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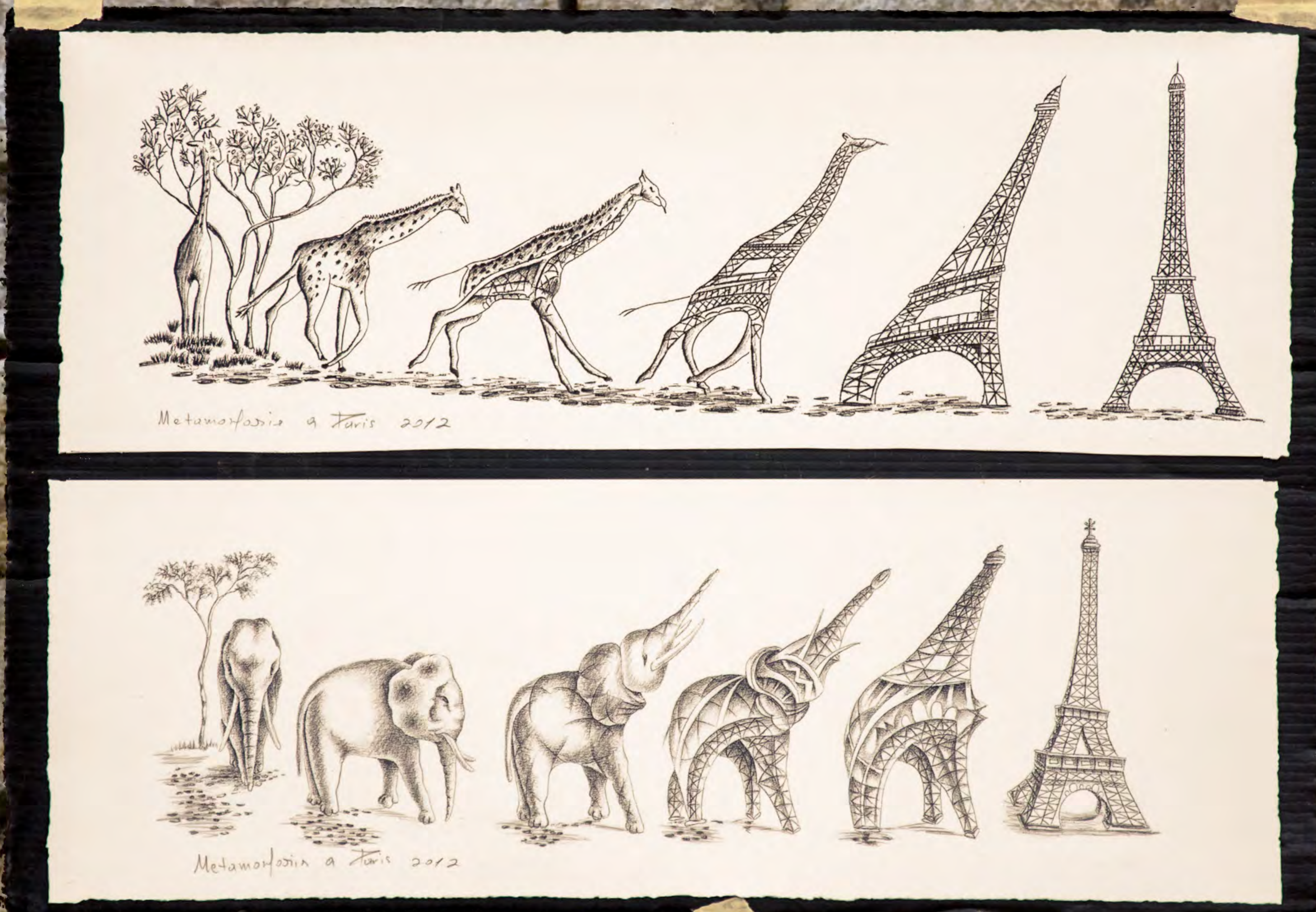

International Big History Association

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International Big History Association

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A Match Made in Science:
Reconciling Big History and Montessori Education

by Kyle Herman

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Introduction

How did the universe begin? How did we appear? What is the meaning of our existence? Is our fate in our own hands, or are we at the mercy of uncontrollable forces? These questions have excited the curiosity and creativity of humans for millennia, and that being the case, they deserve a central place in every culture's education. Putting the biggest questions humans can ask at the center of a curriculum does invite controversy, but the benefits are well worth it: depth and diversity of thought, critical thinking, synthesis of oppositional ideas, and most important of all, the potential for students to arrive at their own profound conclusions about ethics, spirituality, and their role in shaping the future. If we intend to make learning more valuable than GPA points, we have to help our students plunge below the surface of academics in search of the deeper meaning they crave.

For the past four years, I have taught big history in a public Montessori high school because it offers a viable means of reaching this deeper meaning. By tracing the route from past to present at various scales, big history unifies otherwise disconnected subjects into a transdisciplinary "map" of space and time that orients students to the complex world in which they live. A traditional high school curriculum, on the contrary, produces a dizzying blur of bits of information that don't hang together or seem to hold any clues about anything very meaningful at all. Big history shifts the experience of learning from grasping at bits of information to assembling a mosaic into which every piece fits to form an emergent image of our origin story as we know it. Moreover, the curriculum of big history aligns so naturally with Montessori's cosmic education that it seems tailor-made for use in Montessori adolescent programs. Although these two schools of thought line up so well structurally, and to some extent philosophically, there are some sticking points that have to be worked out before we can explore why big history makes such an ideal companion for Montessori education at the secondary level.

Understanding the Controversy

Montessori practitioners can be quite protective of the philosophy; that is, they want a faithful application of her methodologies as she laid them out in her writings and lectures because diluting her method in any way diminishes its potency. Therefore, the first question a Montessori teacher has to ask is whether the grand narrative of big history is out of place in the third plane of development (adolescence), given that Montessori designed her cosmic curriculum for the second plane based on the sensitive periods unique to children ages 6-12.[1] As cosmic education is the core of Montessori philosophy, some would argue that it should be carefully extended within its own traditions and limited to the second plane of development. Although Montessori did not provide much guidance for the third plane compared to the first and second, she did outline a syllabus[2] to complement the *Erdkinder* experience that she felt served the developmental needs of adolescence.[3]

While the manual work of *Erdkinder* is a quintessential feature of Montessori adolescent programs, big history can aid the intellectual work at this level, especially for those of us trying to maintain Montessori integrity in a public high school program that doesn't allow ample time for tending to livestock, running a shop, building a path, working in a garden, and so on. Since the state imposes graduation requirements and dictates to a large extent the curricula of mandated courses, the learning experience in a public high school program – even a Montessori one – quickly becomes mechanical and meaningless: "just tell me what to do and whether or not this will be on the test" is a mentality that students who are overwhelmed or weary with boredom adopt as a kind of survival strategy. I have found that incorporating big history into our program has helped students make connections among everything they study, which generates much more enthusiasm and genuine curiosity than studying for the sake of accumulating credits. My anecdotal evidence of this shift in mindset is enough to convince me that we ought to find a way to make big history work in the Montessori world. Additionally, though, for Montessori students who have experienced the cosmic curriculum, big history provides a logical extension and magnification of the elementary story. Even the eight thresholds of big history, which begin with the birth of the universe and end with humanity, feel very familiar to the student oriented to the five Great Lessons that move in the same macro to micro direction. Finally, although I realize some of my colleagues will disagree with me on this point, Montessori philosophy is not static or immutable. She wanted her method to incorporate the latest and best ideas from every field of scholarship, to orient the child and adolescent to the world they will inherit so that they might then forge a *new* world. Given that it rests on the most up-to-date scholarship of the twenty first century, big history can aid in this lofty goal. Or can it?

Montessori, Metaphysics, and Methodology

Montessori insisted that education is not about the transmission of information; rather, it is about nothing less than the "salvation of humanity and civilization."[4] Does big history hold the same conviction? Does it contain moral or ethical revelations that can guide us toward a more peaceful and sustainable future? Does the grand narrative of big history point humanity in a *certain* direction? The answer is yes and no, at least the way that I see it. Let me explain.

In his essay, "Big History is Not an All-Encompassing World View," Fred Spier defines big history as a purely "academic enterprise," and as such, it eschews "discussions about what is right and wrong; how to act; and how to interpret it in religious, spiritual, or metaphysical ways."[5] This position is grounded in methodological materialism, which aims to limit conclusions to the empirical world of matter and energy. Just as you can't observe a physical God with a telescope or microscope, so too you can't observe moral rules in subatomic particles, the arrangement of galaxies, or the DNA helixes of humans; thus, it would be an illogical jump for scientific materialists to make any claims whatsoever about spirituality or morality. Both topics exist outside the purview of scientific materialism.[6] As Spier puts it, "There is simply no academic basis for assigning ethical values or moral rules based on empirical evidence and scholarly interpretations."[7] Here we have the "no" part of the answer to the questions above.

Cynthia Stokes Brown explains methodological materialism as "a restriction on method," which ensures "that researchers will not make any non-material assumption as a way to eliminate confusion when studying the natural world."[8] There are many benefits to such an approach, not the least of which being that it allows scientists to present a picture of the natural world untainted by personal bias (insofar as that is possible). But the other benefit of this method, which I consider to be the saving grace for how we can use big history in Montessori education, is that the metaphysical conclusions are up to the individual. Here, we have the "yes" part of the answer.

As Brown asserts, "People of various metaphysical positions need to realize that they can use the big history narrative as a foundation on which to add whatever cultural or religious metaphysical background they bring with them." She goes on to explain that teachers of high school students should strive "to help them understand that they can assimilate the methodologically materialist big history narrative as a foundation, even if they already have a metaphysical framework that is not materialist." Not only does this mean that students of faith are included in this narrative, but it also allows for Montessori's metaphysical framework (i.e. the discovery of our cosmic gift/cosmic task) to stand on a big history foundation.

Even though Spier wants to make a sharp distinction "between academic big history and one's personal point of view," he does allow for the same open-ended interpretations of big history as Brown: "It will be up to the persons who engage in big history to decide what ought to be done, as well as how big history can be accommodated in their religious, spiritual, or metaphysical world views."[9] So no, big history does not contain any pre-packaged moral injunctions, but yes, it can be used by individuals to arrive at their own moral conclusions. Practitioners of big history just have to understand that when we step into the metaphysical realm of spirituality and morality, we are going beyond the self-imposed limits of big history as a strictly objective and empirical discipline. I don't see this caveat as proof that big history doesn't work with Montessori philosophy, as I have no qualms about straying from the boundaries of big history to serve the bigger aim of Montessori education. In fact, it seems like a perfect match to me: Montessori philosophy can pick up right where big history leaves off! This is not to say that Montessori education tells students what moral lessons they ought to find in big history or cosmic education; rather, it's just to say that such explorations are well within the purview of our discipline.

Crossing the First Threshold

Once we decide that big history has a place in the world of Montessori education, we come to the most polemical controversy of all: the apparent ideological impasse of science and religion, which the teacher must negotiate from day one. At the outset of this epic journey, as we cross the very first threshold of the Big Bang, we encounter the turbulence of different faiths, family values, and unexamined assumptions. So how we frame this whole study is absolutely critical. We should not shy away from the picture of the universe as modern science sees it, but if we alienate students of faith at this juncture, the rest of the story will almost certainly fall on deaf ears.

