Members' Newsletter

International Big History Association

Volume III Number 11
December 2013

Globalization's Birth and the Anthropocene

Call for Papers

Big History on the History Channel, Stephen Colbert

ChronoZoom: New Thinking in Timelined Knowledge for History & Historical Sciences

Big History Project Goes Public

"Globalization's Birth and the Anthropocene"

Dennis O. Flynn *
Alexander R. Heron Distinguished Professor of Economics
Department of Economics, University of the Pacific

At the inaugural IBHA conference at Grand Valley State University in Grand Rapids last year, Walter Alvarez warned of scientific discomfort with claims about proper start-dates for the "Anthropocene." He explained that a worldwide network of geological scientists must formally vote on such designations, and (to my knowledge) no such vote has been scheduled. David Christian is organizing a conference on the Anthropocene in Sydney during December 2014, on the other hand, so I feel justification for at least proposing connection between the Birth of Globalization and the Anthropocene (if sanctioned scientifically later on), with apologies for unscientific terminology to Professor Alvarez and geologists generally.

This essay briefly summarizes three interrelated arguments. First, conceptual integration of economics – which should be a physical science, but is not – with natural sciences requires a new type of economic theory, a simplified version of which is outlined below in form of a "Hydraulic Metaphor." Second, Hydraulic Metaphor reasoning essentially forced colleague Arturo Giráldez and me to conclude that Globalization began c. 1571, neither sooner nor later. Third, birth of Globalization arguably initiated the Anthropocene (ascendance of human influence over earth's environment) during the sixteenth century; or at minimum, Globalization's origin represented a critical 16th-century phase transition within the Anthropocene (if the reader accepts an Anthropocene start date prior to 1571).[1]

Although perhaps bold-sounding claims, our multi-century narrative is modest in context of Big History themes that subsume all human history within a multibillion-year continuum stretching back to Big Bang origins. Still, David Christian has recognized revolutionary transitions in human history during the sixteenth century:[2]

> The creation of a truly global exchange network in the sixteenth century decisively increased the scale, significance, and variety of informational and commercial exchanges. The coming together of the different world zones of the Holocene era marks a revolutionary moment in the history of humanity…. And the new level of creative synergy generated by linking the two largest world zones – Afro-Eurasia and the Americas – was and remains the most powerful single level of change in the modern world.

Fred Spier has likewise emphasized sixteenth-century transformations:[3]

> …an increasing integration of humans all around the globe into one single, ever more complex network of interdependencies. People, produce, plants, some animals, natural resources and infectious diseases were increasingly spread all around the world. This included the colonization of the Americas, while American silver was transported to China traveling both East and West.
>
> This first wave of true globalization also led to what I would call the first Earth icons: images of our planet used by people to show that they were global players. On many contemporary maps and in a number of books dealing with


