Origins

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International Big History Association

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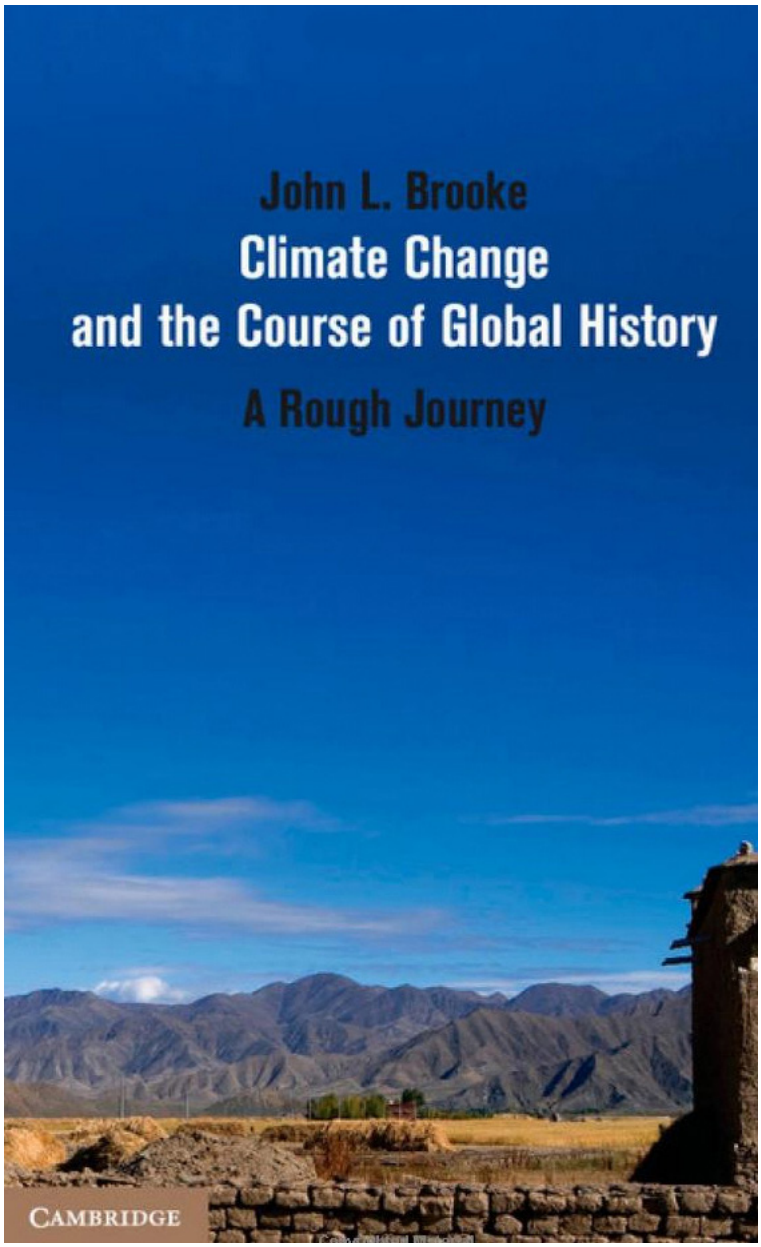
Time, Nature, and Humanity: Climate Science, Big History, and Our Global Future

John L. Brooke
Humanities Distinguished Professor of History and Adjunct Professor of Anthropology
Ohio State University

WHAT IS OUR GLOBAL FUTURE? The science is in, and the prospect is not great. There is a massive consensus among climate scientists that the rapid buildup of greenhouse gases, particularly carbon dioxide and methane, driven by an accelerating combustion of fossil fuels since the launch of the modern economy in the 1870s, has warmed the oceans and lower atmosphere to the point that global climate systems are changing irrevocably. If there are promising signs that population growth rates have been tapering off, we have since the 1870s risen from just over a billion to more than seven billion, making devastating demands on the earth system. The 5th IPCC Report and now the 2014 National Climate Assessment describe the scale and reach of these impacts, and sketch the outlines of the mitigations and adaptations that are necessary now to avoid massive financial and human costs in the foreseeable and immediate future. The evidence for climate change has been become real and dramatic in the past few years, as drought, wildfire, ferocious storms, melting ice and rising sea levels have begun to manifest the warnings that have been coming from the scientific community for over a quarter century. Facing an uncertain future, a new moral philosophy has emerged, which asks what our collective obligations are to future generations. Yet a majority of Americans refuse to accept the science behind this global challenge.

An American refusal to make climate change a priority should not be all that surprising. The picture is not a pretty one: modern economic growth has for over a century been directly tied to energy production from fossil fuels, and the dumping of waste in the form of emissions into a global "commons." In particular, Americans have been the worst offenders, accounting for well over five times as much carbon emissions per person as the global per capita average since the beginning of the industrial revolution. Mitigation and adaptation will cost money. Self-interest in an era of economic uncertainty accounts for a good measure of American foot-dragging.

But there is also a simple problem of visualization. Nature and humanity occupy the same geography, but on a different cadence. Human history is marked traditionally by great events: the voyages of Columbus, the American Revolution, the World



Wars, the moon-landing, 9-11. Natural history takes more time: fields grow into forests in decades, evolution has unfolded over hundreds of millions of years, as have the complex interactions of the geosphere, atmosphere, and biosphere that make up the earth system. In fact, natural history seems so slow that it would appear timeless, a vast background literally standing still as human history churns along. Some might, inspired by ancient texts, even deny that nature has a history: climates cannot change and evolution did not happen. But even if one is neither a creationist nor a climate change denier, the scales of natural history and human history are difficult to reconcile.

The means to such a reconciliation is being sketched in the work of two very different groups of environmental scholars. Since the 1980s, and the first cores drilled in the Greenland ice sheets, climate scientists have developed an amazingly detailed picture of the natural history of the planet. Increasingly sophisticated analyses of ancient rock chemistry, fossil plants, ice cores for continental and mountain glaciers, oceanic and lake sediments, and tree rings have built an amazingly detailed web of information about global patterns of climate change unfolding over millions of years. As these natural archives approach the present they are "legible" down to the level of decades and years. While they are intended to establish a baseline of evidence against which to assess present conditions and future climatic change, they give us for the first time precise information about the environmental conditions which shaped human history in longer and shorter time scales.

On the other side of the ledger, a number of historians have committed themselves to what is variously called "big history," "deep history," or "evolutionary history." While not rejecting the significance of recent history, these deep-time historians have – since William McNeill's Plagues and Peoples was published in 1976 – worked with paleo-anthropologists and prehistoric archaeologists to write a unified world history of humanity. This work focused on the material circumstances of the human condition: the shape, functioning, and health of the human body, food and diet, economy and technology. In the historical profession this work is part of what is being called the "material turn."

Bringing the climate scientists and the deep historians together at the same table is helping to resolve the problem of visualizing the place of humanity in nature, in the complexities of the history of the earth system itself. This new synthesis of science and history allows us to see with increasing clarity the ways in which trajectories in natural history have acted upon proto- human and human societies over the past five million years, and then allows us to see how modern economies are now intervening in those trajectories. With seven billion people pressing against planetary boundaries, and projected to rise to ten billion within a century, we have no margin for error. Understanding the integral relationships between natural histories and human histories is giving us a platform upon which to map our global future.

