures of order, nested in different levels. First, several letters are combined in a specific order, but it is only when they form words that they gain some meaning. When we combine words in a specific way, we obtain a verse – an additional level with different value and information. The complexity increases successively, to a stanza, the order of the stanzas and then to the entire poem. In conclusion, poetry is an *indivisible whole*, which requires to be read completely before revealing its full meaning. This structure can not be broken by removing some verses or adding some verses from another poem, even with intelligent, beautiful or similar verses. By the way, this is exactly how genetic manipulation works. We intervene on a whole that has a complex order and is subtly

interconnected and interdependent with its environment, without having the remotest idea of the consequences of these interventions (Dürr, 2009).

To understand the value and beauty of Julia Lawrence-Chant's poetry (figure 4, above), I first need to know English and understand that she wants to deliver a profound meaning through her work. People that do not know the language can only see what is objectively verifiable in Lawrence-Chant's poetry, that is, the succession and frequency of the letters that have a certain order. I can also calculate the probability and improbability of the order of the letters in order to find an "objectifiable" value of the poetry. Following the example of Hans-Peter Dürr, I simulated this objective and reasonable contemplation by inverting the order of the letters of the alphabet in the poem, by replacing A by Z, B by Y and so on (figure 4, below). The result is worthless, even to people who know English. But the *objective* characteristics of the poem in terms of aggregation and order of the symbols, their probability and improbability did not change, nor did its objective "valuation". Dürr concludes that from the point of view of scientific and also economic analysis, there is no difference between the first and the second versions (Dürr, 2009).

The poem with the inverted letters is a good example of our reductionist way of seeing the world. Now, if we compare the relatively few letters and symbols of this poem with the biological diversity in living nature, we find an even greater diversity and therefore a greater complexity. In the animal and vegetal realms, there are some species in smaller numbers and others in larger numbers. This is similar to the letters of the poem, although in a much simpler form. Some letters are very rare while others abound. Diversity seems to play an important role in both cases, but we are only starting to understand the relationships, or we don't understand them at all (Dürr, 2009).

This lack of understanding is the reason why we think we have to *improve* the world, reorder it and organize it in a clearer and more efficient way, according to our understanding. That's why we write a poem in a

Julia Lawrence-Chant
Celestial Beings

Never forget that you were born for these times.
Your knowing is not just your mind in flow, but divine communication.
Your heart is not just a beat, but vibrational force.
Your light is a cosmic particle, cast towards Earth to spread joy and hope for the elevation of unity consciousness.
Rise up and dance.
For this is the hour…

Qforz Ozdimxv-Xszmg
Xvovhgrzo Yvrmth

Mvevi ulitvg gszg blf dviv ylim uli gsvhv grnvh.
Blfi pmldrmt rh mlg qfhg blfi nrmw rm uold, yfg wrermv xlnnfmrxzgrlm.
Blfi svzig rh mlg qfhg z yvzg, yfg eryizgrlmzo ulixv.
Blfi ortsg rh z xlhnrx kzigrxov, xzhg gldziwh Vzigs gl hkivzw qlb zmw slkv uli gsv vovezgrlm lu fmrgb xlmhxrlfhmvhh.
Irhv fk zmw wzmxv.
Uli gsrh rh gsv slfi…

Figure 4: The poem *Celestial Beings* of Julia Lawrence-Chant. Julia Lawrence-Chant's poem *Celestial Beings* in original above, and below with the letters reversed (a=z, b=y etc.) (based on an idea by Dürr, 2009).

different way, ordered by the letters of the alphabet and the frequency of its appearance (figure 5). This way, we make it *manageable*, so to speak, everything written in order, and in doing so we believe that as men we know more than nature (Dürr, 2009).

aaaaaaaaaaaaaaaa	mmmmm
bbbbb	nnnnnnnnnnnnnnnnnn
ccccccccccc	oooooooooooooooooooooooooooo
ddddddd	pppp
eeeeeeeeeeeeeeeeeeeee	qq
fffffff	rrrrrrrrr
ggg	sssssssssssssssss
hhhhhhhhhh	ttttttttttttttttttttttttt
iiiiiiiiiiiiiiiiiii	uuuuuuuuuuuuu
j	vvvv
k	wwww
lllll	yyyyyyy

Figure 5: The poem *Celestial Beings* reordered and organized. The frequency of the individual letters of Julia Lawrence-Chant's poem *Celestial Beings* (based on an idea by Dürr, 2009).

What is the result of the reductionist analysis of Julia Lawrence-Chant's poem (figure 4, above)? First we gave it an objective and reasonable contemplation from the scientific point of view by inverting the order of the letters of the alphabet (figure 4, below), then we rearranged and organized it in a clearer and more efficient way to manage it better (figure 5). In the end, what remains of the beautiful poem *Celestial Beings*?

Dürr concludes the parable with the following reflective words:

> But of course we have lost the more deeply rooted meaning, the meaning as a whole, through our lack of understanding and the resulting reinterpretation. This is the reason why we should become more humble in radically changing the world we perceive only in a very limited way – especially in its structure of relationships – since we are in danger of destroying our own foundations of life and thus saying goodbye to the evolution of life (Dürr, 2009: 173).

Systems thinking

It's common to say that trees come from seeds.
But how could a tiny seed create a huge tree?
Seeds do not contain the resources needed to grow a tree.
These must come from the medium
or environment within which the tree grows.
But the seed does provide something that is crucial:
a place where the whole of the tree starts to form.
As resources such as water and nutrients are drawn in,
the seed organizes the process that generates growth.
In a sense, the seed is a gateway through which
the future possibility of the living tree emerges.
Peter Senge, C. Otto Scharmer, Joseph Jaworski & Betty Sue Flowers [8]

Systems thinking, or systems theory, is a branch of holistic science. While quantum physics made its findings at the atomic and subatomic levels, systems thinking deals with living systems on another scale. It emerged in the 1920s and 1930s and has its roots in organicist biology, psychology of form, general systems theory and complexity theory (Capra, 1996). The Austrian physicist Fritjof Capra, one of the most renowned systems thinkers, answers the question what is a living system like this

> When we walk out into nature, living systems are what we see. First, *every living organism*, from the smallest bacterium to all the varieties of plants and animals, including humans, is a living system. Second, *the parts of living systems* are themselves living systems. A leaf is a living system. A muscle is a living system. Every cell in our bodies is a living system. Third, *communities of organisms*, including both ecosystems and human social systems

8 Senge et al., 2004: 2

> such as families, schools, and other human communities, are living systems (Capra, 2005: 19).

Today, thinking in terms of complex systems is at the forefront of science. It is paradoxical to understand that precisely the systems thinking that has evolved from Western science in the 20th century has many elements in common with the indigenous worldviews all over the world (see chapter *The indigenous worldview*). As with the findings of quantum physics, the understanding of this new science has not, to date, aroused the interest of the dominant culture. Capra analysed why people have so many problems with systems thinking and found two main reasons: first, living systems are *non-linear*, they are networks, whereas our entire scientific tradition is based on chains of cause and effect, on *linear* thinking. Second, we live in a culture that is fundamentally *materialistic*, both in its values and in its vision of the world (Capra, 2005).

Donella Meadows, one of the world's leading systems analysts, also worked through our difficulties with systems theory, finding both resistance and acceptance of systems principles. On the one hand, we all went through the learning of rational analysis, of thinking in a straight line, cause-effect, dividing everything into small and understandable parts, and solving problems by controlling the world from the outside. But on the other hand, long before going through this social experience, we live and interact with complex systems. Our bodies are extraordinary examples of integrated, interconnected and autonomous systems. We relate to people, animals, plants, the garden, the forest, the neighbourhood – each and every one is a complex system. We grow and build with these relationships intuitively, without analysing, often without words, in a practical sense of understanding and interacting with them (Meadows, 2008).

According to Donella Meadows, a system is recognized by having *elements*, *interconnections* and a *function* or *purpose*. She defines a system as:

> A set of elements or parts that is coherently organized and interconnected in a pattern or structure that produces a characteristic set of behaviors, often classified as its "function" or "purpose" (Meadows, 2008: 188).

Some examples of systems are the digestive system, a football team or a school, a mountain, a continent or the Earth. It is important to stress that there are no separate systems, as the world is continuous and some systems are nested in other systems. But depending on the purpose of the discussion, boundaries can be placed around a system. So it is worth asking, is there anything other than a system? Yes, there is. An accumulation without particular interconnections or function, such as sand scattered on a road, is not a system (Meadows, 2008).

The *elements* are the most easily recognizable parts of a system, many of them are visible and tangible. If we take the university as a system we have buildings, teachers, students, books, computers etc. But not all the elements are physical, there are also intangible elements such as institutional pride or academic reputation. These elements can have a very high value within the system.

The *interconnections* are the relationships that connect the elements. It is usually easier to learn something about the elements than about their interconnections. In the university, interconnections include admission standards, financial flows, but also hall gossip and, most importantly, the communication of knowledge. Just as there are physical interconnections between the elements, many are flows of information. But if the information flows are difficult to detect, with the functions or purposes the situation is no better.

The *function* or *purpose* of a system is often not stated, written or expressed in any way. The best way to deduce the purpose of the system is to observe its behaviour for a long time (Meadows, 2008). "Purposes are deduced from behavior, not from rhetoric or stated goals," states

Donella Meadows (2008: 14) and adds "The least obvious part of the system, its function or purpose, is often the most crucial determinant of the system's behavior" (2008: 16).

Another important characteristic: a living system is an open system. The Austrian biologist Ludwig von Bertalanffy, one of the founders of systems theory, called them open systems because they require a continuous flow of matter and energy to stay alive:

> The organism is not a static system closed to the outside and always containing the identical components; it is an open system in a (quasi-) steady state ... in which material continually enters from, and leaves into, the outside environment (Bertalanffy, 1968, quoted by Capra, 1996: 48).

Open systems, unlike closed systems, are far from a state of thermal equilibrium. They are in a dynamic balance, a "stable" state characterized by continuous flows and changes. To describe this dynamic equilibrium state, von Bertalanffy coined the German term *Fließgleichgewicht* [flowing equilibrium]; they are open systems in stable states far from equilibrium (Capra, 1996).

Another characteristic of living systems is self-generation, the Chilean biologists Humberto Maturana and Francisco Varela coined the term *autopoiesis* for this process (from the Greek *autos* = same and *poiein* = to do). Autopoietic organization means – literally – that living beings continuously regenerate themselves, based on networks of relationships (Maturana & Varela, 1984). Hathaway and Boff describe the autopoietic system called human body:

> The human body is an open system that is constantly exchanging material with its surrounding environment. On average, over a period of seven years, every single atom in the body is lost and replaced through a process of constant regeneration (and indeed, 98 percent of the body's atoms are exchanged every single year!).

> From a strictly materialist point of view, then, we are totally different persons at the end of each seven-year-period; yet, from a systems perspective, we remain the same because the overall pattern of our existence has remained intact, even if it has changed in some respects through growth or aging (Hathaway & Boff, 2009: 198).