Emphasizing Big History as a modern origin story is critical because it shows that science and religion align in their desire to explain our origins. Here is our common ground, a shared starting point. Furthermore, such an emphasis is disarming because, like every other cultural or religious origin story, our scientific knowledge of the universe is not infallible or exhaustive. As David Christian admits, "Many of the stories we tell today will seem quaint and childish in a few centuries, just as many elements of traditional creation [stories] seem quaint today...In their day, all creation [stories] offered workable maps of reality, and that is why they were believed. They made sense of what people knew." Similarly, a modern creation story "must start with modern knowledge and modern questions, because it is designed for people who live in the modern world. We need to try to understand our universe even if we can be certain that our attempts can never fully succeed. So, the strongest claim we can make about the truth of a modern creation [story] is that it offers a unified account of origins from the perspective of the early twenty-first century."[10]

It's fair to ask why the scientific perspective reigns supreme in big history and Montessori philosophy, especially if, just like religion, it can't claim to have all of the answers. It comes down to the fact that science makes unbiased observations and is willing to change its story based on new observations, while religion makes normative claims that tend to impose a predetermined and rigid worldview onto its believers. These worldviews imply moral judgments that can be twisted to justify egregious behavior. As a result, in the words of E.O. Wilson, "The cost to society of the bowed head has been enormous."[11] We see the proof of this truism in the centuries-long holy wars of the Crusades, the tortures of the Inquisitions, and the heinous and cowardly acts of terrorism inspired by religious extremism that beleaguer our modern world. This is not to say that all people of faith are violent, as that would be a gross misrepresentation. In fact, violence, discrimination, and terror in the name of any religion are perversions of religious spirituality.

Nor is this to say that religion serves no great purpose in our lives. On the contrary, as Wilson acknowledges, religions "perform services invaluable to civilization. Their priests bring solemnity to the rites of passage through the cycle of life and death. They...comfort the afflicted and take care of the desperately poor. Inspired by their example, followers strive to be righteous in the sight of man and God."[12] The unfortunate flaw among sectarian religions, though, is that all of them define themselves by competing creation stories, and "No matter how gentle and high-minded...the core belief assures its members that God favors them above all others....There is no way around the soul-satisfying but cruel discrimination that organized religions by definition must practice among themselves."[13]

Simply put, religion sets up an "us and them" scenario, whereas from a scientific point of view, we are all part of nature, so we are all part of the same origin story. Every nationality, every culture, every ethical system, every belief from the dawn of civilization to the modern era is part of our big history. Of course, big history doesn't validate one over the other. With that being said, it would be a mistake to exclude or even downplay the spiritual world from this academic narrative, because to do so would betray a bias and efface a vital part of our story.

Cosmologist Brian Swimme articulates well the inclusive quality of a scientific narrative: "The creation story unfurling within the scientific enterprise provides the fundamental context, the fundamental arena of meaning, for all the peoples of the Earth. For the first time in human history, we can agree on the basic story of the galaxies, the stars, the planets, minerals, life forms, and human cultures. This story does not diminish the spiritual traditions of the classical or tribal periods of human history. Rather, the story provides the proper setting for the teachings of all traditions, showing the true magnitude of their central truths."[14]

Montessori also celebrated the inclusive quality of science, asserting that "The community of interests, the unity that exists between men, stems first and foremost from scientific progress, from discoveries, inventions, and the proliferation of new machines."[15] Montessori marveled at mankind's genius made manifest through scientific advancements. She understood that our ability to fly through the air, traverse the seas, and communicate with people all over the world had united us, at least in a superficial way. However, the technological advancements of science were less important to her than the metaphysical implications that scientific discoveries held[16]. In another lecture, she posits that, "...there is something that involves all mankind and perhaps even the universe itself, creation, cosmic harmony. This 'something' might be considered as involving a religious ideal. But what I should like to discuss is the possibility that science may have a predominant role to play in helping us discover this single universal mission."[17] Although a religious woman, Montessori gave primacy to science as the ideal means of realizing our interconnectedness and purpose (i.e. cosmic task) on this planet.

Approaching the Ninth Threshold

Although a scientist by trade, Montessori warned that advances in science also invite new and complicated problems for humanity. In her time, she witnessed the Great War, the rise of Fascism, and World War II, so she understood all too well that, despite the incredible outward progress of science and technology in the twentieth century, our inward progress had not kept up, which put us in a perilous situation: we existed at odds with one another and with nature itself, completely unconscious of our "terrestrial destiny and of the fact that the whole of humanity is so intimately united that it forms but one organized energy."[18]

Montessori lamented that, in the process of advancing our external world and extracting riches from the planet, "Men did not take care of humanity. Its growth was neglected and left to chance and thus remained inferior in development to the development of the environment in which he lives. He is without orientation and without control over his own creation."[19] This was true in Montessori's time, and since we have been slow to recognize the danger, the situation is even more dire today. As Brown admits, "…our current pattern of living is not sustainable; something new and different must emerge, either from us humans or from the rest of the planetary system…Big history seems to indicate that humans are now at a major turning point in the whole story; we are not living at a time consisting of gradual, on-going change. We are living at a moment of great uncertainty in which our decisions will matter greatly and have unusual significance. The narrative of big history dramatically reveals this conclusion."[20]

So, what will the next threshold be? I suppose that depends on if and how we utilize scientific methodologies to liberate ourselves from antiquated ideologies that have divided humanity since the dawn of civilization. Big history tells an uplifting tale of how humanity emerged from the abundant and complex creativity of life on this planet, and it leads to a host of harrowing conclusions about the deleterious byproducts of humanity's unbridled acceleration into the modern era: global warming exacerbated by deforestation and the burning of fossil fuels, mass extinctions from over-hunting and destruction of natural habitats, pollution of the water and soil and air, and the proliferation of nuclear weapons that threaten the very existence of our species.

Does big history really lead us here just to abandon us? Does our strictly academic map of space and time disorient us at the very point when we need directionality the most, as we approach the next critical threshold in our epic journey? I think not. If a detailed and comprehensive scientific account of reality cannot tell us where to go from here, then we will be destined to remain victims of our own myopic prejudices and selfish pursuits. Without the lens of science to correct our vision, we will almost certainly stumble across the next threshold, falling deeper into war with one another and with nature itself.

However, with the corrective aid of an education designed to explore our origins, our human history, and yes, the very meaning of our existence, we can envision "A new world for a new man," which Montessori told us 80 years ago was "our most urgent need."[21] This "new world," could also be our next threshold, one that marks our conscious departure from the Anthropocene into the Ecozoic era.[22]

In 1932, Montessori gave an address to the International Office of Education in Geneva in which she made a prescient observation that "An immense chapter of history taking millennia to unfold has now closed."[23] She understood even then, long before all of the ramifications of industrialization had fully manifested, that we had brought ourselves to the brink of a new threshold. Although she portrayed the reality of the modern era in stark terms, she had faith in our ability to transform ourselves and our planet into a higher state: "we, the last earth-bound men, must make the great effort of lifting up our eyes and hearts to understand [the reality of our time]. We are undergoing a crisis, torn between an old world that is coming to an end and a new world that has already begun and already given proof of all the constructive elements it has to offer. The crisis we are experiencing…can be compared only to one of those biological or geological epochs in which new, higher, more perfect forms of life appeared, as totally new conditions of existence on earth came about."[24]

As a result of centuries of empirical scientific inquiry, we have thrown off many of the superstitions and illusions that stifled our inward progress as we built up our complex external world. The "totally new conditions of existence" are defined by an emergent consciousness informed by science and freed from "old world" dogmas and doctrines. There is still work to be done, though, and the stakes are too high now to pledge allegiance to the creed that science has no say in ethics.

In closing, it seems appropriate to pose the question that Montessori concluded her speech with in 1932: "Who will sound the trumpet awakening [humanity]? Man today lies slumbering on the surface of the earth, which is about to swallow him up. What will he do?" It's likely that the answer to this question will determine our next threshold. Education is our trumpet, but if sectarian groups, religious fundamentalists, demagogues, and profiteers are the ones who sound it, then mankind's best and brightest scholars will indeed have taken us on nothing more than an academic enterprise. Montessori education is bigger than that, even if big history doesn't want to be.

Endnotes

1 Montessori observed that in the second plane of development, the imagination flourishes and the child is hungry for culture, so the universe story capitalizes on these sensitivities. It stokes the flame of imagination and generates curiosity to learn (though retaining facts is not the point of the cosmic curriculum) as well as a sense of connection with the living world in general and humanity in particular. Adolescence, on the other hand, has its own sensitivities unique to that plane of development (see endnote iii).

2 Montessori, Maria. *From Childhood to Adolescence*, 71- 81 (Amsterdam: Montessori-Pierson Publishing Company, 2007). It is worth noting that the academic content of part three in Montessori's adolescent "Study and Work Plans" dovetails with Big History's last five thresholds. *The study of the earth and living things* fits within the fourth and fifth thresholds, and *The study*

of human progress and the building up of civilization fits within the sixth, seventh, and eighth thresholds.

3 *Erdkinder* translates to "land-child," and it is to the adolescent curriculum what Cosmic Education is to the elementary curriculum; it is based on the developmental needs of the adolescent for physical movement and manual work to balance their intellectual work. To contribute one's labor to a group of one's peers help adolescents experience "valorization," which can be understood as the feeling of dignity and self-worth that comes from acting as an integral component of a society that is greater than the sum of its parts. From a Montessori perspective, the utilization of social and personal "super-values" is the paramount objective of adolescent education, as adolescence "is the time, the 'sensitive period' when there should develop the most noble characteristics that would prepare a man to be social…" (63). There is no doubt that *Erdkinder* should have a prominent place in any adolescent program that calls itself Montessori, but big history can weave together the academic threads of Montessori's Study and Work Plans and promote an intellectual understanding of one's place in society at a variety of scales.

4 Montessori, Maria. "Educate for Peace." *Education and Peace*, 28. (Amsterdam: Montessori-Pierson Publishing Company, 2007).

5 Spier, Fred. "Big History is not a World View." *Origins* (Feb. 2016) VI, 2.

6 In "The Meaning of Big History," Cynthia Stokes Brown clarifies that a methodological materialist need not come to metaphysical materialist conclusions. In other words, a methodological materialist (or 'naturalist') may still derive ethical beliefs from purely materialistic methods. Stokes Brown explains that, "A new ethics is emerging from naturalistic accounts of reality---not dependent on supernatural enforcement, and scientists are beginning to speak out on ethical issues in ways they haven't done before." (e-mail message to author, March 7, 2016). Clearly science has something important to reveal to us about our behavior, and it can offer these revelations without making any divine leaps of faith or pawning off responsibility to a higher power. Therefore, to say that ethics is beyond the purview of science may be to deprive us of one of the most advantageous applications of science.

7 Spier, Fred. "Big History is not a World View." *Origins* (Feb. 2016), VI, 2.

8 Brown, Cynthia Stokes. "The Meaning of Big History, Philosophically Speaking." *Origins* (Jan. 2016), VI, 1.

9 Spier, Fred. "Big History is not a World View." *Origins* (Feb. 2016), VI, 2.

10 Christian, David. *Maps of Time: An Introduction to Big History*, 11. (Berkeley: University of California Press, 2005).

11 Wilson, E.O. *The Meaning of Human Existence*, 184. (New York: Liveright Publishing Corporation, 2014).

12 *Ibid.*, 150.

13 *Ibid.*, 151.

14 Swimme, Brian. *The Universe is a Green Dragon: A Cosmic Creation Story*, 38-9. (Rochester: Bear & Company, 2001).

15 Montessori, Maria. "The Need for Universal Accord so that Man may be Morally Trained to Defend Humanity." *Education and Peace*, 64. (Amsterdam: Montessori-Pierson Publishing Company, 2007).

16 Here, of course, is where many big historians get off the Montessori bus.

17 Montessori, Maria. "Fifth Lecture." *Education and Peace*, 66. (Amsterdam: Montessori-Pierson Publishing Company, 2007).

18 Montessori, Maria. *Basic Ideas in Montessori's Educational Theory: Extracts from Maria Montessori's Writings and Teachings*, 130. (Oxford: Clio Press, 1997).

19 *Ibid.*, 131.

20 Brown, Cynthia Stokes. "The Meaning of Big History, Philosophically Speaking." *Origins* (Jan. 2016), VI, 1.

21 Montessori, Maria. "Peace." *Education and Peace*, 21. (Amsterdam: Montessori-Pierson Publishing Company, 2007).

22 The Anthropocene is a new geological time distinction in which mankind represents a major geological force that is impacting the entire biosphere in deleterious ways. The Ecozoic era is a theoretical future time distinction proposed by Thomas Berry, in which mankind recognizes his interdependence with the planet and enters into a "mutually-enhancing relationship" with the Earth. Obviously, the Anthropocene and the Ecozoic represent two divergent paths for the future of humanity and the planet.