Cause and Direction in Global Environmental History: Exogenous Forces and Endogenous Pressures

Since the end of the Second World War modern humanity has been haunted by the specter of crisis and civilizational collapse. First it was the atomic bomb, then the population bomb; now we are beginning to understand the accelerating impacts driven by one hundred and fifty years of advancing industrial greenhouse emissions. Modern economic growth is altering the earth system, and we worry about the costs of mitigation, even a sudden systemic breakdown, in the face of heat-waves, droughts, rising seas, super-storms and storm clusters: some of the effects of global warming.

What does history have to tell us about the stress and collapse in past human societies? This is the central and pressing problem for the field of environmental history. Environmental history emerged with the post-war rise of the environmental movement, as the impacts of radioactive fallout, chemical pollution, and rapid population growth began to seep into the public consciousness. In the United States environmental consciousness gained a legitimate place in the public mind with Earth Day 1969,

the year after Paul and Ann Ehrlich put out *The Population Bomb*, describing a world imminently threatened by the vast expansion of human numbers.

The Ehrlich's powerful invocation of the Malthusian equation of rising population, limited resources, and ecological degradation was quickly assimilated as a core paradigm by founding environmental historians as an explanation for the entire sweep of the human condition. A generation of influential scholars – among them Clive Ponting, Donald Hughes, Mark Nathan Cohen, Marvin Harris, Charles Redman, David Christian, Joachim Radkau, and Jared Diamond – applied this Malthusian framework of human sustainability crises to paleo, ancient, and medieval circumstances. The explicit lesson was that fate of these societies should stand as object lessons to the present.

Thus was forged what can be called the "endogenous paradigm" in environmental history. Humanity was the sole actor in this story, and humanity's trials and tribulations over centuries and millennia were caused simply by the pressures of growing populations and expanding economies, degrading essentially inert natural systems. The long sweep of human history was thus defined as a series of endogenously driven crises of sustainability. This was a model that I accepted and elaborated for classes in global environmental history for over a decade at Tufts and Ohio State, assigning Marvin Harris's *Cannibals and Kings* as a wonderfully accessible grand synthesis.

But new evidence has called into question this long-established unitary "endogenous" model of deep historical time. Quite simply, our world is very different than that of our premodern ancestors. Ironically, the evidence developed as the United States government worked to avoid action when the problem of climate change and global warming was put before the public in the late 1980s. Delay action while we "study the problem," we were told. Climate scientists were put to the task and over the past twenty-five years their efforts have been amazingly fruitful. Their core public mandate has been to assess the degree to which modern global climates are deviating from "historical norms." In doing this arduous work they have generated a vast body of carefully calibrated data describing the shape and history over decades, centuries, millennia, and even millions of years into the past, from far before humanity first began to evolve, several million years ago in the scrub forests of East Africa. We now have at hand an amazing body of knowledge about climatic and environmental change in times past, for the entire sweep of earth history and the human experience of society, agriculture, and civilization.

This data calls into question the "endogenous paradigm." As historians we can no longer assume that climate history is unknowable, and thus irrelevant. We now know its patterns, and we need to integrate natural forces "exogenous" to the human system into our historical accounts. In short, we as historians need to move to a new model of the field of historical causation. Rather than simply assume that human agency is and was the only legitimate active force in shaping our past, we need to take much more seriously the active forces of nature.

It is abundantly clear that vast environmental shifts shaped both biological and human evolution in deep paleo-time. But let us consider briefly the evidence for the reasonably warm Holocene, the last ten thousand years, which points to two very different histories. In the first history, running from the paleo-past up to the rise of modernity between 1400 and 1800, human circumstances were shaped by global climate forces, in rather eerie synchonicity, what Victor Lieberman has termed "strange parallels." The material fate of human societies around the world was shaped by the force of large-scale shifts in Holocene climate, in recurring "optimums and "Dark Ages." In short, the millennial-scale pattern of solar maxima and minima known as the Hallstatt cycle has been the foundational driver of the material condition of humanity for the last six thousand years. Since patterns of temperature and particularly precipitation had different regional manifestations during the same climatic regimes, regional experience of immiseration and crisis might vary. But the general pattern is clear: the global climate regime, shifting on a periodicity shaped by millennial-scale solar variation, has had a profoundly shaping force in our collective history. Rather than population pressure, pure and simple, crisis came from outside the human

system, in virtually every case the "exogenous" forces of nature played a role in civilizational crisis and collapse in the pre-modern past.

Thus in the first history, premodern time, "exogenous" natural forces were the ultimate actors on the global stage. In the second history, modern time, the "endogenous" pressure generated by humanity has become a primary earth system force of its own. Modern economic growth, shaped equally by explosive developments in scientific knowledge and industrial application, in politics and governance, makes our world utterly different than that of just a few generations in the past.

The central differences in the material condition of premodern and modern societies involve numbers and chronology, and earth system scale. On numbers: the background reality is that ancient and medieval societies never really had capacity to achieve populations that would threaten endogenously their ecological sustainability. And as their populations grew, slow shifts in technology could and did rise to meet the challenge. But the essential reality is that pre-scientific societies were constantly struggling to maintain their numbers against the exogenous pressures of disease and climatic shifts; massive infant mortality kept life expectancy low. Conversely, the societies in which these people lived were remarkably long-lived: they may not have been pleasant places to live, but they could last in coherent form for centuries on end. Ironically, we have reversed this equation in modernity: our long life expectancies of eighty or more years loom very large against the shallow chronology of modern industrial society.

Finally, there is the issue of earth system scale. Ancient and medieval societies did not collapse at the slightest push of climate change: the great collapses were shaped by great global forces, ultimately determined by the multi-millennial Hallstatt solar cycle. But here lies the problem. Measured against the known variations in the atmospheric system, nothing in the Holocene remotely resembles the speed and scale of modern anthropogenic climate change and its driver, industrial greenhouse emissions.

The history of atmospheric CO_2 directly illustrates the problem. Through the operation of the earth system's greenhouse bubble, atmospheric CO_2 powerfully determines global temperature: the more CO2 the hotter the world. During the last great global climate crisis, the Little Ice Age of the sixteenth and seventeenth centuries, atmospheric CO_2 dropped from about 282 parts per million to roughly 276 parts per million. Geoffrey Parker's new book *The Global Crisis* charts the devastating human impacts correlated with this droop in CO_2, and associated cooling. Recovering from Little Ice Age lows by 1800, atmospheric CO_2 climbed thirteen points over the next century, to about 296ppm in 1900. In 1958, when Charles Keeling first began measuring CO_2 on Mona Loa in Hawaii, when I was five years old, the CO_2 level stood at 315ppm. Last May, 56 years later, they hit a monthly average of 400 ppm. Our best estimates are that the last time that global atmosphere held this volume of CO_2 was in the Oligocene, 35-40 million years ago, just before a balmy, forested Antarctica began to freeze over. In the spring of 2014 it became clear that Antarctica has begun to melt. Clearly, modern "endogenous" human pressures have met and exceeded "exogenous" natural forces, indeed fused with them in a perfect storm. Population, economic output, and atmospheric CO_2 have risen in perfect tandem since 1800, and accelerated with the super-cycles of modern economic growth.