Key characteristics of living systems

Since living systems are non-linear and based on patterns of relationships (compare with chapter *Quantum physics*), understanding the principles of ecology requires another way of thinking and looking at the world. In many respects the holistic approach is diametrically opposed to the postulates of reductionist science (see chapter *Holism versus reductionism*). Systems thinking implies strong changes in perception (Capra, 2005). Based on the works of Capra (1996, 2005, 2011), Harding (2006), Hathaway and Boff (2009), Meadows (2008) and Wheatley (2006, 2012) can we identify some key characteristics for the change of perception from the mechanistic world to living systems:

A. The whole is more than the sum of its parts. A system cannot be reduced to its components without changing its characteristic pattern, nor will we understand the context or function of the whole system. As pattern we understand certain groupings of relationships that repeat over and over again. More than the individual parts, the pattern is the essence of a living system. The *emergent properties* are behaviours that surprisingly appear at the level of the whole, they cannot be understood if we only focus on the parts. Systems learning scholar Margaret Wheatley writes about emergence:

> Emergence is a process whereby interactions create something new and different that cannot be changed. Once something has

> emerged, it's here to stay. The only way to create something different is to start over, to begin again.
> [...]
> Emergence demands a different relationship with life, where we're curious, open, alert. The only thing we can predict is that life will surprise us. We can't see what is coming until it arrives, and once something has emerged, we have to work with what is. We have to be flexible and willing to adapt – we can't keep pushing ahead, blustering on with our now outdated plans and dreams. And it doesn't help to deny what has emerged. We need to be present and willing to accept this new reality. This is what it truly means to work with emergence (Wheatley, 2012: 32-33).

The ancient Sufi story *The blind men and the matter of the elephant* tells the concept of the whole that is more than the sum of its parts in illustrative form (see box 2).

B. Changing from observing objects to understanding relations. The key to understanding the phrase "The whole is more than the sum of its parts" are the relations. Or, as Capra (2005: 20) says "An ecosystem is not just a collection of species, but is a community." The essential thing in a living system are not the parts – the objects – but the networks of relations between the different elements (figure 6). Each web of relations is an integrated *whole*, but is also part of greater networks. Each living system is a subsystem of another larger system. It is important to notice that many relations in a system are non-linear.

C. Changing from an objective to a contextual knowledge. The objective thinking of a human being separated from nature does not fit in a living system. The properties of the parts can only be understood within the context of the whole. Here, by context, we mean the relations between the system and its environment. We must shift from linear to non-linear thinking and explain the phenomena in terms of their environment: all systems thinking is environmental thinking.

Lina Herrera

Box 2: The blind men and the matter of the elephant

Beyond Ghor, there was a city. All its inhabitants were blind. A king with his entourage arrived nearby; he brought his army and camped in the desert. He had a mighty elephant, which he used to increase the people's awe.

The populace became anxious to see the elephant, and some sightless from among this blind community ran like fools to find it.

As they did not even know the form or shape of the elephant, they grouped sightlessly, gathering information by touching some part of it.

Each thought that he knew something, because he could feel a part...

The man whose hand had reached an ear ... said: "It is a large, rough thing, wide and broad, like a rug."

And the one who had felt the trunk said: "I have the real facts about it. It is like a straight and hollow pipe, awful and destructive."

The one who had felt its feet and legs said: "It is mighty and firm, like a pillar."

Each had felt one part out of many. Each had perceived it wrongly...

This ancient Sufi story was told to teach a simple lesson but one that we often ignore: The behavior of a system cannot be known just by knowing the elements of which the system is made.

Source: Meadows, 2008: 7

D. Changing from giving value only to quantity to giving value to quality. Since the scientific revolution, we believe that science is objective, measurable and quantifiable. That is why "objective" scientists label the qualitative as less reliable or simply deny its existence. But the relations and context of systems are neither measurable nor quantifiable, while their importance is undeniable. In this new scientific way of approaching phenomena, we have to consider not only the how but also the meaning that these relations have.

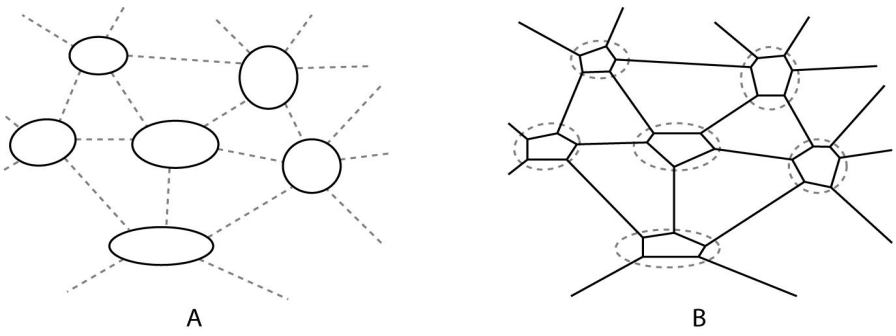

Figure 6: Figure/ground shift from objects to relationships (Capra, 1996: 38).

E. Changing from seeing the structure to understanding the process. Living systems organize themselves, regenerate, develop and evolve. Since they are open systems, there is a continuous exchange of matter, energy and information with the environment, while the pattern and the general order remain. It is only when a system does not find the required inflows and outflows that it looks for new patterns to keep on working. The Austrian systems scientist Erich Jantsch describes that any living system is a "never resting structure that constantly seeks its own self-renewal" (Jantsch, 1980, quoted by Wheatley, 2006: 20). That is to say, the living system is related to the terms of renovation, change and transformation. Margaret Wheatley points out a paradox when we think about change: "A living system produces itself; it will change in order to preserve that self. Change is prompted only when an organism decides that changing is the only way to maintain itself" (Wheatley, 2006: 20). But also this new way of seeing the world supposes that we understand that the structure is not a simple receptacle inside which things happen, but that the structure and the form are intimately related to the process and in fact are an expression of it (compare with the chapter *Quantum physics*). Life itself is a permanent process.

Principles of ecology

Fritjof Capra identifies some basic concepts that describe patterns and processes with which nature sustains life. For these fundamental facts of life he proposes the names of "principles of ecology, principles of sustainability, principles of community or, even, basic facts of life" (Capra, 2005: 23). In table 1 are described eight of the most important ecological concepts that together form the *principles of ecology*. These concepts are networks, nested systems, interdependency, diversity, cycles, flows, development and dynamic balance (Capra, 2003: 231, 2005: 23-27).

Table 1: Principles of ecology according to Fritjof Capra

Networks	Since the members of an ecological community derive their essential properties, and indeed their very existence, from their relationships, sustainability is not an individual property, but a property of the whole network.
Nested systems	At all scales of nature we find living systems nesting within other living systems – networks within networks. Although the same basic principles of organization operate at each scale, different systems represent levels of different complexity. At each level, phenomena manifest properties that do not exist at lower levels.
Interdependency	The sustainability of individual populations and the sustainability of the entire ecosystem are interdependent. No individual organism can exist in isolation. Animals depend on plant photosynthesis for their energy needs, plants depend on carbon dioxide produced by animals and nitrogen fixed by bacteria in their roots. The exchanges of energy and resources in an ecosystem are supported by widespread cooperation. Life did not take over the planet by combat, but by cooperation, collaboration and networking.

Diversity	The role of diversity is closely related to the network structures of the systems. A diverse ecosystem will be resilient because it contains many species with overlapping ecological functions, which may partially replace each other. When a particular species is destroyed by a serious disturbance so that one link in the network is broken, the diverse community will be able to survive and reorganize itself because other links can at least partially fulfil the function of the destroyed species. The more complex the pattern of the network of interconnections, the more resilient it will be.
Cycles	All living organisms have to feed on the continuous flows of matter and energy in their environment to survive, and all living organisms continuously generate waste. However, an ecosystem does not generate net waste; the waste of one species is the food of another species. Therefore, matter circulates continuously through the web of life.
Flows	All living systems, from organisms to ecosystems, are open. Solar energy, transformed into chemical energy through the photosynthesis of green plants, drives most ecological cycles, but the energy itself does not circulate. When it is converted from one form of energy to another, some of it – often much of it – inevitably comes out and is dispersed as heat. That's why we depend on a constant flow of energy.
Development	All living systems develop and all development implies learning. During its development the ecosystem goes through a series of successive stages, from a pioneering, changing, and rapidly growing community, to slower ecological cycles and a more stable and fully achieved ecosystem. Each stage of this ecological succession represents a distinct community in its own right.

Dynamic balance	An ecosystem is a flexible network, always fluctuating. Its flexibility is a consequence of multiple feedback loops that keep the system in a state of dynamic balance. No single variable is maximized, all variables fluctuate around their optimal values.

Sources: Capra, 2002: 231; Capra, 2005: 23-27

Living in a world of systems

Remember, always,
that everything you know,
and everything everyone knows,
is only a model.
Donella H. Meadows[9]

All models,
including the ones in our heads,
are a little right, much too simple,
and mostly wrong.
Donella H. Meadows, Jorgen Randers
& Dennis Meadows[10]

Donella Meadows finishes her manual *Thinking in Systems* with the chapter *Living in a World of Systems* in which she reaches the following conclusion:

> Living successfully in a world of systems requires more of us than our ability to calculate. It requires our full humanity – our rationality, our ability to sort out truth from falsehood, our intuition, our compassion, our vision, and our morality (Meadows, 2008: 170).

Meadows summarized her experiences in some general "systems wisdoms". She assumes that her list is not complete, considering herself still an apprentice in the school of systems. Below, some of her *Guidelines for Living in a World of Systems* with brief explanations (Meadows, 2008: 170-185, see these pages for detailed explanation).

9 Meadows, 2008: 172
10 Meadows et al., 2004

Get the beat of the system. Before disturbing a system of any form, first observe how it behaves. If you start with the observation of the system, you will be forced to focus on the facts rather than on theories. It helps you not to fall rapidly in your own false beliefs or interpretations – or in that of others. By applying this principle to the functioning of an organization, organizational culture researcher, Edgar Schein, said: "If you want to understand an organization's culture, go to a meeting" (Schein, 1992, cited by Senge et al., 2004: 48).

Expose your mental models to the light of day. If you have a mental model of the system in your head, you need to expose it by writing it down, drawing it, explaining it, and discussing it with others. This way, you can recognize the uncertainties, correct your mistakes and become more flexible. *Mental flexibility* is essential in order to recognize when a system changes to a new mode. Meadows calls it a prerequisite when you live in a world of flexible systems.

Honour, respect and distribute information. Information holds systems together. If information is delayed, partial, biased, scattered or incomplete, it leads to the malfunction of the system. Meadows considers this as the main cause of malfunction. Information is power: when static power, the *power-over*, restricts, controls and looks for invulnerability, the system does not work. But if information flows, if *power-with* reigns, the system will have the openness, vulnerability and willingness to change that it needs for its survival and development (see the chapter *A brief analysis of power*).

Use language with care and enrich it with systems concepts. Our information flows are primarily articulated through language. To keep information flows clear, we have to use language that is as concrete, meaningful and truthful as possible. We must also expand it to be consistent with our understanding of systems.

Pay attention to what is important, not just what is quantifiable. Our culture is obsessed with numbers, giving more importance to what is measurable than to what is not. We give more value to quantity than quality, even though there are many qualitative elements in systems. One of the pitfalls of the system lies in establishing goals for elements that are easy to measure, instead of setting goals for what is truly important. We need to improve our ability to evaluate quality. Donella Meadows encourages us not to let ourselves be paralysed by sayings like "if you can't define it or measure it, don't pay attention to it." She notes, "No one can define or measure justice, democracy, security, freedom, truth, or love. No one can define or measure any value" (Meadows, 2008: 177). Our task must be to advocate the inclusion of values in all systems, however qualitative they may be.

Go for the good of whole. Hierarchical systems evolve from below, hierarchies exist to serve the lower layers – not the upper ones. In the human body the brain is considered to occupy the upper level of the hierarchy, but only if it receives food from the digestive system can it be protected by the immune system, and only if it is mobilized through the extremities can it perform its activities. An imbalance in any of the function of the various systems has repercussions on the performance of the entire body. This is why parts of the system should not be maximized at the expense of the whole. Or as Kenneth Boulding once said, "Don't go to great trouble to optimize something that never should be done at all" (quoted by Meadows, 2008: 178). The goal should be to improve the properties of the entire system, such as its growth, stability, resilience and sustainability.