23 Montessori, Maria. "Peace." *Education and Peace*, 22. (Amsterdam: Montessori-Pierson Publishing Company, 2007).

24 *Ibid.*, 22-23

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The Little Big History of: The Eiffel Tower (La tour Eiffel)

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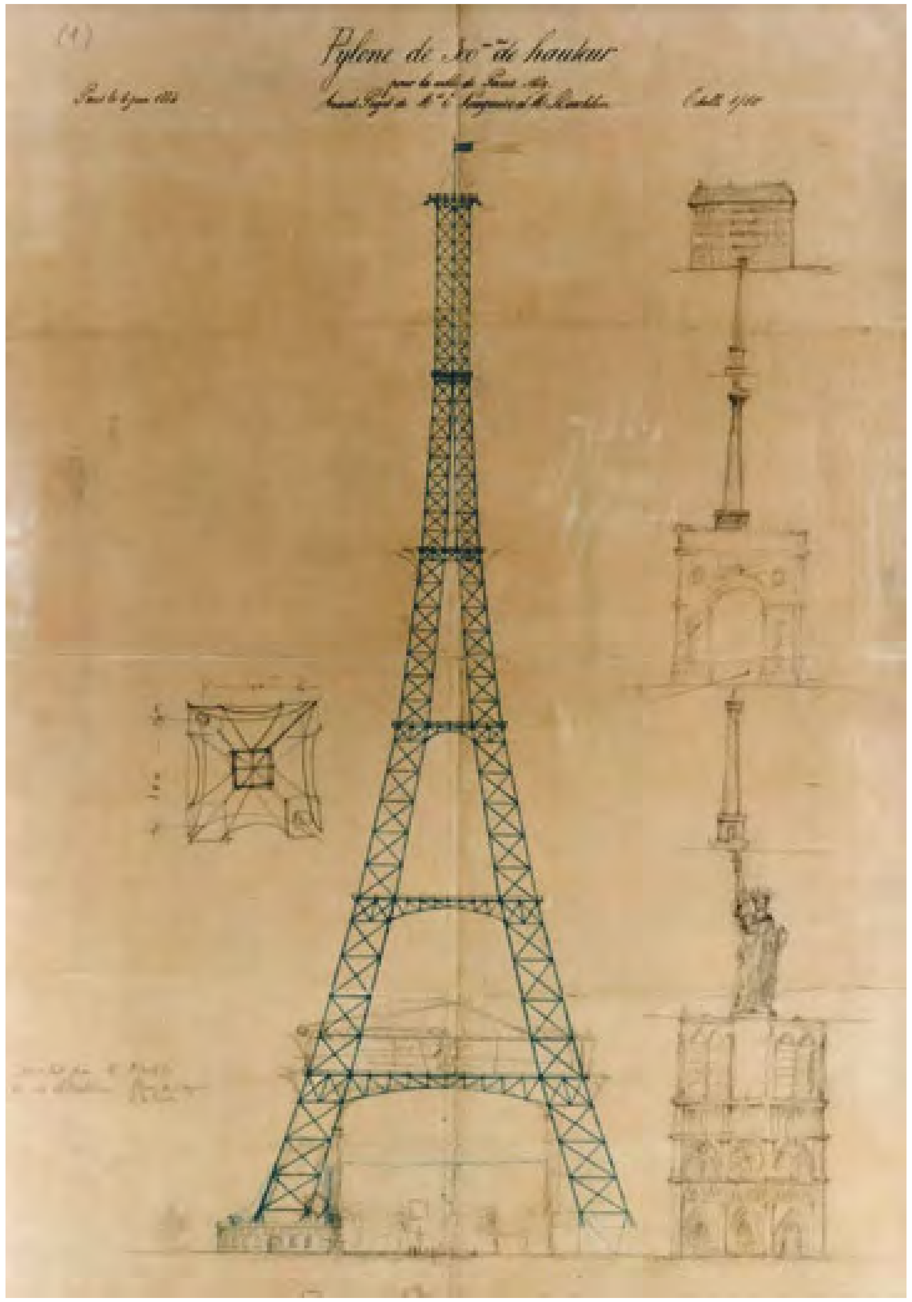

Fig.1: The first conceptual drawing of the Eiffel Tower, called 'the Koechlin plan' after the structural engineer Maurice Koechlin (1884). [2]

Introduction

The iron tower on the Champ-de-Mars in Paris is one of the most recognizable structures in western European culture. The Eiffel Tower (La tour Eiffel) has become a global landmark. The tower is named after engineer Gustave Eiffel, whose company designed and built the tower as a centerpiece of the 1889 World's Fair (Paris Exhibition). [1] The first conceptual drawing of the tower was made in 1884. [2]

One might say that the history of the Eiffel Tower begins with this first drawing of the tower and thus starts in 1884. However, the history of the tower can actually be viewed long before. The history of the Eiffel Tower, as the history of everything on Earth, actually dates back to 13.8 billion years ago, back to the Big Bang, considered to be the moment that the universe began to expand from one single point. Take the material of the tower, for example. Without the Big Bang, and later on the emergence of stars, iron would not have formed in our universe, and therefore the Eiffel Tower, as it is known today, would not exist. In a sense the Eiffel Tower partially owes its existence to stars, in particular large stars. But, of course, the Eiffel Tower also owes its existence to a great many other events. Throughout the history of our universe numerous key moments have contributed to the form and existence of the Eiffel Tower in some way.

To explain exactly how the Eiffel Tower is connected to the history of our universe in general, the connection between the Eiffel Tower and these key moments in Big History is discussed.

Cosmic Evolution

The Eiffel Tower is a human-made global landmark on our home planet Earth. This small blue planet is the third terrestrial planet from a star known as the Sun. The Sun is just one of billions of stars in a barred spiral galaxy known as the Milky Way galaxy. And the Milky Way galaxy is just one of many billions of galaxies in the universe. The Eiffel Tower is, in fact, a very small object in this vast universe. How exactly is the beginning of our universe and its sequential cosmic evolution related to this object?

According to the current scientific view, the history of our universe starts with the Big Bang that took place 13.8 billion years ago. This event marks the beginning of the history of everything that would sequentially come to exist in our universe, including the Eiffel Tower. At the moment our universe emerged, it was much less complex than it is now. With the Big Bang, the universe began to expand and become increasingly complex. As our universe became increasingly complex, stars were, in fact, the first complex entities in the universe. Stars were formed 700 million to 2 billion years after the Big Bang. [3] Large stars produced many of the chemical elements of the periodic table, including the iron that the Eiffel Tower is made of. But why is the Eiffel Tower actually made of iron and not another material?

Iron is the heaviest chemical element that can be formed in many large stars. It is formed through the silicon burning process. Silicon is formed in large stars due to a series of collapses of the star and new fusion processes. Finally, silicon is fused into iron.

Silicon burning is the final stage of nuclear fusion for many large stars. When a star has completed the silicon burning process, no further fusion is possible. [4] At this stage the center of the star is full of iron. The star collapses and explodes in a supernova. So in conclusion, iron is the most stable end product of fusion in many large stars. That is why it is a common element in the universe and on our home planet. Iron is the sixth most abundant element in the universe, and it is abundant in terrestrial planets like Earth. Iron is by mass the most common element on Earth, forming much of Earth's outer and inner core. It is the fourth most common element in the Earth's crust. [5] Iron is the most common metal on Earth. One might say that the abundance of this metal is the reason why the Eiffel Tower is made of iron. Because of its abundance and physical properties, iron held immense potential as a metal building material. However, humans did not quickly realize exactly how to tap fully into this potential.

The Eiffel Tower is constructed from puddled iron, which is a form of wrought iron. Wrought iron is, in fact, the iron that is referred to throughout Western history and was originally produced by a variety of smelting processes, all described today as 'bloomeries'. [6] There were various innovations that eventually led to the use of wrought iron.

The earliest known iron artefacts are nine small beads that were welded roughly 5000 years ago (circa 3200 B.C.). These beads were found in two burials in Gerzeh (northern Egypt). These beads were made from meteoric iron and shaped by carefully hammering the metal into thin sheets before rolling them into tubes. [7][8]

These beads are the oldest known example of metalworking. They suggest that people of the Egyptian civilization had already mastered the art of blacksmithing 5000 years ago. [8]

Fig.2: Three of the nine iron beads from Gerzeh, Egypt (2013).[8]

However, humans did not master the technology of smelting iron, extracting usable metal from iron ores, until the Iron Age. Once humans had mastered this technology, a very inexpensive yet powerful material became available. The place and time for the discovery of iron smelting is unknown. This occurred in different times and in different places. The Iron Age can be defined as the period of time when iron gradually replaced bronze as the dominant metal used for making tools and weapons. Unlike other materials, iron ores were widely available. Iron was also easier to process into a usable grade of metal than was bronze.

Many of the innovations in iron smelting have had a tremendous impact on human societies. These innovations had a much larger impact than innovations in, for instance, wood-working or masonry. The major innovations in iron smelting occurred thanks to an increasing level of cultural adaptation humans managed to achieve. These innovations triggered a trend of rising complexity in human-made structures, similar to the trend of rising complexity in the universe. Once humans realized how to tap into the potential of iron on Earth, they managed to create a metal material that was just right for maintaining certain constructed complexity. One might say that humans managed to create a material that provided ‘Goldilocks circumstances’ for increasing constructed complexity. Humans have managed to create a great deal of ‘Goldilocks circumstances’ that help them not only to survive, but also to thrive.

The rise of the Iron Age can be seen as an instance of a cultural adaptive radiation, which came as a result of the wide availability of iron ores and major cultural innovations in iron smelting. If not for the processes that took place in large stars after the Big Bang, the iron ores would not have been so widely available on Earth, and the ores would not have set the cultural adaptive radiation (the Iron Age) in motion. The processes that took place in large stars and that humans devised in the Iron Age eventually led to the use of wrought iron for the construction of the global landmark the Eiffel Tower in the 19th century.

Life on Earth

From the moment the universe began to expand, it became increasingly complex. One form of greater complexity that emerged is life, namely, biological organisms. Life is different from stars and galaxies, because life forms do not use energy that originates from supplies of matter and energy stored within them. In contrast, all living things need to tap matter and energy flows continuously from their surroundings to maintain themselves and, if possible, to reproduce. [9]

We are currently only able to study life that has emerged on our own planet. We do not know of possible life elsewhere in our solar system, let alone in the Milky Way galaxy. Earth is characterized by important circumstances that have been vital for the emergence of life. On Earth the required building blocks (or ingredients) and conditions needed for life to form were available., namely, a great variety of complex chemical compounds (including RNA and DNA), the right amount of energy (radiation from the sun) and liquid (water).

Obviously, if life had not emerged on Earth, the Eiffel Tower would not exist. The tower is an inanimate structure or object made by living creatures. But there are other less obvious ways that the development of this human-made structure can be linked to the rise of complex life on Earth.

For instance, in some respect the Eiffel Tower as a whole may resemble forms of biological symbiosis, in which there is a certain mutual benefit for all the organisms involved. In the tower there is a ‘structural symbiosis’. The different structural parts and different construction materials jointly insure the structural stability, and further existence, of the tower.

More interestingly, there are a few striking parallels between the rise of complex life and the construction of the Eiffel Tower.

