Harnessing the Power of the Net

Ioannis Syrigos

Last year, the Scientific and Medical Network (SMN) celebrated the 40th anniversary of its creation. That's 40 years of bridging the gap between science and spirituality, and seeking answers to questions that tantalise every human being, like the purpose of our existence, the nature of consciousness, perception and cognition, and the possibility of an afterlife. SMN combines the best of these two domains – spirituality explores a transcendent dimension within the human condition and seeks to experience the divine, while science provides the means to theorise, conceptualise, and test hypotheses about the world. The SMN approach is based on the premise that the answers to some of the most vital questions pertaining to our existence can be found through the delicate intermingling of these two domains.

The message of the SMN has broadened considerably since its creation. Our target group has gradually evolved, from an audience primarily interested in science and medicine initially to one that also explores various other fields – such as ecology, philosophy, creativity and the arts. Currently we have more than a thousand members but recently we have been working on exciting plans to reach a much greater number of people. Developments in technology have gone a long way to removing the boundaries that separate us, and our members now come from countries throughout the world, so we need a new strategy for spreading our message more efficiently and effectively.

Today we live in an era of continuous transformation at all levels of human existence, from communications to relationships and ways of doing business. Indeed, the major feature of our society is the continuous and sometimes daunting advances in technology. Every day we hear about new inventions and the changes entailed impact all aspects of human activity.

One of the areas in which technology has vastly transformed our lives is the Internet. The World Wide Web has made the world seem much smaller by enabling people to connect easily at a multinational and international level, without the costly and time-consuming restrictions of travel. The result is that even people on opposite sides of the planet are brought close together. You can now send an email instantly instead of waiting at the post office to mail a letter, you can talk on your phone from the top of a mountain peak, or video-chat with anyone anywhere in the world. The Internet has also given people access to vast realms of information, innumerable resources being available at the click of a button. Communication and dissemination of information have been completely revolutionised.

The SMN has been harnessing the power of the Internet for a number of years already, but until now this has not been a major focus of our activities, since the technology has not been mature enough. But today there is a shift, with more and more people looking to the Internet as a means of communication and source of information. This allows an ever larger audience to access the important resources that we have to offer, bringing together people from all over the world in our common goal of bridging the gap between science and spirituality.

In meeting this goal, we have developed a brand new website that will bring the SMN to the forefront. Among the new features are webinars, instant access to all SMN resources, discussion forums and blogs, an events calendar, surveys, personal webpages, online booking, a fully searchable database of back issues of *Network Review*, and audio and video archives. The website upgrade will increase its usability and help spread the word, making it easier for new members to join online and enabling those who cannot attend events in person to tune into webinars, communicate with other members, share ideas, and get involved in interesting discussions.

The website development will also enhance our involvement in educational activities – in particular, our participation in the Master Course in 'Consciousness, Spirituality and Transpersonal Psychology' run by Les Lancaster, which is now in its second year and has already attracted nearly 40 students. The Local Group functionality will also be upgraded, making it easier for coordinators to customise their group pages so that they attract and appeal to website visitors. Each webpage will be the face of the group in the online community. Group members will be informed about events in their area and may participate in them even if they are not SMN members. This will enable newcomers to learn about the SMN and its work before deciding if they wish to become members.

The Internet has the potential to play a significant role in the positive transformation of society, as it places every corner of the world within our reach, enabling us to know what is happening – both good and bad – in other countries, cultures and religions. It is the new generation which will mould the future of humanity and that future must not be dominated by selfishness, arrogance, greed, violence, corruption, materialistic thought, fanaticism and superficiality, all of which are major components of today's society.

For the first time in history, people are able to unite with one voice, to speak out against injustice and organise positive action to make a change for the better. We have already seen a proliferation of international Internet activist movements, in which small steps are being made to correct the mistakes of the past and ensure a better future. The SMN is not an activist organisation but part of our remit is to question current views and perspectives, and this is not confined to purely scientific issues. However, one of our guiding principles is to seek the truth through objective scientific methods.

The crucial role of the Internet is especially relevant for young people. However, as the SMN expands, we would like everyone to have the opportunity to become a part of this. The new features of the website will allow more people to get involved, from forum moderation, to article and blog posting, website administration, and many other simple tasks. We therefore hope that the new website will disseminate the knowledge that the SMN has to offer in a bigger and better way, sparking interest in the minds of the increasing number of individuals who want to participate in our growing family. If you feel that you have specific Internet skills which could be part of this effort, please email me at *ioannissyrigos@live.co.uk.*

Postscript from Chair

Although I usually write the editorials, I am delighted that Ioannis has agreed to do so on this occasion, since – along with our webmaster Bernhard Harrer – he has played a key role in spearheading the exciting developments described above. He is currently based in Australia but (as expected in the Internet age) this imposes no restrictions on his effectiveness in overseeing these reforms. However, I would like to add a caveat. Adapting to a changing world can be uncomfortable and we are aware that not all our members will be enthused by these developments, preferring the more traditional style of activity that we have followed in the past. I would therefore like to stress that – alongside these developments – the SMN will continue to operate as it always has. Nothing can replace the benefits of direct contact and attending live events. It is just that we are now able to offer new pathways to our resources. Our aim is to preserve the best of the past, while encompassing the best of the future. Perhaps the phrase 'Scientific and Medical Inter-Network' captures this fusion.