Humanity in the paleo, ancient and medieval past lived in a world fundamentally different from ours. We now live in the Anthropocene: we have become a fundamental cause in the earth system, in global environmental history. We have created this new world; we need to face this fact and take responsible action.

John L. Brooke is Humanities Distinguished Professor of History and Adjunct Professor of Anthropology at the Ohio State University. His new book, Climate Change and the Course of Global History: A Rough Journey, was published by Cambridge University Press in March of 2014. The following comments, published originally on the CUP site "fifteeneightyfour," [http://www.cambridgeblog.org/] frame some the larger issues of his project for a non-professional audience.

The Platypus on Ararat

by David Christian
(from sometime in the 1990s)

The platypus on Ararat remembers
Two strange birds descending in the Southern night,
Eclipsing with their giant wings the full moon.
They fed with Wattamolla people,
Sharing shellfish cooked in embers.
They slept, wrapping their giant wings about
Their furless skin, nestled together before the fire.
They came again at dawn, Wattamolla people teaching,
Teaching how to spear the water as they spread the nets downstream,
And teaching, too, the care of captured platypi.

And then the flight, so long, so long,
So long the stars began to change,
As hour by hour others joined them,
Winging in from South and East,
Calling out or dancing greetings in the air,
Each pair with its own strange captives,
Male and female,
Swaddled gently in giant arms.
Then North and West once more,
And dreaming through the long dark hours,
Rocked by the giant pulse of giant wings.

And then,
Endless darkness in the airless hold of the rocking ark,
Scream of bats, goanna stink,
Avoiding foot of elephant,
The condor's cruel, hypnotic eye,
The eel's malevolence,
And in the swaying nights,
The long, sad dreams of Wattamolla underneath the moon.

And now, on earth again,
Testing unsteady legs.
Above, the rainbow slithers across the sky,
Shoving back the lingering thunderclouds.
Below, the earth is stinking, black and scoured of life,
Ash of the holocaust.
And the giant birds are gone.

The platypus on Ararat prepares
To journey back to Wattamolla,
Through the wide world and its wider seas,
Abandoned by the angels,
But with one small and timid friend.

Science and / or Story Telling?

Bill McGaughey

I mean this to be an extension of a discussion that took place in panel #13, titled "Research Open Roundtable," on Friday, August 13, 2014, at the International Big History Association conference at Dominican University of California in San Rafael, California.

I expressed the opinion that much that had been earlier discussed at the conference seemed to me to be science rather than history. The aim of science was to discover patterns or laws in nature that would explain phenomena. Discussions related to per capita energy consumption or increasing complexity in the universe, while illuminating, were more in the nature of science than history. History, on the other hand, was story telling to explain things, though in a different way. Don't neglect the story-telling aspect of Big History, I urged.

In the ensuing discussion, one of the most accomplished and respected members of the IBHA commented that, in his field of study, story telling was not respected. If we emphasized this, the IBHA would lose credibility with academics.

So the lines were drawn. Would it be science or would it be historical story telling? Which should the IBHA prefer?

Let's begin with the observation that Big History is in its creative, expansive phase; and the International Big History Association hosts a "big tent". There is room both for scientists and story tellers within its framework of activity. As an advocate of story telling, I acknowledge the value of scientific efforts to find explanatory patterns in history. Let the creative juices flow where they may. From diverse activities may come a consensus regarding the type of scholarship associated with this organization.

In the meanwhile, however, let me continue to advocate on behalf of story telling as a form of knowledge. It is a most ancient form which the IBHA may wish to update with the discoveries of modern science in telling the story of creation.

Part of good story telling would be the skill with which the author tells the story. It would lie in choice of words, the rhythms and flow of expression, and so on. However, the works of Big History ought not to be a literary production whose worth would reflect the author's personal skill. The style of writing is less important than content.

In this case, the story's content would be elements of knowledge or experience that best explain how our world came to be. We start with nothing and end with the universe that exists today. How we got from one situation to the other is what the stories of Big History should narrate. What were the critical events that caused significant and lasting change in the world?

When we look at Big History this way, we find a need for discipline in telling stories. We need, first, the discipline of historical and scientific accuracy. Even more important, we need a sense of how events flowed. We need to identify significant events that led to or caused the world in which we live. We need completeness in the range of stories that tell how our world was created. In all that, there is room for criticism and thoughtful correction. Academics can find a role in this enterprise. Big History is not "anything goes".

I would suggest that Big History should consist of grand narratives about the creation and development of the universe. Each narrative would contain a set of stories - about the development of the cosmos, the appearance of life on earth, and human communities and culture.

We already have such narratives in books published by distinguished members of the IBHA. David Christian's book, *Maps of Time*, is an example of Big History. So are Cynthia Stokes Brown's *Big History*, Fred Spier's *The Structure of Big History*, and the textbook, *Big History: Between Nothing and*

Everything coauthored by David Christian, Cynthia Brown, and Craig Benjamin. And I plan to publish my own version of this story in the near future.

Let me propose that a basic work in the field of Big History might be a narrative up to or around 500 pages in length like David Christian's *Maps of Time*. It should be written as much as possible in the form of stories whose events are arranged in chronological order. Now, of course, deviations from this form may be necessary as when events in different nations or regions proceed on separate tracks or where technical explanations of subjects are required. But, in the main, storytelling takes the form of "first this happens, then this, then that" as we move from one situation to another and the world is changed. We are, of course, talking about stories from the different domains of astronomy, geology, biology, archeology, anthropology, and history, all assembled in a single piece of writing.

To date, storytelling has been mostly an individual endeavor. What we need in this case, however, is a collaborative effort. Theoretical science is the model. Individual scientists do research in various areas and develop theories that are communicated to the scientific community. Others test the theories. Some become generally accepted while others are rejected. Theories change as new evidence is introduced. From this diversified activity comes a consensus of what scientists believe to be true.

I believe that much the same model can be applied to historical story telling. It, too, can be collaborative in nature. And the International Big History Association can be the prime facilitator of collaborative Big History.

We start with basic models - books like David Christian's *Maps of Time*. However, this is not the only model of Big History that should be accepted. Christian himself stated at the conference that he wanted to encourage other approaches to be considered as well. So we need to throw several different works into the hopper. Ideally, these would be narratives of Big History that are roughly 500 pages in length. They would be seamless sets of stories covering the subjects of Big History. The IBHA would post these different models on a web site. Here is where the collaboration begins.

If the story of Big History appears in a 500-page book, there is no reason why a 5,000- page book should not later be written covering the same material in greater detail even if few persons would be interested in reading such works in their entirety. The basic model would provide an outline of where the story should go. Each grand narrative told in a book already published would be substantiated with smaller stories that descend to the level of immediate or personal experience. And so we would have a pyramid of history arranged from the general to the specific. Specialists in the field would write that part of the story that they know best. They would fill in the details of the generalized stories in a collaborative effort.