Listen to the wisdom of the system. The system counts on forces and structures to maintain itself, much of which is found in the lower layers of the hierarchy. At the head of a family of lions, there is a dominant male who survives thanks to the joint work of the lionesses on the hunt. In turn, he is responsible for the survival of the family's cubs, hence for the continuation of the species. You can encourage and stimulate these

forces and structures as long as you do not destroy the ability of the system to maintain itself. Before trying to "improve" things, look at the values that already exist.

Locate responsibility within the system. This point is valid as much for the analysis as for the design of a system. Respect of the analysis means to observe how the system creates its own behaviours. Many times, external forces act upon the system, forces that are difficult to control – if they are controllable at all. In general, it is easier to increase the responsibility inside of the system, to increase the "intrinsic responsibility". This means that the system is designed to quickly send feedback on the consequences of a decision to the decision makers. An example for system design with intrinsic responsibility would be that all cities or industries that throw waste waters to streams would be obliged to take their drinking water *downstream* of the waste-water outlet. Another example that shows the loss of responsibility is the moment when the president of a government no longer leads the troops in a battle after having declared war. One last example proposed by American ecologist Garrett Hardin: People against abortion practice intrinsic responsibility only when they are willing to *personally* take care of the child to be born. These examples show how little Western culture places *responsibility* for the actions we take, and how poorly designed systems are in place that do *not* force us to feel the consequences of our actions.

Stay humble – stay a learner. Donella Meadows tells that her work with systems, on the computer, in nature, with people in organizations, always reminded her "how incomplete my mental models are, how complex the world is, and how much I don't know" (Meadows, 2008: 180). We must learn through experimentation, or as American visionary Buckminster Fuller described, "through trial and error, error, error" (quoted by Meadows, 2008: 180). In a world of complex systems, learning demands small steps, constant monitoring and the will to change course whenever necessary.

Expand time horizons. According to Donella Meadows, the interest rate, that led to the amortization period and other financial instruments, was one of the worst ideas that humanity has had to provide a rational and quantitative excuse to ignore the long term. The time horizon of the industrial society does not go further than the next shareholder assembly, the next amortization period or the next elections; in most families, it covers as much as three generations. In contrast, many Native American cultures take decisions by considering the effects on the seventh generation in the future. The longer the time horizon, the better the chances of survival. In the strict sense of systems theory, there is no distinction between short term and long term. Phenomena of various time scales are nested one inside the others and each action affects the various scales. Meadows advises to observe the short and the long term, hence the entire system.

Defy the disciplines. The complexity of systems requires that people from various disciplines work together in an interdisciplinary way, but this term has been so badly used that it has lost its meaning. Donella Meadows explains how interdisciplinarity works:

> Interdisciplinary communication works only if there is a real problem to be solved, and if the representatives from the various disciplines are more committed to solving the problem than to be academically correct. They will have to go into learning mode. They will have to admit ignorance and be willing to be taught, by each other and by the system.
> It can be done. It's very exciting when it happens (Meadows, 2008: 183).

Expand the boundary of caring. If we wish to live successfully in this world of complex systems, we must not only widen the time horizons and the thinking horizon, we have to expand the horizons of what we have to *take care of*. There are moral reasons for doing so, which are in fact practical reasons as well. We live in an interconnected and interdependent world, such that any action that we take towards other people or ecosystems have repercussions on us. Resorting to quantum physics, this reveals a mysterious aspect of the parts and of the whole, or in the words of the physicist and philosopher Henri Bortoft, "Everything is in everything" (quoted by Senge et al., 2004: 7). This means that the moral and practical rules are the same in the end. All that is needed for human beings is to recognize and comply with them.

Don't erode the goal of goodness. Archetypes are the common structures of a system that produce characteristic patterns of conduct, one of them is the "drift to low performance". The most harmful example of this archetype in our societies today is the erosion of the objective of ethics. Bad human behaviour is exhibited, amplified and glorified by the mass media and by the advertising industry, and is presented to the public as characteristic and proper behaviour. We barely account for the many and more numerous examples of human kindness, because "good news is no news." This lowers expectations in such a way that the breach between desired behaviour and real behaviour grows. The public discourse is filled with cynicism, political and economic leaders teach an amoral and immoral behaviour, without regret. Why? Because in general we are not required to be accountable. At the same time idealism is ridiculed. There are two antidotes to the erosion of the objectives and the drift to low performance: the first is to maintain absolute standards independently of performance, and the second is to orient the objectives towards the best performances of the past, rather than towards the worst ones. Donella Meadows closes this last guideline, and her book, with a reflection on the outreach of systems thinking:

> Systems thinking can only tell us to do that. It can't do it. We're back to the gap between understanding and implementation. Systems thinking by itself cannot bridge the gap, but it can lead us to the edge of what analysis can do and then point beyond – to what can and must be done by the human spirit (Meadows, 2008: 185).

Holism versus reductionism

Understanding is the result of integration,
while knowledge has been the result of detachment.
That understanding is holistic,
while knowledge is fragmented.
Manfred Max-Neef [11]

The idea of chapter two has been to introduce the concepts of holistic science. Since the beginning of the 20th century, the findings of quantum physics and systems thinking have revolutionized the scientific world. For reasons of space, this text is limited to the description of these two fundamental branches. But I want to emphasize that holism is an emergent science that is unfolding. Other branches of holistic science are complexity and chaos theory (Gleick, 1988; Capra, 1996), Gaia theory (Lovelock, 2006, 2009; Harding, 2006), deep ecology (Naess, 2008; Capra, 1996; Seed et al., 1988), ecopsychology (Roszak et al., 1995; Buzzell & Chalquist, 2009), applied phenomenology (Abram, 1997, 2010), the science of Goethe (Bortoft, 1996; Colquhoun & Ewald, 1996; Wahl, 2005) and new biology (Maturana & Varela, 1984; Lipton, 2005; Sheldrake, 2009, 2012). Other very interesting fields of application of holistic science are organizational learning and change (Senge, 1992; Wheatley, 1994, 2006; Senge et al., 2004; Scharmer, 2007; Peat, 2008; Briskin et al., 2009; Jaworski, 2012). Hathaway and Boff present an extended synopsis on holism and its relation with reductionism (2009, 2012). And finally I want to recommend a beautiful illustrated book for all ages by Linda Booth Sweeney (2008) that explains twelve principles of living systems based on twelve timeless legends.

11 Max-Neef, 2009: 18

Finally, I summarize various concepts of reductionist science (chapter 1) and their equivalents in holistic science (chapter 2) in table 2. The differences are profound. By comparing the two columns of the table, it is easy to understand why the eminences of holistic science speak of a change in the scientific paradigm since the beginning of the 20th century. But this change of paradigm should not be misinterpreted as a replacement or annulment of reductionist science by holistic science. Reductionist science remains valid and has its own importance. However, holistic science transcends and includes reductionist science. Or, to express this in a systems way, reductionist science is nested within a larger system: that of holistic science. The major difference is that holistic science is inclusive, not reduced to reason, and looks out for the well-being of the whole of creation.

Table 2: Differences between reductionist and holistic science

Reductionist science	Holistic science
Matter Matter is the basic substance of the universe, composed of small atoms and of even smaller, elementary and immutable particles. Form and aspect are in second place. **Object** Each object is made of matter. The universe is composed of objects.	**Form** *Matter is not made of matter!* What is primordial is form, aspect, symmetry, relationship – the pattern. Substance is in second place. **Relationship** Every experience and every event is first and foremost a relationship. The relationship is what sustains the whole and what creates substance: a web of relationships. **Spirit** *The foundation of the world is not material, but spiritual.* What is primordial is the holistic, open, living, the potentiality of a realization.
The part Each object can be divided into parts. If I understand how the parts work, I understand how the *whole* object works.	**The whole** *The whole is more than the sum of the parts.* A system cannot be reduced to its parts without changing its characteristic pattern. The integrated whole is always more than the sum of its parts.
Purpose There is no purpose in nature or in the cosmos. However, there are fixed and external laws that govern it.	**Purpose** The world is a system, an organism full of life and purpose, nested in the larger system of the cosmos.

Reductionist science	Holistic science
The world as a machine The world is a large machine whose behaviour can be predicted with precision. Man is designed to take control of the world.	**The living Earth – Gaia** The Earth is a self-regulating system to made up entirely of organisms, surface rocks, the ocean and the atmosphere, closely linked in an evolving system.
A linear system The world can be understood in a linear way: there is always a cause-effect relationship. Each effect has a defined cause or set of causes.	**A non-linear system** The Earth functions – like all living systems – in a complex, cyclical and non-linear way, inherently unpredictable and uncontrollable, and based on feedback.
The future The future is predictable and determined.	**The future** *The only thing that we can predict is that life will surprise us.* The future is indeterminate and open, by principle unpredictable.
Reality Reality is a world of things, of isolated objects and their order. There is an objective reality that exists outside one's own mind.	**Existence** *Existence is not reality.* Existence is creative, limitless, open, dynamic, unstable, undividable. It contains the potential to manifest itself as matter and energy, and above all, it is subject to individual perceptions.
The human being The human being is separated from nature, is superior to it and is in charge of dominating the rest of creation.	**The human being** The human being is part of the web of life, is interconnected with all of nature and the cosmos.

Reductionist science	Holistic science
Science The object of study is measurable, quantifiable, linear and free of values. Qualitative and emotional aspects are at the second rank or are ignored. The generation of knowledge comes from a separation from the object of study and from an objective process.	**Science** *Everything is in everything***.** Science is based on the universe that is alive, creative and intelligent. Everything is interrelated. The relationships and context of systems are not measurable or quantifiable. The way to generate knowledge includes the rational, intuitive, emotional and sensory, and a close relationship with the object of study.
Competition Life took over the planet by combat, in an endless competition for survival. Evolution is driven by domination, the "survival of the fittest."	**Cooperation** Life took over the planet through cooperation, collaboration and networking.
Power-over Through the exercise of our rational intellect we can tame and control the world. *Power-over* restrains, controls and seeks invulnerability.	**Power-with** *In life, the issue is not control but dynamic connectedness.* *Life simply is uncontrollable.* Nature and life are inherently unpredictable and uncontrollable. *Power-with* enables the openness, vulnerability and willingness to change that the system needs for its survival and development.

Table based on texts by Capra, 1996, 2005, 2011; Dürr, 2009, 2011; Gribbin, 1987; Harding, 2006; Hathaway & Boff, 2009; Lovelock, 2009; Meadows, 2008; Smith & Max-Neef, 2011; Sheldrake, 2012; Wheatley, 2006, 2010, 2012.

I would like to close this chapter with some reflections on the relationship between science and truth. Henri Bortoft writes:

> It has been widely believed that science advances by the use of its own internal method for attaining the truth, so that scientific knowledge is legitimated by its own authority. However, it turns out that there is no such method, and science is best understood as a culturally based activity, i.e., as the product of a social process (Bortoft, 1996: 31).

