FRED SPIER

big history and the future of humanity

SECOND EDITION

WILEY Blackwell

To William Hardy McNeill:
The historian I admire the most in the whole wide world.

> *We remain submerged in a vast evolutionary process that began with the Big Bang (probably) and is heading to an unknown future – a system in which matter and energy evolve, stars form and break apart, the solar system took form and will eventually collapse (but not before life does), and human societies emerged on planet Earth, beginning an evolution whose end is not in sight.* (William H. McNeill, *The Global Condition* (1992), pp. xiv–xv)

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While this was going on, none of the people I was surrounded by, including my teachers at secondary school and later at university, ever mentioned the profound change in perspective the pictures of Earth from space had produced, but preferred to stick to their established educational programs. Given this situation, I kept most of my thoughts and feelings to myself. Yet I began to feel what I would now describe as a most distressing disconnect. Not only was I increasingly worried about environmental problems, but I also wanted to know how humanity had gotten itself into this situation. This curiosity about human history was fueled by a paragraph in the Dutch introduction to *The Limits to Growth*, which stated that we would only be able to effectively change our current situation for the better if we understood how the current situation differed from those earlier periods of history that had shaped humans in a biological and cultural sense.[3] At that time, academic environmental history did not yet exist, nor was I aware of any world history accounts that could help me in this respect. As a result, I began a long intellectual search for a better understanding of human history, which reached its culmination when I became familiar with big history.

For me, big history has become a wonderful way of explaining how both my own person and everything around me have come into being. In big history, any question can be addressed concerning how and why certain aspects of the present have become the way they are. Unlike any other academic discipline, big history integrates all the studies of the past into a novel and coherent perspective. In doing so, big history has provided me with a new and most satisfying connect. And judging by the large numbers of students who take big history courses every year on a voluntary basis, it may provide a similar connect for them also. Most of my students were born well after the Apollo space program had ended. For them, the moon flights are part of deep history. Since the end of the 1960s CE, however, many university courses, especially in the humanities, have not changed a great deal. As a result, many students may still be experiencing similar disconnects.

Inspired by the Earthrise photo, over the past 30 years I have striven to attain a detached overview of history with the aid of a theoretical point of view. While such an approach is extremely common within the natural sciences – natural scientists would not know how to do science in any other way – even today most historians and social scientists tend to focus on details at the expense of losing the overview. My approach to history has led to an account of human affairs on this planet that is, therefore, rather different from the more established historical narratives.

The theoretical approach to big history, which will be explained in Chapter 2, is based on the knowledge gained during my rather diverse academic career. I first completed a study of biochemistry, specializing in what was then called

the 'genetic engineering' of plants. The promise of this type of research was that this would help boost world food production.[4] Yet I kept a nagging fear that this might not be sufficient to solve the problems mentioned in *The Limits to Growth* report. After finishing my study of biochemistry, I therefore decided not to pursue a career in this field, even though I was offered several PhD positions. Instead, I started to drift, in an attempt to find a solution to the question of how humans had gotten themselves into their current predicament.

For about one year, I worked on a Dutch ecological enterprise called Gaiapolis. This taught me a great deal both about the Dutch ecological movement and about life in general. I also began to travel overland through Europe, the Middle East and Africa, which helped me to become a little more familiar with life in poorer areas of the world. During a train ride in the Central Sudan in 1979 CE, I met German cultural anthropologist Joachim Theis, whose balanced analyses of local Sudanese situations put me on the track of studying cultural anthropology. A good friend of mine in Leiden, the Netherlands, Leony van der Splinter, gave me a copy of US cultural anthropologist Marvin Harris' general introductory textbook *Culture, People, Nature*, whose broad view I found fascinating. I was very fortunate to meet this intriguing scholar personally in 1988 CE.

Thanks to the generous support of my parents, I studied cultural anthropology and social history in the Netherlands in the 1980s and early 1990s CE. During this period, I carried out a long-term study of religion and politics in Peru during its entire known history, with a focus on one single rural village, the parish of San Nicolás de Bari de Zurite, situated near the ancient Inca capital of Cusco. The central idea behind my research was to find out how a community of largely self-supporting peasants was dealing with nature, what its history had looked like and, most notably, how and to what extent this area had been influenced by the outside world. Because environmental studies did not yet exist in the Netherlands, I decided to focus on the local Andean religion, in the hope that a good many environmental ideas and practices would be expressed in it (which turned out to be the case).

During this period, the Dutch cultural anthropologist Mart Bax, who supervised my work in Peru, introduced me to the process-oriented approach to history that had been developed by German sociologist Norbert Elias, as well as to his own elaboration of this theory within the field of religion and politics. Later, I also received the equally critical support of Dutch sociologist Johan Goudsblom, who became my second PhD supervisor. One of the most important things I learned during that period was that most of the history of the Peruvian Andean village that I had been studying was inextricably linked to major processes in human history. I summarized my research in two books.[5] It is only now, though, after developing the theoretical model explained in the present book, that

I more fully understand how very rationally these Peruvian peasants were exploiting their surrounding natural environment.

After finishing my PhD project in 1992 CE, virtually all interest in Latin America suddenly evaporated in the Netherlands as a result of the collapse of communism in Central and Eastern Europe. Instead of supporting research and developmental aid in countries that were a battleground in the Cold War, West European governments suddenly began to fund efforts to integrate Central Europe into the European Union. This made it virtually impossible to continue any further research in Peru. Fortunately, at the same time Johan Goudsblom became acquainted with David Christian's pioneering big history course, thanks to a visit in 1992 CE to Macquarie University, in Sydney, Australia. In this course, lecturers ranging from astronomers to social scientists all told their part of the grand story. This initiative very much appealed to me also, because it would provide exactly the type of historical overview that I had been trying to find. In 1993 CE, Goudsblom and I started preparing the first University of Amsterdam big history course, which was modeled on Christian's approach. Our first big history course was held in 1994 CE and has been running annually ever since.[6]

In November of 1992 CE, I was very fortunate to meet the US world historian William H. McNeill in Amsterdam. Ever since that time, he has lent me his critical and most generous support. It was critical, not only because it helped me to sharpen my views, including the writing of this book (he challenged me several times to do better in his own, inimitable, most positive way), but also because I might otherwise not have survived the vagaries of academic life after setting off in the direction of big history, for which there was no safe haven within academia. I dedicate this book to him as a small token of my enormous gratitude for all he has done for me.

While I was structuring our first big history course in 1994 CE, I realized that by doing so I was also structuring big history itself. This most exciting insight led to my book *The Structure of Big History* (1996), in which a general structure for all of history is proposed. A visit to the Santa Fe Institute in October of 1996 CE, where I presented my new book, introduced me to complexity studies. Although during the subsequent years this subject began to loom ever larger, I was unable to use it to achieve a good synthesis with regard to big history. In 2000 CE, US astrophysicist Eric Chaisson visited our course and gave a great lecture. He then introduced me to his ground-breaking views on energy and complexity by presenting me with a copy of his manuscript in preparation with a request for commentary. This provided me food for thought for several years.

The breakthrough toward my current approach happened in February 2003 CE, while the annual Amsterdam big history course was running. After returning from a lecture, my American wife Gina – while preparing a delicious Italian dinner – asked me the simple question of why big history happened the way it

did. Trying to be as clear and succinct as possible, I suddenly realized that this was a question no one had ever posed to me in such a way. I also saw that the answer might be both simple and elegant. This book offers my answer to Gina's question. The first summary of this approach was published in 2005 CE as an article by the English-language Russian journal *Social Evolution & History*, entitled 'How big history works: energy flows and the rise and demise of complexity.' This book is both an elaboration and a refinement of the arguments put forward in that article.

I am fully aware of the fact that our scientific knowledge keeps evolving. Even during my 15 years of teaching big history, major changes have taken place, such as the sudden emergence of dark energy in cosmology. As a result, the story of big history keeps changing, which will make many of the 'facts' presented in this book appear outdated somewhere in the future. Yet I hope that my novel theory of history will last longer. If that does not happen, I very much hope that this book will have stimulated attempts to replace it with a better approach.

