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How This Book Came About, What It Is, and What It Is Not

Introduction

To date, I have only twice in my life tried to write a book-length manuscript, and this third attempt is undertaken at a time, and in a discipline, in which journal papers are more highly valued, careerwise, than books. Why would I now write a book? I am close to retirement, so I do not need it for my career. I have published a substantial number of papers, which is certainly easier than writing a book. But I have the urge, no doubt because of my age, to start bringing the various strands of my thinking together. I am, in many ways, writing this book for myself – using the occasion to rethink ideas, to combine themes, and show the relationship between some parts of my academic thinking. But I also would like to give back, to share that effort with the many people who have contributed to these ideas, and, if they are of interest to them, with others.

To lay the groundwork for this endeavor, I will begin this chapter with a (very short) summary of some of the stretches and turning points in what has become a true slalom of a career, spanning four countries in which I resided for a decade or more, and many others in which I had the privilege of doing fieldwork, experiencing the hospitality and collaboration of many colleagues, and sharing ideas and experiences with many more.

Trained in the Netherlands as a cultural and environmental prehistorian and archaeologist, and as a medieval European historian, I began my active career with a stint of excavations in the Euphrates Valley in Syria, as part of the Tabqa dam project (1972–1974). One purpose of the project there was to get a sense of the long-term

development of human–environment dynamic relations, and another to study the evolution of pottery making from a technological perspective. I did my PhD thesis on that last topic, and will come back to that later in these pages (Chapters 12 and 13).

But the dominant experience in Syria for me was living in a Beduin village for about fifteen months, among people who had at that point never been visited by Europeans and had only very rarely had contact with urban Syrians. What an eye-opener!

We lived among people of a different culture, creed, and religion, saw how they managed to make a living based on agriculture and animal husbandry in a very dry area, using a hoe to till the soil, yet undergoing a technological transition due to the availability of cars, water pumps, and various other *accoutrements* of western material culture. All of us were, I think, changed by that experience for the rest of our lives. We shared in the ups and downs of village life – marital troubles, illnesses and how they were treated in the absence of western medicines, neighborhood conflicts, weeks of rain so that everything we owned was permanently wet, the arrival of the first pairs of sunglasses and portable radios bought with money earned on our excavations, etc.

During breaks in the excavation schedule, and after the excavations, I was able to travel relatively widely in the (then still peaceful) Near East, visiting many sites and urban contexts, in Syria, Jordan, and Lebanon. I deeply appreciated the cosmopolitan culture of the area, as well as the amazing landscapes and antiquities (e.g., Palmyra, Petra, Wadi Ram), and everywhere found friendly, open people, such as in one of the Palestinian refugee camps near Amman.

This book is not about that wonderful period of my life, but I think it is through that experience that my interest in the topic of this book was raised: the long-term evolution of how people dealt with their natural environment. When university politics made it difficult for me to continue in the Near East, I was asked to participate in an archaeological project in the Netherlands, which turned out (you never know in archaeology!) to enable us to develop a vision of the emergence of the Western Netherlands from the sea – that unique part of the country that lies below sea level and was literally wrested from the sea over a period of some 2,000 years. Again, the theme was the evolution of the ways people dealt with their environment. One of the results of that work is Chapter 10.

After moving from the University of Amsterdam to Cambridge University in 1985, I was invited by French colleagues at the CNRS to participate in a third regional man–land focused project, this time in the Massif

des Maures in southern France. In 1990 that area was ravaged by a huge wildfire that destroyed all vegetation over a wide area around our principal excavation site. Fortunately, that happened on a Friday – the day that I had given our students and fellow archaeologists a day off, following the Near Eastern tradition, with the result that nobody was hurt even though I still have metal tools in my study that melted while the fire passed over our site. Suddenly, we saw the landscape as it had been before many years of *garrigue* growth had covered it, and we were able to walk everywhere and identify many remains of human activity. We changed the strategy of our project and developed an intensive survey campaign that localized human impact on the landscape going back to pre-Roman times, and we were able to reconstruct yet another instance of human–environment evolution over a couple of thousand years.