About 540 million years ago a spurt in the development of the complexity of life led to greater multicellular complexity than had occurred so far. This period is known as the ‘Cambrian explosion of life forms’ and consisted of the emergence of a range of complex organisms with bones and hard shells. The fossils from the Cambrian explosion represent all the body plans (baupläne) that exist in modern complex organisms. [10] A body plan of an organism encompasses aspects such as symmetry, segmentation and limb disposition. [11]

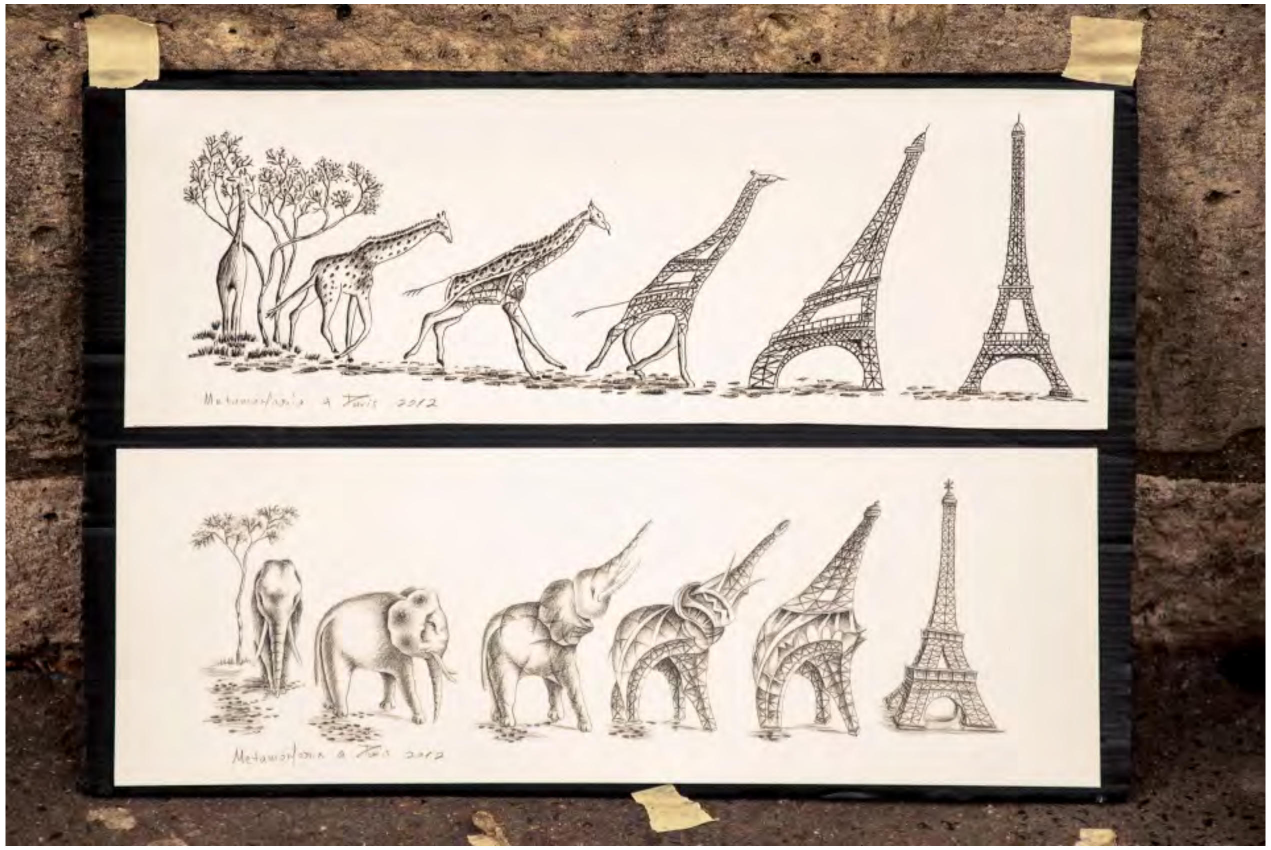

Fig.3: Drawing of the metamorphosis of the Eiffel Tower by a street artist in Paris (2014). [13]

One possible candidate for criterion for visual beauty that might be universally applicable is symmetry. [12] In biological organisms there is a balanced distribution of duplicate body parts or shapes. Obvious deviations from such a balanced distribution have come to be viewed negatively. Obvious asymmetry is by no means associated with positively viewed things such as beauty and order, but rather associated with negatively viewed things such as disorder, malfunction and mutation. The Eiffel Tower is in fact a celebration of symmetry in architecture. The symmetric shape of the Eiffel Tower can, in fact, be seen as a direct result of the Cambrian explosion, since the Eiffel Tower very much resembles a complex organism that would have a body plan from the Cambrian explosion.

The illustration clearly shows the similarities between the Eiffel Tower and a four-legged animal, a quadruped.

The question remains why the Eiffel Tower was constructed to resemble a four-legged animal, when three legs on the Eiffel Tower would have been enough to ensure structural stability and still retain a symmetrical image. There are no known naturally occurring three-legged animals. Most animals seem to require four legs. Animals that are naturally meant to have four legs could have three legs due to mutations or birth abnormalities. Four-legged animals could also become an artificial tripod if they have one limb amputated. Such an appearance remains associated with abnormal (or unnatural) circumstances since there is an unbalanced distribution of the limbs. This could possibly (subconsciously) have driven the builders of the Eiffel Tower to decide it would have four legs. Also, creating a tower with four legs instead of three legs would result in four sides instead of three sides, thus producing more angles from which the symmetrical beauty of the tower could be observed.

Symmetry is a well-known theme in architecture, bilateral symmetry being a particularly common one. [12] It is highly possible that humans have always strived to mirror their own bilaterally symmetrical image within their forms of constructed complexity. Because of the association of symmetry with beauty and order, humans may have strived to reach even more obvious symmetry and precision in their constructed complexity than could be observed in their environment, since symmetry in nature and biology is actually approximate.

For example, plant leaves, while considered symmetric, rarely match up exactly when folded in half. [14] For some species it may have been beneficial to develop slight asymmetries. For example, some fish developed a hugely lopsided jaw that provides distinct feeding advantage. [15] Asymmetries are also common in our species. Humans can be either left handed or right handed, one side of the brain is structured differently to the other, and most people have their heart positioned slightly to the left. [15] When designing and constructing the Eiffel Tower humans seized the opportunity to create an object that is far more obviously symmetric than objects viewed in nature and biology, a marvel of precision so to speak, while not parting ways with a skeletal structure that was already determined in the Cambrian explosion 540 million years ago.

Human History (Monumentality)

There has been an overriding trend of rising complexity in pockets of the universe since the Big Bang. In human history, too, there has been a similar trend in rising complexity in construction. Throughout human history humans have increasingly adjusted their surrounding natural environment and have created increasingly more complex constructions, the Eiffel Tower being one of the most famous monumental complex structures humans have built. In fact, the Eiffel Tower is the most visited paid monument on Earth, welcoming almost 7 million visitors a year, of whom around 75% are foreigners, not French nationals. [16]

But how exactly did humans come to the point that they had the urge to build monumental architectural structures like the Eiffel Tower? Early humans could certainly never have dreamt of building a structure as immensely complex as the Eiffel Tower, but did early humans already imagine or make their own monumental structures?

In early human history new forms of constructed complexity would have emerged from the basic need of shelter. These shelters were fairly simple (and private) and cannot be viewed as monumental structures. However, it is possible that certain religious and social needs in early human history may have stimulated the production of new forms of constructed complexity far more complicated than a hut.

The first found structure humans put together that was bigger and more complicated than a hut is Göbekli Tepe in Turkey. Göbekli Tepe is the world's oldest temple site and was built roughly 12,000 years ago (circa 10,000 B.C.). [17]

Fig.4: The T-shaped pillars on the excavation site Göbekli Tepe (2011). [20]

Göbekli Tepe is a site set on top of a hill with an assemblage of dozens of massive stone pillars arranged into a set of rings, mainly circular and oval-shaped, around two even taller central pillars. [17][18][19] The pillars are limestone pillars shaped like giant capital T's. They are cleanly carved pillars with bas-reliefs of animals such as gazelles, snakes, foxes, scorpions and wild boars. [17] All pillars have heights changing from 3 to 6 meters. Archeologists interpret those T-shapes as stylized human beings or supernatural beings. [18][19] Perhaps these structures, that were quite tall for that time, symbolized the connection between the human and the divine.

It is unknown how early humans and the following generations interpreted the world and their place in it. There must have been a great deal of uncertainty about occurrences that they could not explain to themselves or each other. Occurrences that could not be easily dealt with, such as natural disasters, disease and inevitable death, must have stimulated a desire for an explanation in the form of religion. Religion became an important way of imposing rules and understanding within nomadic bands such as hunter-gatherers.

At the end of the last ice age, the Pleistocene, around 11,700 years ago [21] resources would have become abundant, enabling the nomadic bands to accumulate a surplus of resources. Population growth was a direct result of this surplus of resources. But this surplus would have also enabled early humans to give lavish religious feasts, possibly to worship and appease the 'gods' or 'spirits' that had bestowed these 'gifts' upon them and to secure that this would not be taken from them by these 'spirits'.

There are many ethnographic and archeological records for the holding and managing of feasts. Large amounts of food were needed for this purpose and, of course, beverages, the latter often being alcoholic. [22]

The need to secure food and beverages for these feasts can be seen as a possible reason for the start of the domestication of certain plants and animals and thus the start of the transition to agriculture.

To construct a temple for the holding of feasts, a large amount of manpower was needed. The question remains why so many people were willing to put in the time and effort to create specific places for worship. Why were, for instance, special trees, beautiful open spaces, impressive rock formations or big fires no longer sufficient, and why were temples built? The need to build temples may be connected to certain social needs in growing groups of humans, the need to create or solidify an overlapping identity of different groups of humans.

T-shaped pillars, comparable to the pillars of Göbekli Tepe, have been uncovered or are visible on the surface in various other parts of Turkey, but no excavation work has been carried out there so far. [22] These places seem to form a group of sites belonging to one cult. Groups sharing a common religious culture must have used these sites. Having similar temples, with similar symbols, would have created or solidified a bond or alliance among groups. Together the groups were more certain of further survival. The religious feasts could have been used to obtain positions of social power within the cult or to strengthen the coherence of the cult by reciprocal feasting at the similar temples. Göbekli Tepe supports the theory that the urge to worship, a religious need, may have sparked a rise in constructed complexity. Furthermore, constructing Göbekli Tepe, and other similar temples, may have been a first attempt to form a certain kind of bond among groups of humans. One might say that the Eiffel Tower now serves a similar purpose, welcoming millions of visitors from all over the world.

Göbekli Tepe is the oldest example of monumental architecture. Compared to other structures built roughly 12,000 years ago, these pillars were immensely tall structures and constructing them was a monumental feat. These pillars were made in a time when useful hand tools were hard to come by, and nothing of comparable scale existed in the world. Yet the builders still managed to erect these giant pillars. The Eiffel Tower was a bold new form of constructed complexity in the time it was built. The Eiffel Tower held the title for the tallest human made structure in the world for 41 years, until 1930. [23] It seems as though humans have always been seeking to create monumental structures reaching for the skies, Göbekli Tepe around 12,000 years ago and the Eiffel Tower in 1889.

Humans continued with the domestication of plants and animals and began to practice agriculture and hold animals around 10,000 years ago. [24] Agriculture emerged across the globe in a number of different ways. Eventually this led to the decline of the number of nomadic bands such as hunter-gatherers. Increasingly more humans began to practice agriculture and permanently settle in one place. These agriculturalists became strongly tied to the land they worked and also became more tightly bound to each other than ever before. As a consequence, towns emerged where people lived in larger numbers and closer to each other than in earlier societies. [25]

Between 6,000 and 5,000 years ago the first states evolved. [26] The key to the emergence of states is an agrarian surplus. The surplus ensured that some people in a society did not have to farm, and they began to fill other duties; there was a diversification of labor. The first urban areas emerged between 5,000 and 4,000 years ago, depending on what one would call a city. [27]

The 'architecture of power' was a prominent feature of early state societies. The ziggurats in Mesopotamia and the pyramids in Egypt are both examples of forms of novel monumental architecture in early state societies. These structures are much taller than a structure like Göbekli Tepe, for instance, and, more importantly, they are very strongly connected to social power. One might say that the Eiffel Tower fulfills a similar purpose in Paris. However, the Mesopotamian ziggurats and the Egyptian pyramids were also connected to religion, like Göbekli Tepe. The Eiffel Tower does not fulfill a religious purpose in Paris.