In big history, it is clearly impossible to personally peruse all of the extant sources. In addition to reading as much as possible, my solution has been to submit my ideas to specialists in the various fields, ranging from astronomers to social scientists, many of whom have provided me with most valuable feedback. Although this has helped me to keep my knowledge about all of these different fields as up-to-date as possible, I cannot guarantee, of course, that the views presented in this book always represent the latest and best in science. I have also been deeply influenced in my thinking by many people before I started writing this book. Without them, this book would surely have been different, if it had existed at all. Furthermore, many scholars lent their critical support to this project. I am thus indebted to a great many people in a great many ways, some of whom are sadly no longer among us.

I mention them here in alphabetical order: Walter Alvarez, Mart Bax, Craig Benjamin, Charles Bishop, Maurice Blessing, Svetlana Borinskaya, Julián Cconucuyca F., Ernst Collenteur, Lennart Dek, Carsten Dominik, Randy van Duuren, Dennis Flynn, André Gunder Frank, Adriana Galijasević, Tom Gehrels, Mr. & Mrs. Louis Giandomenico, Arturo Giráldez, Leonid Grinin, Huib Henrichs, Ed van den Heuvel, Henry Hooghiemstra, Teije de Jong, Machiel Keestra, Bram Knegt, Marcel Koonen, L. W. Labordus, Alexander Malkov, Koen Martens, John R. McNeill, Akop Nazaretyan, Juan Victor Núñez del Prado, Don Ostrowski, Maarten Pieterson, Robert Pirsig, Nikolai Poddubny, Harry Priem, Esther Quaedackers, Lucas Reijnders, Richard Saunders, GertJan Savonije, André Schram, Vaclav Smil, M. Estellie Smith, Graeme Snooks, Jan Spier, Paul Storm, Egbert Tellegen, Joachim Theis, Machiel van der Torre, Bart Tromp, Antonio Vélez, Erik Verbeeck, John de Vos, Jan Weerdenburg, Jos Werkhoven, Peter Westbroek and Ralph Wijers.

I am also indebted to all other lecturers not mentioned above and to a great many students, as well as to others who contributed in ways that I may not exactly remember or may not even be aware of anymore.

I am especially grateful to David Christian for many wonderful and stimulating discussions; William McNeill, for his unfailing support and always wise criticism; Bob Moore, for his constructive criticism, his excellent corrections of English in all of the chapters and his critical support in getting this book published; Eric Chaisson, for pointing out crucial errors while making important suggestions; Karel van Dam and Gijs Kalsbeek, for carefully commenting on the manuscript; Frank Niele, for his sharp criticism, which substantially improved my treatment of energy; Barry Rodrigue, for his tireless efforts to weed out stylistic errors while providing most stimulating commentary and support; Jeanine Meerburg, for her unfailing support of this project (and of big history); my father and mother, for their loving support and interest; the Institute for Interdisciplinary Studies, for providing the opportunity to write this book; and last, but certainly not least, my wife, Gina, for her unceasing interest, stimulation and loving support, as well as our children Louis and Giulia, for their patience and curiosity. None of the persons mentioned above can, of course, be held responsible in any way for the views expressed in this book.

In this second edition a few errors have been corrected and some explanations have been added or improved. A number of notes were shortened or deleted, while a few new notes were added. Because science has not stood still over the past five years, new insights have been added or old ideas updated. In each chapter a few text boxes have been added that are addressing salient topics not included in the main text.

This second edition is also intended to be used as a textbook for big history courses. The first edition has already successfully been used as such in a number of courses around the world. In this new edition commentary from users has been incorporated. Most of the teaching materials, however, including learning goals, have been kept out of the book and will appear on the accompanying freely accessible website www. bighistory.info designed for classroom use of this book.

While improving the book I have greatly profited from the pioneering writings by Canadian-French astrophysicist Hubert Reeves as well as from discussions with a great many students and colleagues over the past five years, most notably at the University of Amsterdam, Amsterdam University College, the Eindhoven University of Technology, Grand Valley State University, Villanova University and Dominican University of California. In addition to those mentioned earlier, with many of whom I have continued our stimulating discussions, I have also become indebted to David Baker, Mojgan Behmand, David Blanks, Daphne Bouwmeester, Cynthia Brown and Jack Robbins, Lowell and Connie Gustafson, Henk Hoekstra, Michiel Hogerheijde, John Mears,

A SHORT TIME LINE OF BIG HISTORY

ABB: After the Big Bang
BP: Before Present (In BP, the present is usually defined as 1950 CE)
CE: Common Era = AD (Anno Domini)
X years ago: x years before 2015 CE (date of publication of this book).

TIME	EVENTS
13.8 billion years BP	The big bang
First 4 minutes ABB	Emergence of elementary particles, protons, neutrons, electrons and neutrinos
4–15 minutes ABB	Nucleo-synthesis of deuterium, helium, lithium and beryllium
50,000 years ABB	Transition from the Radiation Era into the Matter Era
380,000 years ABB	Neutralization of the universe and the emergence of the cosmic background radiation
700 million to 2 billion years ABB	Emergence of galaxies and stars
4.6 billion years BP	Emergence of our solar system
4.6–4.5 billion years BP	Emergence of the inner planets
4.5–3.9 billion years BP	Hadean Era, including the cosmic bombardment
3.8–3.5 billion years BP	Emergence of life
3.4 billion years BP	Oldest stromatolites and the emergence of photosynthesis
2.0 billion years BP	Emergence of free oxygen in the atmosphere and of eukaryotic cells
540 million years BP	Cambrian explosion of complex life forms
400 million years BP	Life moves onto land
200 million years BP	Emergence of warm-blooded animals

TIME	EVENTS
65 million years BP	Asteroid impact supposedly ends the reign of the dinosaurs and makes room for mammals
4 million years BP	Emergence of bipedal Australopithecines
2 million years BP	Emergence of *Homo erectus*
200,000 years BP	Emergence of *Homo sapiens*
10,000 years BP	Emergence of agriculture
6,000 years BP	Emergence of the first states
500 years ago	First wave of globalization
250 years ago	Second wave of globalization (Industrialization)
70 years ago	Third wave of globalization (Informatization)

1

INTRODUCTION TO BIG HISTORY

Introduction

This book is about big history: the approach to history that places human history within the context of cosmic history, from the beginning of the universe up until life on Earth today. In a radical departure from established academic ways of looking at human history, in big history the past of our species is viewed from within the whole of natural history ever since the big bang. In doing so, big history offers modern scientific answers to the question of how everything has become the way it is now. As a consequence, big history offers a fundamentally new understanding of the human past, which allows us to orient ourselves in time and space in a way no other form of academic history has done so far. Moreover, the big history approach helps us to create a novel theoretical framework, within which all scientific knowledge can be integrated in principle.

The term 'big history' was coined by historian David Christian (1946 CE–).[1] In the 1980s CE, Christian developed a cross-disciplinary course at Macquarie University, in Sydney, Australia, in which academics ranging from astronomers to historians gave lectures about their portions of the all-embracing past. This course has become a model for other university courses, including two courses that I have been teaching since 1994 CE, first at the University of Amsterdam and later also at the Eindhoven University of Technology.

Although all the knowledge taught in big history courses is readily available in academia, only rarely is it presented in the form of one single historical account. This is mostly the result of the fact that over the past 200 years, universities have split up into increasing numbers of specializations and departments. Since the 1980s CE, however, academics ranging from historians to astrophysicists have been producing new grand unifying historical syntheses, set forth in books and articles.

Big History and the Future of Humanity, Second Edition. Fred Spier.

In the pages that follow, I seek to explain big history. Within the emerging field of big history scholarship, this book presents a novel account of our all-embracing past. Building most notably on the work by US astrophysicist Eric Chaisson (1946 CE–), a historical theory of everything is proposed, in which human history is analyzed as part of this larger scheme. In Chapter 2 this theoretical approach will be introduced, while in the subsequent chapters it will be applied to big history. In this first chapter, a selected number of themes are discussed that are vital for a better understanding of big history.

