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A Short History of Fire

by Dana Visalli

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We tend to think of fire as a force that destroys life, but in fact the opposite is true. Strange to say, fire is in fact a creation of life, and fire is necessary for life on land to flourish. Think about it: for the first four billion years of the history of the earth, there was no such thing as fire (that is, the burning of organic materials; super-heated rocks turn to magma but they just get hot, they do not burn up) because there was no life on land.

It was necessary to pass through two major evolutionary thresholds before fire could come into being on earth. First, fire requires oxygen, and the early atmosphere of the earth contained no oxygen whatsoever. Oxygen is a highly reactive element that readily combines with other elements to form compounds that are then removed from the atmosphere. The only reason that air is currently 21% oxygen is that photosynthetic organisms constantly pump it into the atmosphere as a by-product of photosynthesis.

The other necessary threshold to reach was the colonization of land by plants. There can be no fire without dry organic material to burn, and prior to 450 million years ago plants did not exist. In the Silurian Period, 450 to 410 million years ago (see the "Geology & Biology of the Methow" chart to get oriented to the geologic timescale), a few species of green algae slowly evolved into organisms that did not need to be regularly immersed in water — and thereby became the first plants. The rest is history, as they say, and a fiery history it is.

The earliest plants appeared 450 million years ago, but they were too small and dispersed to carry fire. The first evidence of widespread fire appears in the Devonian Period, 410 million years ago, in the form of fossilized charcoal, called fusain. The atmosphere at that time was about 13% oxygen. With the appearance of the first forests during the Carboniferous Period 350 million years ago, and a sharp rise in atmospheric oxygen concentration to 30%, fire became commonplace. The Carboniferous coal seams contain 10 to 20% fusain. If our atmosphere today was 30% oxygen we would not have to blow on our campfires to get them to burn; in fact it would almost impossible to put fires out.

Insects reached gargantuan sizes during the Carboniferous Period because of the high oxygen content; there were for example dragonflies with two foot wide wingspans. Insects do not have the ability to pump oxygen into lungs or through their bodies, it simply diffuses, so the higher concentrations allowed for more effective diffusion and larger sizes.

But why did atmospheric oxygen reach such a high level of 30%, only to fall back to 21% in our own time? The cause is not known for sure, but one theory is that plants had only recently evolved the capacity to produce lignin — the complex hydrocarbon

A fossilized dragonfly from the Carboniferous Period 350 million years ago. Some had wingspans of two feet—the largest insects that ever lived.

that we call 'wood.' Today carbon cycles from the atmosphere, through animals and plants and back into the atmosphere, a nearly closed system in which the amount stays nearly constant. During the Carboniferous Period vast quantities of organic matter was sequestered in the earth as coal — which is a hydrocarbon (carbon plus hydrogen). Removing organic matter from the biosphere reduced the amount of carbon and carbon dioxide (carbon and oxygen) in circulation, and thereby increased the amount of pure oxygen. This occurred in part because no organisms had yet evolved that could decompose the newly invented, complex structure of wood.

Earth is an open system for energy — it flows in from the sun on a daily basis. But it is a closed system for elements and nutrients — they were all present at the formation of the earth 4.5 billion years ago, and no more are being delivered from space. Plants are made up of about 45% carbon, while the earth consists of only 0.07% carbon. If plant material weren't recycled life would soon run out of carbon and grind to a halt. Thus the sequestration of vast amounts of carbon in the earth as coal could not continue indefinitely without diminishing the vitality of the biosphere. In wet environments specific fungi and bacteria evolved the capacity to break down lignin and return the carbon and other nutrients bound up in its structure back into the soil. In dry habitats fungi and bacteria cannot function, and fire does the job.

What is fire? Basically it is the electrons of hydrocarbons being drawn electromagnetically away from the carbon and towards oxygen. Oxygen acts as a powerful positively charged magnet in the chemical world. Positive poles of magnets attracted electrons, which are negatively charged. It just so happens that the hydrocarbons created by plants have an abundance of electrons that are not very firmly bound into place. Thus what life on earth has managed to create is a battery of sorts, with a positive charge in the sky (the oxygen) and a source of negative electrons on the ground.

A marriage of these two electrical charges is inevitable: we call the result fire. When oxygen saturates the atmosphere and hydrocarbon fuels encrust the land's surface, they can and will interact when conditions are right. From this perspective fire is a creation of life and could not exist without it. Remarkably the ultimate source of this battery is the energy coming from the sun, which powers photosynthesis on earth even though it is 93 million miles away.

When oxygen and hydrocarbons react (when they 'burn'), electrons are transferred from the organic material to the oxygen and the chemistry is rearranged; instead of oxygen in the sky and cellulose and wood on the ground (the hydrocarbons), there is now water (which is of course hydrogen and oxygen, H_2O) and carbon dioxide (CO_2). Other elements critical to life that were tied up in the plant matter such as nitrogen, phosphorus and potassium either fall as ash onto the ground (thus enriching the soil) or go up in smoke.

The shrub-steppe burning on Balky Hill in the Methow and recycling carbon and phosphorus on July 19th, 2014.

Why does the transfer of hydrogen and its electrons to oxygen result in the release of energy? It has to do with how far away from the nucleus the electrons in question are orbiting. When electrons move from a more distant orbital to an orbital closer to the nucleus, they give off energy and become less energetic themselves, and that is in fact the fate of electrons when they are transferred from a hydrocarbon to oxygen. In the case of fire this release of energy is experienced as heat, and lots of it.

Fires are born, age and die. Once born they browse through landscapes in search of food, for wildfire does not remain where it originates. In nature there is no visible hand to stoke flames with new fuel and fan them with fresh oxygen, so burning is spasmodic, and even the most eruptive fires will not long persist. Heat, fuel and oxygen describe the zone of combustion, and terrain, weather and fuels prescribe the behavior of the combustion zone. At each altered instant it burns differently — grass, brush trees, wind, moisture, topography.

Lodgepole pine is 'dying to burn.' It is a short-lived species for a tree, and big, stand-replacement fires result in a new, young lodgepole forests.

The fact that once lit a fire can easily burn through thousands of acres tells us that organic matter is never far from combustion and conflagration. Why doesn't the world's organic matter just burn up and get it over with? Organic matter exists on a thin edge between moist life and fiery death. Fire requires the presence of three physical factors simultaneously: dry fuel, abundant oxygen and ignition. The first two factors are present on an annual basis in most global ecosystems, either as the dry season in the tropics, or as the heat of summer at higher latitudes. But fires rarely combust spontaneously; a source of ignition is needed. For most of the 400 million years that fire has existed, the primary source of ignition has been lightening. On a global scale, lightening hits the earth on average over two million times per day, so ignition is widely available when other conditions are right.