The collaboration might also take the form of correcting the basic models themselves. Each book of Big History, no matter how well researched, will contain factual errors needing to be corrected. Beyond that, each book involves a certain selection of materials to be covered, which necessarily means that other areas of experience will not be covered. The author must exercise judgment as to which events and stories best represent the way our world developed.

Not all big historians think alike. Not all will focus on the same sets of stories. Therefore, we open the existing stories up to criticism and comment with the idea that they might be modified to produce a more complete, balanced, and accurate representation of the world.

I have in mind a Wikipedia-like enterprise devoted to producing larger and better expressions of Big History. However, some guidance from the IBHA would also be needed to ensure quality. The collaboration would, of course, be computer-based. Here is how it might work:

The IBHA, with the help of computer experts such as Microsoft Research, would first set up a web

site to display the basic models of Big History that were selected as being worthy of further study. It would gain the consent of the book authors to waive copyright protection of the displayed works in certain respects.

The next step would be to number the book chapters and the paragraphs in each chapter. So, for example, we would have "Christian 3-26" to indicate the 26th paragraph in the 3rd chapter of David Christian's book, *Maps of Time*. (This is the paragraph that introduces the idea of plate tectonics to the earth sciences.) This would identify the place where further work might be focused.

At the end of each paragraph posted on the web would be a link to another page where work might be done to improve or expand upon information in the paragraph.

First, it would be helpful if the author of the basic model would indicate the source of information upon which his or her statements are based. For example, where did Christian encounter the idea of plate tectonics and learn that this theory became generally accepted in the late 1960s?

Second, there might be a place on this page where an outside reviewer might make comments about materials in the paragraph. He or she might question Christian's source of information or propose that other information be included. If a substantial challenge is made to the veracity or relevance of the author's assertions, the reviewer might rewrite the paragraph and propose that it be substituted for what the author wrote, after offering a reason to make the substitution based upon scientific evidence or interpretation.

Third, there might be a place on this page where the outsider could present an expanded version of the story told in the basic model. Slowly the base of the historical pyramid would be filled, each scholar contributing what he or she knows, until we had a complete 5,000-page book. The idea here is to construct a continually expanding and improving set of stories in each work of Big History. Let specialists in each area do the work and hope that eventually a well-rounded and more accurate history will emerge. There would be several different models of Big History. Interested persons could pick whichever model he or she wished to amend, leaving the others alone. In such a way, each original model would acquire a body of proposed changes, additions, or corrections upon which to base a new version.

The next step then is to compile the amended work. Let's call the book *Maps of Time* "Christian, version 1.0". Using proposed materials submitted by outside reviewers, "Christian, version 1.1" would be created.

Who would decide which proposals would be accepted for the new work? Let's say that the original author - in this case, David Christian - would have the authority to accept or reject the various proposals. Alternatively, another person considered to be of sound judgment who is associated with the IBHA, or perhaps a committee of such persons, would be authorized to produce version 1.1 of Christian's book. It all depends on who is willing to do the work. In any event, the production of the new structure of writing would be a collaborative effort involving not only the original author but also other persons who have something to contribute to the emerging work.

Let's return to the idea that academics dislike stories. And since the IBHA is a professional organization of scholars in various academic disciplines, we do not wish to offend those who fund our conferences or otherwise contribute to the discipline that we are building.

First, let me point out, somewhat contentiously, that academic professional associations, especially in the humanities, are beginning to wither as higher education in the United States moves increasingly toward a business model of operation. Today's colleges and universities are not as willing to fund faculty trips to attend conferences in distant locations as they used to be. Instead, they are investing in amenities-rich faculties to attract students who can pay the high tuitions if not in high-powered marketing efforts to attract paying students. So if

the IBHA stakes its future on development of an academic discipline alone - as important as this is - it could be making a mistake. Non-academics also play a role in this organization. Big History is directed as well toward the public at large.

Second, the disciplined activity of building larger and improved structures of Big History may attract support from academics in the so-called "silo-based" disciplines, especially if they themselves choose to participate in this project. An archeologist may wish to write his own version of history in the chapter related to archeological discoveries; a geologist may wish to rewrite geological history, etc. As more academic specialists become involved in the project at a level of greater detail, their support for Big History as its own discipline may increase. There need not be deliberate courting of such individuals for the field itself to gain academic respectability.

But again, Big History, like any other history, starts with story telling. Stories are a legitimate vehicle for expressing knowledge. We need not be ashamed.

Physicist Brian Greene strides across the stage to illustrate a concept for the audience at the Science Storytelling ASU Origins event. The panel included (left to right) Tracy Day, Ira Flatow, Neil deGrasse Tyson, Lawrence Krauss, Richard Dawkins, Bill Nye and Neal Stephenson.
Photo by: Andy DeLisle, ASU https://asunews.asu.edu/20130402_storytellingofscience

In Contact with Big History

Anne-Marie Poorthuis
Stichting Eigentijdse Verbindingen
Jos Werkhoven
Uitgeverij De Arend

Big History for Primary Education
The discovery of repeating patterns helps to observe relationships, to create connections and it becomes possible to work more and more in an interrelated way. This is at least the experience that we, Jos Werkhoven and Anne-Marie Poorthuis, have had in recent years. As spouses we knew each other's work and we inspired each other, but otherwise our work took place in our own, separate worlds. This has changed dramatically.

Jos works as a teacher, director, trainer and publisher in Montessori education and is always concerned with the question: "What is the best we can offer children (curriculum)" and "How can we enable the children so that they are able to work independently on their development?"

Anne-Marie is a researcher and professional in networked organizing and concerned with matters of organization. Her main question is: "How can we reinforce the self-organizing capacities of people, schools, organizations, cities, neighborhoods and regions so that they can handle complex issues?"

We find each other in learning in relation with everything there is. Jos' concept is 'the questioning of time and space', and Anne-Marie's concept is 'networked organizing'. Both of us are discovering the patterns of our concepts and will pass them on.

Since we have come in contact with Big History and met Fred Spier in 1997, Big History is an inspiration and a theme we work on together. So far this collaboration has resulted in a project to make Big History accessible to children six years and older. Before we continue to tell about this project, we will first describe our work and discoveries.

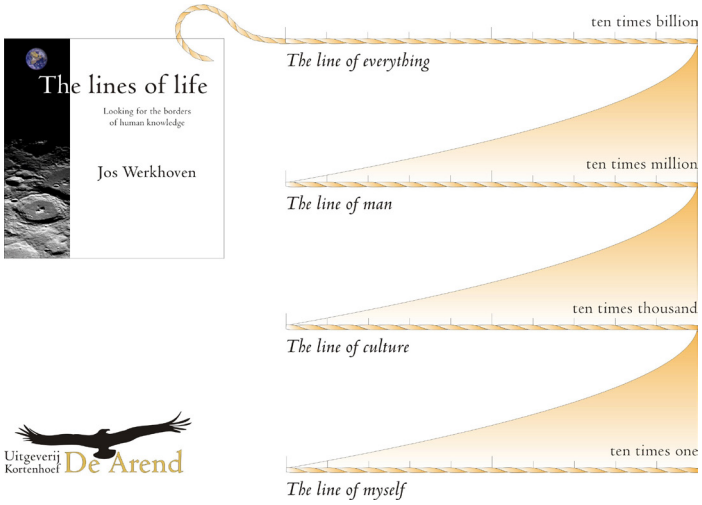
Jos Werkhoven
I (Jos) have worked in Montessori education in the Netherlands since 1972, respectively as a teacher, director, trainer and publisher. One aspect of Montessori education that has always inspired me and in which I have invested much, is cosmic education, which is closely related to Big History. Despite the fact that the Netherlands are often called 'a Montessori country' because of the many activities of Maria and Mario Montessori and the large spread of Montessori education in the Netherlands, this aspect of Montessori education in the Netherlands has been absent over the past decades, even during the training of teachers. Luckily, as individual teacher, director, trainer and publisher I could make my own choices and I integrate cosmic education in my work. Thus, I have developed a clear vision and a lot of material for cosmic education over the years.