Bernard Carr

Learning from Leonardo

Fritjof Capra

Leonardo da Vinci, the great genius of the Renaissance, has been the subject of hundreds of scholarly and popular books. However, there are surprisingly few books about Leonardo's science, even though he left voluminous notebooks full of detailed descriptions of his experiments, magnificent drawings, and long analyses of his findings.

I have been fascinated by Leonardo's genius for several decades and have spent the last ten years studying his scientific writings in facsimile editions of his famous Notebooks. I have written two books about Leonardo da Vinci. *The Science of Leonardo* (2007) is an introduction to his life and personality, his scientific method, and his unique synthesis of art and science.

In my new book, *Learning from Leonardo* (2013), I present an in-depth discussion of the main branches of Leonardo's scientific work from the perspective of twenty-first-century science — his fluid dynamics, geology, botany, mechanics, science of flight, and anatomy. Most of his astonishing discoveries and achievements in these fields are virtually unknown to the general public.

A Systemic Thinker

Leonardo da Vinci was what we would call today a systemic thinker. Understanding a phenomenon, for him, meant connecting it with other phenomena through a similarity of patterns. He usually worked on several projects in parallel, and when his understanding advanced in one area he would revise his ideas in related areas accordingly.

Thus, to appreciate the full extent of his genius, one needs to be aware of the evolution of his thinking in several parallel but interconnected disciplines. This has been my approach to absorbing and understanding Leonardo's scientific thought. Since I have contributed to the systems view of life that has emerged in science in the last thirty years, and have written several books about it, I found it very natural to analyse and interpret Leonardo's science from that perspective. Indeed, I believe that the ever-present emphasis on relationships, patterns, qualities, and transformations in his writings, drawings, and paintings — the tell-tale signs of systemic thinking — were what initially attracted me to his work and have kept me fascinated for so many years.

The Nature of Life

What emerged from my explorations of all the branches of Leonardo's science, was the realisation that, at the most fundamental level, Leonardo always sought to understand the nature of life. My main thesis is that the science of Leonardo da Vinci is a science of living forms, radically different from the mechanistic science of Galileo, Descartes, and Newton, that emerged 200 years later.

Leonardo's art served this persistent quest for life's inner secrets. In order to paint nature's living forms, he felt that he needed a scientific understanding of their intrinsic nature and underlying principles; and in order to analyse the results of his observations, he needed his artistic ability to depict them. I believe that this is the very essence of his synthesis of science and art.

Leonardo thought of himself not only as an artist and natural philosopher (as scientists were called in his time), but also as an inventor. In his view, an inventor was someone

who created an artifact or work of art by assembling various elements into a new configuration that did not appear in nature. This definition comes very close to our modern notion of a designer, which did not exist in the Renaissance. Indeed, Leonardo's synthesis is a synthesis of art, science, and design; and in all three dimensions he uses living nature as his mentor and model. As I delved into the Notebooks, I discovered not only Leonardo the systemic thinker but also, to my great surprise, Leonardo the ecologist and ecodesigner. And this is why his synthesis is not only intellectually fascinating but also extremely relevant to our time.

Leonardo's Legacy

The persistent endeavour to put life at the very centre of his art, science, and design, and the recognition that all natural phenomena are fundamentally interconnected and interdependent, are important lessons we can learn from Leonardo today.

As we recognise that our sciences and technologies have become increasingly narrow in their focus, unable to understand our multi-faceted problems from an multidisciplinary perspective, we urgently need a science and technology that honour and respect the unity of all life, recognise the fundamental interdependence of all natural phenomena, and reconnect us with the living Earth. This is exactly the kind of synthesis Leonardo da Vinci outlined and practised 500 years ago.

Structure of the Book

In previous decades, scholars of Leonardo's Notebooks tended to see them as disorganised and chaotic. My own sense, however, is that in Leonardo's mind, his science was not disorganised at all. In his manuscripts, we find numerous reminders to himself as to how he would eventually integrate the entire body of his research into a coherent whole. I have tried to follow these clues, arranging the material of my book in a framework that I feel is consistent with Leonardo's thought. In fact, several of my chapter titles — "The Movements of Water, "The Elements of Mechanics," "The Human Figure" — are the ones Leonardo himself intended to use.