Science is a constant search and an evolutionary process in which ideas change with culture and its cosmology. It is precisely the time for a new renaissance, a new "scientific revolution." The ideas that emerged in the Enlightenment have completed their cycle and we are now in the transition from an anthropocentric model to an ecocentric model. Just as in its time there was a shift from a theocentric model to an anthropocentric one, from seeing the Earth as flat to seeing it as round. In reference to this, US American physicist David Bohm formulated the wise words "science is the search for truth, whether we like it or not" (quoted by Margulis, 2006: 8). And Manfred Max-Neef proposes the following path for the future:

> Perhaps it would make sense that we start seeing brothers and sisters surrounding us. Perhaps it would be good to believe in the possibilities of harmony between many possible truths. Perhaps it would be to our advantage to dare to imagine and believe that the earth has a soul and that everything is life. Perhaps it would be good to realise that there is no reason whatsoever to banish intuition, spirituality and consciousness from the realm of science. Or, to put it in Goethe's words: 'If [we] would seek comfort in the whole, [we] must learn to discover the whole in the smallest part' (Max-Neef, 2009: 20-21).

3 Holistic paradigms and education

We believe that the roots of these crises
lie in the stories we have been telling ourselves.
We intend to challenge the stories
which underpin our civilisation:
the myth of progress,
the myth of human centrality,
and the myth of our separation from 'nature'.
These myths are more dangerous for the fact
that we have forgotten they are myths.
The Dark Mountain Project[12]

As we saw in chapter two, it has been more than eighty years since the findings of quantum physics changed the scientific paradigm. However, the principles of holistic science have hardly found an entry into the hegemonic Western culture. Patriarchal societies and mainstream science are opposed to giving up some of the power rooted in the reductionist paradigm.

In turn, the hegemonic economic model is like a train going in a straight line – in a linear fashion – with an increasingly fast speed towards the precipice. Neoliberalism has uninstalled the brakes and the train continues to increase its speed. We have two options today: to end up shattered at the bottom of the cliff, that is, to destroy the basis of our survival on Earth, or to work on new ideas so that something new can emerge (see chapter *Key characteristics of living systems*). It is necessary to understand and

12 The Dark Mountain Project, 2009

become aware that we live on a finite planet and that this planet functions – like all systems – largely in a *non-linear* way. Stephan Harding advocates the need to implement holistic science:

> If we cannot predict the exact nature of emergent properties, and if small changes can have unforeseeable and potentially dramatic outcomes, we have to accept the possibly uncomfortable conclusion that nature is inherently unpredictable and uncontrollable. Indeed, systems thinking suggests that the metaphor of control is the wrong basis on which to build a fruitful relationship with nature – participation is clearly more appropriate, and is in fact the only available option (Harding, 2006: 33).

Donella Meadows also strongly rejects reductionist thinking and its foolish pursuit to control the world; she supports holistic science with the following words:

> Self-organizing, nonlinear, feedback systems are inherently unpredictable. They are not controllable. They are understandable only in the most general way. The goal of foreseeing the future exactly and preparing for it perfectly is unrealizable. The idea of making a complex system do just what you want it to do can be achieved only temporarily, at best. We can never fully understand our world, not in the way our reductionist science has led us to expect. Our science itself, from quantum theory to the mathematics of chaos, leads us into irreducible uncertainty. For any objective other than the most trivial, we can't optimize; we don't even know what to optimize (Meadows, 2008: 167-168).

Chapter three first introduces the indigenous worldview and shows how holistic science harmonizes with it. Afterwards, I will present some ideas about the holistic paradigm and discuss the role of ethics in this. The promotion of holistic education is of crucial importance for a paradigm shift and the following section will present examples for holistic education. Finally, the concept of living well is related to the holistic paradigm.

The indigenous worldview

Thus, the toad, by his way of being,
knows Andean climate issues that man,
by his own way of being,
does not reach to know.
But if man talks with the toads
he can be enriched
by their wisdom and vice versa,
the toads that talk with men
are enriched in their own knowledge.
Grimaldo Rengifo & Eduardo Grillo[13]

The theoretical physicist F. David Peat experimented and lived the indigenous science with native people of North America. In the book *Blackfoot Physics* (2002), he narrates his deep experience with the indigenous worldview of the inhabitants of *Turtle Island* – the name given to the North American continent by indigenous peoples. As a person raised and trained in Western society, Peat describes his difficulties in understanding and immersing himself in a different worldview:

> Western education predisposes us to think of knowledge in terms of factual information, information that can be structured and passed on through books, lectures, and programmed courses. Knowledge is seen as something that can be acquired and accumulated, rather like stocks and bonds. By contrast, within the Indigenous world the act of coming to know something involves a personal transformation. The knower and the known are indissolubly linked and changed in a fundamental way. Indigenous science can never be reduced to a catalogue of facts or a database in a supercomputer, for it is a dynamic and living process, an

13 Rengifo & Grillo, 2008: 86

> aspect of the ever-changing, ever-renewing processes of nature (Peat, 2002: 5-6).

The apparent paradox between Western, analytical, linear science and indigenous *coming-to-knowing* is diluted when one examines the findings of holistic science. Many concepts harmonize with the knowledge of indigenous science, as Peat shows with the following examples:

- Quantum theory stresses the irreducible link between observer and observed and the basic holism of all phenomena. Indigenous science also holds that there is no separation between individual and society, between matter and spirit, between each one of us and the whole of nature.
- The physicist David Bohm has spoken of what he calls the implicate, or enfolded, order (an order in which the whole is enfolded within each part) as being a deeper physical reality than the surface, or explicate, order that is immediately perceived by our senses. In a similar way, members of the Gourd Society wear a necklace of mescal beads in which each bead symbolizes the cosmos and reminds them that within each object is enfolded the whole.
- In modern physics the essential stuff of the universe cannot be reduced to billiard-ball atoms, but exists as relationships and fluctuations at the boundary of what we call matter and energy. Indigenous science teaches that all that exists is an expression of relationships, alliances, and balances between what, for lack of better words, we could call energies, powers, or spirits.
- Several leading-edge thinkers in physics suggest that nature is not a collection of objects in interaction but is a flux of processes. The whole notion of flux and process is fundamental to the Indigenous sciences of Turtle Island. Algonkian-speaking peoples, such as Cheyenne, Cree, Ojibwaj, Mic Maq, and Blackfoot, all share a strongly verb-based family of languages that reflects this direct experience.

- Some physicians question our current medical models and suggest that healing involves the whole person – body, mind and spirit. Native healers have never fragmented their vision of health, for it is regarded as emerging out of the whole of nature and is one with the processes of renewal.
- Ecologists stress that we must attend to the basic interconnectedness of nature and to the sensitivity and complexity of natural systems. This has always been the approach of Indigenous peoples. The traditional Thanksgiving Address of the Iroquois people, for example, specifically acknowledges the wholeness that is inherent within all life.
- Scientists are alerting us to the fragility and sensitivity of our planet. It is the tradition of the Iroquois people that in arriving at a decision they consider its implications right down to the seventh generation that comes after them (Peat, 2002: 6-7).

What Peat describes based on his experiences with the indigenous peoples of Turtle Island has its analogy in research on the worldview of the indigenous peoples of *Abya Yala*. The word Abya Yala is a Kuna expression that explicitly refers to the pre-conquest Latin American indigenous continent, meaning "the fertile land in which we live" (Estermann, 2008).

The Swiss philosopher Josef Estermann presents in his *Filosofía andina: Sabiduría indígena para un mundo nuevo* [Andean philosophy: Indigenous wisdom for a new world] (2006) an intercultural analysis of the thought of the Andean peoples. According to Estermann, Andean rationality is articulated in a series of fundamental principles or axioms, the main one being the *principle of relationality* or *holistic principle*. That means that everything is somehow related, linked or connected to everything, or repeating what Henri Bortoft said, "Everything is in everything." The basic entity is not substance or matter, but relation. Based on the network of interrelations and connections, the particular entities are constituted (Estermann, 2006).

The basic principle of Andean philosophy is the *relationality of the whole*. Estermann describes three principles derived from this axiom: The first one is the *principle of correspondence* that says that the "different aspects, regions or fields of 'reality' correspond in a harmonious way" (Estermann, 2006: 136). The second one is the *principle of complementarity* which means that every entity and every action is always in coexistence with its specific complement. And the third is the *principle of reciprocity* which expresses correspondence at a pragmatic and ethical level, "to each act corresponds as a complementary contribution a reciprocal act" (Estermann, 2006: 145). Reciprocity rules in each type of interaction, between humans, between the human being and nature, and between the human being and the spiritual. It is universally valid and ethics is not limited to the human being and his action, but has cosmic dimensions (Estermann, 2006).

The book *Suma Qamaña: La comprensión indígena de la Vida Buena* [Suma Qamaña: Indigenous understanding of the good life] (2008a), is a compilation of texts on the indigenous worldview of some of today's most important Aymara and Quechua thinkers. In a comparison between the Western Good Life and the Amerindian Sweet Life, Javier Medina notes that the former excludes work because it is understood as divine punishment, while the latter includes work as something good and positive. This comes from the animist cosmovision as the background of the Andean concept of work:

> Man knows himself to be part of a living, sacred, animated cosmos, and of a Mother Earth. The cosmos is whole, not broken by the opposition matter-spirit; nor disintegrated by the contradiction religion-technology and the divorce between ethics and economy; not broken by the separation of man from his work and by the alienation of the product of his work (Medina, 2008b: 34).

According to the Bolivian sociologist and Aymara thinker, Simón Yampara, the design, architecture and engineering of Andean peoples' lives resemble the weaving of the spiderweb (figure 7). At the centre is

the *jatha*, the seed with spirit, the grouping of families, similar to a living cell. From there, a series of envelopes or higher and complementary stages of organization in the form of a spiral are generated. In the second wrapping is the *ayllu*, the village, the people, the organized community, that forms part of the cell matrix. The holistic institutionality of the *ayllu* is structured by four main elements: a) territory, b) production and economy, c) cultural tissue and rituality, d) political government and authorities. In the third wrapping, there is the *marka*, the territorial communities, and in the fourth wrapping, the *suyu*, the territory of the great nation (Yampara, 2008). Simon Yampara characterizes the Andean cosmic house in the following way:

> In this holistic, integral and interactive vision, there is no such differentiation between biotic and abiotic beings, which Western ecologists differentiate to explain the science of ecology. This

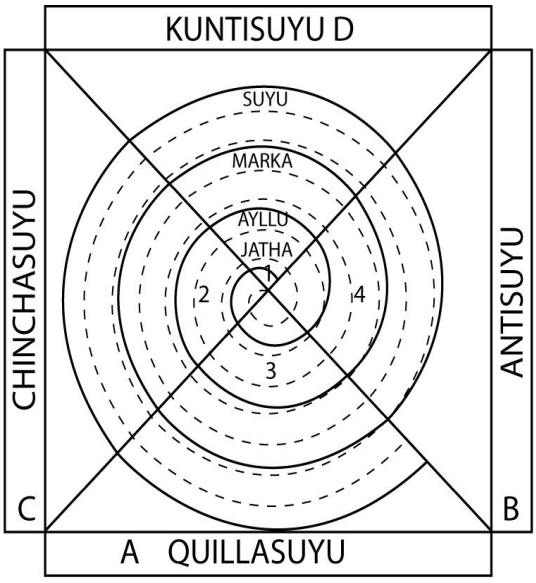

Figure 7: The cosmic house of the Andean peoples (Yampara, 2008: 76).

> natural biotic world, woven in webs, makes us affirm that everything has sexuality and gender: the lithic world, the vegetable world, the animal world, and finally, the territory, where and with whom the Andean man/society coexists on a daily basis. And since all of this has a spirit, *japhalla/qamasa*, there are reasons to converse/come to an agreement, daily and periodically (Yampara, 2008: 77).