Studying the Past

To understand the view of history proposed in this book, it is important to first address the question of how the past can be studied. Harvard historian Donald Ostrowski (1945 CE–) succinctly formulated his answer as follows: 'We can't study the past precisely because it's over, gone.'[2] By saying so, Ostrowski pointed to the undeniable fact that all we know about history can only be found in the present, because if this knowledge were not available here and now, how could we possibly know about it? This is just as much the case for the history of the universe as for the history of us people. The idea that all historical knowledge resides in the present is not a new point of view among historians. Yet it is rarely stated very clearly.[3] As I hope to show, in big history, this issue is perhaps even more urgent than in traditional historical accounts.

Because all evidence of the past can only be found in the present, creating a story about the past inevitably implies interpreting this evidence in terms of processes with a certain history of its own. We do so because we experience both the surrounding environment and our own persons to be such processes. As a result, all historical accounts are reconstructions of some sort, and thus likely to change over time. This also means that the study of history cannot offer absolute certainties, but only approximations of a reality that once was. In other words, true historical accounts do not exist. This may sound as if there is endless leeway in the ways the past is viewed. In my opinion, that is not the case. Just as in any other field of science, the major test for historical reconstructions is whether, and to what extent, they accommodate the existing data in a concise and precise manner. Yet there can be no way around the fact that all historical reconstructions consist of a selected number of existing data placed within a context devised by the historian.

The idea that all our knowledge of the past resides in the present also means that we do not know anything about things that may once have happened but did not leave any traces in the present. We do not know anything either about events that actually did leave traces in the present that have not yet been

1500 CE, during a period of intense internal competition, global conquest and expanding trade.

Von Humboldt regarded his own *Kosmos* book series, published in German between 1845 and 1859 CE, as the culmination of these developments. Yet even while he was writing these books, the sciences were differentiating in ever more specializations. This made it increasingly difficult to construct all-embracing world views. It was only in the twentieth century, thanks to the emergence of a scientific history of the universe, that such large science-based cosmic views would again become feasible.

As part of this long-term trend of improving world views, there has been a growing tendency to look at the Earth from a distance, as exemplified by the Apollo 8 Earthrise picture. In his book *Earthrise: How Man First Saw the Earth* (2008), British historian Robert Poole (1957 CE–) provided an illuminating overview of how over thousands of years and in many different places stories were told of people traveling to the moon and looking back at the Earth, thus imagining what our home planet would look like embedded in the cosmos. Furthermore, the efforts at mapping the Earth as a whole have played an important role in this trend toward shaping ever-improving cosmic world views. These developments were described very well by US Alexander von Humboldt professor of geography Denis Cosgrove (1948–2008 CE) in his book *Apollo's Eye: A Cartographic Genealogy of the Earth in the Western Imagination* (2001).

It is impossible to predict the relevance of academic answers to questions about reality. Much depends on the creativity, knowledge and ingenuity of the academics involved as well as on the freedom to express such new opinions within the societies they live in. Answers to what at first sight appear to be almost irrelevant questions may turn out to have fundamental implications. Two examples: the question posed in 1928 CE by Scottish scientist Sir Alexander Fleming (1881–1955 CE), while looking at a Petri dish that had become contaminated with a mold that was apparently killing the surrounding microorganisms and wondering what was going on, led to the discovery of penicillin as well as a great many fundamental insights into biological warfare in the world of small organisms. And, while wondering in 1913 CE what those fuzzy little objects were in the sky, US astronomer Vesto Melvin Slipher (1875–1969 CE) discovered to his surprise that their light was red shifted, which meant that they are all very rapidly moving away from us. Measuring their distances led to the discovery by another US astronomer, Edwin Powell Hubble (1889–1953 CE), in the 1920s CE that the whole universe is expanding. As a result, their combined

findings offered empirical evidence for an entirely new view of cosmic history, and thus provided a fundamentally new answer to the old question of how the universe had come into being.

To reinforce the importance of empirical evidence as answers to questions underlying all of big history, students are sometimes requested to do in-class experiments and observations related to the subject under discussion, preferably with unknown outcome. In addition, the importance of curiosity, inquisitiveness and following one's intuition receives due emphasis, especially when something does not seem to be right, is ill-understood, strange or otherwise intriguing, because that is how major discoveries have been, and will be, made.

The resulting answers must, of course, conform to the established scientific method. All scholarly accounts of the past are constructed with the aid of empirical evidence ordered by logical reasoning, including some sort of theoretical framework, which may be either implicitly or explicitly formulated. Ideally, all the available data should fit this framework. In practice, however, that is rarely the case, which often gives rise to long discussions of how the past should be viewed. These general issues have been discussed by generations of historians and philosophers. It is not my intention to provide an overview of these issues here. Yet it may be helpful to consider that an important human characteristic that allows us to make reconstructions is our capacity for pattern recognition and map making, which helps us to simplify the great many sensory data and make sense of them by ordering them within certain patterns. Humans are endowed with this capacity to a much greater extent than any other animal.[4] This capacity has allowed our species to become what it is today.

However uncertain historical reconstructions may be, the only firm statements we can actually make all deal with the past. Clearly, we do not have any data at our disposal giving an idea of what the future will bring. As a result, we can only construct more or less likely scenarios of the future, based on observational data in the present. One might argue that it is possible to make firm statements about the present, but unfortunately, the present is also a rather fleeting category. Although the present is 'where the action is,' as soon as we talk about it, it has become part of the past. This is also the case for scientific experiments. Even while performing scientific measurements, those aspects of the present we are seeking to get a grip on are gone forever. What we do retain, however, if we do our work well, are the observational data, which may be more or less durable, depending on how well we did our job in recording them. As a result, every study of the present inevitably becomes a reconstruction of the past. That is why the study of history should be regarded as both the queen and king of the sciences.

The present is actually an even more problematic category. I sometimes point out to my students that, while looking at one another during our meetings, we

are looking at images of one another's pasts. There is no way around this conclusion. Everything we perceive about one another is based on sensory data: within a student–teacher setting, this is mostly sound and light, but also smells. These data take time to reach us. Sound in air at sea level under so-called standard conditions travels at about 1,225 km per hour (761 miles per hour), while light in a vacuum moves at about 1,079,252,848 km per hour (about 670,616,629 miles per hour). Although, within an academic class setting, the resulting time lags are very small and therefore in practice virtually negligible, they do exist. As a result, we are always looking at images of the past, while the only present we can be sure of is to be found within ourselves.

Yet even that statement is problematic. One may wonder, for instance, where within us the present would be located. Is it situated in our brains, where supposedly the awareness of us and of the surrounding world resides? Surely, any sensory data that we pick up with, for instance, our eyes or our fingers must have taken time to reach our brains. And then, one may wonder, where exactly in our brains? My conclusion is, therefore, that all the commonly used views of a shared and known present are human constructions.

While considering direct human interactions, this may sound like nitpicking. Yet in big history, these problems soon become overwhelming. For what can we say about the present of larger settings, such as our current position within the universe? Because the universe is so large, it takes a long time for all the light to reach us. In general, the farther light has traveled before it reaches us, the longer it has existed. Astronomers therefore often say that, by capturing light from the sky, we are probing back in time.[5] This immediately means that, with the current state of knowledge, it is impossible to gain an overview of the universe in its present form, because most of the light that is being emitted now in the universe has not yet reached us.