To build all these structures---Göbekli Tepe, the ziggurats, the pyramids and the Eiffel Tower---a great deal of human effort and other sources of power were needed. All this effort and power was used to defy gravity and build bigger and taller structures than had ever been built before.

The Eiffel Tower is a clear example of 'architecture of power' within a society. The tower is still the tallest structure in Paris. The tower can be seen from various points in the city, repeatedly reminding the inhabitants of Paris of the monumental feat that was achieved when this tower was erected.

In the 1920s the tower became a symbol of modernity and new or experimental ideas and methods in art, music or literature. Little by little, the image of the tower was associated with Paris. [28] Now the tower has even become a symbol known globally for both the city of Paris and the State of France.

Globalization & Industrialization

A little more than 500 years ago, a new stage in human history began, namely, the first wave of globalization, which was triggered by Christopher Columbus' transatlantic voyages. [29] Humans began circling the globe, thus unifying major world areas into one single human web. [30] The network of exchange in this human web eventually led to a fundamentally new way of producing constructed complexity, namely, the industrial revolution.

The industrial revolution can also be seen as an instance of a cultural adaptive radiation. Much like the spurt in the development of the complexity of life in the 'Cambrian explosion of life forms', the industrial revolution was a spurt in the development of constructed complexity.

Industrialization emerged in the late 18th and early 19th centuries. Now new forms of constructed complexity could be produced with the aid of machines driven by fossil fuels. [31]

For a long time coal and oil had served as energy sources for burning fires and were used for making utensils out of metal and glass, yet they were not employed as a replacement for human or animal muscle power. [31] Industrialization emerged first in Great Britain where, apparently, 'Goldilocks circumstances' favored this innovation. [32]

Many states in Europe followed the British example, including France. The Eiffel Tower is a great example of the new complex structures that could be built in industrialized societies. Humans now had the possibility to adjust their surroundings to their needs and desires in a way that had not been possible before. But how exactly did the possibilities that the industrial revolution brought lead to the production of a structure as precise and complex as the Eiffel Tower? Or how did the industrial revolution lead to a different degree of precision in constructed complexity?

Since machines, rather than humans and animals, could do a great deal of work, this may have created different expectations. A much higher degree of precision was expected in constructed complexity, as well as a much higher degree of efficiency in construction methods. Many structural parts could be mass-produced and produced far quicker than before. Humans were aiming for far more perfection and far quicker production. Tall constructions could be far more efficiently and swiftly built than ever before.

As mentioned before in this paper, symmetry is a well-known theme in architecture, bilateral symmetry being a particularly common one. [12] And when observing monumental architecture in human history, one may conclude that it seems as though humans have always been seeking to create tall monumental structures that were far more symmetrical and precise than objects in their natural environment. The examples of monumental architecture in this paper---Göbekli Tepe, the Mesopotamian ziggurats and the Egyptian pyramids---all demonstrate symmetry and were all very tall structures at the time they were built. However, the Eiffel Tower is a far more precisely symmetrical structure than the aforementioned monuments and is also far taller. The industrial revolution brought with it unprecedented possibilities in such things as precision, symmetry, order and efficiency. The Eiffel Tower is, in fact, a culmination of these new possibilities and a clear representation of the importance of precision, symmetry, order and efficiency in the industrial revolution.

Why were things such as precision, symmetry, order and efficiency important in industrialized societies? As mentioned before, the industrial revolution was much like a spurt in the development of constructed complexity. There was a rapid increase in things such as production speed, for example. New jobs in factories became available for people in cities. Populations in cities also began to grow rapidly. Simple key words that can be associated with the industrial revolution are 'speed' and 'power'. Life in an industrialized society was far quicker than in other societies and may have felt quite chaotic. This may have been an important reason for having a high degree of precision, symmetry, order and efficiency in constructed complexity. The balance and order in constructed complexity rather contradicted the somewhat quick and chaotic life people were living in industrial societies; the constructed complexity may have been needed to maintain order within the society itself.

It may also have been deemed necessary by people in leadership roles to assert a certain amount of power within industrialized societies. The Eiffel Tower was an unprecedented novel form of 'architecture of power' at the time it was built. The Mesopotamian ziggurats and the Egyptian pyramids were forms of 'architecture of power' that asserted their power in a different way. To build these large structures a great deal of human effort was needed. The Eiffel Tower however, was built with quite a lot of aid of machines. The Eiffel Tower was meant to show what great structures humankind could now produce with the aid of machines or what power humans in industrialized societies now had at their disposal. The ziggurats and the pyramids were very robust. The Eiffel Tower, on the other hand, seems less robust, as one can look through the structure. The Eiffel Tower was meant to show how seemingly light humans could build a large structure that still emitted power.

All this is a result of the fact that humans had different expectations of constructed complexity, since a great deal of work could be done by machines rather than by humans and animals. If the industrial revolution had not occurred, humans would never have raised their expectations to such a high degree, and the Eiffel Tower would not exist, at least not as it is known today.

Gustave Eiffel said that the tower symbolized "not only the art of the modern engineer, but also the century of Industry and Science in which we are living, and for which the way was prepared by the great scientific movement of the eighteenth century and by the French Revolution of 1789, to which this monument will be built as an expression of France's gratitude." [23] One might say that the Eiffel Tower is not only a symbol for Paris and France, but also a symbol for the industrial revolution and the impact it has had on modern societies. The Eiffel Tower reminds us of the first steps that were taken towards making many new forms of constructed complexity with the immense power that humans have been able to unleash from nature with the aid of fossil fuels.

Before the tower was built it was a subject of some controversy, attracting criticism from both those who did not believe that it was feasible and those who objected on artistic grounds. Some of the protestors changed their minds when the tower was built, others remained unconvinced. Today, the tower is widely considered to be a striking piece of structural art.

The Future & Conclusion

The age we live in today, the information age or the digital age, is characterized by information computerization. In this day and age the information industry allows many humans to explore their personalized needs and to communicate or network globally very rapidly. Many humans can now access and share a great deal of information at an unprecedented rate, as well as connect across geographic borders far more swiftly than ever before. What is the function that a landmark like the Eiffel Tower has in such a global network? Or what place does such a landmark hold? As one of the most recognizable landmarks in the world, the Eiffel Tower has become a global icon in the digital age. The Eiffel Tower is widely featured in photographs, films, television shows, music videos and video games. The Eiffel Tower is a way to establish immediately a shot set in Paris. The tower has been replicated in various places on Earth, and it has been overtaken in height by many modern structures, yet it remains a strong and unique symbol as the most visited paid monument on Earth. As mentioned before, the tower welcomes almost 7 million visitors a year, of whom around 75% are foreigners, not French nationals. [16] Many who are not of French nationality seem to, or at least attempt to, establish themselves as true cosmopolitans by visiting this monument, documenting this visit and sharing the experience with the world digitally. In a sense, global landmarks like

the Eiffel Tower have the capacity to connect the many people currently inhabiting Earth, people that now have a very wide variety of cultures and traditions. These people from various cultures all flock to the Eiffel Tower, essentially creating a global society with a shared experience. When approaching the Eiffel Tower for the first time, a visitor is quite often astonished by its size and magnificence. A monumental feat was achieved when the tower was erected, and nothing of its scale had been built before. Mere centuries, or possibly even decades before it came to be, humans could not have imagined the possibility of building a structure as astonishing as the Eiffel Tower. Our species has made great strides in our forms of constructed complexity, often with negative effects for our planet. Humans are currently still heavily dependent on non-renewable fossil fuels. However, it is highly possible that humans will be able to develop new ways of dealing with current problems concerning energy and resource shortages. Much as iron smelting and the industrial revolution brought unprecedented possibilities, the current connected network of potential innovators can also supply the human race with unprecedented possibilities and possible solutions for many globally alarming issues. The Eiffel Tower, in a sense, goes to show what great things people are capable of achieving when they come together and aim for more than had been achieved before. This gives hope for the future of constructed complexity, as well as the future of our species and other lifeforms on this Earth.

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New and Returning

IBHA Members

One of the key purposes of the IBHA is for those of us who are interested in Big History to have a place to associate. It is a place to learn of other members' Big History activities and thoughts. So we are delighted to welcome new members to the IBHA – and by the vote of confidence and recognition of the value of our association by those who have renewed their membership within the past month. It is a pleasure to have each of you with us.

Fenna Blomsma	**Alex Holowicki**
Richard Blundell	**Jeremy Lent**
Samuel Carlos	**Marg Paulussen**
Bea Heres Diddens	**Andrea Prescott**
Duane Elgin	**D. Blake Ross**
Tony Harper	**Ken Solis**
Ian Hesketh	**David White**
Kyle Herman	**Barbara Winkler**
Jess Hollenback	

IBHA Members are from:

Australia	Hong Kong	Norway
Austria	India	Peru
Bahrain	Ireland	Russia
Brazil	Italy	Serbia
Canada	Japan	South Korea
Chile	Korea	Spain
China	Netherlands	United Kingdom
France	Nicaragua	United States
Germany		


Third IBHA Conference
July 14 - 17, 2016
Amsterdam

INTERNATIONAL BIG HISTORY ASSOCIATION CONFERENCE

July 14-17, 2016

The University of Amsterdam

The Netherlands

Building Big History: Research and Teaching

> The International Big History Association (IBHA) defines its purpose as "to promote, support and sponsor the diffusion and improvement of the academic and scholarly knowledge of the scientific field of endeavor commonly known as "Big History" by means of teaching and research and to engage in activities related thereto."
>
> Article 2 of the IBHA Articles of Incorporation.

The theme for the 2016 conference is "Building Big History: Research and Teaching." The conference seeks to present the latest and the best in Big History research and teaching, while creating a forum for the articulation and discussion of questions that are central to Big History. Among the topics that are to be addressed at the conference through a series of panels, roundtables, and discussions, are: Approaches to Big History; Big History research agenda; Scholarship contributing to Big History; Big History teaching at universities, secondary, and primary schools: achievements and challenges; Little Big Histories; Reactions to Big History.

All presenters at the conference must be members of IBHA. Presenters may become members at www.ibhanet.org and will need to do so prior to registration for the conference.

The IBHA Conference will convene on premises of the University of Amsterdam, The Netherlands, located in the center of this beautiful European city. Attendees will have the option of selecting from one of several hotels in Amsterdam and the surrounding area with whom special conference arrangements have been made.

For all things Amsterdam, you can go to http://www.iamsterdam.com/en/. For a complete guide to the Netherlands and its many attractions, you can visit http://www.holland.com/us/tourism.htm. If you have more time to explore the larger area, similar websites exist for nearby Belgium, France, Germany, and Great Britain. Please find more details on the conference at www.ibhanet.org. We very much hope that you can join us at the 3rd IBHA conference.

Program Committee: Jonathan Markley (chair), Cynthia Brown, David Christian, Lowell Gustafson, Andrey Korotayev, Esther Quaedackers, Fred Spier, Sun Yue.

The conference will take place at the Oudemanhuispoort (Old Man's Home Gate). Part of it was built, as the name implies, as a home for poor old people in the early 17th century. In the late 19th century the University of Amsterdam started to use the building. Around that the same time book traders also moved into the little shops that line the main hallway of the building. The book traders are still there. Fred Spier started teaching a Big History course in Oudemanhuispoort 20 years ago. It ran there for 10 years.

Oudemanhuispoort (Old Man's Home Gate)

We have retained two hotels – IBIS Amsterdam Centre Stopera within a 15 minute walk to the University of Amsterdam, and the Volkshotel (https://www.volkshotel.nl/, use code "IBHA" for discounted rate) within a 15 minute metro ride to the University. The two hotels are totally different types of hotels; Check the great reviews of these hotels on tripadvisor (http://www.tripadvisor.com/). Please start planning to join us in Amsterdam in July of 2016!

For more information, please contact Donna Tew at tewd@gvsu.edu. IBHA Office Coordinator.