Because the origin of fire is tied to the origin of plants, the two have co-evolved together. Fire will only burn under certain conditions, and all plants have some strategy to survive on a fire planet — even if it is only to avoid fire by growing in wet habitats. Conifers — our pines, firs, cedars and junipers — first appeared on the planet 300 million years ago, and have co-evolved with fire ever since. Mature sequoias, for example, have bark up to three feet thick, and the first branches can be 100 feet above the ground. Our more demur ponderosa pine has bark six inches thick and first branches are frequently 50 feet high. Such species can easily survive low-intensity fires; sequoias live for 2000 years and ponderosas for up to 700 years. But the seeds of both require sunlight and mineral soil to germinate — conditions that exist after a fire.

A mature coniferous forest contains on the order of 500 tons of organic matter per acre, which needs to be cycled back to the soil and atmosphere before rejuvenating new life can appear. Fire does the job.

150 million years ago another new group of plants first appeared on earth—flowers. Their rapid spread across the planet and radiation into hundreds of thousands of species (there are only 700 species of conifers, while there are over 250,000 species of flowering plants) is due in part to their co-evolution with fire. Most of the early flowering plants on the planet and many of them today are relatively diminutive annuals or

Young lodgepole pine regenerating after a stand replacement fire. Some lodgepole cones only open after heating to 125° Fahrenheit.

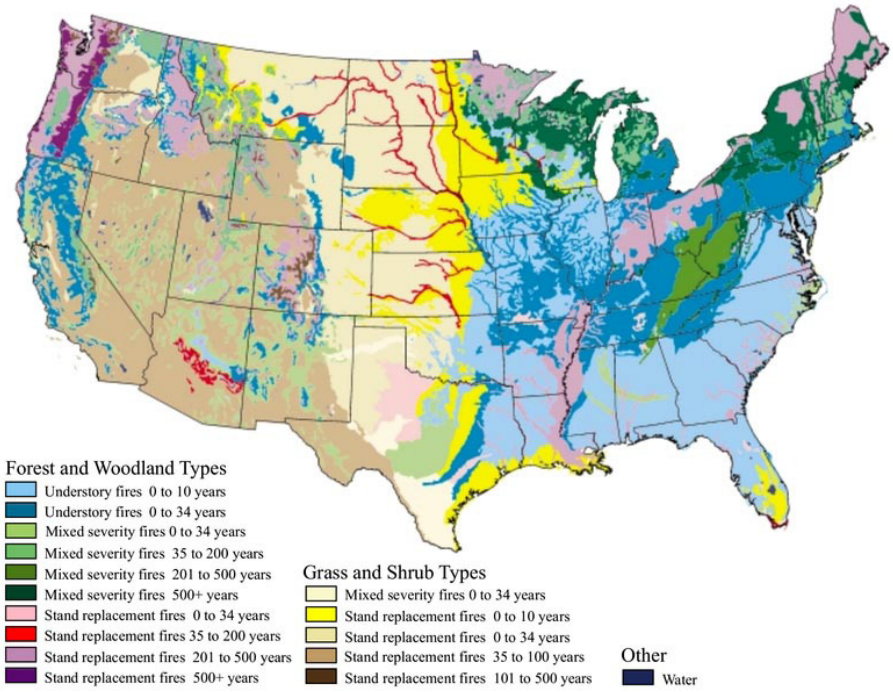
perennials that are well adapted to habitat disturbance and set seed abundantly on an annual basis. We call some of these plants "weeds," in fact warnings are being expressed that there will be an explosion of "weeds" in the Methow next year due to this year's extensive fires. Why? Because many weeds and other flowering plants are well adapted to fire.

Moreover, flowering plants are not only adapted to fire, they promote it. The most frequent fires and the largest fires on the planet are in ecosystems dominated by flowering plants—shrubs, herbs and grasses. Indeed their intense co-evolution with fire may be the answer to the mystery of how stubby little flowering plants managed to replace towering conifers over much of the earth's surface at low and mid-latitudes.

Grasses are among the most recent of the flowering plants to evolve, and it is speculated that landscapes are not simply aflame because they are grassy but are grassy because they are so often aflame. With its fine, dry texture and dense growth habit, grass encourages fire—and reappears immediately afterwards. By burning through flashy fuels fires can propagate more quickly than through woods; they move with the winds and can reach staggering dimensions, burning six million acres and more in a single fire. In one local example of how fast fire can travel, is reported that on July 17th of this year the Carlton Complex fire traveled through shrub-steppe at a rate of three acres a second.

For 400 million years after the appearance of fire on land, oxygen and fuel were always available, but fire had to await ignition. Then in the most revolutionary event since flames appeared in the Devonian, an animal acquired the capacity to manipulate fire directly — the genus *Homo*. The human species, *Homo sapiens*, is 300,000 years old, but it appears that a prior hominid, *Homo erectus*, first learned how to control fire, perhaps as much as 1.5 million years ago. A unique fire planet had evolved a unique fiery creature.

It is thought that the rise of *Homo erectus* from its less complex ancestors was driven by the ability to use fire,



Fire regimes or periods in the United States. Note every location expects fire.

and in particular the new ability to cook food. Heating adds value to raw bio-mass; it makes eating easier and more efficient and can amplify nutritional value. It renders foodstuffs more digestable, it detoxifies foods of many harmful chemicals and kills off disease-bearers and parasites.

With less need to break down biomass mechanically and chemically, humans have, compared to other primates, downsized jaws, stomach and intestines. We have smaller teeth since fire has already done the preliminary mastication. We have tinier stomachs and intestines since fire has begun the biochemical breakdown of fiber and meat. We not longer need a massively muscular skull or a gargantuan digestive tract. Our head can become big and our gut small. We now process verbage rather than herbage.
The relationship between humans and fire is deeply unequal. Remove fire, and humanity will soon wither away. Remove people, and fire will adapt and reestablish its own stable regime. With or without people fire will endure.

Further Reading:
Fire, Nature and Culture by Stephen Pyne

"A Burning Story: The Role of Fire in the History of Life" by Pausas & Keeley

"Fire and the Spread of Flowering Plants" by Bond & Scott

Comparison of chimpanzee (top) and homo erectus (bottom) skulls.

Note the change in the size of the jaws and braincases.

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A Path to the Big History Community

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When I get into a vehicle, I would rather do anything than just drive. One of my more productive habits behind the wheel is listening to books and lectures on CD. Over the years, I have earned at least one unofficial B.A.'s worth of study, and by far the most exciting item in my eclectic curriculum was David Christian's *Big History* lectures, produced by The Learning Company. I checked these out from my local library and listened to them avidly as I commuted to work at Seacrest Country Day School in Naples, Florida, where I teach high school history and middle school Latin.