The study of history inevitably implies using a time frame that allows us to order the events that we are studying according to when they happened. During the past centuries, historians have expended a great deal of effort in constructing such a reliable chronological time frame, which has become the backbone of history. This historical time frame is centered on Earth, while the recurring events of Earth's orbit around the sun (years) and its rotation around its own axis (days and nights) provide stable markers that make it possible to subdivide the chronological time frame into days, weeks, months, years, decades, centuries and millennia. For studying the period of recent human history, about 10,000 years, these rotational movements have been sufficiently stable not to cause any serious problems. Yet as soon as we start examining the history of Earth, which covers a period of about 4.6 billion years, we find that the rotation of Earth around its own axis has slowed down progressively, while we cannot be sure that its orbit around the sun has not changed either. In other words,

while the years might have been different in the past, days and nights were also significantly shorter.

Because, in big history, we want to trace back events to the beginning of the universe, now thought to have happened about 13.8 billion years ago and thus long before Earth and the sun came into being, these issues become even more severe. Clearly, we cannot trace the remnants of early cosmic events in any other way than by observing them in the present from an Earthbound perspective. As a result, while making our reconstruction of big history, we inevitably use an Earthbound time frame that ends in the present. We simply do not have any other time frame at our disposal that can do the job. The time frame of our big history account is thus by necessity centered upon us. This does not mean, of course, that the evolution of the universe is Earth-centered. It only means that our account of it is centered on the present.

This point may need some further elaboration. With the exception of meteorites and other cosmic objects, all the data we receive from the rest of the universe consist of forms of electromagnetic radiation. Depending on the distance and our relative velocities, it takes a certain amount of time before this radiation reaches us. The radiation emitted by events that happened long ago and far away may reach us only now, while the radiation of other events that happened more recently and closer may reach us at the same time. We do not know anything, however, about still other events that may have happened recently but far away, because that radiation has not yet reached us. In a similar way, neither do we know anything about events that happened a long time ago close to Earth, because that radiation has already passed us and will never return.

As a result, our ability to reconstruct the past of the universe with the aid of observed electromagnetic radiation is limited. For the past 10,000 years of human history, for instance, we cannot even tell how our own Milky Way has developed, because we are still waiting for most of the radiation to arrive. For what happened in the universe during the period of globalization (about 500 years), we only have data about the universe at a distance of, at most, 500 light years, which is a very small portion of our galaxy. In other words, the closer we come to the present, the less we know about the universe at large. And, as soon as we reach the present, we have only data at our disposal that deal with us – all the other data are about the past that is gone forever. This is why big history accounts are by necessity Earth- and human-centered. In 1845 CE the great Prussian naturalist Alexander von Humboldt (1769–1859 CE) formulated this as follows:[6]

> These events in the universe belong, however, with reference to their historical reality, to other periods of time than those in which the phenomena of light are first revealed to the inhabitants of the Earth: they reach us like the voices of the past.

One may argue that, because humans have been observing the sky for thousands of years, we possess data that actually make it possible to reconstruct longer stretches of cosmic history. The records of ancient star explosions, for instance, made by contemporary observers, coupled with modern observations, make it possible to reconstruct a sequence of events that happened after these cosmic fireworks went off. But that does not invalidate the general principle, namely that if we want to study empirical data from the universe that were generated close to the present, they must have been generated close to us. It may be fair to assume that the rest of the universe has developed in ways that are similar to our closer cosmic surroundings. If this were the case, our big history view would indeed be larger. Yet, with current detection techniques, such an assumption cannot be based on empirical data and could possibly be wrong as a result. If one wants to stick to a big history account that is based on empirical data, it is by necessity Earth-centered.

In sum, because the data that we use to reconstruct the past inevitably reside within the present, our analyses are always anthropocentric and geocentric to some extent. The art of making grand historical analyses of cosmic history consists, therefore, first of all in recognizing this, and then in dealing with the data accordingly. This is not easy. Yet it appears to be the only reasonable thing we can do.

The idea that our knowledge of the past resides within the present can be turned around by saying that, if we really want to know how everything we observe originated, we have to study big history. For instance, in Chapter 3 we will see that the building blocks that are shaping our personal complexity today, as well as all the complexity surrounding us, can all be traced back to the emergence and evolution of the universe. This very basic insight offers a compelling reason why big history should be important for all people who are interested in the origins of everything from a scientific point of view.

Most human societies have understood this intuitively. As David Christian has often emphasized, every known society has told stories about how they themselves and everything around them came into being. From an academic point of view, such narratives are now considered origin myths.[7] But this does not mean that these stories should be considered unimportant. To the contrary, they have often provided shared orientation, meaning, identities and goals, not least because their geographic settings represented maps of their societies' natural and social environments. Up until today, most, if not all, humans have been exposed to such stories in one way or the other. We do not know, of course, whether all people have always fully believed them. Surely, it seems wise to suspect that skeptics would have existed in all human societies. Yet we may also suspect that in most, if not all, early human groups the majority shared most of these views, especially because, quite often, the number of available competing world views would have been limited, if they existed at all.

these larger aspects of time and space are taken into account? And would perhaps some theoretical approaches advocated in big history also help to better understand the smaller accounts of the past?

To be sure, telling stories about the history of all scales seems important. And the meticulous research performed by a great many historians studying human societies, life, the Earth and the cosmos has yielded the empirical evidence on which those accounts, and, in consequence, also big history, are based. All accounts of big history must be able to accommodate the evidence provided by historians who study at smaller scales. As soon as major discrepancies arise, these must be explored. This may lead to either a reinterpretation of the empirical data or a change in the historical account. That is how the academic enterprise works, and big history offers no exception to that rule.

A Very Short History of Academic History

The modern academic discipline of history emerged in the nineteenth century as part of the formation of nation states in Europe and the Americas. The first task of academic historians was to formulate a proud history of their own nation state (still known as 'patriotic history' in the Netherlands), which would provide a common identity to the inhabitants of these new social entities. In doing so, they followed in the footsteps of Roman historians of antiquity such as Titus Livy (*c.* 59 BCE–17 CE). The project of producing patriotic histories led to a great emphasis on the use of written documents. Over the course of time, historians also began to study other aspects of both their 'own' and other regions, while the study of national histories has become far more detached. Yet within academia, the study of human history as a whole has only rarely been practiced up to the present.[10] This remarkable situation may be linked to the fact that to do so would produce global identities, which are not directly associated with any presently viable state society.

As a result of the emphasis on written sources, most historians begin their overviews of the past with the rise of literate societies. The attention is usually focused on those early states (often called 'civilizations') that are considered to be the precursors of their 'own' societies. The rest of human history is called 'prehistory' and is left to archaeologists.[11] Whereas this academic division of labor appeared to have been caused mainly by the emphasis on written sources, there may also be another aspect to it. US historian Dan Smail (1961 CE–) emphasized in 2005 CE that the time span modern historians cover, about 6,000 years, is very similar to the total duration of history as told in the Old Testament. The reader may recall that, according to the famous calculations made by English bishop James Ussher (1581–1656 CE) in 1654 CE, the biblical world would have been

created in 4004 BCE. Would this similarity between the biblical time span and the period established historians usually cover be coincidental, Smail wondered, or could modern historians perhaps still be 'in the grip of sacred history'?[12]

Up until the eighteenth and early nineteenth centuries, as we saw earlier, a good many popular human histories were written in Western Europe and North America that began with the biblical account. Subsequently, the recently acquired knowledge about the histories of people all around the world was integrated into this narrative. These accounts continued the tradition of the medieval incipient big histories. Some of these books became very popular and were printed in considerable numbers. This type of history remained popular until the middle of the nineteenth century.

Around 1840 CE, however, the emerging science of geology, which was stimulated by the industrial revolution, had made clear to academics in France, Britain and the USA that Earth must be much older then previously thought, even though nobody knew exactly how old it was, because reliable methods for dating rocks and fossils did not yet exist. This much larger time span inevitably meant that the Mosaic account could not possibly be correct. As US scholar Joseph E. Worcester (1784–1865 CE) formulated it in 1850 CE on p. 5 of the new edition of *Elements of History, Ancient and Modern*, a textbook that was 'required in the examination of candidates for admission into the freshman class at Harvard College':

> The modern science of Geology, which has brought to light a vast number of important and interesting facts previously unknown, has produced a conviction among men of science that the origin of the earth is to be ascribed to a period far more remote than has been heretofore supposed, and the most learned Christian divines have adopted a mode of interpreting the Mosaic account of the creation which is in accordance with this opinion.