But in the midst of that project, my career was definitively sent on a different trajectory – by what was in those days a very large grant from the European Commission's Research Directorate – to study modern human–environment relationships in all the countries of the northern Mediterranean rim, under the umbrella of "Desertification in Europe."[1] The funding enabled me to bring a team together of some sixty-five scientists covering every conceivable discipline from theoretical physics and complex systems through mathematics, the natural, earth and geographic sciences to the social sciences, including history, rural sociology, and archaeology. And importantly, I was given the freedom to choose scientists from all over Europe without any institutional constraint so that I was able to assemble a team of people I liked to work with. It was a unique opportunity for me to get a third university education, this time completely transdisciplinary. In various forms the core of the team stayed together for a decade (1991–2000), so that we had ample time to learn from each other and develop a group identity to replace the disciplinary identities of the individuals concerned. Quickly, our research focus moved from desertification to environmental degradation and from studying principally the environment to studying the people in their environments, and ultimately how they made decisions about their environment. I will refer in certain places in this book to that project, the ARCHAEOMEDES project, so I will be short here. We investigated areas in Greece (2), in Dalmatia (1), in Italy (1), in France (several, depending on how you counted them), in Spain (3), and in Portugal (1). In some areas, the research spanned 12,500 years, in others a few decades. The areas varied from a couple of hundred to more than 10,000 square kilometers, as did the intensity of the research with them. An important innovation was that

much of our thinking was based on a complex adaptive systems (CAS) approach. Though I did not realize that fully at the time, in that sense the ARCHAEOMEDES project was far ahead of its time. And again, that laid the foundation for a very important aspect of this book.

In the mid-1990s I moved from the United Kingdom to France for personal reasons and decided that, while retaining the long-term perspective that is also at the core of this book, I would focus on its impact on contemporary people and their environments. I relinquished my responsibilities in various archaeological activities that I had maintained thus far, and became, in essence, a sustainability scientist *avant la lettre*.

In 1999–2000, somewhat tired of project management, I was offered a year's sabbatical at the Santa Fe Institute and Arizona State University, which – again – ended up being a life-changer. It reconnected me with North American colleagues in archaeology, some of whom I had known since the mid-1970s, but the post also gave me the opportunity to gain deeper insights into CAS, and in particular to further develop my CAS thinking in the social sciences, grounded in the ARCHAEOMEDES experience.

In that process, I reconnected with two very early interests, one in the evolution of technology (as embodied in ceramic technology) on which I had done my thesis in the 1970s, and the other in the role of information processing in human evolution that began in the early 1980s, and I combined them. The ceramic interest was due to my early love of pottery making, in high school, and working together for my thesis with Jan Kalsbeek, a professional potter who instilled in me the potter's way of looking at archaeological potsherds. It taught me a lot about the contrast between creative thinking and scientific thinking and led to ethnographic fieldwork on pottery making in the Near East and the Philippines in the 1980s. But above all, it gave me a completely novel 'inside' perspective on techniques and technologies and their coevolution. In the very early 1990s, at the invitation of colleagues at the National Autonomous University of Mexico, my interests in this topic found their culmination in ethnographic fieldwork on innovation in pottery making in Michoacán with my wife Anick Coudart and Dick Papousek.

Stimulated by the SFI experience, I combined this interest with my early foray into the role of information processing as a major driver of societal evolution, and this led a couple of years later, again funded by the European Commission but now through its Information Technology Directorate, to the "Information Society as a Complex System" (ISCOM, 2003–2007) project, which aimed in particular at the relationship

between innovation and urban dynamics, an interest that I have actively pursued until this day, and which has contributed a lot to the thinking that I will elaborate in this book. It is this project, which I initiated while at the Santa Fe Institute and conceived and codirected with David Lane, Denise Pumain, and Geoffrey West, that a few years later gave birth to the "allometric scaling" approach to urban systems codeveloped at the Santa Fe Institute and Arizona State University (Bettencourt et al. 2007), as well as to a series of projects dealing with the dynamics of invention and innovation.[2] One of the results of the project is the approach to the coevolution of cognition, societal organization and environment that is reflected in Chapter 8 in this book, and which was first published in a volume that gave birth to yet another lively project: IHOPE (Costanza et al. 2007) as well as in the ISCOM book (Lane et al. 2009a).[3]

But in 2003–2004 I moved to Arizona State University (ASU), attracted by its president's very innovative vision about universities as well as by the very collegial atmosphere I had experienced in its anthropology department in 2000. I accepted the directorship of that department, with the charge to develop it into a transdisciplinary school, for which the name "School of Human Evolution and Social Change" was chosen. A few years later, in 2010, that was followed by the deanship of the School of Sustainability that ASU created in 2005, and a little later by the directorship of ASU's Complex Adaptive Systems Initiative. Much of this last decade, therefore, I devoted with much pleasure to institution building in the very exciting and rewarding atmosphere of ASU. I published a number of papers on aspects of my thinking about the long-term coevolution of societies and their environments, but this left me too little time to undertake writing a book like this. So here we are.