At first I thought these brilliant talks would only strengthen my grasp of the outline of world history, elevating my perspective from about 30,000 feet to the altitude of the International Space Station. But the view was far grander than that, and I began my 2011 World History course with some of the temporal and spatial scales so memorably framed by Dr. Christian. It was only a two-week unit, but it really helped my students understand the relative brevity of *H. sapiens* and our self-image as the apex of Nature.

I spent the summer of 2011 musing about the endlessly exciting connections to be discovered in the field of cosmic evolution. As I entered my final week of vacation-time planning for my history courses, I did a web search of 'Big History,' just to see what resources might be out there. To my great delight, my first hit was The Big History Project, https://school.bighistoryproject.com/bhplive, with its invitation to join the second wave of pilot schools offering the course to ninth graders. I was amazed to watch Bill Gates's introductory video on that site: he learned of the course the way I did, and I share his opinion that it is the most important class I never had in school.

During the first week of faculty meetings, I asked my good friend, Dr. John Fuller (physics, astronomy), if he would like to co-teach Big History at Seacrest. Without hesitation, he assented, and I pitched the course to my administration. We contacted Andy Cook, who is coordinating the project for Mr. Gates, and proposed that we would teach it as a year-long elective course for juniors and seniors. In our view, it would be a valuable opportunity for our students to synthesize what they have learned in their traditional science, history, math, and language classes, taking this integrated knowledge in grand narrative form to their colleges and universities. Mr. Cook and his staff agreed; we became a pilot school; and John and I received first-rate training in BH pedagogy at conferences in Kirkland, Washington, and in Long Island.

We are now in our third year of teaching the course. Although I have broken my book budget and overloaded our course website with articles on everything from 'Anthropocene' to 'World Languages,' it has been a great delight to teach and learn along with our young Big Historians. My hope is that Big History will be a permanent part of the Seacrest curriculum – and that of every private and public school in the U.S. The rapidly proliferating challenges facing our kids today demand an education based on *universal* perspectives of emerging complexity.

John Fuller (left) Bill Hammond (right) at Seacrest Country Day School

Big History, World History, and Opera: Is There a Connection?

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The main problem of our modern culture is that it presents a carefully calculated grab for power and profit as an inevitable natural process. Today we call this process globalization. It has the profit-based economy at its core, and we are expected to accept global financial capitalism as a natural way of doing things. That is what the dominant ideology does. It is presented to us as an inevitable, natural state of affairs. One of the reasons why I became disenchanted with World History and moved toward Big History is that World History is uncritically dominated by the implicit glorification of globalization. Just look at any World History textbook currently in circulation, and you will see that its main organizing principle is globalization. Now, it is true that some authors are critical of the globalization that we are currently experiencing, but all textbooks see it as an inevitable fact, a force of nature.

We are repeatedly told that globalization is the defining characteristic of the society that we live in. World History took it upon itself to trace globalization's development back from the first moment when human race left its African homeland. After being firmly established as a force of nature, globalization is then dragged through World History as the main organizing principle of the various chapters of the great majority of the textbooks. Genghis Khan is seen as a globalizer, as is Prophet Muhammad, Christopher Columbus, Alexander the Great, Admiral Zheng He, and the inevitable Ibn Battuta. Poor Ibn Battuta could now cynically be described as a medieval equivalent of an innocent American tourist visiting local McDonald's establishments in every corner of the Islamic world. I used to love Ibn Battuta, but the more I read about him in the textbooks, the more he looks to me like Rick Steve, the popularizer of safe international travel for American suburbanites. Often the entire medieval history, once criticized for being hopelessly isolated and insular, is retold as the history of globalization, with missionaries and crusaders playing the role of globalizers. The present definitely shapes the past, and this is a serious danger for conscientious historians. Unfortunately, World History has become an instrument of the dominant ideology. I have hopes that this might change with Big History.

The way in which Big History deals with globalization will determine if it represents a step beyond World History or something else. If it follows the path of World History---making history about balancing the percentages between European, East Asian, South Asian, Middle Eastern, African, and American history---then Big History does not have a bright future, at least in my opinion. If it goes directly about historicizing the current structures of thinking, explaining to us how we came to think the way we do, then I believe it has a brighter future.

There is a personal aspect to my argument. I am European, and European history has not been in the good graces of World History. World History sought a more global balance, and that was a positive development. However, modern profit-driven capitalism is a system originating in Europe (and in what we call the West), and a picture of world history that does not explain the social and cultural reality in which we live presents a false picture to the world. The culture in which we live is the main source of our illusions, which make us get history wrong. In other words, we see the world through the lenses of Western style profit-driven capitalism, and we need to be aware of it.

Let me use opera here, something that I personally like, to give you an idea of how globalization could be understood on the micro-level on a particular cultural tradition. Opera is an European phenomenon. It is not evenly distributed around various continents and thus, according to many authors of World History, it is not relevant in a global world. To be even more local, opera is really an Italian thing because it was invented in Italy. Italian composers, singers, musicians dominated the world of opera from the first opera composer, Claudio Monteverdi (1567-1643), let us say, until the death of Giacomo Puccini (1858-1924).

I was born in Europe, and opera is a part of my heritage. In my 20s I worked as an extra in the Serbian National Opera in Belgrade. This low-paying college job allowed me to see opera inside and out. For three years I attended and participated in pretty much every performance of a major European opera house. I also took part in the rehearsals and saw how opera was made. Ever since, for 30 years now, I am passionate about opera. I've been to opera houses in Italy, Greece, Germany, Spain, the United Kingdom, Russia, and all over the United States, from Sarasota, Florida, to Detroit, Michigan, and everywhere I find people who share a similar passion. Since opera is important to me personally, I wonder why it is not popular in the modern globalizing society.

Opera also has a reputation of being a genre of art for the elite, for the snobbish and the rich, the class that is largely responsible for European imperialism and colonialism. How accurate is this statement? Let me tell you a story as a way of answering this question. This year, as I was getting ready to travel to the Lincoln Center, Renee Fleming was getting ready to become the first opera singer to sing at the Super Bowl. Opera for the aristocrats and football for ordinary Joe and Jane, right? I should be aware that the passion for opera is not universal, right? Let me answer this by saying that taste in music is a very tricky thing.