Peruvian agricultural engineers Grimaldo Rengifo, of Amazonian Quechua origin, and Eduardo Grillo, of Moche origin, contribute to the indigenous worldview with fundamental concepts. Their thinking is based on a motto of the Andean world: *Nurture life and let yourself be nurtured.* They talk about "the delicate nurturing of our harmony, because only our exuberant diversity knows how to nurture the harmony that is convenient here and now" (Rengifo & Grillo, 2008: 84) and they explain the Andean world with wise words:

> The Andean world is a world of nurturing in which everyone finds the delight of his life in nurturing and letting themselves be nurtured. A world of symbiosis in which the life of each facilitates the life of all; in which there is no room for abstraction nor for the separation and opposition of subject and object and of ends and means; here there is not a world "as such" that is distinct from us, as in the West where a differentiation is made between the whole and the parts, the content and the container, man and nature, and of which one could talk of in the third person: "the world is such and such." No, here the world is us. We are not a world of knowledge because we do not want to transform the world but we love it as it is (Rengifo & Grillo, 2008: 84).

Rengifo and Grillo claim that the Andean world is *not* a world of knowledge; but in reality, their article is a brilliant example of the indigenous science, that shows how holistic science – the vanguard of Western knowledge – fits in with it. As in systems thinking, they emphasize contextual knowledge when they make clear that in the Andean world, the definitions are contextual (Rengifo & Grillo, 2008).

Here is another except of their remarkable text that reinforces the concepts of nurturing and symbiosis:

> We find the full delight of our lives in nurturing the *Ayllu* and in letting ourselves be nurtured by our *Ayllu*. We live in symbiosis, that is, facilitating the life of our communal brothers and letting them facilitate our life. Our nurturing way of life is pleasant both to those who are nurturing and to those who are being nurtured, a situation that is reversed at every moment. This is our way of participating fully in the daily celebration of our life. This is our attitude in life. Here we know how to enjoy everything without holding on, which would be damaging (Rengifo & Grillo, 2008: 89).

This brief overview of the indigenous cosmovision shows how holistic science coincides with indigenous science. The wisdom of the animist worldview is indispensable for an harmonious and sustainable coexistence with Pachamama, the living Earth. But reality goes otherwise: since the "discovery" of Abya Yala, the masters of Western knowledge have ridiculed, despised and subjugated native peoples and their worldview. Estermann describes this imbalance between the dominant and exploiting power and the dominated and exploited peoples:

> 'Andean science' is not detached from religious, ethical and mythological concepts, but takes them into account as valuable sources of human knowledge. For this reason, it is inadequate and even absurd to try to approach the Andean culture and philosophy from the ideology of a 'materialistic science'; Western reductionism is not able to grasp the wise and 'scientific' wealth of the Andean human being, and therefore he considers him 'pre-scientific', 'primitive' and 'superstitious' (Estermann, 2006: 120).

Peat also analyses the imbalance between paradigms and points out the problems caused by a society that exercises economic and political power: it subjugates the other cultures and imposes a single, uniform worldview, thus eliminating the flexibility and diversity previously existent. The consequences of such occurrences are serious:

> When Western science claims to be speaking the truth then, by implication, other peoples' truths become myths, legends, superstitions, and fairy stories. A dominant society denies the authenticity of other peoples' systems of knowledge and in this way strikes at the very heart of their cultures (Peat, 2002: 42).

To get a deeper knowledge on the fascinating worldview of the native peoples of *Abya Yala* and *Turtle Island*, I recommend the books of Estermann (2006, 2008), Huanacuni (2010), Medina (2008a, 2008c) and Peat (2002).

The holistic paradigm

In today's world, we face overwhelming problems – interconnected and interdependent problems that mutually aggravate each other. To give a few examples, we have chemical pollution, ocean acidification, the appalling rate of biodiversity loss, cultural homogenization and loss of cultural diversity, social injustice, the economics of waste and destruction, and finally, as the ultimate consequence of all the damage caused at the global level, climate change (Capra & Henderson, 2009; Elbers, 2011, 2012b; Rockström et al., 2009a, b). This is a list that could be extended *ad infinitum*. The *Dark Mountain Project*[14], a network of writers, artists and thinkers, describes in its *Manifesto* the situation in the face of climate change:

> And over it all looms runaway climate change. Climate change, which threatens to render all human projects irrelevant; which presents us with detailed evidence of our lack of understanding of the world we inhabit while, at the same time, demonstrating that we are still entirely reliant upon it. Climate change, which highlights in painful colour the head-on crash between civilisation and 'nature'; which makes plain, more effectively than any carefully constructed argument or optimistically defiant protest, how the machine's need for permanent growth will require us to destroy ourselves in its name. Climate change, which brings home at last our ultimate powerlessness (The Dark Mountain Project, 2009).

In Western society, science and reductionist logic reign and cancel out intuition and holism. We look for the solution to our problems *outside* of ourselves, in external agents, always thinking in a linear logic of cause to effect. We systematically exclude and negate the *inside*, our responsibility in all what is happening (Meadows, 2008). Donella Meadows analyses the situation with discernment:

14 https://dark-mountain.net/

> Hunger, poverty, environmental degradation, economic instability, unemployment, chronic disease, drug addiction, and war, for example, persist in spite of the analytical ability and technical brilliance that have been directed toward eradicating them. No one deliberately creates those problems, no one wants them to persist, but they persist nonetheless. That is because they are intrinsically systems problems – undesirable behaviors characteristic of the system structures that produce them. They will yield only as we reclaim our intuition, stop casting blame, see the system as the source of its problems, and find the courage and wisdom to *restructure* it (Meadows, 2008: 4).

In other words: we look for specific problems, we try to solve them in a linear way, and then we are surprised because nothing changes and the problems persist or multiply. But all the crises, however difficult they may be, offer an opportunity. If we wish to overcome the fundamental problems of the system, we need to understand its complexity in order to be able to provide appropriate solutions.

Based on her broad experience in systems thinking, Donella Meadows compiled a list of twelve leverage points to intervene in a system (Meadows, 2008: 145-165). Among them, the second most efficient point refers to a change of paradigm, and is called: "Paradigms – The mind-set out of which the system – its goals, structure, rules, delays, parameters – arises" (Meadows, 2008: 162). The author explains the existence of ideas shared in the minds of society, important *undeclared* assumptions, which reflect our canon of deeper beliefs about the functioning of the world. These beliefs don't even have to be named because *everybody* knows them (Meadows, 2008). Margaret Wheatley calls this dynamic *paradigm blindness* and explains it this way:

> We all see the world through a particular lens, and we can't see anything beyond that. Anything new and different isn't visible. It's not that we personally are invisible – it's our way of being in the world that is.

> If people *are* willing to notice our work, their lens will filter out what's new and different and only bring into focus those achievements or methods that look familiar. Everything else, all the innovative, bold, new things we've done, will be invisible (Wheatley, 2010: 109; compare also the quotes from Hathaway & Boff (2009: 141), and Smith & Max-Neef (2011: 58) in the chapter *The cosmology of domination*).

Hereunder, some examples of undeclared assumptions from Western culture (Dumanoski, 2009; Meadows, 2008; Norberg-Hodge, 2011; Smith & Max-Neef, 2011):

- Money measures something real and has a real meaning; consequently, less paid people are worth less – and this in the literal sense of the words.
- The growth of global trade is necessary to increase employment and reduce poverty.
- Nature is a warehouse of resources waiting to be used for human purposes.
- Large-scale industrial and hydrocarbon-based agriculture is needed to feed the world.
- One can "own" land.
- Despite global warming, the planet will continue to operate largely as it did since the end of the last ice age, and the warming will perturb but not unhinge the system.

If we present these assumptions to people of other cultures, they will by no means find them obvious. On another side, if we present the leverage point "change of paradigm" to Western society, the vast majority of people will flatly reject the feasibility of intervening in the system at this level. But the system works this way – in a non-linear way; there exist many examples of such interventions as shown by scientists Nicolas Copernicus and Johannes Kepler, Albert Einstein, Werner Heisenberg

and Niels Bohr, or the civil rights pioneers Mahatma Gandhi, Martin Luther King and Nelson Mandela. Donella Meadows addresses the doubts:

> You could say paradigms are harder to change than anything else about a system, and therefore this item should be lowest on the list, not second-to-highest. But there's nothing physical or expensive or even slow in the process of paradigm change. In a single individual it can happen in a millisecond. All it takes is a click in the mind, a falling of scales from the eyes, a new way of seeing. Whole societies are another matter – they resist challenges to their paradigms harder than they resist anything else (Meadows, 2008: 163-164).

And to the question, "How do we change a paradigm?", she responds:

> You keep pointing at the anomalies and failures in the old paradigm. You keep speaking and acting, loudly and with assurance, from the new one. You insert people with the new paradigm in places of public visibility and power. You don't waste time with reactionaries; rather, you work with active change agents and with the vast middle ground of people who are open-minded (Meadows, 2008: 164).

In Donella Meadows' list there is another leverage point even more important than changing the paradigm: "Transcending Paradigms." It is based on the understanding and acceptance that *none* of the paradigms hold the "truth," that any paradigm that we build is always very limited in front to the immensity of the universe that infinitely exceeds human comprehension. Since we practically build our world based on these paradigms, it is difficult to accept that there is not certainty in *any* vision of the world (Meadows, 2008). Getting to this point is the basis for a *radical empowerment* that Donella Meadows characterizes as follows: "If no paradigm is right, you can choose whatever one will help to achieve your purpose. If you have no idea where to get a purpose, you can listen to the universe" (Meadows, 2008: 164).

The transition process

In order to initiate a change process – a transition process – we need to be conscious of the need for change and we need a framework for action. First of all we have to understand that we are already entering a phase of profound change. Based on the work of Hopkins (2008) and Kossoff (2011) I present some principles and characteristics of a framework for transition:

- **Vision.** First we need a clear goal, a motivation, where to move. We need a vision that inspires and illuminates, a vision of the future for a desirable and sustainable society.
- **Inclusion.** To face the challenges, we need to include people from other sectors of the society; it is not enough to add people with similar ideas, we have to get out of our comfort zone. We need broad processes of dialogue and inclusion.
- **Awareness raising.** Most people are not informed of the real situation of the planet and of the problems we face. We cannot assume that everyone is aware of the situation; on the contrary, we must assume that people do not have even the most basic knowledge. It is a duty to provide clear, easily comprehensible and didactically prepared information, so that people understand the key arguments and formulate their own questions.
- **Conceptual model.** We need to provide a conceptual model elaborated in transdisciplinary collaboration and nested in a local context. The conceptual model cannot be developed by "external experts."
- **Interconnection.** The proposed projects and practices have to be connected and integrated, the system can only unfold its potential through a free flow of information in a dense interlacing.
- **Resilience.** The hegemonic model of governing the planet is completely lacking of resilience. The system demands the opportunity to self-regulate – to regulate itself in a benign state

for us – to regain strength in face of perturbations and to repair the damages that we cause. Resilience is key to any conceptual model (see Folke et al., 2010; Walker & Salt, 2012).

- **Sustainability.** We need to recover the original meaning of sustainability. Aspiring to sustainability has qualitative, human and ethical implications that were lost with the technocratic and economistic appropriation of the concept. To indicate the seriousness of the situation, Diane Dumanoski suggests the term ***survivability*** rather than sustainability, and defines its objective as "safeguard the human knowledge and institutions that give us the *capacity* to respond with imagination and flexibility to a changing world" (Dumanoski, 2009: 9).
- **Psychological knowledge.** Among the main barriers that inhibit people from engaging in a process of transition are feelings of powerlessness, isolation and overwhelm in the face of the magnitude of the problems (see the excellent analyses on this topic in Hathaway & Boff, 2009; Macy & Brown, 2010, 2014; Macy & Johnstone, 2012; Wheatley, 2012). Hence it is very important to create a shared and positive vision, safe spaces where people can talk, digest and sense how these issues affect them. We must design the processes in a way that give many opportunities to celebrate success together.