Stepping Stones

While writing the chapters that follow, I was often reminded of Deng Xiao-Ping's famous dictum when he wanted to change the course of Chinese history: "Cross the river by feeling for stones." For much of my life, I have wondered and marveled at where I was going. Here and there, reading in very different corners of the intellectual world, discussing with many friends in different places, I have found things that appealed to me because "they fitted." But what did they fit? I was often not aware of the pattern in which they might fit, but followed a kind of hunch that "this was interesting." It is only with the benefit of hindsight, over the last ten years or so, that I began to see a pattern. Each of the following chapters is

thus a kind of stone in the river that allowed me make another step in crossing my stream both literally (to a comfortable senior citizenship) and intellectually (from study of ancient techniques and societies, to a preoccupation with the impact of information technology on our modern societies).

I am emphasizing this for a number of reasons. First, because the book is not a tightly knit piece of work that holds together, examining a specific set of issues from every possible angle, profoundly digesting a complete literature. Instead, it resembles a network of stepping stones, in themselves coherent and that deal with different, loosely connected issues. To link them into the kind of direction where I found myself going I have made some large, only feebly documented jumps, in particular when discussing the impact the ICT revolution might have on our future.

Second, the domain that I propose to explore is not clearly defined, and there is no coherent community in existence to reconnoiter it. I have thus used my intuition as a compass to point in a new direction for sustainability research, rather than design a map in order to answer specific questions. It is too early for that. The interactive dynamic between the domain of research and the community interested in it has not had sufficient time to mature.

Third, the reader is reminded that the book represents about forty years of intellectual and physical wandering. Hence, some of the stepping stones are much older than others. That is particularly reflected in the literatures on which my arguments are built. I have not tried to update those references, as this is beyond my reading capacity. Moreover, as a historian designing an approach that is fundamentally processual, historical, and focused on the emergence of novelty, I feel a certain pride in showing the reader how I traveled, which stones I stepped on and how they relate, rather than – like Thucydides – hide that process by overlaying it with multiple rewrites. After all, I cannot – and cannot be expected to – master the many very different topics that I have touched on. The stones, therefore, are very different in nature and quality. Many topics I refer to have been the subject of decades, if not centuries, of discussion and I have therefore had to rely on relatively general summaries to include them in the discussion.

As Anick observed, the result is that I have done not much more than open a window and describe, in vague terms, the vista that one sees when looking out through that window. I can only hope that there are people out there who feel challenged by that vista. If there are none, my consolation is that writing this book has been a very satisfying voyage

of personal discovery. I do not believe in convincing people – people convince themselves.

The Book: What It Is and What It Is Not

So, what is this book about, and what is it not about? To whom am I addressing myself? What is the core message? To introduce that first question, I will begin with an anecdote. One that occurred in the very first days of the ARCHAEOMEDES project. We were in northern Greece, in Epirus, close to the Albanian border, initiating our research on environmental degradation as was part of our brief for that project. The anthropologist of our team, Sarah Green,[4] who was born and raised in Greece, started walking around the landscape in an attempt to find out what people considered degradation. After a couple of weeks, in despair, she took a local family into their own backyard where there was a very large hole of (I seem to recall) 20 meters across and about a meter deep, caused by underground solifluction. She pointed to that hole and asked "Is that not degradation?" The family shook their heads and said something to the effect of "No – we have had that hole in the ground forever, and we live with (and around) it." So, asked Sarah, "What is degradation?" They laughed a bit, pointed to a nearby mountain called Kasidiares (which means "the bald one" in Greek) and said: "The fact that the bald one is growing hair." What they meant was that for them, degradation was the fact that there were now trees growing on a mountain that had always been bald before!

That idea certainly relativized our concept of environmental degradation – here people considered the growing of trees to be degradation. How was that possible? This apparent contradiction initiated a highly interesting strand in our research, which led us ultimately to accept that environmental degradation as a concept is culturally defined and directly related to the experience of the inhabitants/observers. In this precise case, we drilled down quite deep and became convinced that the growing of the trees, for the Epirotes of the region, symbolized the fact that their experience of their own society's evolution since World War II was essentially negative. That determined in many ways the direction this book takes.