Partly on my initiative the attention to cosmic education has begun to grow. Last year the Dutch Montessori Association has launched a national working group 'cosmic education'. In this group I have also established the relationships with Big History.

During my work as a teacher in Montessori Education in the Netherlands, I had many questions. In the educational practice I didn't see the vision of Maria Montessori about the child in the world enough: "Give the world to the child" and "Help me to do it by myself". Just like in traditional schools all subjects were separated and limited, and relationships were hardly established.

"How to give the whole world to the child" remained an unanswered question. Until one evening in the eighties. During the preparation of a lesson of 'all the time', suddenly there was **discovery number one** and not long after that **discovery number two and three**.

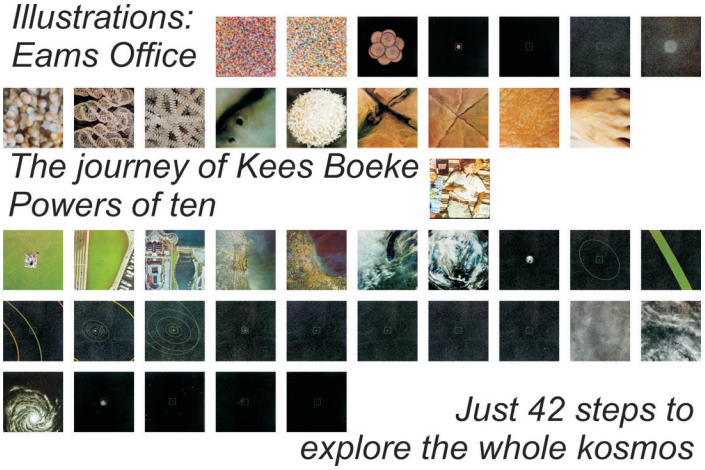
Discovery number one.
Wow!



I had an easy to understand and easy to teach overview of all the time in front of me!

These timelines I shared not only with the children in my class, but with all my colleagues. At one time I got answers to all my nagging questions: "What is the best we can offer children (curriculum)". To tell the wonderful story from the beginning of time chronologically provides the necessary curriculum for the children almost automatically. And the curriculum is always in relation to the larger whole, and/or any of its parts. These timelines make the children more and more curious and with the help of question structures, they can do independent research.

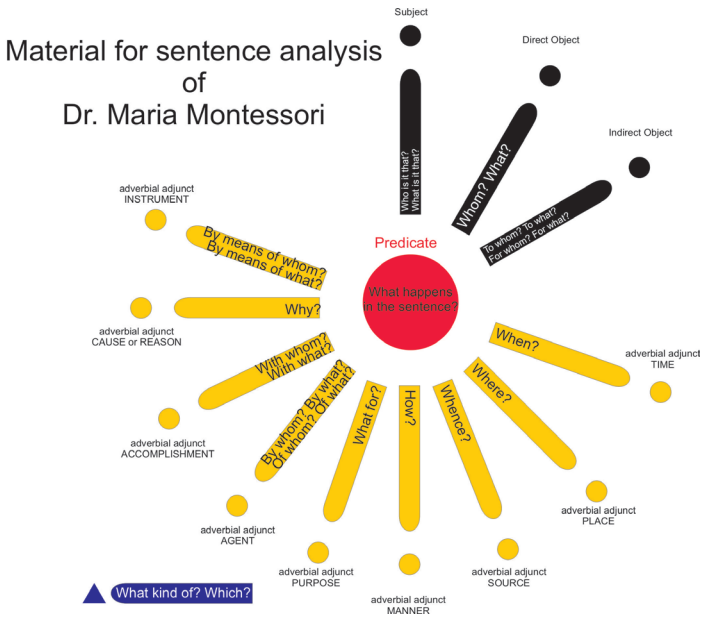
Essential information now came into view that was not mentioned in the readymade methods for primary school: anything that can be placed in The line of everything and in The line of man! The mathematical beauty of the timelines spoke directly to me as a teacher: they were not just a means to study history, but additionally proved to be a tool to perform and provide (number line) arithmetic operations. Now the time has a place. But what about the other dimension: space? This came into picture after a tip of Fred Spier in an email exchange in 1997.



Discovery number two.
Again, wow!
I had an easy to understand and easy to teach overview of all the space in front of me! It was Eames' Powers of Ten, an idea by Kees Boeke.

Its mathematical beauty had a direct relationship with my lines of life. It gave me an 'Aha-Erlebnis': space and time captured in two beautiful frames.
Now the relations in space and time could easily be displayed. The study of 'The powers of ten' provides sense of scale and repeated patterns in the micro and macro world.

Discovery number three.
Wow moment number three!
It is (in my opinion) no coincidence that the patterns of human language follow the repeated patterns of the cosmos: the energy-rich core (predicate) combines with the subject, direct object, indirect object and adverbials, all beautifully portrayed by Maria Montessori as 'the material for the analysis of the sentence'. This cannot only be used to dissect



the linguistic sense, but also to dissect ‘meaning’ of the cosmos. With this material we, the children and I, were able to formulate our own questions on any topic.

We see that network patterns in the cosmos are repeated in language. And we use the network patterns of the language again to explore the cosmos. There are patterns as in the example below.

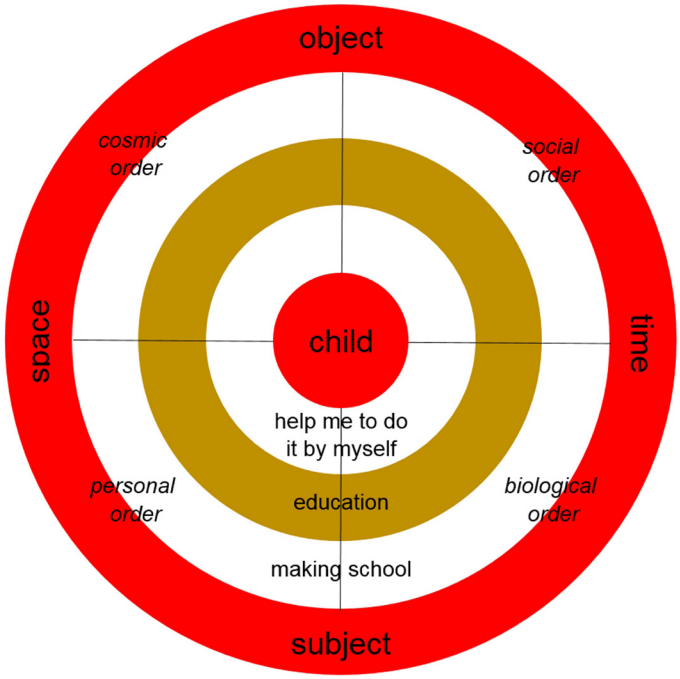
Depending on the age and abilities of the child, the study can be simple

or more complicated.