Our culture proudly asserts the freedom to choose in accordance with our own personal preferences. Some

2014 Summer Opera Rigoletto La Donna e Mobile and the Quartet Performance
Alexander Mirkovic
https://www.youtube.com/watch?v=jRSyvuwAtFA&index=4&list=UUqKNKiQFIfE5toLI23SnHVw

people like popular music presented during the half-time breaks at the Super bowl, while others like opera. To each its own. These claims not withstanding, I think that taste, including taste in music, is not just a matter of personal choice as it might seem on a first glance. Taste is a social construction masquerading as a personal choice. We were already told this by Pierre Bourdieu. This is not to say that we don't have a choice at all. You can choose to like more the bubbly music of Jessica Simpson, or a bit darker version of the same thing sung by her dark haired sister, Ashley Simson. Some people call that a choice. I would not go that far. It is, however, true that the proverbial system (that is, global profit-driven consumer capitalism) wants you to make certain choices, and it does everything in its power to make those choices seem natural and voluntary.

Opera is one of those things that the system does not want you to choose. The system wants you to believe that the majority of people simply prefer Beyoncé over Renee Fleming, and popular music over opera. Thus, for the solemn occasion of the singing of the national anthem, Renee Fleming is called on to give it an aura of aristocratic high-class dignity, but for the half-time of the game, when everyone has already had a couple of beers, people want to see Beyoncé's hips shaking.

I believe that common sense is deceiving us here. We are presented with the widely held view that popular music is for the people, whereas opera is for the elites, because such a view is very profitable for the music industry. Today's capitalistic system wants us to consume music, not to make and enjoy music on our own. They want us to watch Beyoncé's hips shaking on the screen, not to stand up and shake our own hips. The music industry wants us to buy music, not to play music. That is why they are marketing electronic devices that play music and not those that make music. All the forms of music that are predominantly about making music, such as musicals, orchestral, choral, or opera music, are purposefully labeled as elitist, and gradually squeezed out of the market.

This is what globalization and the dominant ideology of profit-driven capitalism have done to music, to opera in particular. It has made us accept as a given the claim that opera is the pretentious music for the aristocracy while Katy Perry is an unassuming musician for the freedom-loving masses. In fact quite the opposite is true. Katy Perry, much like many other music starlets of our time, is a creature made in the laboratories of the wealthy elite. Musicians who make opera today are mostly working class, that is to say, very poor. They dress in tuxedos and elegant gowns, but that overdressing of classical musicians further underlines their systemic poverty.

The difference between opera and popular globalized music today is not in quality, as many aficionados of opera and classical music believe. I don't think that Placido Domingo is a better musician than Carly Rae Jepsen, the girl responsible for the ear-worm, "Call Me, Maybe." Both of them are good at what they do; they just do different things. The problem is of a different kind. In the era of globalization we are not encouraged to make music; we are encouraged to consume music. The forces of globalization are successfully trying to convince you that you cannot make music. It's too complicated; give it up. It's easier to consume it. They even managed to convince Peter Gelb, the general manager of the Metropolitan Opera, that the future of opera is in HD broadcasting. This system broadcasts Met performances to hundreds of cinemas all over the country, thus reducing the need of local communities to have their own opera. The message is simple----you get better quality by simply consuming. Just don't make your own music. Why even try to make your own opera, which will not be as good as the Met's production? To get top quality, go to your local cinema and watch Met in HD, directly broadcasted to you from the stage of the Metropolitan Opera in New York. They just forgot to tell you that in the process you also become, not a participant, but a consumer.

A long time ago E. P. Thomson used to say that working class identity was shaped by sport clubs, in the cloakrooms, and on the bleachers. On the other hand, in the nineteenth century the bourgeois identity was expressed through the visits of the well-dressed privileged classes to the Opera House. Things have changed since the days when sport clubs were the bastions of the working class and opera houses the strongholds of the bourgeoisie. The bourgeoisie today

does not find the Paris Opera House as glamorous as in the times of the Third French Republic, and Wall Street magnates do not come to the Met as often as they did in the time when governor John D. Rockefeller built the Lincoln Center. We are living in times when opera is no longer high art of the well-to-do. In order to enjoy the privilege of seeing and being seen in the blasé Metropolitan Opera hallways, I recently paid for my bourgeois experience $96. At the same time I was visiting the Metropolitan Opera, the Super Bowl tickets were being sold on Times Square for $1000 and more, while the major corporations of New York City rushed to give generous sponsorships that amounted to billions of dollars. E. P. Thomson could not have predicted that corporate America would have taken to heart his message of working class pride and, during the last half-a-century, invested heavily in the expunging of working class consciousness from sporting events. The current NFL commissioner made about $44 million last year, while the general manager of the Metropolitan Opera about $1.3 million. For us ordinary working class mortals both amounts are in the realm of fantasy, but a good mathematician would have noticed that NFL managers are paid 40 times better than opera managers. The bourgeoisie now forges its consciousness in sport clubs, where the money is, and no longer in the opera.

One of the other things that Big History does for me, which World History did not or could not do, is to raise the issue of the future. When we interpret the past, we build a trajectory through time that will lead us into a possible future. Many historians are not aware of this fact and stick with the traditional ideal that history is not about the future. Because the future was taboo for historians, we were trained to ignore the fact that every historical interpretation is a comprehensive hermeneutics of past, present, and future taken together. The present does not stop the social and cultural forces that make the trajectory of time, but it carries them on into the future. Big history has opened up the possibility of thinking about the future and encourages us to think that the future might surprise us. For the first time since the dissolution of the Marxist ideology in the 1980s, I see historians talking again about the future and being willing to guess what it is going to look like. Thinking about the future requires us to look at the present and past critically, and to question the dominant ideological narrative. The assumption of the ideology of globalization is that it is the only truth today, and also that it will continue to exist in the future. It wants us to believe that the future is going to be like the present, just a little better. In other words, thinking about the future makes us think about the present in a deeper and more meaningful way. Thinking about the future makes us question whether the world of sustained positive economic growth based on profit-driven capitalism and an inexhaustible supply of fossil fuel will be the future in which our grandchildren will live.

Since Big History is at least in part about predicting the future, let me also make a prediction here. A society that is encouraged only to consume and not to produce cannot sustain itself. The same applies to music. Opera will make a comeback when we decide to make music, when we start enjoying a performance art that is best seen live, when we decide to be one of the people in the audience cheering, clapping, and booing over what two hundred live protagonists do on the stage, when we cease to consume music either on YouTube, or on the TV, radio, iPods, tablets, or over the live HD transmission and actually start making music, like the previous generations did. This will happen when your community, no matter how small and musically ignorant it might be right now, decides that it wants to make music on its own, and not just buy music. Therefore, switch off your radio, shut down the TV, turn off the Internet, and make some music. Start singing, terrorize your family members with the sound of your own husky voice singing "The Impossible Dream." You have a right to do that, because that is the future! If somebody objects to it, respond by saying that you want to make this society into a nation of producers and not just consumers.