Regrettably, Worcester did not inform us what this new biblical interpretation looked like.

When modern nation states began to take shape – and with them the academic historical profession – these incipient big histories were ignored within academia. The emerging academic discipline of history decided to get rid of the biblical account and start their narrative with the period about which they had reasonably reliable documentary evidence, namely the early states in Mesopotamia and Egypt. These ancient societies were seen as the precursors of their own modern nation states. In doing so, the writing of national histories and the tracing of the preceding cultural trajectory (known as the Western Civilization Trajectory in the USA) took precedence over efforts to write a history of all people on Earth, including all of their origins.

However, by discarding the traditional answers to the big origin questions that were no longer deemed credible, historians also cast aside the big origin

questions themselves. This may have happened almost entirely unnoticed. They were replaced by answers to origin questions that were first of all related to the emergence of the historian's 'own' nation state and its presumed cultural roots.

Furthermore, by concentrating on human action until today most historians have paid relatively little attention to the natural environment, which instead became the object of study for the emerging sciences of geology and geography. The trend of focusing on human action could also be witnessed in the emerging social sciences: psychology, sociology and cultural anthropology. As a result, the study of human affairs became increasingly divorced from the biosphere, let alone the universe.

Certainly some historians, most notably French historian Fernand Braudel (1902–85 CE) and his followers, have paid systematic attention to the natural environment as an integral part of the history they studied. But most historians have not followed their example and have instead preferred to write narratives focused on human action. Further, the sub-discipline of environmental history that emerged in the late 1970s and early 1980s CE, which was part and parcel of the rise of environmental concerns during that period, has not yet been fully integrated into mainstream historical accounts.

The lack of such an integrated attention to the relationship between humans and their natural environment may mirror the difference in focus between what Christians call the Old and New Testaments. While in the first and longest part of the Bible there is a considerable attention to human relationships with the surrounding nature, the story of Jesus of Nazareth, by contrast, almost exclusively focuses on human affairs. The underlying reason for this may be found in the fact that the authors of the New Testament as well as most nineteenth- and twentieth-century academic historians lived in urban environments. As a consequence they did not directly experience a great many human interactions with the rest of nature, which they neglected in their writings as a result. If correct, the still popular Western Civilization Trajectory may to a considerable extent represent a secularized version of history focusing on the life of Jesus, his precursors and everything else that followed in the Christianized part of the world, while other societies only enter the story when they were seen as interacting with the Christian cultural sphere.

As a result of the continuing importance of national histories, no secular histories of humankind as a whole have become established within academia, even though Leopold von Ranke (1795–1886 CE), a major culture hero of academic historians, was very much in favor of writing human history, which he called both *Weltgeschichte* (world history) and *Universalgeschichte* (universal history).[13] Enlightenment historians, such as David Hume, Edward Gibbon, William Robertson and François-Marie Arouet de Voltaire, who became culture heroes for academic historians, distanced themselves from religious approaches

and, perhaps as a result, largely abandoned the search for origins. While sometimes attacking the popular human histories, these authors produced histories of 'their' nations or of similar other nations as well as of 'their' cultures by tracing them back to antiquity.

During the first half of the twentieth century, only a few dedicated and courageous academic historians, most notably Arnold Joseph Toynbee (1889–1975 CE), kept the study of human history alive. Outside of academia, however, human histories remained popular, such as the books written by H. G. Wells (1866–1946 CE). More likely than not, this interest was stimulated by the ongoing process of globalization. Even though, for instance, British historian Geoffrey Barraclough (1908–84 CE) argued strongly in favor of new forms of 'universal, or general, history' as long ago as 1955 CE, until today most academic historians have not yet embraced any such accounts of the human adventure on Earth.[14]

In the middle of the twentieth century, however, some change began to take place. Following Toynbee's example, a few farsighted scholars took the lead, most notably US historians William H. McNeill and Leften S. Stavrianos (1913–2004 CE), while English historian John Roberts (1928–2003 CE) wrote *History of the World*. All these authors realized that for a good understanding of recent history it was important to trace the past all the way back to the origin of Earth, if not farther, and as a result paid increasing attention to the natural environment in which humans lived. More recently, historian Bob Moore (1941 CE–) at the University of Newcastle, one of Roberts' students, has been an English pioneer in human history. In the 1980s, the idea of human history (usually called 'world history' in the United States) began to globalize.

A good example of this type of scholarship in the twenty-first century is *The Human Web* by father and son William H. and John R. McNeill (1954 CE–), which was published in 2003 CE. In this book new ideas were offered, including solutions for imperfections in *The Rise of the West* (1963 CE) that had been pointed out by William McNeill in the introductory essay to the 1992 CE edition. These changes included, most notably, systematic attention to global human connections as well as to our dependence on the biosphere. This improved vision came as a result of the ongoing globalization process and growing environmental concerns.

Not only have most academic historians paid relatively little attention to human history as a whole, but by defining history as the history of literate people they have also ignored the past of almost everything else we can observe around us. As a result, the history of life has become the domain of biologists; geologists are taking care of the history of our planet; while astronomers and cosmologists have been reconstructing the history of the universe. During the past 50 years or so, only very few academics have tried to forge all these stories into one single coherent historical account explaining how we, as well as everything around us, have come to be the way we are now.

De historiae utilitate and *Mercator sapiens*

'About the usefulness of history' was the title of a lecture delivered in Latin by Gerardus Vossius, inaugurating the new Atheneum Illustre school in Amsterdam in January 1632 CE. In founding this school, the city of Amsterdam actually sought to found a university in disguise, since the central government would not allow them to found a real university because the nearby city of Leyden already had one. In consequence, they gave their school a different name, while two internationally renowned academics, Gerardus Vossius (1577–1649 CE) and Caspar Barlaeus (1584–1648 CE), were requested to lend their fame to the new institution.

A few days later Barlaeus argued in his presentation that a good merchant needed to be wise and well instructed. In all likelihood both scholars pushed their points of view a little further than the city fathers intended. Yet while the first lecture has been almost entirely forgotten, the presentation about the wise merchant has resonated throughout the centuries in the city of Amsterdam, although it has often been misquoted or misinterpreted. In fact, the University of Amsterdam which evolved out of the Atheneum Illustre still uses the term for the organization selling its merchandise.

Here is a lesson that historians may want to keep in mind. Caspar Barlaeus was smart enough to flatter his sponsors, the wealthy city aldermen, most of whom were enterprising merchants, and was successful as a result, even though his message was not completely accepted or perhaps even understood. Gerardus Vossius, by contrast, was much more straightforward, flattering no one in particular. Quite possibly, in consequence his message about the usefulness of history has almost completely been ignored. So the lesson may be that wrapping the argument the right way may have mattered more than the argument itself.

To be successful, all people, including merchants who operate in complex social networks, need good knowledge of their world. But that may not always be the knowledge university professors teach or deem useful. As a result, throughout the centuries there has been a in-built tension between those who provide money for education and those who teach this knowledge.

Because the Atheneum Illustre did not yet have its own building, the gentlemen just mentioned held their presentations in a chapel called the Agnietenkapel. In the nearby courtyard of the venerable old university complex called Oudemanhuispoort, statues of both professors can be

before finishing his project. In the first volume, he summarized his program as follows:[17]

> Beginning with the depths of the space and the regions of remotest nebulae, we will gradually descend through the starry zone to which our solar system belongs, to our own terrestrial spheroid, circled by air and ocean, there to direct our attention to its form, temperature, and magnetic tension, and to consider the fullness of organic life unfolding itself upon its surface beneath the vivifying influence of light. … By uniting, under one point of view, both the phenomena of our own globe and those presented in the regions of space, we embrace the limits of the science of the Cosmos, and convert the physical history of the globe into the physical history of the universe, the one term being modeled upon that of the other.