Dennis O. Flynn

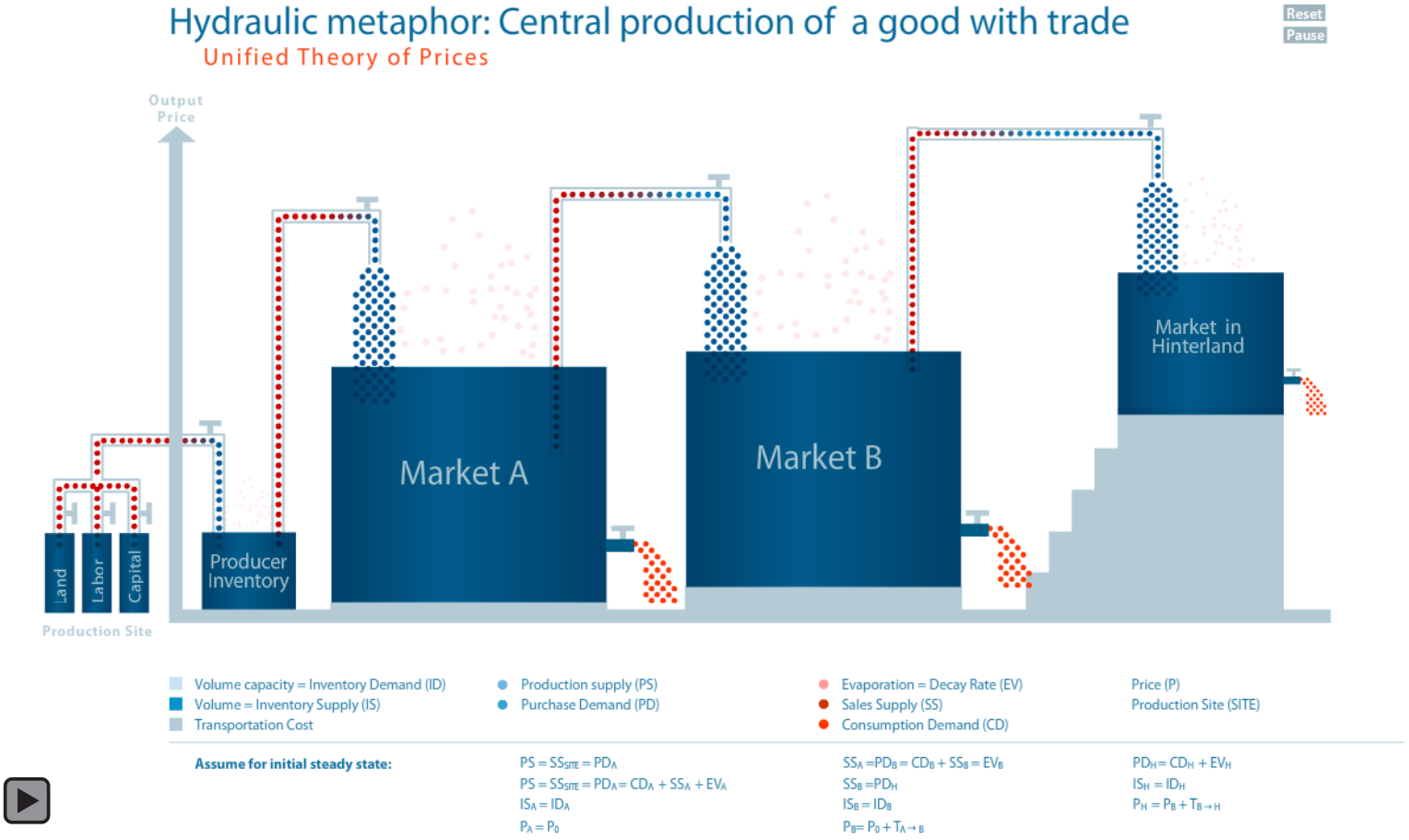
> global aspects one can find such allegorical pictures, depicting, for instance, the maiden of Amsterdam holding up high a globe, while people from around the world are displaying their wealth at her feet. During one of my icon hunting expeditions in Amsterdam, I even found a gable stone dating back to 1639 C.E. displaying the Earth. All of this points to a vivid global awareness in this city at that time.

Arturo Giráldez and I were initially surprised to discover the extent to which 16th-century reintegration of the America's with the AfroEurAsian Old World seemed to radically redirect history throughout planet earth. Processes begun five centuries ago were evidently far more complex than suggested by traditional "Age of European Discoveries" terminology. Thanks to work by Alfred Crosby and others, it is now widely recognized that Old World diseases wiped out populations throughout the Western Hemisphere (and Pacific islands). Exploitation of vast American resources required labor, on the other hand, so depopulation set the stage for centuries of importation of African slaves via the Atlantic Ocean.[4] Meanwhile, introduction of Old World plants and animals thoroughly transformed physical landscapes throughout the Americas, furnishing fundamental social building blocks visible throughout the New World to this day. Arturo and I had simply been trying to understand one aspect of worldwide trade interactions: Connections between silver-production sources and major end-markets, especially in China. We subsequently discovered that silver-laden ships also carried plants and seeds that physically transformed the entire AfroEurAsian Old World, setting the stage for unprecedented population explosions that unfolded worldwide (including seemingly-isolated places such as highlands of New Guinea) over many generations. In particular, Chinese 18th-century dynamism seemed to us astounding.[5] We realized that profitable trade in silver (including items for which silver exchanged) was intertwined with dramatic epidemiological, ecological, and demographic histories at a planetary level. Moreover, population explosions worldwide impacted back upon global economic activities everywhere in recursive fashion that continues to reverberate into the 21st century, and all of these exchanges were intertwined with innumerable cultural transfers in multiple directions.