The three discoveries felt like a trinity: complete, simple, transferable. And then there was still a fourth discovery.

Discovery number four.
Although the prepared environment that surrounds the child is one of the major principles of Maria Montessori, I only discovered its real power when Anne-Marie and I developed a picture of the prepared environment in (Montessori) education.

Montessori considers all activity of the teacher as ‘preparation’. The teacher prepares for ‘help me to do it by myself’ by creating a rich environment for the child. The teacher attunes to the child and the child makes his or her own choices. The teacher readjusts



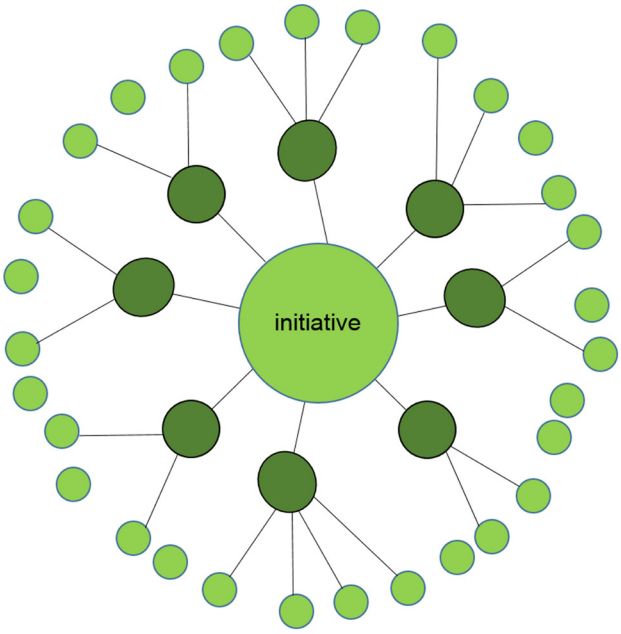
the environment in line with the centered child.

Anne-Marie Poorthuis
Since the eighties, I (Anne-Marie) research questions of organizing and work with the network as an ordering principle. I start with some words about networked organizing in general, before I turn to its place in the big history education for children in particular.

Networked organizing helps us humans to organize ourselves in relationship with everything there is and to do so while making use of the self-organization of everyone involved. In networked organizing, the network is both ordering principle and unit of analysis.

Someone who organizes in a networked fashion starts from a current initiative or theme, analyzes everything involved (entities, things, ideas, thoughts, observations, resources and so on) and searches for nodes that connect these ingredients with the initiative. This way, the network gains identity. Next, the network further develops itself to strengthen its capacity to handle complex issues.

What is the value of networked organizing? Well, I posit that the future of humanity profits from the



reinforcement of the capacity to handle issues, which also is, as said, the result of networked organizing. Increasing complexity demands commitment to and insight into the relationships between subject, object, space and time. Inspired by Big History, we can say that these relationships (between subject, object, space and time) have emerged over and over again in the course of millions of years. Whatever appears depends on the current starting point and its circumstances, and is always a surprise.

Yet, stating this as a matter of fact isn't enough. Networked organizing isn't what we humans easily do collectively. It becomes more and more clear that humans cannot completely oversee their role in this Big History, or at the very least are restricted in how *they organize with and profit from everything there is.*

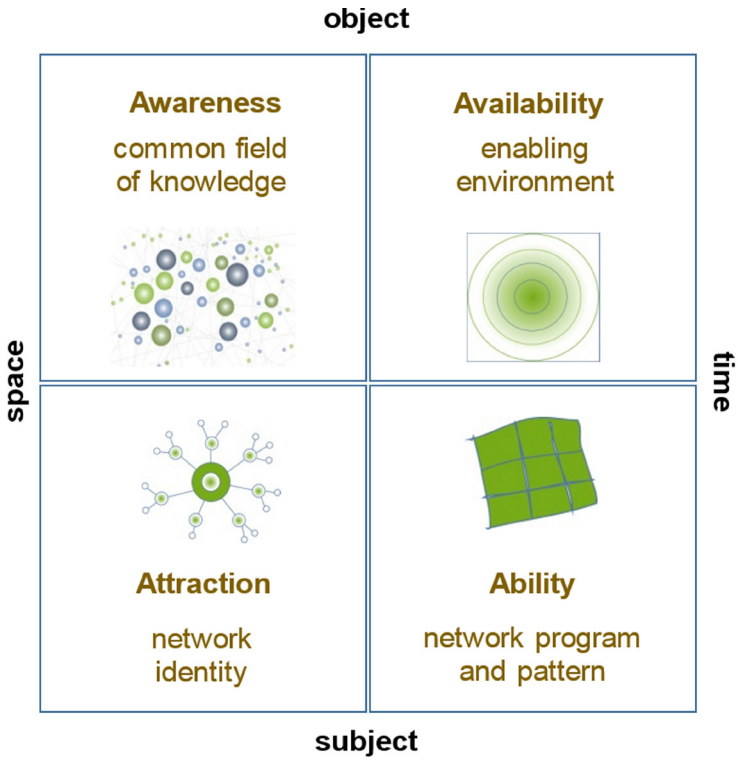
I think it is of the utmost importance that people learn to organize in a networked fashion at the youngest age possible. It is therefore my ambition that children in elementary school learn to organize their own development in a networked fashion and along the way learn to make use of the total big history and develop the capacity to handle the complex issues of the future. The focus is not so much on knowing the answers, but on perceiving involvement, creating and deepening relationships, making use of potentials and opportunities, and being prepared for surprises.

The role of the teacher in this is crucial. The craft of the teacher is first, to posit big history as inspiring context, second, to assume the self-organization of the child in this context and third, to facilitate the development of the child via networked organizing. It is the challenge for the teacher to become more and more superfluous. This way, the pupil makes more and more his own school in relationship with everything involved. The responsibility shifts from teacher to pupil. The relationship between teacher and pupil generates a continuous dynamism between organizing from the child (organizing from the inside) and organizing from the teacher (organizing from the outside). The craft of networked organizing is to connect these two. The context of big history then becomes a facilitating context and self-organization becomes a developmental challenge.

As mentioned earlier networked organizing starts with analyzing the network around a current theme or initiative. The analysis of the network generates a network identity. The teacher teaches the pupil to build up his own network with the network analysis for initiators. The pupil is the one who takes initiative and the teacher can help by asking to name the initiative as core. We use paper table cloths to make the network analysis. The child positions the initiative or core in the middle of the table cloth and in a brainstorm writes up everything that is involved in a large circle around it (things, ideas, entities, thoughts, et cetera). Next, he looks for people he knows who can function as a link between the initiative and everything involved. This way, the network appears. The child invites the people and repeats the networked analysis together with these people.