In 1825/6 CE von Humboldt had already outlined his cosmic approach in the Parisian salon of the Marquis de Montauban. After returning to Berlin in 1827 CE the Baron elaborated these ideas in 61 lectures at the University of Berlin as well as during 16 well-attended and even better-publicized presentations at the Berliner Singakademie.[18] In these lectures and books von Humboldt made the ambitious attempt to systematically link everything with everything, from the most remote corners of the universe to human beings, providing a history where possible. I consider him therefore the first big historian. Because in his time the ages of rocks and fossils could not yet be determined, while the universe as a whole was considered stable and timeless, von Humboldt refused to place his analysis systematically within a historical perspective, even though he thought that the cosmos must have existed for millions of years.

Because von Humboldt saw everything as linked with everything else, his take on human history started with analyzing its natural environment. In this respect many of his views are still very modern. Yet von Humboldt very much depended, of course, on the level of scientific knowledge that had been attained during the first half of the nineteenth century, when many of our current great scientific paradigms had not yet been formulated. In his time, for instance, the theory of natural evolution formulated by Charles Darwin (1809–82 CE) and Alfred Russel Wallace (1823–1913 CE) did not yet exist in the public sphere (von Humboldt died six months before Darwin's *On the Origin of Species* was published). And the Prussian scholar was not familiar, either, with our current theories of particle physics, big bang cosmology and plate tectonics. As a result, the Baron could not describe nature and human affairs in terms of these theories. His descriptions are, therefore, attempts to provide systematic overviews of all these different aspects while indicating all the links that he saw. In doing so, he was very much aware of the possibility that important scientific insights were still lacking and might be discovered in the future.

Figure 1.1: Alexander von Humboldt in his library, Oranienburger Straße 67, Berlin, Germany. Chromolithograph, copy of water-color drawing by Eduard Hildebrandt, 1856 CE. (Original in possession of the author)

Alexander von Humboldt, as shown in Figure 1.1, did not operate within a university setting. He was able to do a considerable part of his research and writing thanks to an inheritance, which made him financially independent. Such independence is characteristic of many original thinkers, including Robert Chambers, Charles Darwin, Albert Einstein and James Lovelock.[19] Even though von Humboldt was never attached to a university, he was part and parcel of the emerging North Atlantic scientific tradition, to which he contributed a great deal.

Before von Humboldt was ready to write *Kosmos*, he had pursued what can be considered an exciting career by almost any standard. Trained as a mining inspector, von Humboldt traveled through the Americas for five years at the end of the eighteenth century, together with his French companion Aimé Jacques Alexandre Bonpland (1773–1858 CE), experiencing the most amazing adventures while making an almost unbelievable range of scientific measurements. At 29 years of age onboard a sailing ship waiting to leave Spain for the New World, von Humboldt formulated his main goal in a letter dated 5 June 1799, as follows:[20]

> I shall try to find out how the forces of nature interact upon one another and how the geographic environment influences plant and animal life. In other words: I must find out about the unity of nature.

Although this sounds familiar to scientists today, to search for an explanation of the workings of nature without invoking any supernatural influence was still a revolutionary idea 200 years ago.

At the time, the only Europeans allowed to travel in the Spanish Americas were Spanish nationals. Even such people were subject to a great many restrictions. This was part of Spanish governmental efforts to keep control over their American colonies, which had become economically self-supporting. As a result, for most Europeans and North Americans, the Spanish-American colonies were almost a *terra incognita*. However, because a considerable part of the Spanish royal income was derived from mining activities in the Americas, and because the royal finances were in dire straits, any research that would help to discover more such wealth was welcome. This explains why Alexander von Humboldt received special royal permission to do his research, which he used for his own benefit. It also helps to explain why his voyage was followed with such great interest in Western Europe and on the eastern seaboard of the recently formed United States. The contemporary globalization process allowed von Humboldt to travel the way he did and also become famous for it, at least within learned European and American circles. And it was also very helpful that, unlike today, quite a few leading politicians were good scientists.

In order to place his all-embracing cosmic approach into a historical perspective von Humboldt wrote a *History of the Physical Contemplation of the Universe* in the second volume of *Kosmos*. This brilliant overview of scholars who started thinking about the universe as a whole opened with the earliest written records and continued all the way down to his own time. Even today, this is one of the best accounts, if not the best, of how over time people living in different world areas have enlarged their views of the history of everything toward a scientific mode of observation and interpretation as a result of ecological and cultural interactions.

Furthermore, the Prussian scholar took great care to specify his contemporary academic sources. These included outstanding scholars such as the French naturalist Georges-Louis Leclerc, Comte de Buffon (1707–88 CE), who wrote the earliest science-based history of our planet (1780 CE). His holistic approach inspired von Humboldt, even though he challenged Buffon's opinion that species in the New World were inferior. Von Humboldt also admired, among others, the French mathematician and cosmologist Pierre Simon de Laplace (1749–1827 CE) and the British naturalist Charles Lyell (1797–1875 CE), one of the founders of modern geology.[21] All of this allows us to understand the intellectual regime within which von Humboldt was operating. By the late eighteenth and early nineteenth century these enlightened universal scholars, mostly naturalists, were already convinced that the cosmos and Earth had existed far longer than the biblical account allowed, and that one could understand nature and humankind better by using science rather than by following religious traditions.

Most notably, French (German-born) scholar Paul-Henri Thiry, Baron d'Holbach (1723–89 CE), had been a leading force in promoting such ideas. After inheriting a fortune, he had become financially independent. A leading atheist thinker and a most active participant in the French Enlightenment, d'Holbach wrote and translated countless articles on a great variety of subjects for Diderot and d'Alembert's famous *Encyclopédie*. In his widely read and famous book *Système de la nature ou des loix du monde physique et du monde moral* published in 1770 CE in Amsterdam under the pseudonym of Jean-Baptiste de Mirabaud, d'Holbach placed humans squarely within the rest of nature, including the universe, which he saw as solely ruled by matter, motion and energy (a rather modern point of view). The thrust of his argument was to deny any religious explanations of nature or divinely decreed moral rules for humans. Instead, d'Holbach argued that humans should be free to pursue happiness, which, if done properly, would automatically lead to harmonious societies. More likely than not, this revolutionary approach to human morality inspired Thomas Jefferson to include the famous phrase 'the pursuit of happiness' in the US Declaration of Independence of 1776 CE.[22] Because d'Holbach did not attempt to sketch a history of everything, he should not be considered an early big historian. Yet his approach of viewing humans as part of nature ruled by natural laws very much contributed to paving the way for big history.

By that time, a few enlightened European philosophers had also made considerable contributions to the understanding of nature and human societies without invoking supernatural influences. In his major book *Le Monde, ou, Traité de la lumière*, published posthumously in 1664 CE, French philosopher René Descartes (1596–1650 CE) analyzed the workings of the heavens in terms of natural processes without any divine intervention. Elaborating these ideas in 1755 CE, German philosopher Immanuel Kant (1724–1804 CE) anonymously published his ideas of the cosmos, including a theory of how the solar system emerged that is still accepted today, as well as the idea that nebulae were actually island universes far beyond our Milky Way. Like Descartes, Kant thought that all these things would have come into being as a result of natural forces. In Kant's view, however, divine action was still detectable in the ways in which the natural laws shape reality. This was apparently an attempt to hedge himself against accusations of atheism. In 1784 CE, Kant promoted the idea of universal history – we would call it human history today – solely based on natural explanations, although with a teleological slant. According to the great philosopher, there was a purpose in nature for human history, namely 'the achievement of a universal civic society which administers law among men to produce perfect world citizens.'[23] Although Kant never wrote a comprehensive analysis from one single perspective, he should be considered another important forerunner of big history. Similarly, Georg Wilhelm Friedrich Hegel's *Enzyklopädie der*

philosophischen Wissenschaften im Grundrisse, first published in 1817 CE, may also be considered a precursor of big history. In this monumental work, Hegel (1770–1831 CE) strove to find a common philosophical basis for all of nature including humanity.[24]