Before and / or after the conference

Since you'll be in one of the world's great cities for the IBHA conference, you'll want to take advantage of its museums, quirky festivals, theatre, live music, laid-back bars and delightful restaurants. A few of the most popular museums are located together on Museumplein, such as the Rijksmuseum, Van Gogh Museum and Stedelijk Museum. Equally unmissable are the Anne Frank House, Hermitage Amsterdam, EYE Filmmuseum and Foam.

You may wish to take a canal boat tour of the city. With its sense of style, Amsterdam inspires shopping. You'll want to enjoy the city's cuisine and nightlife.

What a great location for our conference!

Rijksmuseum

Big History (and the IBHA Conference) at the University of Amsterdam

The next and third **IBHA conference will be held from July 14th to July 17th 2016 at the University of Amsterdam**.

The University of Amsterdam has a long history. It was founded as the Atheneum Illustre in 1632, during the Dutch Golden Age. The prosperous city of Amsterdam wanted and needed a university to educate its citizens about the riches of the world. Yet the central government did not allow it to have one, since a university had already been established in nearby Leiden in 1575, possibly as a reward for that city's successful resistance against the Spanish. Amsterdam, however, was not discouraged and simply established an educational institution under a different name. It subsequently hired a number of internationally renowned scientists and scholars and started teaching from the Agnietenkapel, a former nunnery. This chapel, which currently houses the university museum, is right around the corner from the IBHA conference location.

The university's slightly anarchistic nature never quite disappeared. After almost 400 years and numerous upheavals, some of which led to major university reforms, the institution still identifies with its somewhat rebellious roots. Even today, one of its three core values is a form of determination, described on the university's website as "inherent to any Amsterdam citizen who looks at the world from an independent, critical and self conscious perspective. University of Amsterdam researchers, teachers and students are competent rebels who, boldly yet responsibly, choose their own paths and set trends."

Partly because of its history and identity, the University of Amsterdam was one of the first in the world to adopt the groundbreaking and unconventional approach to history that was being pioneered by David Christian at Macquarie University in Sydney in the early 1990s. After visiting David in 1992, University of Amsterdam professor Johan Goudsblom brought the syllabus of the big history course that was being taught in Sydney home and decided to set up a similar course at his own university. He did so together with his former Ph.D. student Fred Spier, who after Goudsblom's retirement in 1997 became the course's main organizer.

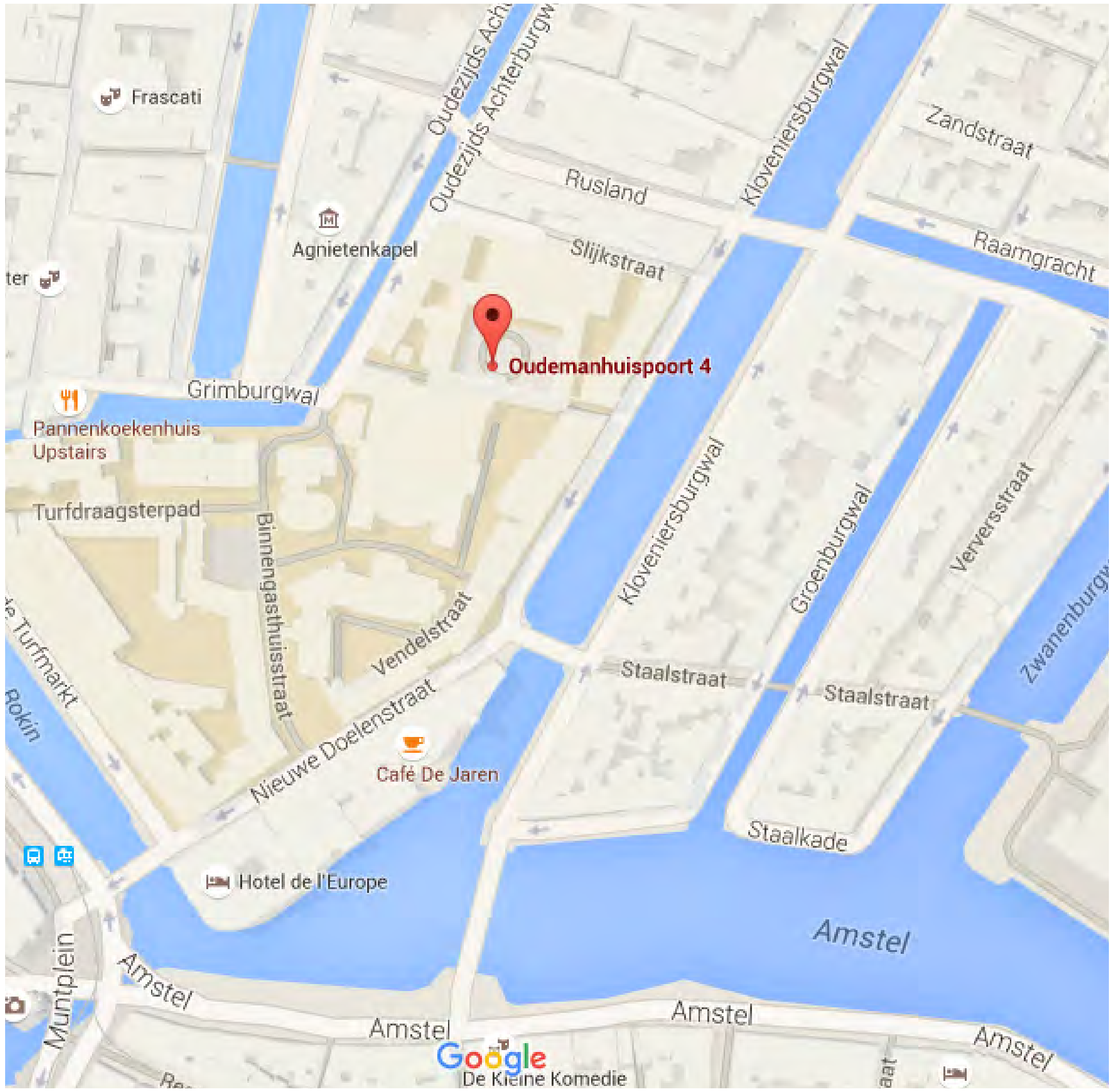
The new course proved to be a big success. About 200 students attended its first run and hundreds of students have registered for the course each year ever since. Within the university, the course's success occasionally led to some resistance, mainly from faculty members who deemed the big history approach to be too broad. But thanks to student engagement and the strong support of a number of the university's most prominent scientists a semi-permanent position in big history was created for Fred Spier in 1997 and was turned into a permanent position in 2006.

Meanwhile, new big history courses, aimed at slightly different student populations, were established both within the University of Amsterdam and outside the university. The university started to function as a kind of big history course contractor, which in turn made it possible for the university to develop into a regional big history hub. The university's latest efforts to create a big history MOOC that will be published on Coursera in early 2016 (alongside Macquarie's big history MOOC that will be published on the same platform in the upcoming months) neatly fits into this pattern.

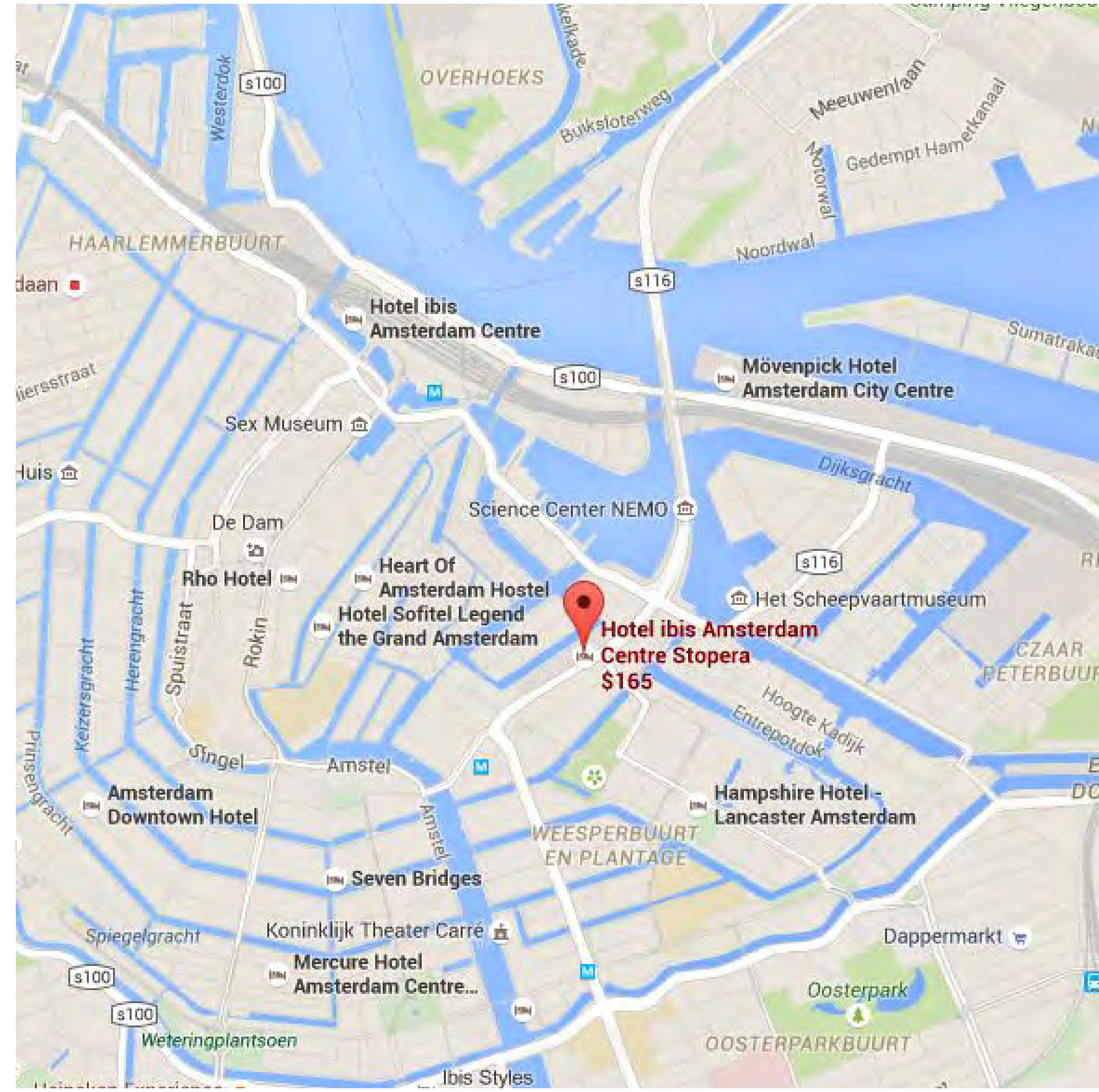
All of these developments have led to the creation of another permanent position in big history in August 2015, which will be filled by Esther Quaedackers. These developments have also enabled the University of Amsterdam offer to host the 2016 IBHA conference. This offer has been accepted by the IBHA, which, given the university's dedication to big history, deemed it to be a suitable place to hold its first conference outside of the US.

For more information on the history of big history at the UvA, you can also read Fred Spier's [The Small History of the Big History Course at the University of Amsterdam] that appeared in World History Connected in May 2005.