A fundamental idea underlying Leonardo's scientific writings is that nature as a whole is alive, and that the patterns and processes in the macrocosm of the Earth are similar to those in the microcosm of the human body. For example, he compared the flow of water in the landscape, nourishing the vegetation, to the flow of blood in the human body, nourishing the body's tissues. Accordingly, I have divided the contents of *Learning from Leonardo* into these two basic categories: nature's forms and transformations in the macrocosm and in the microcosm.

In the macrocosm, the main themes of Leonardo's science are the movements of water, the geological forms and transformations of the living Earth, and the botanical diversity and growth patterns of plants. In the microcosm, his main focus was on the human body — its beauty and proportions, the mechanics of its movements, and how it compared to other animal bodies in motion, in particular the flight of birds. In this essay, I can only mention of the highlights of Leonardo's achievements in all these fields.

The Movements of Water

Leonardo was fascinated by water in all its manifestations. He recognised its funda-mental role as life's medium and vital fluid, as the matrix of all organic forms:

> It is the expansion and humour of all living bodies.
> Without it nothing retains its original form.
> (Ms. C, folio 26v)

This view of the essential role of water in biological life is fully borne out by modern science. Today we know not only that all living organisms need water for transporting nutrients to their tissues, but also that life on Earth began in water, and that for billions of years, all the cells that compose living organisms have continued to flourish and evolve in watery environments. So Leonardo was completely correct in viewing water as the carrier and matrix of life.

Throughout his life, Leonardo studied its movements and flows, drew and analysed its waves and vortices. He experimented not only with water but also investigated the flows of blood, wine, oil, and even those of grains like sand and seeds. He was the first to formulate the basic principles of flow, and he recognised that they are the same for all fluids.

These observations establish Leonardo da Vinci as a pioneer in the discipline known today as fluid dynamics. His experiments with granular materials are especially remarkable. He realised that he could learn something about the flow of water by observing a similar but somewhat simpler phenomenon — the flow of grains in which the individual flowing particles are actually visible. This method of using simplified models to analyse the essential features of complex phenomena is an outstanding characteristic of our modern scientific method. Leonardo's repeated use of such scientific models shows a level of abstraction in his thought that was centuries ahead of his time.

The Living Earth

Leonardo saw water as the chief agent in the formation of the Earth's surface. This awareness of the continual interaction of water and rocks impelled him to undertake extensive studies in geology. His geological observations are stunning not only by their great accuracy, but also because they led him to formulate general principles that were rediscovered only centuries later and are still used by geologists today.

Leonardo was the first to postulate that the forms of the Earth are the result of slow processes taking place over long epochs of what we now call geological time.

With this view, he was centuries ahead of his time. Geologists became aware of the great duration of geological time only in the early 19th century with the work of Charles Lyell, who is often considered the father of modern geology.

The Growth of Plants

Leonardo's Notebooks contain numerous drawings of trees and flowering plants, many of them masterpieces of detailed botanical imagery. These drawings were at first made as studies for paintings, but soon turned into genuine scientific inquiries about the patterns of metabolism and growth that underlie all botanical forms. Leonardo paid special attention to the nourishment of plants by sunlight and water, and to the transport of the "vital sap" through the plants' tissues.

He was the first to recognise that the age of a tree corresponds to the number of rings in the cross-section of its trunk, and – even more remarkably — that the width of a growth ring is an indication of the climate during the corresponding year. As in so many other fields, Leonardo carried his botanical thinking far beyond that of his peers, establishing himself as the first great theorist in botany.

The Human Body in Motion

Whenever Leonardo explored the forms of nature in the macrocosm, he also looked for similarities of patterns and processes in the human body. In order to study the body's organic forms, he dissected numerous corpses of humans and animals, and examined their bones, joints, muscles, and nerves, drawing them with an accuracy and clarity never seen before. He demonstrated in countless elaborate and stunning drawings, based on his dissections, how nerves, muscles, tendons and bones work together to move the body.

Unlike Descartes, Leonardo never thought of the body as a machine, even though he was a brilliant engineer who designed countless machines and mechanical devices. He clearly understood that the means of the body's movements were mechanical, but that their origin lay in the soul, the nature of which was not mechanical but spiritual (by which he meant "immaterial"). I have found that Leonardo's concept of the soul, in fact, comes very close to what we call "cognition" today. In *The Science of Leonardo*, I discuss Leonardo's concept of the soul in some detail.