The network develops from four different angles based on the relations between subject, object, space and time.

The first angle is attraction. Attraction concerns the initiative that radiates and attracts the current involvement around the initiative. The network builds an identity and develops from the core. Remove the core, e.g. let go of the initiative, and the network subsequently slowly falls apart.



The second angle is awareness, which emerges in conversations. The network builds a common field of knowledge. The initiative develops into a shared theme of the network. Through the network we gain access to a whole of nodes and connections. This is also called a nodal universe. Each node and connection opens the way to a diversity of sources. The conversations are an aid to generate and deepen a shared awareness of the theme. In communication the nodes become visible and connections can be made. We use different tools, for instance a narrative analysis to collect personal stories and create a shared story, or a network portfolio to collect stories, examples, initiatives, remarks, words, ideas, networks and events about a current theme. We use theme analysis to start the collection.

The third angle is availability and that refers to the potentials of the network and its interactions. The network builds an enabling environment. In an enabling environment, use is central. This is in line with the prepared environment, an aforementioned principle of Maria Montessori (1949). An enabling environment organizes access to each other's networks, tunes in on opportunities to use and changes in the course of time. The challenge is to repeatedly fine-tune this environment to its user.

Inspired by the four basic operations of arithmetic and the three major ecological regime transformations (Fred Spier), one can say that a user of a prepared environment learns to add (as a gatherer and hunter), to divide (as a farmer), to subtract (as an industrial) and to multiply (as a concept of mankind).

And finally, the fourth angle is ability, the capacity to handle issues. It is not necessary to know all the answers if we are prepared for the surprises and to make creative use of everything there is. The network builds up its programs and patterns. Ability can grow as we construct examples. Key here is practicing what we are, what we know, what we want and what we can as a network. This translates into a practice of self-organization and a visualization of the development of a self-organizing network.

These four angles develop on their own, sequentially, interactively and as a whole. The four angles assume each other and each angle contributes in an unique way to self-organization, while relating to the others. Bateson (1979) helps to connect these various angles with each other. He describes a 'pattern that connects' as a dance of interacting parts.

Self-organization from a network perspective is about the human as he is accompanied by networks that consist of everything that is involved. By connecting these networks, the separate initiative power of each core remains active.

It is my experience that when you learn networked organizing and learn to build up and see your own programs and patterns (in life, work, research and so on), you learn to see and read programs and patterns in everything there is. The emphasis is on collective. My hypothesis is that we as humanity can collectively learn to handle self-organization from a network perspective and this will make available an enormous potential of powers, a potential that at the present time is hardly used and that can contribute to the capacity of humankind to handle issues.

Big History in primary education

Our (Jos and Anne-Marie) joint project is Big History in primary education. The main motivation for this

project is the sensitivity for Big History of children from about six years. After the period of introspective kindergarten, the child comes into a new phase: it discovers that the world is much, much larger than its previously known world. The psyche of the child focuses less on itself and more and more on the outside.
Big questions arise:

- Where do I come from (as a human)?
- What is beyond the stars?
- How can there be so many living creatures in a drop of water?
- Why does the earth quake?
- Why are we at war?

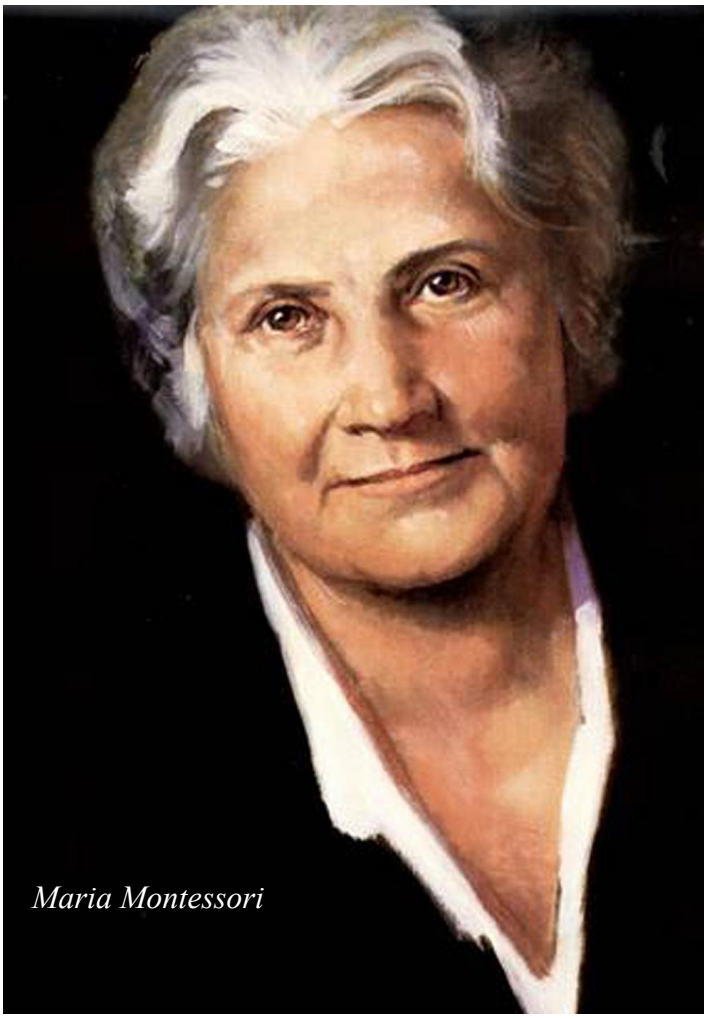
Maria Montessori speaks of sensitive periods: the period when a child is extra sensitive to familiarize themselves with new affairs. This period (from about six years) is the best time to familiarize the world 'as a whole in space and time'. The intrinsic interest is largely present. The child now only needs to be 'nourished'.
Maria Montessori: "Seed! Scatter the seeds! Seed as much as possible! It will be a surprise to see the seeds germinate."

In essence Big History can be the basis for learning and organizing for the entire school. This means that the school is willing and able to align its education and pedagogy with the total space and time. A matter-of-factly introduction by the teacher inspires the child with a story of the total space and time, and at the same time invites the child to start an own story that continues throughout school time. These stories are the basis for the child to do its own discoveries. It is important that the teacher prepares the learning of the child by providing a rich learning environment that the child can access independently.

Since Jos isn't a teacher anymore and can't work with Big History in his own classroom and his own school, our question is how we can focus the attention of primary schools to Big History. We focus on different levels. First, we participate in the national working group 'Cosmic education for Montessori Education' and so establish the link between Cosmic education and Big History. Second, we connect to primary school teachers and build a network of teachers who are interested in Big History or who are an example. The Big History Conference 2016 in Amsterdam can be a great attractor for this network. Third, we collect teaching materials from the schools and make materials from our own publishing house, like the 'Lines of life' and the 'Stories of space and time'. Finally, and in collaboration with the network of teachers, we make a preview program with which a teacher can get to work.

The Big History project for primary education is a great challenge and we would like to present the first results at the Big History Conference 2016 in Amsterdam.