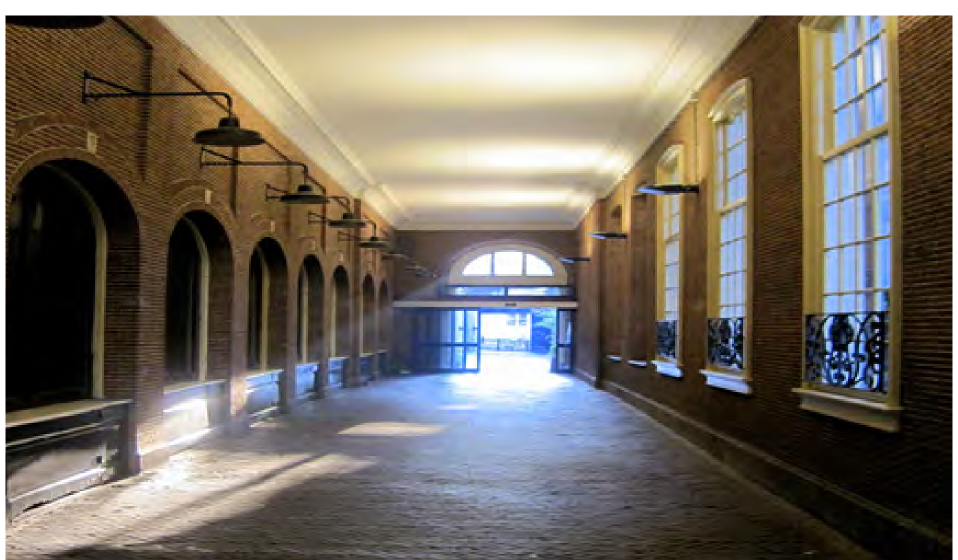
The Agnietenkapel
(source: Wikimedia Commons)



Location of Conference: Oudemanhuispoort 4-6, 1012 EZ Amsterdam



Hotel ibis Amsterdam Centre Stopera, Valkenburgerstraat



Volkshotel, Wibautstraat 150, 1091 GR Amsterdam

Candidates for IBHA Board of Directors

The members of the IBHA Board of Directors hold staggered three year terms. Each year, a few seats become open. This year, four seats become open. Since the IBHA was founded, there have been a number of Board members who have cycled off the Board, a number of new people who have joined it, and a number who have stayed on. In the interest of serving the purpose of the IBHA while fostering both continuity and change, the IBHA selects Board candidates in two ways:

(1) the existing Board proposes a list of names; and
(2) IBHA members may identify additional names

As a result of this process, the candidates for IBHA board are listed below, each with brief statements. An electronic election for new Board members will begin on June 1, 2016, and end on June 30, 2016. The new Board will be announced in July. We welcome your active engagement in this important process.

Barry Rodrigue is an archaeologist, geographer and historian. His technique of telescoping local, regional, global and universal studies into a unified context made him an early advocate of micro/macro studies. A founder of the International Big History Association (IBHA), he serves on its Board of Directors as International Coordinator. He is also a founding member of the Eurasian Center for Megahistory & System Forecasting (Russian Academy of Sciences), in which he is a research professor, as well as of the Asian Big History Association. He organized the big history sessions at the 2011 WHA conference in Beijing, the 2012 Global Futures 2045 conference in Moscow, and the 2015 International Congress of Historical Sciences in Jinan. He serves on the board of the Network of Global & World History Organizations as an IBHA representative. His latest production is the three-volume collection, From Big Bang to Galactic Civilizations: A Big History Anthology, which includes articles by 100 scholars from 25 nations.

John Mears, a member of the history faculty at Southern Methodist University for forty-nine years, is retiring this spring as professor emeritus. A specialist in early modern Europe, he received his undergraduate education at the University of Minnesota and his Ph.D. from the University of Chicago. He began to study what we now call big history in the 1980s after he joined the World History Association, ultimately serving as the association's president. His scholarly work increasingly involved giving conference papers as well as publishing article and essays that placed topics of persistent concern within the framework of cosmic evolution. He is currently writing what has become a two-volume work tentatively entitled TO BE HUMAN: A PERSPECTIVE ON OUR COMMON HISTORY in which he sets forth an interpretation of the human experience viewed as an integral dimension of the epic of evolution. As a member of the IBHA board, he would hope to encourage the elaboration of interdisciplinary approaches that would tighten connections between the natural sciences and humanities.

Lucy B. Laffitte: My education and experience are detailed in my nomination announcement so I thought I would share here what shaped my journey to Big History here. My intellectual north star aligned early on with big thinkers like Rachel Carson (the narrative of ecosystems), David Attenborough (the narrative of evolution) and Carl Sagan (the narrative of the cosmos). I sought to build a bedrock understanding of "natural history" as an undergrad—taking astronomy, geology of the solar system, physical geography, paleontology, evolution, biogeography, ecology, climatology, and meteorology. Bolstering this with a PhD in environmental history, environmental decision-making, and institutional systems thinking, I came away curious about the relationships between ecosystems, human institutions, and the status of human dignity. When my practice as a science educator introduced me to the work of Chaisson, and then Christian, Spier, and Brown, I felt a jolt, knowing I'd found an intellectual home. I would be honored to contribute my services to an organization that supports the growing group of scholars, teachers, writers, and researchers who fuse scientific evidence and the arrow of time into narratives that edify the socio-ecological system that is now planet Earth.

Andrey Korotayev: My original research interests were in Ancient Yemen and general theory of social evolution. When I first heard about the Big History idea in the mid-1990s, this idea appeared very attractive for me immediately, as it implied the possibility to find some meaningful patterns that could be relevant for a few types of evolution. In 2000s together with Alexander Markov and Leonid Grinin I have undertake a few attempts to identify patterns that are common for the biological and social phases of the Big History and to demonstrate that they could be described with similar mathematical models. Finally, I hope to contribute to a general theory of universal evolution that could serve as a sound theoretical basis for the Big History. With respect to the IBHA activities I hope to contribute to the integration of a rather substantial Eurasian Big History community into the global community of the big historians. l also hope to contribute to the publication activities of IBHA - first of all to the publication of scholarship from the forthcoming Amsterdam IBHA conference and additional research by Big Historians. I promise to contribute to this as much effort as possible.

Lowell Gustafson: I have appreciated being secretary and vice-president of the IBHA, as well as editor of *Origins*. It has been a great intellectual adventure to learn from so many of the brilliant people who have developed this new field — and such a pleasure to see how students from preschool to graduate school, academics, professionals, retirees, and citizens of nations from around the world share a passion for exploring the evidence based narrative of the entire known past. My modest contributions include chapters such as "From Particles to Politics," "Big Politics," web publications such as "Nature and the Imagination," academic papers such as "Science, the Deep Past, and the Political," and other publications and presentations. I am a professor of political science at Villanova University in Pennsylvania, USA, with a PhD in Government and Foreign Affairs from the University of Virginia. Goals that I share with others include developing an IBHA academic journal that will publish scholarly articles about Big History, inviting more people to particpate in the IBHA, and to watch how the field of Big History develops.

Big History is all about learning from a constantly changing world

Rozelle Laha, Hindustan Times, New Delhi | Updated: Apr 08, 2016 15:48 IST

Big History explores the evolution of humans, goes back even further than the extinction of the dinosaurs to understand the appearance of life on earth and lot more. (Shutterstock)

There are exciting Big History activities underway in South Asia, and especially India . . .

From the creation of the universe to the release of the latest smartphone - that's what Big History, an emerging field of study, is all about. It links knowledge across all subjects into a single coherent story to enable us to understand the history of our universe, our planet, and us. The subject explores the evolution of humans, goes back even further than the extinction of the dinosaurs to understand the appearance of life on earth, the creation of the chemical elements, the birth of stars and the appearance of our universe in the Big Bang. Hooked and want to learn more? Macquarie University, Australia, where the term Big History was coined by historian David Christian, is launching The Big History: Connecting Knowledge, as a massive open online course.

Prof Andrew McKenna, director, Big History Institute at the university says the subject "will enable Indian students to think critically and innovatively to solve problems in fundamentally new ways."

Why should a student study Big History?

In a world where innovation and change are constant, the teaching strategy of Big History is to enable students to make sense of the complexity of the modern world. India is undergoing massive and rapid change. It is important to be able to place that in context for India and the rest of humanity. No individual subject enables you to see the whole picture. Big History by contrast connects knowledge and gives students a framework to think about the big challenges of the 21st century.

It's all about innovation

Students get to connect knowledge and think innovatively. They are taught about the four claim testers, which are authority, evidence, logic or intuition. Through these testers students can identify the basis on which they accept or reject a claim of knowledge. For instance, the claim that the Himalayan mountain range has been formed by the collision of the Indian plate and the Eurasian plate is based on the theory of plate tectonics, and students of Big History will be able to identify whether they accept or reject that claim of knowledge based upon one or more of the 'testers' This visible critical thinking process is very powerful.

Big History concept of collective learning is itself a foundational concept of innovation. What separates humans from other species is that each generation of humans learns more based on the advances of previous generations. Collective learning helps explain why network hubs like cities are so important for innovation – more people means more ideas and more innovations. For instance, in the 1830s and 1840s India was one of the most lucrative markets in the world for ice – ships would deliver frozen blocks of ice from the northeastern United States to Mumbai and Kolkata. This trade ceased following the invention and development of refrigeration, but refrigeration could not be invented until science had worked out that changing the volume or pressure of a gas (air) impacted the temperature of the gas (air). So, innovation is a process of ideas building upon each other.

Is the subject relevant for Indian students?

Big History is hugely relevant for Indian students. This capacity is in strong demand in companies and organisations across the world. Big History does not replace other subjects or specialisations, rather it complements, so that graduates are able to work more effectively in teams and to appreciate the many dimensions of the problems the organisation must solve. Real-world problems do not come neatly packaged into particular disciplines – they are complex, complicated and connected. Big History provides students with multi-domain knowledge, cross-disciplinary critical thinking, and innovative synthesis and problem solving skills required to meet the complex challenges of today's world.

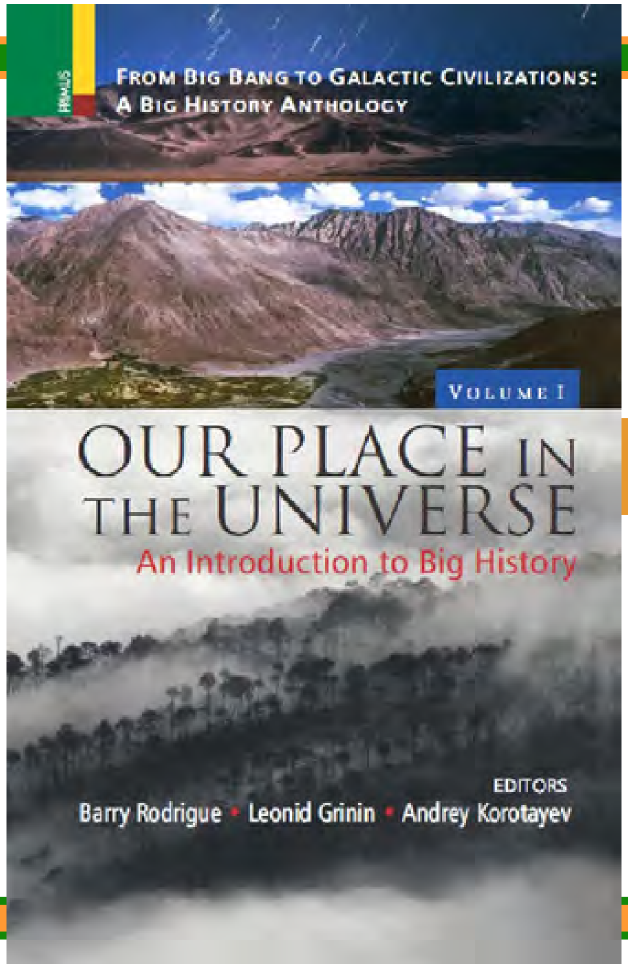
The Big History MOOC course on Coursera. Who should do it and why?
The course is suitable for Class 11 and 12 students and adult independent learners. It's free but a certificate costs 69 AU$ (approx Rs 3,473). Certified learners willing to do an undergraduate course in any subject at the university can apply for Macquarie University Big History International Student Undergraduate Scholarship that covers tuition fees which, depending on the programme of study, will be up to 50,000 AU$ (approx Rs 2,516,574) per year for an undergraduate degree of 3-4 years duration.

From Big Bang to Galactic Civilizations: A Big History Anthology, Volume I
Our Place in the Universe
An Introduction to Big History
Edited by Barry Rodrigue, Leonid Grinin and Andrey Korotayev

has recently been published by Primus Books, an imprint of Ratna Sagar P. Ltd., Virat Bhawan, Mukherjee Nagar Commercial Complex, Delhi 110009. India.

Volumes II and III are forthcoming.

In his role as International Coordinator of the IBHA, Barry Rodrigue has also been instirumental in fostering the Indian Big History Network.