To face the transition, we must apply the holistic paradigm to *everyday life* (Kossoff, 2011). The need to have a vision that inspires and illuminates is mentioned as the first principle in the list. Face to global size problems, the vision must be as inclusive as possible, hence the need to include the principle of diversity in building the vision (see Hathaway & Boff, 2009; Meadows, 1996; Meadows et al., 2004). Donella Meadows writes about the transcendence of conceiving and building a shared vision:

> Vision is the most vital step in policy process. If we don't know where we want to go, it makes little difference that we make great

> progress. Yet vision is not only missing almost entirely from policy discussions; it is missing from our whole culture. […]
> The process of building a responsible vision of a sustainable world is not a rational one. It comes from values, not logic. Envisioning is a skill that can be developed, like any other human skill (Meadows, 1996: 1).

And the American author Duane Elgin expresses the need for a shared vision as follows:

> When we can collectively envision a sustainable and satisfying pathway into the future, then we can begin to construct that future consciously. We need to draw upon our collective wisdom and discover images of the future that awaken our enthusiasm for evolution and mobilize our social energies (Elgin, 1993: 7).

Wicked problems

As mentioned at the beginning of the chapter, we are facing countless problems in the 21st century. These problems can be considered as "wicked problems", a term coined by German design theorist Horst Rittel to describe a type of badly defined, complex, systemic and supposedly unsolvable problems (Irwin, 2011). Returning to Albert Einstein's wise aphorism that we cannot solve problems with the same mindset with which we created them, designer Terry Irwin states the following: "The ability to solve wicked problems will call for new ways of thinking about design, our world and the human presence in it" (Irwin, 2011: 233).

The solution to the complex and interdependent problems of the 21st century requires from us a new mentality or vision of the world. Speaking of a new paradigm for planning or design, Terry Irwin argues that the fundamental principles can be applied to each discipline and by all people (Irwin, 2011). The key lies in developing the crucial ability of

collaborative and transdisciplinary planning. To this end, Terry Irwin formulates the following principles:

> 1. Wicked problems and their contexts are complex systems that operate according to the same intrinsic principles and dynamics as living systems;
> 2. These systems are comprised of countless strands of relationships between people, the environment and the things that people make and do – a relationship triad;
> 3. These principles have the potential to inform a new kind of design process that will be better equipped to address wicked problems; and
> 4. A new mindset is needed, one that enables people to see wicked problems and conceive fundamentally different solutions which incorporate ethics and a deep concern for both the social and environmental spheres (Irwin, 2011: 233).

Terry Irwin differentiates between problems that are tame, complex and wicked. The way that a problem is perceived and framed within a specific context defines the level of simplicity and complexity (see figure 8), and also whether the solution will be sustainable or unsustainable. The solutions that are searched within the hegemonic economic model with profit as the main objective, are almost always designed as for tame problems – those that exclude the social and environmental concerns. With this, two important objectives are achieved: first this makes them "solvable", and second, the simplification allows to "solve" the problems rapidly and in an economic way (Irwin, 2011). Terry Irwin warns:

> The important point is this: *any problem becomes wicked when social and environmental concerns are taken into account*. Tame problems are almost always illusory; they are poorly framed fragments of wicked problems and designers fail to see wicked problems and, moreover, do not understand the dynamics at work within them (Irwin, 2011: 239).

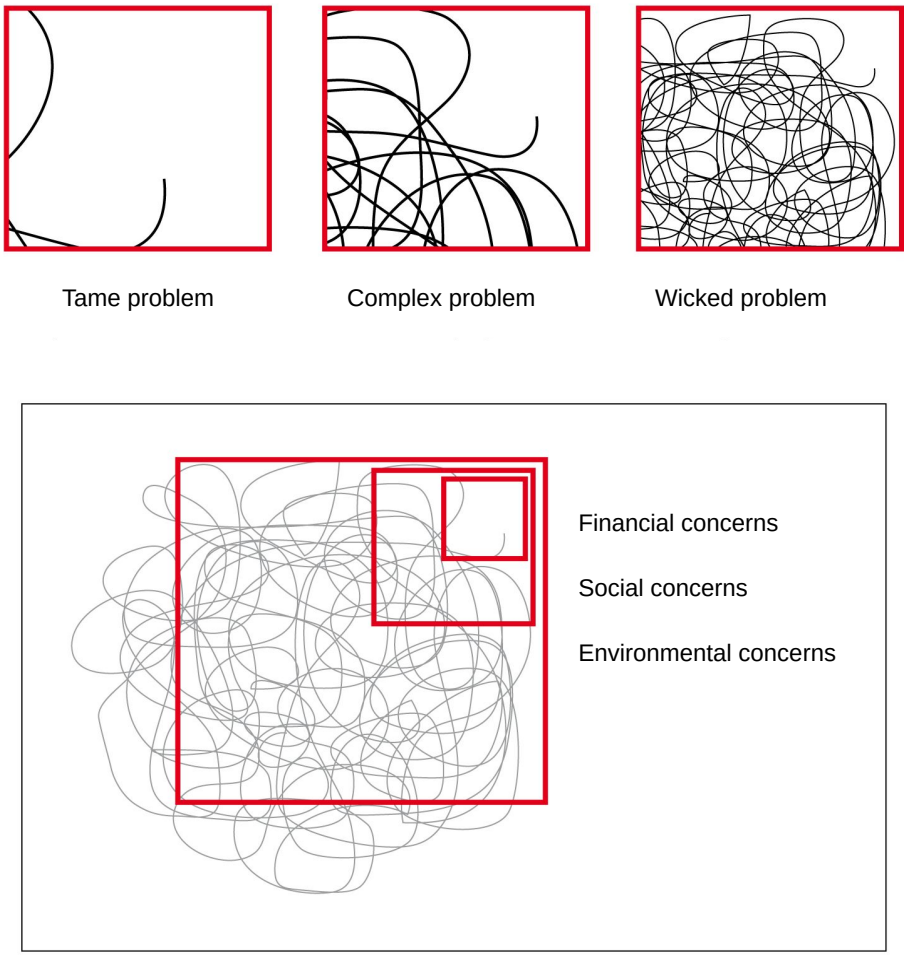

Figure 8: Tame, complex and wicked problems. Figure 8a) represents three problems of varying complexity that are framed in a context. Figure 8b) shows that they are all part of a larger or 'wicked' problem, and that the perceived degree of simplicity or complexity depends on how closely the problem is framed in a particular context (Irwin, 2011: 237).

New values and ethics

The transition towards a new paradigm, that can be called ecological paradigm, animist paradigm or holistic paradigm (Capra, 1996; Harding, 2006; Hathaway & Boff, 2009; Medina, 2008a), can not emphasize only on changes of perceptions and modes of thought. It must address *our values* and *our ethics*. Fritjof Capra points out the connection between changes in thinking and values, and describes them as changes from assertiveness to integration:

> These two tendencies – the self-assertive and the integrative – are both essential aspects of all living systems. Neither is intrinsically good or bad. What is good, or healthy, is a dynamic balance; what is bad, or unhealthy, is imbalance – overemphasis of one tendency and neglect of the other. If we now look at our Western industrial culture, we see that we have overemphasized the self-assertive and neglected the integrative tendencies (Capra, 1996: 9-10).

Table 3 shows how Capra classifies these opposite tendencies in thinking and values.

Table 3: Self-assertive and integrative tendencies in our thinking and values

Thinking		**Values**	
Self-Assertive	*Integrative*	*Self-Assertive*	*Integrative*
rational	intuitive	expansion	conservation
analysis	synthesis	competition	cooperation
reductionist	holistic	quantity	quality
linear	non-linear	domination	partnership

Source: Capra, 1996: 10

In patriarchal society assertive values, expansion, competition and domination are generally associated with men (compare with the chapter *The domination of nature and women*). Power in patriarchal society, *power-over*, that dominates, restricts and controls, is excessive assertiveness that reflects itself in the hierarchical order of Western society (compare with the chapter *A brief analysis of power*). Therefore, the change in paradigm includes a change from hierarchy to networks in the social organization (Capra, 1996).

While Western society is based on anthropocentric (human-centred) values, *deep ecology* is characterised by ecocentric (Earth-centred) values. Values and ethics are central to the postulates of the Norwegian philosopher Arne Naess, the founder of deep ecology:

> Every life-form has a worth of its own, independent of its usefulness for human beings.
> Animals have a right to exist, no less of a right than that of human beings.
> Live diversity is a good thing, independent of human usefulness.
> Life on earth is a value even without human beings to value it
> (Naess, 2008: 300).

And Stephan Harding argues that the holistic perception of wholeness connects us naturally with the domain of ethics:

> Ethics, simply put, is the ability to decide whether a thing is right or wrong, whether it is good or not. Conventional science ignores ethics, leaving it to society to decide how to use the fruits of scientific research in the world at large. […]
> Holistic science is about reuniting fact and value in ways that enable our culture to explore new possibilities of living harmoniously with the Earth. This work involves integrating an animistic relationship with the Earth back into Western culture; clearly a difficult challenge, since the objectivistic view opposes any notion that the universe is alive, creative and intelligent. This is where holistic science

> could be of great value by showing how it is possible to embed animistic insights into an expanded science that combines qualities with quantities whilst taking into account the ethical dimension of participating in a living cosmos (Harding, 2006: 36-37).

Now the big task is to translate the reflections on the holistic paradigm into practical guidelines and principles that allow us to work for the benefit of transition, of transforming a system that is currently destroying the survival capacity of humans and the bases of life on Earth.

Holistic education

Education can never be apolitical,
'objective' or 'value neutral':
it is – and ever must be – a political endeavour.
It either moulds the young
to fit in with traditional beliefs,
or it critiques those beliefs
and helps to create new ones
Mary Clark[15]

The dominant education system in Western society is a faithful reflection of its worldview. It prepares children and young people – who were all born into a holistic world – so that they rapidly fit into a mechanistic world, and, preferably, without causing any problem. Stephen Sterling, a sustainable education teacher, describes this situation as follows:

> *Education is still fundamentally reductive*. Despite the discourses of postmodernism and post normal science, the rise of complexity theory, and everyday evidence of the systemic nature of the world, the fundamental building blocks of the prevalent education epistemology – reductionism, objectivism, materialism, dualism, and determinism – largely prevail, reflected from the dominant cultural worldview and exerting influence in purpose, policy and provision as well as in educational discourse (Sterling, 2011: 22).

This way of thinking resides in the foundations of the education system, foundations anchored in the important undeclared assumptions of Western culture mentioned in the chapter *The holistic paradigm*. Some examples of this educational culture are individual and narrow disciplines, abstract knowledge, belief in a knowledge free of values, preference of

15 quoted by Sterling, 2011: 20

cognitive and intellectual knowledge over affective and practical knowledge, reluctance to consider ethical issues (Sterling, 2011). Other examples that specially characterize Latin America are funnel-type vertical education, discrimination of teaching in native languages, education of very different quality between rural and urban, between public and private schools. These last points reflect well the "leadership" of Latin America as the most unequal region on the planet.