Sustainability is a word that has many different meanings, uses, (mis-) interpretations, emotions, and rationales associated with it. At a later stage, I will discuss how one might define "sustainability," its content, its temporal dimension, its relations with other concepts currently used in the domain explored in this book. This book is about a particular vision

of sustainability, climate change, and a whole range of related phenomena as primarily social and societal rather than environmental.[5] Indeed, it has been recognized for some time in our community that we are dealing with socioenvironmental dynamics, and I subscribe to that. The Resilience Alliance, Elinor Ostrom and many others have cogently argued for that. But I want to go a step further, and argue that the *second order socio-environmental dynamics* (the ways the socioenvironmental dynamics have changed over long timeframes) *are essentially driven by societies and the societal dynamics within them*. After all, humans do not only define what they consider their environments, but they also define what they consider to be environmental challenges (essentially challenges to the environment as they see it). And finally, societies devise what they consider solutions to these challenges. Those solutions, as I will argue in Chapter 10, have unintended consequences, and these in turn cause challenges and ask for solutions.

This position – that societies define their environments, environmental challenges, and potential solutions depending on their culture – goes to some extent against the prevailing conclusion in the western world that nature and culture are two opposites. That conclusion therefore needs consideration. A more detailed examination of the concepts "nature" and "culture," for example by examining how the contrast between "natural history" and (social or cultural) "history" emerged in the eighteenth and nineteenth centuries makes very clear that nature and natural history are in effect cultural constructs. Nature as we know it has been defined within the western cultural tradition as distinct from culture. It is therefore not surprising that when we look around at other cultures, whether in Amazonia, in Japan, in India, or in traditional China, the relationship between human societies and their environments has been viewed very differently.

To summarize, *sustainability is a social and societal issue, rather than an environmental one*. It involves all the different fields and dynamics of our human behavior in societies: politics and governance, institutions, the economy, our collective perceptions and decisions, our social interactions, etc. It is not just about the emission of CO_2 and other greenhouse gases, however much these may impact on our climate. I will argue in this book that those emissions are only one aspect of a much more fundamental threat to the continuity of our current ways of living on Earth. What I call "the crisis of unintended consequences" is hitting our way of life in many other ways, some of which (regional water shortages, food security, global societal instability) may well become dramatic before climate change or sea level rise do.

One core message of this book is that one can only begin to deal with these issues if one stops defining them as a potential crisis that needs to be avoided. Though fear has over the last thirty years alerted people to an emerging challenge, it does not, in the long term, mobilize societies to change – hope on the other hand does. The fact that our societies are waking up to the fact that they may be getting close to a tipping point in their relationships with their environments also offers an amazing occasion to think through and to implement a very different way forward, which some have called green growth – a way to reduce poverty by deliberately aiming for a very different kind of economy and lifestyle, based on partial dematerialization of our value systems. After all, if you want to get out of the hole you have dug for yourself, the first thing to do is to stop digging!

One must remember that many societies, at different times in history and in different places, have been faced with the kind of tipping point that we currently see emerging on the horizon. *Sustainability has always been a challenge.* And in many such instances, there is no substantive evidence to argue that such a tipping point was directly related to climate change. Indeed, one could justifiably argue that focusing on such emissions is a form of escapism – an escape from meeting the underlying issues head-on.

It is one of the other important tenets of this book that thinking about the future must be developed into a coherent approach, moving from a science that explains the present by studying the past toward an approach that uses the study of the past to learn about the present, and aims to use that knowledge to improve our perspective on the future, even though we may at present not quite see what that approach would look like. I will elaborate on that in Chapter 6, developing some tentative pathways to do so.

Yet another emphasis in this book is on the role played by the *organization of information processing and its evolution throughout human history*. This focus finds its origin in the fact that for the first time in the history of our species we are faced with a major transition in that domain, from human to electronic information processing. In my opinion, it is not coincidental that that transition occurs in parallel with the approaching sustainability tipping point. Moreover, the information and communication technology (ICT) revolution that embodies this transition will profoundly influence what the future will look like, and how people may be able to deal with the challenges facing us.[6] Treatment of the massive data on the environment and sustainability at large that is available today as part of the "Big Data" revolution is helping us

to better understand the processes involved, both in the environment and in society, but the ICT revolution has many other consequences for society that have generally not been taken into account in this context, and I will devote substantive attention to them.