Arizona State University announces partnership with Big History

ASU announced a partnership with the Big History Project, established by Bill Gates to bring a multi-disciplinary approach to history to learners around the world.

As ASU begins to turn its attention to course delivery at scale, developing the capability to grade writing at new levels has become increasingly important. Writing is a critical tool in helping students succeed, both as a study in itself, and as a way to assess students' understanding in other subjects. However with the current system relying on expert human graders, incorporating writing assignments in digitally scaled courses is a significant challenge. Download Full Image

Researchers from ASU's University Academic Success Programs, funded by the partnership announced today, will work with the bgC3 Big History team to provide consistent, high-quality writing feedback for tens of thousands of Big History essays over the 2016-2017 school year. The data produced by this exercise will be used to accelerate ASU's investigation of next-generation grading approaches, including those based on machine learning driven by natural language processing.

The Big History project is already working with thousands of teachers to expose students to David Christian's unique approach to teaching the history of humanity in the context of the evolution of the universe. BHP hopes the ASU grading service will help encourage more teachers to adopt Big History as part of their curriculum by making it easier for teachers to give their students high-quality feedback on major writing assignments.

"Our mission is to find ways to more effectively use writing assignments in Internet-scale courses," said Adrian Sannier, Chief Academic Technology Officer for EdPlus at ASU. "We want to make it easier for teachers to incorporate opportunities for students to write as part of their coursework by providing more scalable support for writing evaluation"

ASU and the Big History Project announced the venture at the ASU GSV Education Innovation Summit, the annual event where education and technology converge in the spirit of innovation and where the BHP founder, Bill Gates is a keynote speaker this year.

ASU's EdPlus anticipates that this program could be used to enrich course assessments in its own large-scale courses, including the Global Freshman Academy, which has had more than 120,000 students since its launch in fall 2015.

For more information or media inquiry, please contact Carrie Lingenfelter by emailing Carrie.Lingenfelter@asu.edu.

World History Conference
July 2 - 5, 2016 in Ghent, Belgium

Craig Benjamin, current Treasurer of the IBHA and outgoing President of the World History Association, wants to remind members of the IBHA that the World History Association will hold its 25th annual conference in Ghent, Belgium from July 2-5, 2016, ten days before the IBHA Amsterdam Conference. The WHA conference will be held in Het Pand (right), the historic cultural center of Ghent University. Het Pand is an old Dominican monastery located in the heart of the city on the banks of the river Leie, near the medieval port. If any IBHA members planning on attending and presenting at Amsterdam are also interested in attending and perhaps presenting at the WHA Conference in Ghent, please contact Craig Benjamin who can assist in organizing designated Big History panels. Craig's email is: benjamic@gvsu.edu

Ghent canal, Graslei and Korenlei streets, Ghent, Belgium

2016

IBHA Post-Conference Tour

A TASTE OF EUROPE

JULY 18–27, 2016

International Big History Association

Craig Benjamin, pioneering Big Historian and tour lecturer, on the Jungfraujoch.

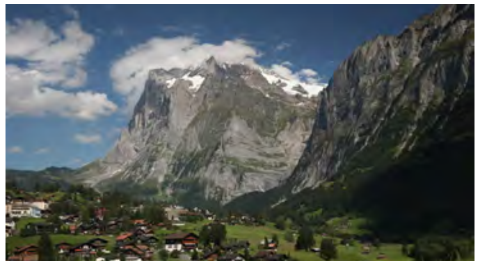
10 DAYS

Jump into world history and scientific discovery in Five European Countries

From First World War battlefields in Belgium and Paleolithic cave art in France to world-class wine vineyards in Germany and thematic lectures provided by leading historians, this tour has it all. Discover distinct style, substance and science in the cultural capital of Paris, among the magnificent *chateaux* in the Loire Valley and in the center of particle physics research at CERN. You'll absorb the best of history and beauty on this fascinating tour through five European countries.

Overview

A TASTE OF EUROPE


Let us handle the details

- Expert Tour Director
- Local cuisine
- Handpicked hotels
- Sightseeing with local guides
- Private transportation
- Personalized flight options

Your tour includes

- 9 nights in handpicked hotels
- Breakfast daily, 4 three-course dinners with beer or wine
- Multilingual Tour Director
- Private deluxe motor coach
- Guided sightseeing and select entrance fees

Your tour highlights

- World-class museums and beautiful gardens in Paris
- Magnificent architecture and rich history at Château de Chenonceau
- Stunning replicas of Paleolithic art in the Lascaux II Cave
- Sweeping, mountainous landscapes in Auvergne
- Impressive scientific technology at CERN, the European Organization for Nuclear Research
- Medieval castle views in the UNESCO-recognized Rhine River Valley
- Daily lectures by leading historians

Where you'll go

OVERNIGHT STAYS

2 nights • Paris
2 nights • Dordogne Region
1 night • Geneva
2 nights • Grindelwald
2 nights • Heidelberg

Price is on a sliding scale for 20-40 travelers - $3439-$3139.

Tour Notes

By tour lecturer Craig Benjamin

One of the highlights of the IBHA Post-Conference tour will undoubtedly be our two days in southwestern France, where we will visit Lascaux II and the National Prehistoric Museum at Eyzies-de-Tayac. The region is famous for its Paleolithic cave paintings, particularly those of the UNESCO World Heritage Site of Lascaux, which are estimated to be 17,300 years old. The caves themselves are products of the erosion of the sedimentary karst and limestone basin of the Vezere River, before it joins the Dordogne River. The Lascaux valley is located some distance away from the major concentration of decorated caves and inhabited sites, which are further downstream. Near the village of Eyzies-de-Tayac there are in fact 37 decorated caves and shelters, all dating to the Upper Paleolithic Era.

The entrance to Lascaux Cave was discovered on September 12, 1940 by 18-year-old Marcel Ravidat. He later returned with three friends, and after entering the cave via a long shaft they discovered that the walls were covered with depictions of animals. The cave complex was opened to the public in 1948, but by 1955, the carbon dioxide, heat and humidity produced by 1,200 visitors per day had damaged the paintings and introduced lichen onto the walls. The cave was closed to the public in 1963; the paintings were then restored to their original state and were monitored daily.

In 1988 the cave was beset with a fungus, blamed on a new air conditioning system, and in 2008 the cave was infected with black mold which scientists are still trying to keep away from the paintings. Today only a few experts are allowed to work inside the cave for a couple days a month, but the efforts to remove the mold have taken a toll, leaving dark patches and damaging the pigments on the walls. In 1983 the French government opened Lascaux II, a replica of the art work in the Great Hall of the Bulls and the Painted Gallery. Lascaux II is located 200 meters away from the original, which means that visitors like us can view the paintings without further damaging the originals.

The original Lascaux cave contains nearly 2,000 figures, including animals, human figures, and abstract signs. The paintings contain no images of the surrounding landscape or the vegetation of the period. Most of the images were painted onto the walls using mineral pigments, although a few were also incised

into the stone. Over 900 images can be identified as animals, and 605 of these have been precisely identified. There are 364 paintings of horses, 90 paintings of stags, and aurochs, bison, seven felines, a bird, a bear, a rhinoceros, and a single human are also depicted. The most famous section, which is reproduced in Lascaux II, is The Great Hall of the Bulls where aurochs, horses and stags are depicted. The four black aurochs, which appear to be in motion, are the dominant figures; one is 17 feet long, the largest animal discovered so far in cave art.

Many theories have been advanced to try and explain why the images were painted: that they represent past hunting successes, or some sort of ritual to improve future hunting; that they depict myths in which dangerous animals play a prominent role; or that they are simply realistic representations of the real life and environment of these animals, which humans interacted with on a regular basis. Whatever their original purpose, they demonstrate the very sophisticated level of art that had been achieved by humans in the Upper Paleolithic, and offer an astonishing window into the world of our stone age ancestors.

Australian soldiers at the Somme, July 1916.
Courtesy: The Australian War Memorial

The day that we pass through southern Belgium and northern France and visit the Flanders Fields Museum and Menin Gate – July 18th - marks the one hundredth anniversary of the final day of one of the bitterest campaigns of the First World War, the Battle of the Somme. The Battle took place on both sides of the Somme River between the 1st and 18th of July, as British and French troops tried to dislodge the German army from its entrenched positions. At the cost of one million men killed or wounded, this ranks as one of the bloodiest battles in all world history.

The casualty rate was exacerbated by the fact that the Battle of the Somme marked an important stage in the industrialization of warfare, in that both aircraft and tanks played a decisive role. This is precisely the sort of critical relationship between science and human history that big history attempts to highlight.

My grandfather Eric Benjamin served on the Western Front as part of the Australian Imperial Forces, and although he (fortunately!) arrived too late to participate in the Battle of the Somme. I look forward to sharing with you all some of the entries from the meticulous diaries he kept of his experiences one hundred years ago in this part of Europe as a soldier in the First World War.

Those of you attending the IBHA conference before the tour might also enjoy attending a panel that I will be participating in with my colleagues Jonathan White and Gordon Olson, who with his wife Christine will be a member of the tour party. The panel, 'Big History and the Great War', specifically explores these sorts of connections between geography, science, technology and human agency.

Now let's turn to a topic that is much more pleasant: the city of Paris, where we will spend a full day and two evenings. Although Paris is known as 'The City of Light', both because of its leading role in the French Enlightenment, and more literally because Paris was one of the first European cities to adopt gas street lighting, the history of Paris has been just as strongly influenced by geography as it has by ideas or street lights.

The city of Paris occupies a small portion of the great Anglo-Paris Basin that includes much of northern France, the English Channel, and parts of southern England. During the Eocene Era, sedimentary processes laid down extensive gypsum deposits on the Right (North) Bank of the Seine, and limestone, chalk, clays and sand on the Left Bank, materials that later proved vital in physically building the city. Paris also sits in a favorable fluvial position just downstream of the Seine-Marne confluence, and upstream of the confluence with the Oise. These naturally occurring fluvial intersections are one of the features that made the site so attractive to early settlers.

The settlement that would become Paris also formed around two natural islands in the Seine, the Ile de la Cité and Ile St. Louis. Today, the 50 acres of these islands are home to many magnificent sacred and secular buildings, such as Notre-Dame, Sainte-Chapelle and the Palais de Justice, and just across on the right bank, the Hôtel de Ville, that were constructed using some of the materials deposited during the Eocene.

If we had visited these island 2300 years ago we would have found ourselves in the fortified settlement of the Parisii, a sub-tribe of the Celtic Senones, who took up residence on the south bank of the Seine in the mid-third century BCE. The Parisii were great traders and had commercial relationships with towns as far south as the Iberian Peninsula, even minting their own coins to facilitate this. The fact that an ancient north-south trade route also crossed the Seine via the Ile de la Cité made this an even more strategic choice for their settlement

All that changed in the Year 53 BCE when Roman legions under the command of Julius Caesar conquered the Paris basin, displaced the Parisii, and constructed a garrison camp on the Ile de la Cite. During the centuries of Roman control that followed they extended their settlement in a more permanent way to Paris's Left Bank, making good use of the available natural resources, particularly limestone and water. The Gallo-Roman town was still known as Lutetia, although its full name was Lutetia Parisiorum, 'Lutetia of the Parisii'. It became a prosperous city with a forum, baths, temples, theatres, and an amphitheater. By the time the Western Roman Empire disintegrated in the fifth century CE, the town was known simply as Parisius in Latin and Paris in French. We will certainly be thinking about the role of geography as we stroll the streets of these two stunning islands and the beautiful Latin Quarter, where the layout of the Roman settlement can still be discerned.

Please note that there are still some spaces available on this wonderful tour, so if you have any friends or colleagues who might be interested in joining us, have them contact Donna @ **tewd@gvsu.edu**.

Roman City of Lutetia Parisiorum, 3rd Century CE, which was located in the Latin Quarter on the Left Bank of the Seine today. Note Roman limestone quarries lower right, between amphitheater and river; and Ile de La Cite upper right.

Courtesy: Written-in-stone-seen-through-my-lens.blogspot.com/2014