Despite the fact that more and more people perceive the systemic reality of the world – its complexity, uncertainty and unsustainability – the dominant educational paradigm remains practically unchanged (Sterling, 2011). Stephen Sterling continues:

> The paradox of education is that it is seen as a preparation for the future, but it grows out of the past. In stable conditions, this socialisation and replication function of education is sufficient: in volatile conditions where there is an increasingly shared sense (as well as numerous reports indicating) that the future will not be anything like a linear extension of the past, it sets boundaries and barriers to innovation, creativity, and experimentation (Sterling, 2011: 23).

Over the past few decades there have been many efforts to improve or change education systems. Examples include environmental education, education for development, community education, peace education, human rights education, anti-racism education, and education for sustainability. Without any doubt, there have been advances in these approaches of "education for a better world", but what continues to dominate is the modernist worldview that prevails in education and society at large (Sterling, 2011). Mark Richmond writes in the mid-term review of UNESCO's *Decade of Education for Sustainable Development 2005-2014,* "today, more than ever before, the need for a holistic approach to learning and teaching becomes both vital and urgent", and adds that we need a "paradigm shift in thinking, learning and teaching for a sustainable world" (Richmond, 2009: 3). In line with these ideas, Sterling states:

> Sustainability necessitates a deep questioning and learning response in educational thinking and practice as a whole, just as it does in myriad other human activities, whether economics and business, design and construction, agriculture and energy, trade and aid, health and welfare, and so on. It cannot simply be a matter of 'add-on', but it is a matter of *re-design* with a shift of emphasis from relationships based on fragmentation, control and manipulation towards those based on participation, appreciation and self-organisation (Sterling, 2011: 24, emphasis of the author).

We can not afford keeping the thinking and the educative practice that consider the future as some sort of linear extension of the past. We need an *anticipatory* education in view of the challenges that we have to face as result of global changes (Sterling, 2011). Dianne Dumanoski describes this situation with emphatic words:

> We need to imagine futures that don't much resemble the present – all kinds of futures, creative alternatives as well as frightening scenarios. The question is *not* how to preserve the status quo, but rather how to make our way in a new historical landscape. Today's children will likely confront challenges we can hardly begin to imagine in a radically altered, unrecognizable world. Can we responsibly continue preparing them for business as usual? And if not, what can we do to make them ready for a survival game in which wild cards rule? (Dumanoski, 2009: 9)

The answer to the first question must be a categoric ***no***. Holistic education shows us a path to answer to the second question. According to the English economist E.F. Schumacher, at the heart of such education is an ecological orientation, based on a holistic, systemic, participatory and living vision of the world. A redesigned educational paradigm has to be relational, oriented towards ethics, and relevant at the local and global levels. It is not a question of designing isolated "education for sustainability" programs, but rather a *transformation* of the personal consciousness and the educational culture (Sterling, 2011).

In organizational terms, Sterling presents the implications of the shift to a culture of ecological education for the nested levels of paradigm, purpose, policy and practice (see table 4).

Table 4: The change towards a culture of ecological education

Paradigm	Instead of education reflecting a paradigm founded on a mechanistic root metaphor and embracing reductionism, positivism, and objectivism, it begins to reflect a paradigm founded on a living systems and ecological metaphor and view of the world, embracing holism, systemisism and critical subjectivity. This gives rise to a change of ethos and purpose...
Purpose	Instead of education being mostly or only as preparation for economic life, it becomes: a broader education for a sustainable society/communities; sustainable economy; sustainable ecology. This expanded sense of purpose gives rise to a shift in policy.
Policy	Instead of education being viewed solely in terms of product (courses/materials/qualifications/educated people) it becomes: much more seen as a process of developing potential and capacity through life, at individual and community levels through continuous learning. This requires a change in methodology and practice...
Practice	Instead of education being largely confined to instruction and transmission, it becomes: much more a participative, dynamic, active learning process based more on generating knowledge and meaning in context, and on real world/situated problems and issues.

Source: Sterling, 2011: 25-26

In his enriching conference *Educating the Heart and Mind*[16] (2011), Sir Ken Robinson, English education professor talks about a serious education crisis. He compares it to the climate crisis because they are related. Robinson notes about the global crisis: education contributes to the problem rather than to the solution. Since the European Enlightenment, education propagates standardization and conformity, rather than diversity. We are living an exile of feelings. What we need is a personal and holistic education that fosters empathy, creativity, intuition and spirituality. Robinson sees the root of the dilemma in the different metaphors of education: most education systems are mechanistic and impersonal, while human beings are not mechanisms; we are organisms, and schools also function as organisms (Robinson, 2009, 2011).

Ecological literacy

Fritjof Capra analyses the principles of ecological sustainability in his texts (see chapter *Systems thinking*). He reminds us that if we look for sustainable human communities, there is no need to invent anything, we can simply model them on natural ecosystems: sustainable communities of plants, animals and microorganisms. In order to build sustainable communities, we humans first have to become "ecologically literate", that is, we must understand the organizing principles common to all living systems. Based on the systemic understanding of life, Capra formulated his *Principles of ecology* (see table 1) and gives us the following advice on the transcendence of ecological literacy:

> In the coming decades the survival of humanity will depend on our ecological literacy – our ability to understand the basic principles of ecology and to live accordingly. This means that ecoliteracy must become a critical skill for politicians, business leaders, and professionals in all spheres, and should be the most important part of education at all levels – from primary and secondary

16 https://dalailamacenter.org/programs/speakers-series/sir-ken-robinson/event

> schools to colleges, universities, and the continuing education and training of professionals (Capra, 2011: 75).

Capra is the co-founder of the *Center for Ecoliteracy*[17] in Berkeley, California. The center promotes education for a sustainable life through a variety of activities and products. The books *Ecological Literacy*, edited by Stone and Barlow (2005), *Smart by Nature* by Stone (2009) and *Ecoliterate* by Goleman et al. (2012) illustrate well the approach and activities of the *Center for Ecoliteracy*.

Another centre of excellence for holistic education and training is *Schumacher College*[18] in Dartington, United Kingdom. According to the motto "Innovative learning for ecological and social change", it offers a transformative training with a focus on transdisciplinarity and direct experience. It integrates intuition, transcendence, emotions, sensations and reason in the educative process. Through interactive, experiential and participatory learning in post-graduate programs and training courses, *Schumacher College* deepens a new conception of life on Earth. It offers the practical skills and strategic thinking necessary to face the ecological, economic and social challenges of the 21st century. Its basic principles are:

- Living, working and learning together
- Respecting all living systems: an ecological view of the world
- Healthy mind in healthy body

Since October 2012, *Schumacher College* in partnership with the non-profit organization *Efecto Mariposa*[19] in Colombia, offers the first course in Latin America. The *Certificate in Holistic Science and Economy for the Transition* lasts six months and consists of four modules adjusted to the local reality:

17 https://www.ecoliteracy.org/
18 https://www.schumachercollege.org.uk/
19 http://www.efectomariposa.space/#intro

introduction to holistic science, complexity and the living Earth (Gaia theory), economy for transition, biocultural diversity.

The book *Grow Small, Think Beautiful*, edited by Stephan Harding (2011) and cited several times in this study, contains a collection of essays on sustainable solutions for the current global crisis, written by leading thinkers associated with *Schumacher College*.

Sustainable education: smart by nature

In his book *Smart by Nature* (2009), Michael Stone, the senior editor of the *Center for Ecoliteracy*, presents the four guiding principles of the Center for a sustainable education. The following is a brief description of the guiding principles (for a detailed description, see Stone, 2009: 3-15).

1. Nature is our teacher. To imagine sustainable human communities we can build on the principles of nature that have been evolving for 3.8 billion years, since the beginning of life on Earth. In addition, we can learn from the worldview of indigenous peoples (see chapter *The indigenous worldview*) that has persisted over the past centuries despite all the scorn and mistreatment received by Western society. If we understand that nature is our teacher, we must place ecological literacy at the centre. Capra writes that we must teach our children, our students and our business and political leaders (!) the fundamental facts of life, such as

- Matter circulates continuously in the web of life.
- Most of the energy that drives the ecological cycles flows from the sun.
- Diversity ensures resilience.
- The waste of one species is the food of another.

- Life did not take over the planet by fighting, but by creating networks.
  (Capra, 2004, quoted by Stone, 2009: 9-10)

Other implications of recognizing nature as our teacher are

- Integrating the curriculum by teaching across discipline and grade level barriers.
- Employing systems thinking, which means learning to think in terms of relationships, connections and context.
- Using solutions that are in harmony with the superior model, rather than punctual solutions that harm or destroy this model. An example of this would be to supply the school with food produced organically by small-scale farmers in the region, instead of food with transgenic ingredients produced by agribusiness, often in another country or another continent.
- Developing a healthy relationship with nature implies solutions that fit to human nature evolved during millions of years, prior to industrialization. Some examples: working with natural light and designing the spaces to make this possible, extending the classroom into nature and providing the school canteen with food that is free of artificial colourings and preservatives.

2. Sustainability is a community practice. There is a fundamental organizational pattern or model in ecology: nature sustains life by creating and nurturing communities. No organism can live long in isolation. We all live in networks of mutual dependency. This is an equally valid principle for human beings: we need emotional and physical support. The diversity and interdependency that maintain natural ecosystems vibrant and resilient also influence schools and other human communities.

3. The real world is the optimal learning environment. One of the principles of sustainable education is to connect the students with the natural world and the surrounding human communities through project-based learning. Projects such as school gardening, restoring a habitat, or designing a recycling program for the neighbourhood inspire students. They challenge their knowledge and encourage application to caring for something concrete and tangible. Or, in other words, quoting the American philosopher John Dewey, "Give the pupils something to do, not something to learn, and the doing is of such a nature as to demand thinking; learning naturally results" (quoted by Stone, 2009: 12).

4. Sustainable living is rooted in a deep knowledge of place. A deep knowledge of a place stimulates us to take care of its landscape, its plants and animals, and its human beings. We can learn from its ecology and diversity, from the web of relationships that supports it and from its cyclical life. Place-based teaching is a fundamental pillar of sustainable education. Deeply known places are deeply loved, and loved places have the best chance of being protected and preserved for future generations.

Competencies for sustainable education

To prepare young people for a sustainable life requires of teachers to know how to motivate and orientate all students in the entirety of their values, skills and relationship with the natural world. Lisa Bennett, communication director of the *Center for Ecoliteracy*, describes 15 key competencies that young people need to develop in order to live in sustainable communities (see figure 9):

Head (cognitive)

- Approach issues and situations from a systems perspective
- Understand fundamental ecological principles
- Think critically, solve problems creatively, and apply knowledge to new situations
- Assess the impacts and ethical effects of human technologies and actions
- Envision the long-term consequences of decisions

Heart (emotional)

- Feel concern, empathy, and respect for other people and living things
- See from and appreciate multiple perspectives; work with and value others with different backgrounds, motivations, and intentions
- Commit to equity, justice, inclusivity, and respect for all people

Hands (active)

- Create and use tools, objects, and procedures required by sustainable communities
- Turn convictions into practical and effective action, and apply ecological knowledge to the practice of ecological design
- Assess and adjust uses of energy and resources

Spirit (connectional)

- Experience wonder and awe toward nature
- Revere the earth and all living things
- Feel a strong bond with and deep appreciation of place
- Feel kinship with the natural world and invoke that feeling in others

(Bennett, 2009: 154-155)

Education smart by nature helps students in developing these skills to participate in sustainable communities. Figure 9 shows the well-rounded student with all of her skills.

The path to the future in the 21st century is by far the greatest challenge to humanity in the short time we have been on this planet. Our ability to survive will depend largely on our ability for ecological literacy, and for holistic education and training. We must foster holistic and systems thinking in education, training, science, organizations, public policies; in short, in society as a whole.