To whom am I addressing myself? I am trying to get my core message across to as wide an audience as possible. That potential audience concerns scientists in all disciplines as well as the wider educated public. Part of the message is directly aimed at science and scientists, as it is my opinion that the last two and a half or three centuries of scientific activity have contributed to the challenge that we are facing. Much of the science until recently has been reductionist – gaining clarity about phenomena by reducing the size and scope of what was being studied, as well as reducing the number of dimensions taken into account. Moreover, it has focused on explaining the present by relating it to the past, and as a result has not really dealt with the need to scientifically look toward the future to anticipate future challenges. But some sciences have evolved in the last thirty or forty years, and I see considerable need and opportunity to further develop the sciences of complex systems – which focus on emergence of novelty rather than explaining origins – to help us develop new approaches to deal with the challenges at hand.

But more needs to be done by the scientific community – over the past forty years it has slowly but surely, in many ways unconsciously, lost some of the trust that allowed scientists in earlier decades to help society find solutions to emerging challenges. Another main message of this book is that science has in my opinion promised too much in some domains, while in others it has implemented solutions with unintended, and negatively perceived, consequences. But above all, science has progressively lost the independence it had when it was mostly practiced by amateurs, as was the case in the seventeenth to nineteenth centuries. On the one hand, it has become encapsulated by business as a way to innovate and make money while on the other it has been used by governments everywhere – and at all levels – to justify decisions that society was not always ready to take. If science is to help us again to change course, that trust needs to be regained. But it remains to be seen how scientists will make their community evolve and how this community and the scientific process will be restructured, improving transparency and independence as well as diversity and transdisciplinarity.

Although both the above messages are directed at the scientific community, they are also directed at all those people who actually impact on scientific institutions, practices, and directions, as well as all those who

are active in ways that are influenced by science and scientists. Hence, I am aiming this book at a wider audience than the scientific community alone. I will not try to argue my position in contrast to existing scientific positions, thus engaging in a series of narrow debates. Instead, I think my cause is best served by a 30,000 feet perspective that is written in a language that can be understood by anyone with an education. This will therefore not be a scientific monograph that reviews existing theories and documents additions or changes. It will follow an out-of-the-box approach, outlining its principal theses in bold traits, illustrated with examples.

The book is organized in three parts. The first, comprising Chapters 1–7, presents my perspective on a scientific context within which one can profitably view sustainability issues. The second part, Chapters 8–14, describe from the perspective of information processing the way in which I think we have come to the present sustainability challenge. The third part, Chapters 15–21 discusses various aspects of the way I think we might, as scientists, contribute to smoothing the transition from the present to the future, taking into account the simultaneous acceleration of environmental challenges, the challenges of the ICT revolution, and those of the fundamental global socioeconomic and political system.

NOTES

1 The project was funded by Directorate General XII (Research) of the European Commission under contracts EV5V-91-0021 (ARCHAEOMEDES I), EV5V-0486 (Environmental perception and policy making), ENV 4 CT 950159 (ARCHAEOMEDES II), and ENV5-CT97-0684 (Environmental Communication).

2 The project was proposed under number IST-2001-35006 on November 20, 2001 as an RTD Project under call IST-01-07-2A, Program 1.1.2 (IST), Priority VI.1.1 (FET Open) to the ICT directorate of the European Union, and funded from 2003 under contract IST-2001-35505. It proposed, in its introduction "to achieve a deeper understanding of what 'information society' means by developing a theory and a methodology to investigate how socio-politico-economic structure is related to the ways in which new information, communication and control technologies are generated and used. Our approach will focus on the relationship between information processing and the organization of society. We will focus on the dynamics of invention and innovation in multilevel heterarchical organizations, and on the structures that emerge as a result of these dynamics."

3 It is for the ARCHAEOMEDES and ISCOM research that I later received the UNEP's "Champion of the Earth for Science and Innovation" award (in 2012).

4 Now a professor of anthropology at the University of Manchester in the United Kingdom.
5 Throughout the book, I will use "social" for the dynamics of individuals' interactions and "societal" for society-wide dynamics that affect the structure of the society.
6 Throughout the book, I will use the term ICT revolution, including under this term the "digital revolution" and the "4th industrial (or technological) revolution," as all these are in my opinion part of one and the same longer-term process.