For more information, download here the article 'Once upon a time.....', written by J. Werkhoven and published in 'Evolution: A Big History Perspective': http://www.socionauki.ru/almanac/issues/evolution_2_en/full_text_werkhoven.pdf



Maria Montessori

Teaching Big History

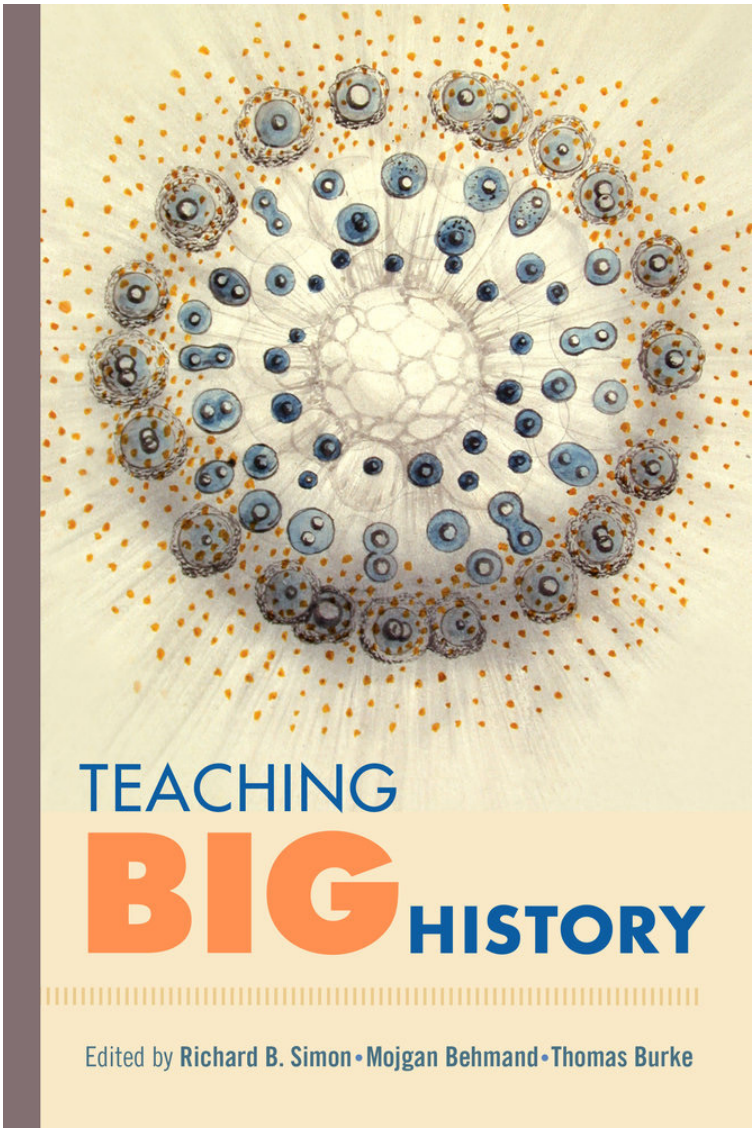
A forthcoming book co-edited by
Richard B. Simon, Mojgan Behmand, and Thomas Burke
University of California Press (November 17, 2014), 432 pages
ISBN-10: 0520283546
ISBN-13: 978-0520283541

Big History is a new field on a grand scale: it tells the story of the universe over time through a diverse range of disciplines that spans cosmology, physics, chemistry, astronomy, geology, evolutionary biology, anthropology, and archaeology, thereby reconciling traditional human history with environmental geography and natural history.

Weaving the myriad threads of evidence-based human knowledge into a master narrative that stretches from the beginning of the universe to the present, the Big History framework helps students make sense of their studies in all disciplines by illuminating the structures that underlie the universe and the connections among them.

Teaching Big History is a powerful analytic and pedagogical resource, and serves as a comprehensive guide for teaching Big History, as well for sharing ideas about the subject and planning a curriculum around it. Readers are also given helpful advice about the administrative and organizational challenges of instituting a general education program constructed around Big History. The book includes teaching materials, examples, and detailed sample exercises.

This book is also an engaging first-hand account of how a group of professors built an entire Big History general education curriculum for first-year students at the Dominican University of California, demonstrating how this thoughtful integration of disciplines exemplifies liberal education at its best and illustrating how teaching and learning this incredible story can be transformative for professors and students alike.



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PART THREE: BIG HISTORY AND ITS IMPLICATIONS

Editors' bios

Richard B. Simon is Adjunct Assistant Professor of English at Dominican University of California, instructor of English at City College of San Francisco, and Contributing Editor at Relix magazine.

Mojgan Behmand is Associate Provost at Dominican University of California. She is also Associate Professor of English and former Director of General Education and First Year Experience.

Thomas Burke is Assistant Professor of English and Cultural Studies at Dominican University of California.

CALL FOR PAPERS
Special Issue of

KronoScope: Journal for the Study of Time

Big History and Time

http://www.brill.com/kronoscope
Managing Editor: Jo Alyson Parker, jparker@sju.edu
Inquiries about this special issue may be directed to Paul Harris (pharris@lmu.edu)

Big history provides a narrative encompassing "all of time," from the Big Bang to the present. However, scholars working on big history seldom address time explicitly. This special issue of Kronoscope invites submissions of papers from any scholarly discipline or perspective that explore how time is treated in big history or how the study of time is impacted by big history. Topics or questions might include (but are not restricted to) the following:

- Is there a concept of time that informs big history?
- How does big history change our idea or concept of time?
- How do emergence and complexity in big history relate to time?
- Do the 'thresholds' of big history imply a concept or notion of time?
- What philosophical treatments of time are relevant to big history?
- What discipline-specific concepts of time are central to big history?
- How can the different temporalities encompassed in big history be integrated or related?

A biannual, peer-reviewed, interdisciplinary journal, Kronoscope is the associated journal of the International Society for the Study of Time. Special consideration will be given to papers that refer to the work of J.T. Fraser, the most prolific contemporary interdisciplinary philosopher of time, and Founder of the ISST.

Published by Brill Academic Publishers since 2001, KronoScope is available in both print and online versions, and it is indexed/abstracted in the following: Sociological Abstracts, MLA, Scopus, Social Services Abstracts, Worldwide Political Science Abstracts, the International Directory of Philosophy, and Linguistic and Language Behavior Abstracts.

Submission guidelines
Please submit your essay electronically (a Word document or PDF, double-spaced) at the following website by December 31, 2014: www.studyoftime.org/ks

Essays should be between 5000-8000 words. They should be geared toward an interdisciplinary audience rather than specialists in your particular field. References and bibliography should be formatted according to The Chicago Manual of Style (16th edition). Either the Notes and Bibliography or Author-Date References style of documentation is acceptable.

Jennifer Joy
comedy with elements of science

Home | Physics of Love | The SciArt6 | Comedy | Contact

Hello!

It's been a busy summer of conferences (shout out to members of the Association of Environmental Sciences and Studies and also to the International Big History Association) and performances. I'm lining up my tour dates for this coming year, and wanted to get in touch.

The Physics of Love: A Romantic Comedy about the Scientific History of the Universe on Tour Now

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