This state of affairs that consumer culture presents to us is the result of a process that could be described as the dumbing-down by capitalism, or to be precise, the dumbing-down of our culture by the consumer-centered, free-market ideology. As with everything repressive in our society today, it is done with scientific, that is, economic, justification. The economic system that we are experiencing now

extended the free-market ideology beyond the so-called "science" of economics into culture. During the culture wars that have been fought since the 70s, the ruling elites have not wanted culture to be exempt from the ideological market rules applied to any other consumer good. Culture, after all, and especially music, could be a very profitable enterprise. Thus, many cultural activities that were in fashion before the advent of consumer capitalism, suddenly went out-of-fashion, supposedly because they could not survive the ideologically motivated cost and benefit analysis. Opera is not alone in being victimized by consumer capitalism, but it can serve as a poster child of an ideological struggle against the arts. The purpose of this dumbing-down is actually not to make us stupid, but to increase the profit. The decline in quality is just related to the increase in sales, and selling cheap music for mass consumption is simply more profitable than making music, especially good music. Today we are told, "it's the economy, stupid!" The problem is that we are never offered more than one way of "doing" the economy, where we can choose whether we really want to make music or to consume music.

Therefore, let us do the economy of opera. The largest opera house in the world, the Metropolitan Opera in New York, seats about 3800. For every performance the Met has to pay several hundreds of people--- about 100 or so members of the orchestra, 100 or so members of the chorus, a dozen of expensive world-class soloists, and an army of stage workers, costume shop workers, and such. Even though it has daily opera performances, the Met's profit margin is slim. Compare this to Lady Gaga, who can easily fill 20,000 seats at Madison Square Garden, while the average price of tickets for her concerts far exceeds the Met averages. One of the most profitable artists today, Beyoncé, sells an average ticket for $342.67 for her performances in large, globally uniform, arenas holding over 20,000 people. Remember that more than a third of 3800 seats at the Metropolitan Opera are priced under $100. Plus, the tendency is for the Met opera ticket prices to go down, since Peter Gelb, the current general manager is determined to decrease the ticket prices in order to entice younger, less musically educated people to attend the opera. It's ironic that the Met's general manager does not see that members of that young musically uneducated audience are often willing to pay $342.67 on average for a Beyoncé concert ticket. I think that the young musically uneducated audience needs education, but not in the complexity of the opera scores, but in the ideological nature of the free market capitalism.

In other words, we are led to believe that opera, and many other things in the area of fine and performing arts, is simply not profitable enough today in the era of consumer-driven capitalism. One recent article argues that opera is outdated because it fails to move with the times. That's why it has lost its audience. It doesn't relate to anyone, only to a cultured elite that fails to see this.[1] We are led to believe that older art forms cannot survive the market competition, because their audiences do not follow the spirit of the times. Recently New York Times announced that even in its homeland, Italy, opera is a dying art. Under pressure from the European Union to keep its state budget balanced, Italy has slashed the funding for the arts, including funding for hundreds of Italian opera houses. Only large corporatized opera houses, such as La Scala in Milan, or La Fenice in Venice, which can count on business sponsorship and large donations, can survive. The small town opera houses, built by hundreds of small urban communities all over Italy in the last four centuries, are doomed to an ignominious economic death unless the local community steps up and pays the bill.

One is tempted to say that opera is simply too complicated for modern capitalism based on instant-gratification, but this is not so. It is a matter of priorities. Do we want to spend money on making music, or do we want to spend money on purchasing music? It's not that there is no money in music today. Young musically uneducated teenagers are willing to spend hundreds of dollars for downloading music over iTunes, and the music industry wants them to keep doing that. But music sold over electronic media has to be cheap and additive in order to increase the profit margin. Anyone who says something that might awaken contemporary music consumers to the truth that they are being bamboozled must be discredited quickly. That is why people like me are being called "those who do not keep up with the times." I, for one,

am very proud not to move with the times, because moving with the times often means accepting the dominant ideology lock, stock and barrel. I actually keep up with what is going on with music today fairly well. However, I don't want to follow where consumer capitalism is taking music and by the same token where the dominant ideology was taking World History. I am sure you have heard these stories about the death of opera and the waning of the classical music many times, but have you ever considered that this story is false? I mean false in a sense that it presents something that is ideologically driven as something natural and inevitable.

The same advice also should apply to Big History. It should focus especially on those aspects that our culture takes as natural and inevitable and historicize them. It should show us how we came to have those beliefs. My annual pilgrimage to the Metropolitan Opera at the Lincoln Center is usually the high point of my year for two reasons. It is in part about my being European. I love walking down the streets of New York and, more importantly, I love opera, a decisively European thing. With a passion of an addict, I travel to New York and get my fix of opera. The thrill of the live performance gets me every time. Opera takes a moment in the life of its characters---a first glance of lovers, a man dying for a foolish mistake, a women fooled by the promises of a treacherous lover---and turns that single moment into a melody that expounds the whole complexity of human emotions. The unrestrained emotionality of the music represents the microcosm that is our mind hidden behind the façade of sociability. Some operas I have heard hundreds of times, yet every new performance is still a fresh experience, making it possible to hear how that particular set of singers, conductors, and orchestra members will interpret the same work. In the upper tiers of the Metropolitan Opera I find similar people who share similar ecstasies year after year.

Has it ever occurred to you that you can actually make opera on your own, in your own community, instead of passively just consuming it through the HD broadcasting system? Isn't opera just too difficult for an ordinary person? Actually the history of opera indicates the opposite to be true. Opera was always drawing on the repertoire of popular melodies. Opera tunes were widely sung in the era before consumer music. Even though the origins of opera were in Renaissance Florence, where the educated and the elitist Medici circles wanted to revive the ancient Greek drama, one should remember that Greek drama was a spectacle for the people and that opera follows the same tradition. That's why Athenian classical theaters were able to seat almost the full number of citizenry of the city; the same applies for many opera houses all over Europe. Second, not long after its "reinvention" in Renaissance Florence, opera became a popular alternative to highbrow church music. Church-centered oratorio is, historically speaking, the binary opposite of opera, because in most Catholic cities, such as in Rome, performing operas was prohibited during Lent. Many comic Italian bel canto operas are full of insider jokes about how opera houses are not visited by respectable people. Throughout its history, up until recently, opera was often scolded as being a lower form of entertainment. Giuseppe Verdi, the most popular opera composer in history, still struggles to be accepted by music critics as a respected composer in the classical tradition.