Elements of Mechanics

To understand in detail how nature's "mechanical instruments" work together to move the body, Leonardo immersed himself in prolonged studies of problems involving weights, forces, and movements — the branches of mechanics known today as statics, dynamics, and kinematics. While he studied the elementary principles of mechanics in relation to the movements of the human body, he also applied them to the design of numerous new machines, and as his fascination with the science of mechanics grew, he explored ever more complex topics, anticipating abstract principles of mechanics that were centuries ahead of his time.

These include his understanding of the relativity of motion, his discovery of the principle now known as Newton's third law of motion (which states that for every action, there is an equal and opposite reaction), his intuitive grasp of the conservation of energy, and — perhaps most remarkably — his anticipation of the law of energy dissipation, now known as the second law of thermodynamics.

The Science of Flight

From the texts that accompany Leonardo's anatomical drawings we know that he considered the human body as an animal body, as biologists do today; and thus it is not surprising that he compared human movements with the movements of various animals. What fascinated him more than any other animal movement was the flight of birds. It was the inspiration for one of the great passions in his life — the dream of flying.

The dream of flying like a bird is as old as humanity itself. But nobody pursued it with more intensity, perseverance, and commitment to meticulous research than Leonardo da Vinci. His science of flight involved numerous disciplines — from aerodynamics to human anatomy, the anatomy of birds, and mechanical engineering.

In my chapter on Leonardo's science of flight, I analyse his drawings and writings on this subject in some detail, and I come to the conclusion that he had a clear understanding of the origin of aerodynamic lift, that he fully understood the essential features of both soaring and flapping flight, and that he was the first to recognise the principle of the wind tunnel — that a body moving through stationary air is equivalent to air flowing over a stationary body. This establishes Leonardo da Vinci as one of the great pioneers of aerodynamics.

In his numerous designs of flying machines, Leonardo attempted to imitate the complex flapping and gliding movements of birds. Many of these designs were based on sound aerodynamic principles, and it was only the weight of the materials available in the Renaissance — wooden struts, leather joints and thongs, and skin of strong cloth — that prevented him from building viable models.

The Mystery of Life

As I have mentioned, Leonardo's forms are living forms, continually shaped and transformed by underlying processes. Throughout his life he studied, drew, and painted the rocks and sediments of the Earth, shaped by water; the growth of plants, shaped by their metabolism; and the anatomy of the body in motion.

His ultimate goal — in his science as well as in his art — was always to understand the nature of life. This persistent quest culminated in the anatomical studies he carried out when he was over sixty, especially his investigations of the heart — the bodily organ that has served as the foremost symbol of human existence and emotional life throughout the ages. He not only understood and pictured the heart in ways no one had before him; he also observed subtleties in its actions that would elude medical researchers for centuries.

During the last decade of his life, Leonardo became intensely interested in another aspect of the mystery of life — its origin in the processes of reproduction and embryonic development. In his embryological studies, he described the life processes of the fetus in the womb, including its nourishment through the umbilical cord, in astonishing detail.

More than that, Leonardo's embryological drawings are graceful and touching revelations of the mysteries surrounding the origins of life. They epitomise the artist's great care, sensitivity, and tremendous respect for life. To me, they exude a tenderness that is deeply moving.

Leonardo was fascinated by the mystery of the origin of life not only in his science but also in his art. His most famous painting, the *Mona Lisa*, was originally a portrait of a young Florentine lady, Lisa del Giocondo. It was commissioned by her wealthy husband, but for some unknown reason the painting was never delivered. Leonardo kept it in his possession until he died and over the years transformed it into his personal meditation on the origin of life.

The painting is different from his other portraits; indeed, it is different from *all* other portraits. The striking difference is the strong contrast between the mellow features of the figure and the wild austerity of the archaic landscape in the background. The forms of the Earth are portrayed here in ceaseless movement and transformation, as the primordial waters cut through the rocks, carving out valleys and depositing masses of gravel and sand which, eventually, will become fertile soil. What we see here is the birth of the living Earth out of the waters of the primeval oceans.

We know that the *Gioconda*, as she is called in Italy, was a young mother; and she may even have been pregnant when she sat for the portrait. It is evident that the central theme of Leonardo's celebrated masterpiece is the procreative power of life, both in the female body and in the body of the living Earth.

Leonardo knew very well that, ultimately, the nature and origin of life would remain a mystery to him, no matter how brilliant his scientific mind. "Nature is full of infinite causes that have never occurred in experience," he wrote in his late forties, and as he got older, his sense of mystery deepened. Nearly all the figures in his last paintings have that smile that expresses the ineffable, often combined with a pointing finger. "Mystery to Leonardo," wrote the famous art historian Kenneth Clark, "was a shadow, a smile, and a finger pointing into darkness." (Clark, *Leonardo da Vinci*, 1993)

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