The second big history pioneer known to me was Scottish publisher and author Robert Chambers (1802–71 CE). Like Alexander von Humboldt, Chambers was familiar with most contemporary science, including, of course, the Scottish Enlightenment. He lived in an increasingly entrepreneurial society that was rapidly industrializing. As a result of the introduction of steam presses, the publishing business was becoming more profitable, which is how Chambers made his money. His book *Vestiges of the Natural History of Creation* was anonymously published in London by John Churchill in 1844 CE. In contrast to von Humboldt's treatment of the history of the universe in *Kosmos*, which is mostly descriptive, Chambers' *Vestiges* offered a dynamic history of everything, beginning with the origin of the universe in the form of a fire mist, and ending with the history of humanity. This dynamic approach to all of history was perhaps Chambers' major contribution. His book consists of a great number of challenging hypotheses, some of which still look surprisingly modern. These include the ideas that the emergence of matter would have taken place in a fire mist and that civilizations emerged as a result of specific ecological and social constraints. But Chambers, of course, was a man of his time and had other ideas, such as a racial theory about the evolution of humans, which would have started at the lowest stage with black savages while Caucasian whites were to be found at the pinnacle of history.[25]

According to British historian James Secord (1953 CE–), who wrote an illuminating study on *Vestiges* and its effects on contemporary society, Chambers was motivated to write this book, among other things, to promote a middle course between political radicalism inspired by the French Revolution and evangelical Christianity.[26] It is not clear to what extent Chambers might have been influenced by von Humboldt's work. In England, both Chambers' *Vestiges* and von Humboldt's *Kosmos* appeared in print more or less at the same time, while von Humboldt had already been lecturing about these things for about 20 years. Whatever the case, *Vestiges* caused a huge stir in Victorian Britain and sold well accordingly. Following the works of Lyell and von Humboldt, *Vestiges* suggested a time span for the history of Earth and of life that was far longer than the biblical account allowed. *Vestiges* contributed, therefore, a great deal to preparing the ground for Charles Darwin's and Alfred Russel Wallace's later work on the evolution of life.[27] Only in 1884 CE was the identity of the author posthumously revealed.

During the second part of the nineteenth century, to my knowledge, no new big histories were published. The academic world was busy splitting up into

insightful natural scientists, such as Canadian-French astrophysicist Hubert Reeves (1932 CE–), US astronomers George Field (1929 CE–) and Eric Chaisson at Harvard University, US scientist Carl Sagan (1934–96 CE) –a former student of William McNeill's – with his immensely popular *Cosmos* television series, US geologist Preston Cloud (1912–91 CE) at the University of Minnesota and German-born US astrophysicist G. Siegfried Kutter (1935 CE–) at Evergreen State College in Washington State, used this new knowledge to achieve fresh grand syntheses. This included university courses and books dealing with a scientifically based history of everything, with an emphasis on their own specializations. Being natural scientists, they paid only limited attention to human history.

Furthermore, already in 1986 CE Hubert Reeves outlined many salient aspects of the rise of complexity in cosmic history in his book *L'heure de s'enivrer: L'univers a-t-il un sens?* published in 1991 CE as *The Hour of Our Delight: Cosmic Evolution, Order, and Complexity*. This brilliant book has so far received comparatively little attention, most likely because the thrust of Reeves' argument was directed at how to avoid nuclear destruction, which had become less of a menace at the time of publication right after the end of the Cold War.

Austrian philosopher Erich Jantsch (1929–80 CE) may have been the first to develop a systematic model for big history in *The Self-Organizing Universe* (1980), in which he summarized many important principles. Soon after its publication, however, Jantsch passed away, which may partially explain why his book did not become better known among academics. Remarkably, in Russia Jantsch's work served as a source of inspiration for a number of scholars, including psychologist Akop Nazaretyan (1948 CE–), to formulate their own approaches to universal history. Unfortunately, these scholars have published most of their work in Russian, which has not facilitated the globalization of their insights, which is currently the fate of academic insights published in languages other than English. In other countries such as France, England, Colombia and Peru, widely interested and intellectually gifted scholars also began to write big histories. Today, it may well be that such people can be found in almost every country on Earth.[33] And although William McNeill has never taught or investigated big history himself, he has argued in favor of this approach, as well as actively supported it, from at least as early as 1991 CE.[34]

Subsequently, these large-scale history accounts began to fuse into a new genre, increasingly known as 'big history' among historians in Australia, the United States and Western Europe, as 'cosmic evolution' among astronomers and astrophysicists and as 'universal history' in Russia.

By the end of the 1980s CE, among academic historians there were at least two pioneers who began to teach the big story: David Christian at Macquarie University, in Sydney, Australia, and US historian John Mears (1938 CE–), another former student of William McNeill's, at Southern Methodist University

in Dallas, Texas. In 1986 CE Mears outlined the idea of a multi-disciplinary, team-taught big history course in a little-known but visionary article. Yet he did not encounter sufficient support to actually organize such a course. While Mears subsequently took up the gigantic task of designing a big history course that he taught all by himself, around the same time David Christian independently invented the same course model in Australia. In the Macquarie University big history course that started in 1989 CE, astronomers taught about the history of the universe; geologists explained Earth history; biologists lectured on life and evolution; while archaeologists and historians took care of human history. This course model not only produced an amazing synergy among the teachers, but also served as an example for similar courses in Australia, the United States and the Netherlands.[35]

By fusing human history with the new scientific account of the emergence of everything into big history, the medieval genre of incipient big histories was unwittingly reshaped into a new form, now based on rigorous science instead of on religious inspiration. Suddenly all the old origin questions were back on the agenda of history, even though the answers had changed. By restoring this ancient tradition in a new way, big history offers a fresh, scientifically based account of all of history, including a time line to which all knowledge can be attached in an orderly fashion. What is more, attention to the natural environment has almost effortlessly returned, because by starting at the beginning of time and space it would be impossible to ignore this most important aspect of human history.

This new, holistic approach to history has generated great interest and enthusiasm among a great many students and teachers, while its diffusion around the world has been greatly facilitated by the emergence of the Internet and email. In terms of publications, the Russian 'Uchitel' publishing house based in Volgograd directed by Leonid Grinin has done pioneering work in publishing big history materials in their English-language journal *Social Evolution & History* as well as the *Almanac Evolution* series.

In 2008 CE, big history caught the attention of Microsoft cofounder Bill Gates (1955 CE–), who listened to an audio version of David Christian's big history approach while working out on his home trainer. Gates became so enthusiastic – he called it 'the greatest course of all time' – that he felt everybody on the planet should have access to it. As a consequence Gates personally funded the development of a website that offers for free all the materials needed to teach big history at secondary schools. After several years of development by David Christian and a team of dedicated coworkers, this website, www.bighistoryproject.com, is now open to all people who have an interest in big history.

On 20 August 2010 CE, as part of this development, seven big history scholars, US geologist Walter Alvarez (1940 CE–), Australian historian Craig Benjamin

(1954 CE–), US big historians Cynthia Brown (1938 CE–), David Christian and Barry Rodrigue (1949 CE–), US political scientist Lowell Gustafson (1954 CE–) and myself, founded the International Big History Association (IBHA) during a meeting at the Geological Observatory in Coldigioco, Italy, where we had met for a week to take a geology course organized by Walter Alvarez and his Italian colleague Alessandro Montanari. In 2011 CE, IBHA was chartered as a nonprofit organization based at Grand Valley State University, Michigan, USA. It held its inaugural conference there in 2012 CE, which was attended by about 200 scholars. Its second conference (of a similar size) took place in August 2014 CE at Dominican University of California. By that time IBHA had 357 members, while there were about 50 big history university courses worldwide. In addition to Bill Gates, big history has attracted the attention of influential people and organizations including among others highly ranked Chinese politicians, the World Economic Forum, former US vice president Al Gore, US comic Stephen Colbert (1964 CE–) and the History Channel 2, which produced a big history series that has been broadcast not only in the USA but also elsewhere around the globe.