I want you to click on these links not because I want you to consume the music that I made, but because I want you to make music on your own, and some among you will choose opera. Question the accepted common sense because opera is not given, but it is fought for. Now that's a free choice!

O Soave Fanciulla from La Boheme

Rigoletto La Donna e Mobile and the Quartet Performance

(Endnote)

1 http://www.theguardian.com/music/2014/jun/06/new-york-met-opera-house-edge-precipice

How We Wrote *Teaching Big History*

Richard B. Simon
Dominican University of California

When Lowell Gustafson kindly asked me to write a piece on how the Big History faculty at Dominican University of California worked together across the disciplines to write our new book *Teaching Big History*, it took me a while to understand how to respond. That's partly because we have had the good fortune to be able to take such collaboration for granted. Cynthia Brown, our "resident Big Historian", has often pronounced herself amazed at what we have done collectively to build the first university program on Earth to require that all first year students study Big History. This level of collaboration among university faculty, she says, is rare. It shouldn't be. We hope that our book may serve as an example of how to do what we have done.

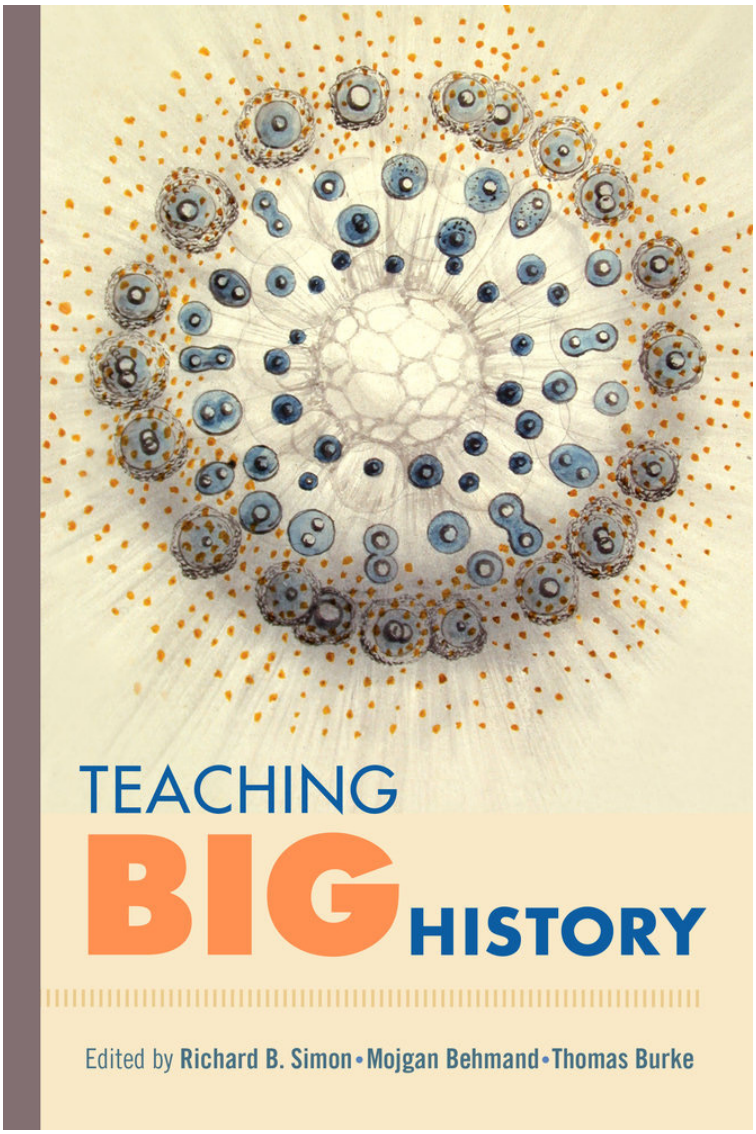
The writing of the book has been its own process, but it starts with the character of our Big History program itself, and that emanates from the people in the program – the individuals who make up our faculty – and from its leadership. From the beginning, Mojgan Behmand, who as the director of the First Year Experience and of General Education became the founding director of FYE Big History, led our large group to innovate and to find consensus in thoughtful discourse and debate. Faculty were invited to opt in. While some have cycled in and out of teaching duty, those of us who have remained close to the project have done so because we have found our experience in Big History transformative. We believe in it. We share the vision that this is where general education must go next.

The conspirators

Two years in, Mojgan realized that because we had been working so intensively and collectively with a large group of sharp and dedicated thinkers – about thirty faculty each year, in a rotating cast, teaching about ten sections of Big History or Big History "Through the Lens" of a specific discipline each semester – we had made some advances in Big History-specific pedagogy that might be of use to others, even perhaps to those who had been teaching Big History in other formats.

She got that twinkle in her eye that usually precedes a lot of work.

"We should write a book," she said.



Mojgan, Thomas Burke, and I began to think about how such a book might work, and what should be in it. As English teachers, we have a lot of experience leading student writers to deadline. That's what we do.

Because I had spent ten years editing my own little corner within a national music magazine and had spent some time getting writers to contribute work on journalistic deadline, I jumped into the role of editor-in-chief.

Mojgan attained resources and made sure that the book remained aligned with a curriculum that was evolving and adapting as assessment information came in, faculty from different disciplines came on board, new "lens" courses came online, and our pedagogical approach took shape through field trial.

Tom was the voice of reason and grace, sometimes in cases where Mojgan and I might have wanted to move in different directions. When we were editing his work, Tom would say "I don't have any ego about this." His example was invaluable for our collaboration. He also made clear sense of the many learning activities that we include – a formidable task.

As for the writing, our colleagues, again, were invited to opt in. In some cases, we solicited particular pieces. But we allowed everyone to write to their own interests while using structural techniques to ensure that the larger work held together coherently.

The book's structure

Popular book-length arguments, which we often use as texts in English composition classes, tend to follow the structure of basic argument. The ones that are the most resonant are grounded in storytelling. That's because the human brain responds to story. That approach seemed a good fit for writing a book about Big History, which is itself a metanarrative about structure, yet in which we were also laying out a case for what should be done, and why, and how.

I initially thought the book should follow the structure of the Big History story. I asked Cynthia Brown to write a Little Big History of Big History itself. And I asked philosopher of religion Philip Novak, who, with Cynthia and biologist Jim Cunningham, had pioneered teaching Big History at Dominican, to write a Little Big History of Big History at Dominican. Phil, characteristically, both honored and interrogated the Little Big History structure, and ultimately crafted an origin story.

Those two pieces were the Big Bang.

I began to think deeply on and sketch out structures and outlines for the book. We three editors would meet and I would propose an outline, and Mojgan and Tom would weigh in with much better ideas – and so we refined the book's structure in the same way that we have revised our program – through discourse, debate, and consensus.