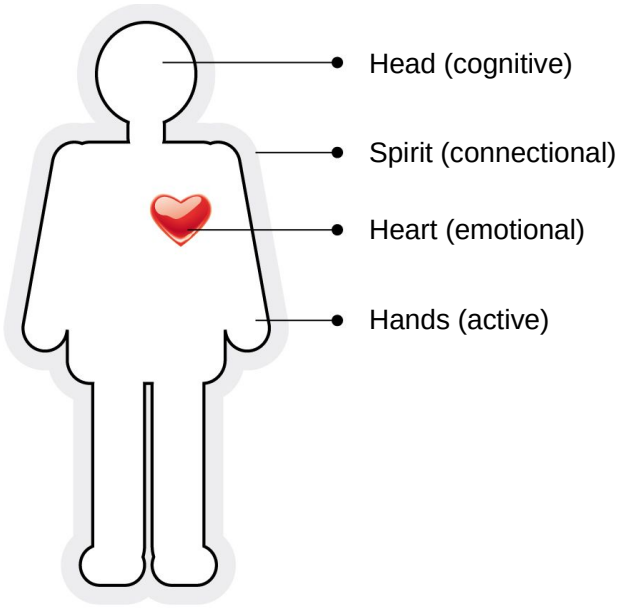

Figure 9: The well-rounded student. Skills needed for sustainable living (based on Bennett, 2009:154).

To search and get on the path to a new vision of the world is a demanding challenge with many fronts. Holistic education and training is only one of them, but it is a very powerful front – obviously in the holistic meaning of the word power. There are promising examples from all over the world, an extraordinary example of this is the Latin American documentary *La educación prohibida*[20] [The forbidden education] (2012) which is available for free download and dissemination on the internet. We must shake off the paralysis from the overwhelming global crisis and start to build this path.

20 http://educacionprohibida.com/?l=es

Living well and the holistic paradigm

> In front of this paradigmatic crisis, there are numerous intentions
> of reformulating the dominant system and to try to find solutions.
> These intentions […] must contemplate the need
> for a change in life paradigm
> based on the philosophy of living well (*vivir bien/buen vivir*)
> inherited from and transmitted by the native peoples
> from different latitudes of the planet,
> but understood in its true essence and meaning.
> *Fernando Huanacuni*[21]

The Spanish expression *buen vivir* (good living) is used in Ecuador to describe the *sumak kawsay* (Quichua) concept, while in Bolivia, the expression *vivir bien* (living well) is used to describe the *suma qamaña* (Aymara). Both words have become famous in recent years. The *buen vivir* or *sumak kawsay* entered as a new development regime in the Constitution of Ecuador in 2008, and the *suma qamaña* or *vivir bien* as ethical-moral principle in the Political Constitution of the State of Bolivia in 2009 (article 8).

Bolivian Aymara researcher, Fernando Huanacuni, notes in his book *Buen Vivir/Vivir Bien* [Good Living/Living Well] that the Spanish translations of this worldview concept of indigenous peoples, does not explain their magnitude, thus, he recommends resorting to the translation of the original terms in both languages (Huanacuni 2010: 7). From the Aymara worldview, *suma qamaña* is translated as follows:

- *Suma:* plenitude, sublime, excellent, magnificent, beautiful
- *Qamaña:* to live, to live together, to be

21 Huanacuni, 2010: 68

And the translation of *sumak kawsay* from Quichua is as follows:

- *Sumak:* plenitude, sublime, excellent, magnificent, beautiful, superior
- *Kawsay:* life, to be

In other words, the translation of both concepts is something like *to live in plenitude*.

As we have already seen in the chapter *The indigenous worldview*, all the indigenous peoples of *Abya Yala* and *Turtle Island* contemplate in their cosmovision common aspects of living well. Fernando Huanacuni presents a synthesis of living well based on the cosmovision of these nations:

> Living well is life in plenitude. To know how to live in harmony and balance; in harmony with the cycles of Mother Earth, the cosmos, life and history, and in balance with all forms of existence in permanent respect (Huanacuni, 2010: 32).

Huanacuni emphasizes on the fact that we must understand the difference between *living well* and *living better*. The two concepts come from two different worldviews and reflect two paradigms with different horizons. Living better is immersed in the logic of the West, Huanacuni characterizes it with emphatic words:

> This way of living implies earning more money, having more power, more fame... than the other. Living better means unlimited progress, unconscious consumption; it incites material accumulation and induces competition. […]
> The West motivates and promotes – through its principle "winning isn't all, it's the only thing" – the logic of privilege and merit and not of real community need. The existence of a winner implies that there are many losers. That means that for one to be happy, many have to be sad.

> The vision of living better has given rise to an unequal, unbalanced, predatory, consumerist, individualistic, desensitized, anthropocentric and unnatural society (Huanacuni, 2010: 32-33).

This characterization of living better by Huanacuni coincides with the analysis of the reductionist paradigm (see chapter *The scientific revolution and the reductionist paradigm*); aside from the human crises, the Earth's crisis is increasingly critical. Living well, on the contrary, is a concept of life based on community, on the interrelations between *all* its members, be they humans, plants, animals or mountains. It is a community paradigm based on animism, a paradigm from which humanity can learn much to continue its tortuous path in the 21st century.

This concept of living well arises from the indigenous worldview and fits perfectly with the holistic paradigm. The following approximation of this concept is an intellectual approach. Eduardo Gudynas and Alberto Acosta have worked a lot on the subject, describing living well as a field of ideas under construction, characterizing it as follows:

> Living well offers a direction for collectively building different and alternative styles to material progress. In this path, the breakdown with the ideology of development as progress is key. Living well points to "decouple" the quality of life from economic growth and the destruction of the environment. For these reasons, it is a concept that is based on a web of relationalities, both among humans and with the environment, rather than a duality that separates society from its environment and people from each other (Gudynas & Acosta 2011: 81).

If we compare Huanacuni's synthesis of living well with the characterization of Gudynas and Acosta, the similarities in vision are obvious. The intellectual discussion of the subject without any doubt plays an important role in finding alternatives to development – **but it is not enough**. As long as we limit ourselves to reason with the mind, we can hardly

understand and sense the holistic concept of good living. US American philosopher David Abram characterizes this dilemma with eloquent words:

> If, at any moment, we suspend our theoretical awareness in order to attend to our sensory experience of the world around us (to our experience not as disembodied intellects but as intelligent, sensing animals), we find that we are not outside of the world, but entirely *within* it. We are thoroughly encompassed by the physical world, immersed in its depths. Hence our sensory relation to the world is hardly that of a spectator to an object. As sensing animals, we are never disinterested onlookers but participants in a dynamic, shifting, and ambiguous field (Abram, 1991: 5).

We have to find ways to overcome our alienation from nature, this artificial separation between the human being and the rest of cosmos, or, using the beautiful words of American biologist Lynn Margulis "what has been called 'the Earth's environment' is no externality. The environment is part of the body" (Margulis, 2006: 11). Systems thinking and holistic education can show us a way for that *re encounter*.

A third approximation to the concept of living well is its use in the political and civil discourse. The expression is used in political discourses and in civil society in a discretionary way. Government measures and civil society seminars receive the stamp for "good living" to demonstrate their timeliness. It is an effect similar to the use of the term *sustainability* described in the chapter *The transition process*: under the technocratic and economistic appropriation of the concept, its qualitative, human and ethical, in short, holistic implications are lost.

A suitable and comfortable replacement has been found for the already overused expression *sustainable development*, instead of delving into the true meaning of living well – which in its logical consequence would be to question the development model.

A good idea on the indigenous concept of living well give the anthologies of Medina (2008a, 2008c) and the book of Huanacuni (2010). The anthologies by Farah & Vasapollo (2011) and Acosta & Martínez (2009) provide valuable contributions from both the indigenous conception and the Western intellectual approach to the subject. Fernando Vega (2012) analyses the third approach to living well with insight.

4 Proposals for action

The kind of hope
that I often think about […]
I understand above all
as a state of mind,
not a state of the world.
Either we have hope within us
or we don't;
it is a dimension of the soul,
and it's not essentially dependent
on some particular observation of the world
or estimate of the situation […].
Hope is not the conviction that
something will turn out well,
but the certainty that something makes sense,
regardless of how it turns out.
Václav Havel[22]

Finally, I want to propose some ideas for the dissemination of holism in Latin America and beyond. As we saw earlier, the Earth – our one and only home – faces multiple environmental, social and economical crises. Since the Earth is a living system, all crises are interconnected and interdependent. We will not solve the problems if we treat them in a punctual manner applying linear solutions. We must recognize the problems in their full magnitude: they are *wicked* problems that can be characterized as being badly defined, complex, systemic and supposedly unsolvable. Margaret Wheatley characterizes our situation with wise words:

22 quoted by Capra, 2002: 268

> Great performances, delicious cookies, successful change projects can never be deconstructed to reveal the real secret of their success. In an emergent world, nothing useful gets revealed by dissection. You can't work backward; you can't hope to either re-create something wonderful or change something bad by becoming reductionist, by focusing on the parts. Specific individuals can never take the credit or the blame – it's impossible to differentiate individual from group contributions. We continue to do this, of course, because we are all so well trained in analysis and breaking things into parts, and also because there are more than enough egos that want to take the credit (Wheatley, 2012: 32).

Two essential working approaches emerge from this context: first, we need ***information*** on the real situation of the planet and its implications for Latin America and other regions, and second, and far more transcendent, we need to be ***conscious*** of the need for change. The subject of information is paradoxical, malicious and sad – it perfectly shows the lack and denial of consciousness, the lack of understanding and sensitivity face to the fact that we are interconnected with all of creation. At no time in human history has more information been produced than today, and at the same time, at no time in history has a single species so mercilessly destroyed the basis of life on Earth.

In order to characterize the situation with respect to the information in Latin America, we must add other elements. Much of the relevant information is not accessible in Spanish. This is an enormous obstacle, but not the only one. In a large part of the society, there is no reading culture, newspaper circulation is low, and the training of journalists that write about environmental issues could be significantly improved.

The third working approach – intrinsically interconnected with the need for information and consciousness – is ***ecological literacy***. It is important that we all understand and feel the basic principles of ecology, the organizing principles common to all living systems, and learn to live

accordingly. We require awareness and deepening in the different branches of holistic science to re-establish or unearth our direct and profound, sensorial and emotional connection with life and the living Earth. We must unfold the ability of ecological literacy in our children, our students and our business and political leaders. Practice must enter education at all levels, from early childhood education to universities, adult education and professional training.

For the above working approaches I propose the following actions for Latin America and beyond:

- Prepare easily understandable and didactic documents that inform about the real situation of the Earth, the region and the countries.
- Prepare easily understandable and didactic documents that explore different branches of holistic science and the principles and possibilities of its application in daily life.
- Design and carry out workshops and training courses on holistic science for the large number of people who have an open mind; workshops that cover the difference between holistic science and reductionist science, and the importance of applying the principles of holistic science in daily life.
- Establish a dialogue of knowledge and include indigenous knowledge and science in the development of documents and in the design of workshops on holistic science and its application to daily life.
- Include the conception and building of a shared vision for a desirable and liveable future as key elements in the workshops and courses.
- Design and carry out workshops and courses of deepening on holistic science, its dissemination and application in the daily life for persons who stand out as agents of change.

- Educate young people based on the principles of ecological literacy and appropriate to local realities.
- Establish working groups on transitions that encourage analysis, dialogue and action towards a world that reveres life.

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