At Dominican University of California at San Rafael, as of 2010 CE all first-year students start with a big history program initiated by US philosopher Philip Novak (1950 CE–), Cynthia Brown, who wrote the engaging book *Big History: From the Big Bang to the Present* (2007 CE), and US scholar and administrator Mojgan Behmand (1966 CE–). The introductory big history course is followed by other courses in which teachers are requested to present their subjects from a big history perspective. In doing so, Dominican University of California may be the first academic institution worldwide to require all incoming students to become familiar with this new grand perspective. Furthermore, IBHA is currently defining a research agenda for big history, a first outline of which was published in 2011 CE.[35]

All of this is part of a worldwide effort of stimulating big history within academia. In doing so, it is the first form of history that is truly globalizing, thus following the trajectory of the natural sciences. These developments can also been seen as a return to more inclusive nineteenth-century global attitudes, when Joseph Worcester's textbook *Elements of History, Ancient and Modern* was required in the examination of candidates for admission into the freshman class at Harvard College, and Alexander von Humboldt's *Kosmos* was translated into a great many languages.

Little Big Histories

Little big histories are essays about subjects or answers to questions about history that are placed within the context of big history. This novel historical genre was invented in the Netherlands in 2007 CE by Dutch

big historian Esther Quaedackers (1980 CE–) and her husband Marcel Koonen (1978 CE–) as a way of stimulating students to think big and out-of-the-box, while seeking to grasp the importance of big history in everyday life.

In writing their little big histories, students are requested to pick a subject that they value and trace its entire history, from the big bang until today. They are also requested to make comparisons between different processes, such as, for instance, the emergence of the universe and the emergence of their subject. Such unusual comparisons may help to clarify the particular aspects of both processes. Students may also look for metaphorical comparisons, such as how humans have projected their views onto their image of the universe, for instance the names and shapes of the constellations, the names of the planets, etc. In fact, they may use any link they like as long as it helps to throw new light on their topic from a big history point of view.

Little big histories have been very successful in motivating our students, and have been adopted worldwide, for instance, in the big history project sponsored by Bill Gates; by the US History Channel; and in various other big history courses around the world. Esther Quaedackers herself is writing an illuminating history of the Tiananmen gate in Beijing viewed from this perspective.

A few other scholars have independently written such long-term histories, such as *Global Brain: The Evolution of Mass Mind from the Big Bang to the 21st Century* (2000) by US author Howard Bloom (1943 CE–), the illuminating article on the big history of grasses (2009) by New Zealand-born US big historian Jonathan Markley (1970 CE–), *The Planet in a Pebble* (2010) by British geologist Jan Zalasiewicz (1954 CE–) and *The Universe Within: The Deep History of the Human Body* (2013) by US paleontologist Neil Shubin (1960 CE–). None of these authors, however, has presented his work as examples of a particular historical genre that could be used to stimulate students to gain a deeper understanding of big history. We found these examples only after little big histories had been invented. The episodes broadcast as *Big History* by the US History Channel 2 in the fall of 2013 CE, by contrast, were presented as little big histories.

A Historical Theory of Everything?

My efforts at organizing big history courses led to the historical theory of everything that will be presented in the next chapter. This theory does not include a claim to be able to explain every detail of everything that has ever happened in

history. Yet by thinking big, it is possible to discern general patterns that would remain obscured if one were to examine only smaller portions of our past. It may be that, at this point, the reader would not be interested in delving into a theoretical discussion without seeing some of the meat of history on its theoretical bones. If this were the case, it might be better to skip Chapter 2 and continue with Chapter 3. As soon as the need emerges for theoretical clarification, the reader could then return to Chapter 2.

Whatever the reader may decide to do, it may be worthwhile to point out that my theoretical approach could already be discerned in the way I earlier explained the rise of big history in the early nineteenth century. It would, for instance, not have been possible to predict or explain everything that Alexander von Humboldt did. Yet we can have some hope of being able to explain the rise and demise of the social and ecological circumstances, with all their opportunities and limitations, within which individuals such as von Humboldt got the chance to do what they did. This involves, of course, a considerable amount of hindsight.

Like most, if not all large-scale historical accounts, big history tends to focus on the emergence of developments that cause major changes, most notably new forms of complexity. Less systematic attention is devoted to the decline of complexity. In a more balanced account, both aspects would need to be addressed more systematically. But in doing so, the story would require many more pages than are available for this current text. The reader is therefore requested to keep this bias toward emergence in mind and, if not mentioned in the text, to keep an eye open for all those aspects of reality that became less important over time or even completely disappeared.

Natural scientists may argue that, in contrast to the study of human societies, they can predict with great precision the future of a great many phenomena, such as the Earth's orbit around the sun (which is not entirely regular). My response would be that this is only the case because these are rather simple regimes, in which patterns occur rather regularly. One wonders whether natural scientists would also be able to predict with similar precision a possible supernova event that might end the existence of our solar system over billions of years, or any possible future impacts on Earth by meteorites whose trajectories cannot be measured yet. It seems to me that in such cases natural scientists would rely on exactly the same approach as the one advocated here.

Hindsight is both a strength and a weakness. It is helpful, because it allows us to achieve an overview of processes of longer or shorter duration. Yet hindsight may also lead us into the trap of a circular argument by assuming that things happened in a certain way because the circumstances were right, while we define which circumstances were the right ones, because at such moments those particular things happened. In the following chapters, I will seek to avoid this trap while making use of the advantages hindsight has to offer. Whatever the

29. For the chronometric revolution, see Christian (2009a&b).
30. Shapley (1959, 1963) and Jastrow (1967, 1977).
31. There were also attempts to produce all-embracing overviews, such as Dutch school-teacher Kees Boeke's pioneering picture book *Cosmic View: The Universe in 40 Jumps* (1957). It became the basis of the far better-known book (1994) and movie by Philip and Phylis Morrison, *Powers of Ten: About the Relative Size of Things in the Universe*, produced during the late 1960s and 1970s CE. Although these productions – there are many variations on this theme now – should not be considered big histories (because they do not deal with history), their authors probably had a very similar goal in mind.
32. Kuhn (1970).
33. See Belgium: Verburgh (2007); Colombia: Vélez (1998); France: Reeves (1981, 1986, 1991), Morin and Kern (1993), Reeves, Rosnay, Coppens & Simonnet (1996 & 1998), Nottale, Chaline & Grou (2000) and Perino (2013); Germany: Lesch & Zaun (2008); the Netherlands: Drees (1996 & 2002), Spier (1996, 1998 & 1999a&b, 2010, 2011a&b) and Lange (1997); Russia: Neprimerov (1992) and Nazaretyan (2001, 2004, 2010); United Kingdom: May, Moore & Lintott (2006), Aunger (2007a&b) and Lloyd (2008); United States: Chaisson (1977, 1981, 1987, 1988, 1998, 2001, 2003, 2004, 2006, 2008 & 2009), Field, Verschuur & Ponnamperuma (1978), Mears (1986, 2009), Asimov (1987), Kutter (1987), Swimme & Berry (1992), Adams & Laughlin (1999), Morowitz (2002), Gonzalez & Richards (2004) [this book is an attempt to link big history to intelligent design], Primack & Abrams (2006), Brown (2007), Gehrels (2007), Genet (2007), Genet, Genet, Swimme, Palmer & Gibler (2009), Potter (2009), Swimme & Tucker (2011), Christian, Brown & Benjamin (2013) and Simon, Behmand & Burke (2014).
34. See McNeill (1992, 1998 & 2001). In 1996 CE, when McNeill was awarded the Erasmus Prize in Amsterdam, he most generously donated half of the prize money to our big history project.
35. See Mears (1986 & 2009), Christian (1991). For a short history of the University of Amsterdam big history course, see Spier (2005b). For a first outline of big history research, see Spier (2011b).

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