Because we had embraced the Thresholds of Complexity model advanced by David Christian, Cynthia Brown, and Craig Benjamin, and drawing on the work of Eric Chaisson and Fred Spier, our program used the thresholds as units. So, it made sense that, as we laid out our pedagogy, we would begin with a chapter on complexity, then follow the thresholds, revisiting complexity at each step, which we felt was essential. From there, we asked our colleagues to volunteer to write on a particular threshold that was of interest. In our annual summer institutes, we were presenting on different parts of the story or approaches to teaching it, and some of our faculty had developed sub-expertise – often closely related to their home disciplines. So, we sometimes asked individual colleagues to write where they had particular strengths or inspiration, and could provide the most insight.

We also asked our colleagues to contribute write-ups of the hands-on learning activities that we had been developing individually and collectively. Some were developed for our Big History survey course, others for a Big History studio art class, or a Big History creative writing class, or a Big History business class. And so the book took on art projects, storytelling exercises, and even a stock-trading game. Those activities have been field tested with students and refined.

Essential to this, again, was that Thomas Burke developed a template into which the contributor would write a description of her or his activity, like a lab report – ensuring that the activity can be readily reproduced in any classroom.

Likewise, the chapters on teaching the thresholds follow a common logical and structural template – or the book would not have worked. We use parallel structure to ensure clarity and maintain the book's coherence.

Because the "Practical Pedagogy" section of the book follows the structure of the Big History story, it has become, itself, a Big History account. Like all Big History accounts, it bears the imprint of its teller and its intended audience. In this case, the metanarrative is told from the point of view of teachers in classrooms, seeking the most effective way to share it with students. And what we have tried to do is to distill, for each threshold, the essentials that should be covered in the classroom in a unit on that threshold.

In each chapter, we tell a story. We lay out key concepts in that threshold. We explain how complexity manifests in that threshold, and include a flowchart for visualizing energy flows therein. We propose student learning outcomes and assessments for those outcomes that can be brought directly into a syllabus or course outline. We lay out and address challenges we have found in teaching each threshold. And we include detailed, tightly-organized lesson plans for activities that can be brought directly into the classroom. In a few cases, that includes handouts that can be photocopied or adapted.

Because there's no fixed content for teaching "the" future, our chapter on teaching the future presents several different approaches to what we think of as "possible futures" – including key concepts, and pondering with students what a Threshold Nine might look like, based on the larger unfolding patterns in the story. In this chapter, we speak in the many voices of our faculty. They don't necessarily all agree! It's a discussion. It feels like one of our summer institutes. The writers are thinking, building on one another's ideas, and innovating.

That has always been a distinct element of our program: many voices, gathered around the table, contributing, arguing, hashing it out, learning from each other, and arriving at solutions to pedagogical problems. We kept the distinct voices of our colleagues in mind in the joyously grueling weeks in which we editors wrestled with our razor-sharp UC Press copy editor. We were careful to maintain each colleague's distinct voice as a teacher and as a storyteller, even as we worked to maintain structural coherence throughout the text.

Eventually, the larger book took on the structure of our program. Part One is about how we built a Big History program as a response to the demands of a liberal education in the twenty-first century. We also include a look at how Big History is taught in the Netherlands and Korea, as well as the Big History Project. Part Two is our Practical Pedagogy; it begins with a chapter on teaching complexity, which frames the threshold chapters. It goes on to include chapters on using reflective writing in the Big History classroom, and on working with campus librarians to embed information literacy into the course.

Part Three: Big History and its Implications plays to what we feel is another important strength: our approach to issues surrounding meaning and religion in the Big History classroom. We are presenting a grand narrative that sometimes challenges students' home cosmologies – and thus the underpinnings of their identities. Helping students navigate this terrain is a big responsibility; we don't take it lightly. We have had a long and challenging and impassioned and often inspiring and transformative wrestling match thereon. Our approach has always been to treat students' religious traditions with great respect. In this section, our colleagues who are expert in the disciplines of philosophy, religion, ethics, and humanities lay out pedagogical approaches for handling the profound questions that are inevitable in the Big History classroom.

Finally, our Annotated Bibliography both models an assignment we give students and serves as a 40-page reference, featuring brief reviews of various relevant texts (including Big History accounts, other

nonfiction works, novels, short writings, feature films, documentaries, videos, and multimedia resources) that Big History teachers can read for inspiration, assign to students, or use in the classroom.

Conclusions

Certainly, we editors had to twist a tail or two to get folks who are accustomed to academic time scales to hew to editorial ones. A few pieces required some heavy drafting, and even some occasional cognitive and editorial push and pull. Frankly, that work has been some of the most rewarding. To be given that sort of trust by colleagues is humbling.

That's really how we did it. Our colleagues trusted us with their work and their words, and we editors worked hard to honor that trust.

It has been one of the wonders of building this program that teaching Big History is meta-educational, because the story, especially when we get to the human part in the last three thresholds and the future, is about humans learning collectively. So when we are teachers learning collectively about humans learning collectively so that we might spur further collective learning (about collective learning) in our students ... well, we are working on many levels.

As it turns out, multi-dimensional collective learning is fun! That, too, may be why we haven't had much problem working across disciplines. We self-selected for interest in this project, and in this sort of collaboration. We like doing this together. And we've been doing it for nearly six years now. The truth is that, from the start, we very quickly became a Big History faculty.

Harlan Stelmach writes that the writing of the book has been the next step in our collective learning. We are looking forward to our next summer institute, where for the first time, we will be working from our own published text.

If I had to tell someone else how to do this part, the writing of a book as a group of professors with strong ideas, I would say, be generous. Respect everyone's voice. Individuals should write from their strengths. And, fractally speaking, the group should write from its strengths.

Start with gracious leadership to set the tone. Also, be rigorous and thorough and fearlessly innovative. Keep a tight structure, and allow people to improvise within and upon that tight structure. Let each person make her piece or his piece a part of her or his own intellectual journey.

And when it comes to the copyediting, when you're poring over every single comma and dash and colon and parsing how its position between these two clauses effects how we project our collective understanding of the essential concepts that underpin the complexity framework, or the cosmos, or life ... feel free to leave that part to the English teachers.

Seriously. We love that stuff.

Edgehill Hall at Dominican University of California

Big History Crash Course Series

The ninth episode in the Big History Crash Course series, *The Anthropocene and the Near Future*, was viewed over 96,000 times on its first day on the web on December 12. The first episode, released two months ago, has been viewed over 690,000 times. The series is written by IBHA member David Baker, with script advice by IBHA Secretary and Board Member Esther Quaedackers.

The Big Bang: Crash Course Big History #1 https://www.youtube.com/watch?v=tq6be-CZJ3w
Exploring the Universe: Crash Course Big History #2 https://www.youtube.com/watch?v=Fi30zjQhtWY
The Sun & The Earth: Crash Course Big History #3 https://www.youtube.com/watch?v=By6CkTN4wkI
Life Begins: Crash Course Big History #4 https://www.youtube.com/watch?v=1WS712DHfmg
The Evolutionary Epic: Crash Course Big History #5 https://www.youtube.com/watch?v=92oHNd8vFwo
Human Evolution: Crash Course Big History #6 https://www.youtube.com/watch?v=UPggkvB9_dc
Migrations and Intensification: Crash Course Big History #7 https://www.youtube.com/watch?v=Oy2XJMczUNc
The Modern Revolution: Crash Course Big History #8 https://www.youtube.com/watch?v=Q4Zdmd4J7TI
The Anthropocene and the Near Future: Crash Course Big History #9 https://www.youtube.com/watch?v=3WpaLt_Blr4

Nominations 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. 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 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 identify additional names.

We encourage you to participate by logging on to the IBHA website at http://ibhanet.org/. Click on "Forum," "IBHA Discussions," and "IBHA Board of Directors Nominations." You may by April 15, 2015 post the names of any members you recommend for Board membership.

Up to that time, please check the forum periodically for new postings and endorse all candidates of your choice. (Just follow the simple instructions at the website.) Moreover, if you become a candidate, please add a statement describing your interest in serving as a Director. Should you be recommended but unable to serve, please let us know. Candidates endorsed by at least 10% of IBHA membership (37 people) before May 15, 2015 will become nominees.

An electronic election for new Board members will begin on July 1, 2015, and end on July 31, 2015.

We welcome your active engagement in this important process.

The new Board will be announced in August.

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. We enjoy learning of each other's Big History activities and thoughts through associating with each other. So we are delighted to welcome new members to IBHA membership. And we are delighted by the vote of confidence and recognition of the value of our association by those who have renewed their membership. It is a pleasure to have each of you with us.

November 27th – **Jung-Kyu Lee** – New Member (South Korea)
November 27th – **Marc Ross** – Renewal (USA)
November 27th – **Anton Trijssenaar** – New Member (from Netherlands)
December 8th – **Andrew McKenna** – Renewal of Contributing Membership (Australia)
December 9th – **Jennifer Joy Pawlitschek** - Renewal (USA)
December 17th – **Joseph Voros** – Renewal (Australia)
December 18th – **Michael Duffy** – Renewal (USA)
December 19th – **Abel Alves** – Renewal (USA)
December 20th – **Karl Benne** – Renewal (USA)
December 20th – **John Knight** – New Member (USA)
December 23 – **James Cummings** – Renewal (USA)
December 24 – **Jennifer Morgan** – Renewal (USA)

International Big History Association

Big History at the World History Association 2015 Conference?

The 24th annual conference of the World History Association will be held at the Hyatt Regency Hotel in Savannah, Georgia from June 30 to July 2 2015. If any members of the Big History community are interested in participating in the conference, please contact IBHA Treasurer (and WHA President) Craig Benjamin, who will help organize potential panels or roundtables. Craig can be contacted at: benjamic@gvsu.edu

A distributed, collective intelligence system for our planet.

The Global Brain Institute call for papers.

The Global Brain can be defined as the self-organizing network formed by all people on this planet together with the information and communication technologies that connect and support them. As the Internet becomes faster, smarter, and more encompassing, it increasingly links its users into a single information processing system, which functions like a nervous system for the planet Earth. The intelligence of this system is collective and distributed: it is not localized in any particular individual, organization or computer system. It rather emerges from the interactions between all its components – a property characteristic of a complex adaptive system. Such a distributed intelligence may be able to tackle current and emerging global problems that have eluded more traditional approaches. Yet, at the same time it will create technological and social challenges that are still difficult to imagine, transforming our society in all aspects.

http://summit.is4is.org/calls/call-for-papers/the-global-brain-and-the-future-information-society

Invited Speaker
Francis Heylighen, director of the Global Brain Institute, Vrije Universiteit, Brussel

Subject and Scope
The concept of the Global Brain touches a wide variety of issues concerned with the large-scale impact of information technologies on society. We give priority to interdisciplinary research that integrates different levels, applications and domains, so as to provide a long-term vision of the future. Possible topics include, but are not limited to, the following:

Futuristic socio-economic paradigms.
Applications of collective intelligence for tackling global challenges.
Sociotechnological evolution, trends, and patterns.
Distributed governance, decision-making, and democracy.
Privacy, security, freedom and ethics in the information age.
Relationship between the Global Brain and the individual.
Information systems and technologies with global impact:
MOOCs and other online education technologies,
Global healthcare management
Human-machine interfaces and convergence.
Internet of Things
Semantic Web.
Smart Grids
Knowledge-based civilization.
Artificial Intelligence

IBHA Conference
July 14 -16, 2016 in Amsterdam

The Board of the IBHA is delighted to announce that our third conference will be held in the beautiful and historic European city of Amsterdam from July 14 - 16, 2016. This will be the first IBHA conference held outside of the United States, and we are looking forward to working with our colleagues at the University of Amsterdam to stage another unforgettable event.

The Conference Planning Committee is already hard at work investigating suitable University of Amsterdam buildings, nearby hotels and hostels (at a range of prices), walking and other pre-conference tours of the city, and a post-conference tour that will visit many of the leading scientific facilities in Europe. Please mark the dates of July 14 - 16 on your calendars, and start planning to join us in Amsterdam in 2016!

Membership Dues Increase

The Board of the IBHA wishes to notify its members of a modest increase in membership dues, effective from January 1st 2015. The increase of approximately 10% across the board is the first increase in dues since the IBHA's inception in 2011. The IBHA needs to generate income of around $20,000 per year to sustain itself, and this modest increase in dues is one way we are working to achieve this. We are also investigating other possible sources of revenue, including soliciting donations and seeking grants, but this small increase in membership dues will help ensure the Association's long term financial sustainability. Please note that, because multi-year memberships are the most convenient for both members and the IBHA Office, we continue to offer generous discounts for two and three-year renewals. Members will also find the following statement on the membership dues page: 'If you have difficulty affording these rates, or have any other questions concerning membership (including student membership), please contact Donna in the IBHA Office' at tewd@gvsu.edu. In order to better serve our members we also need to ensure that we have your institutional affiliation correctly recorded in our data base. Accordingly, could we ask all members to please carefully note their institution when renewing their memberships.

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