Believing that globalization must be conceptualized in geographical terms, Arturo and I proposed a "1/3, 1/3, 1/3 Argument." Since the Pacific Ocean comprises about 1/3 of earth's surface area, while North America, Central America, and South America comprises another 1/3 (including the Atlantic Ocean) combined, arithmetic forced us to conclude that the AfroEurAsian Old World comprised the remaining 1/3 (including the Indian Ocean). Globalization could not have existed prior to the 16th century because, no matter how important, consideration of AfroEurAsian interchange alone excludes two-thirds of planet earth. Old World connections cannot be considered global. One can speak of World History in terms of disconnected components prior to the sixteenth century, but connected "Global History" did not exist prior to 1571 (when Acapulco-Manila galleons finally provided permanent linkage of Hemispheres via the Pacific Ocean, which comprises 1/3 of planet earth surface area). Connection of the Americas to the rest of the world yielded ecological and social/cultural transformations of sufficient profundity that Alfred Crosby has depicted post-15th-century global exchange of fauna, flora and diseases as "a revolution more extreme than any seen on this planet since the extinction at the end of the Pleistocene."[6] And Crosby's criticism of economic historians four decades ago remains valid today:[7]

> Tradition has limited historians in their search for the true significance of the renewed contact between the Old and New Worlds. Even the economic historian may occasionally miss what any ecologist or geographer would find glaringly obvious after a cursory reading of the basic original sources of the sixteenth century: the most important changes brought by the Columbian voyages were biological in nature.

Rather than argue endlessly about pre-modern/modern/post-modern terminologies and chronologies, it makes more sense (to us) to speak of pre-globalization (pre-1571) versus globalization (post-1571) periodization.



Dennis O. Flynn (Alexander R. Heron Distinguished Professor of Economics, University of the Pacific) has researched 16th-18th century global monetary history and world trade since the 1970s. A number of publications since 1995 (with Arturo Giráldez) have focused on the sixteenth-century "birth of globalization;" this interdisciplinary body of work shows intimate relationships among global silver flows, European empires, and how economic activities interacted with environmental, epidemiological, demographic, and cultural interconnections across the globe over three centuries. In recent years, he has turned attention to the formal theory that supports his historical work – "A Unified Theory of Prices."

Professor Flynn has published over fifty scholarly articles, authored/edited eleven volumes, and was General Editor (with Arturo Giráldez) of a seventeen-volume series entitled The Pacific World: Lands, Peoples, and History of the Pacific, 1500-1900 (Aldershot, England: Ashgate/Variorum, 1999-2010).

Theory from History: Laws of Supplies and Demands

Decades investigating certain long-distance trade patterns has convinced me that responsibility for myopic failure to recognize massive biological influences at a planetary level rests primarily, not with economic historians per se, but rather with cornerstones that underlie modern economic theory: Laws of Supply and Demand.

After having served as unwilling U.S. Army draftee during the Vietnam War, my goal in a M.S. Economics program (U of Nevada, Reno) was to better understand why extreme poverty became such a common result of hard work in poor countries. While subsequently a Ph.D. student (U of Utah), formation of OPEC (Organization of Petroleum Exporting Countries) in 1973 led me to alter focus. Dramatic spike in world oil prices in the early 1970s quickly generated double-digit U.S. price inflation alongside double-digit unemployment rates. Since mainstream economic theory stated that rapid price inflation could not coexist with soaring unemployment, it was obvious that received economic theory contradicted reality that everybody could observe. Textbook economic theory entered crisis (as it has again today since onset of the Great Recession).

Wondering whether history might offer insights into the seemingly new and mysterious 1970s "Stagflation" phenomenon, my dissertation on 16th-century "Spanish Price Revolution and the Monetary Approach to the Balance of Payments" taught useful lessons, yet my work over the next few years remained handicapped by Euro-centrism embedded in a vast Price Revolution literature. In a nutshell, I had reformulated a traditional conclusion to the effect that Spanish American silver fed European mints, which elevated European money supplies, which in turn inflated European prices into the early-17th century. A few years of further investigation revealed that New World silver had not in fact flowed to Europe; rather, silver flowed through Europe (indeed through virtually all world trade routes) and mostly onto end-markets within China. My problem was that conventional economic theory was useless – indeed was an impediment – for understanding why silver continued to flow relentlessly to China for centuries. Moreover, few economists seemed interested in such a centuries-old topic, so I began to interact with historically-oriented audiences who at least shared my interest in production and global movement of metals and monies long ago. I intentionally concocted (what I thought was) simple supply-and-demand graphs meant to explain long-term trends to non-economists. After a few years offering simplified explanations (for issues I found to be complex), I sat mortified in my office one day upon realization that my "simple" supply-demand graphs contained an embarrassing, fundamental contradiction. My supply curve should not have been placed in the same space as my demand curve! Note that the supply-curve quantity axis in Figure 1 is labeled "quantity of silver," yet the demand-curve counterpart in Figure 2 is labeled "quantity of silver/time period." Well, any analyst should be aware that a pre-condition for superimposition of functions in the same space is that axes' labels are identical. While my superimposition of functions with different quantity-axis labels clearly violated rules of logic, I nonetheless persisted in belief that general intuition about certain arguments remained valid irrespective of my shameful error.

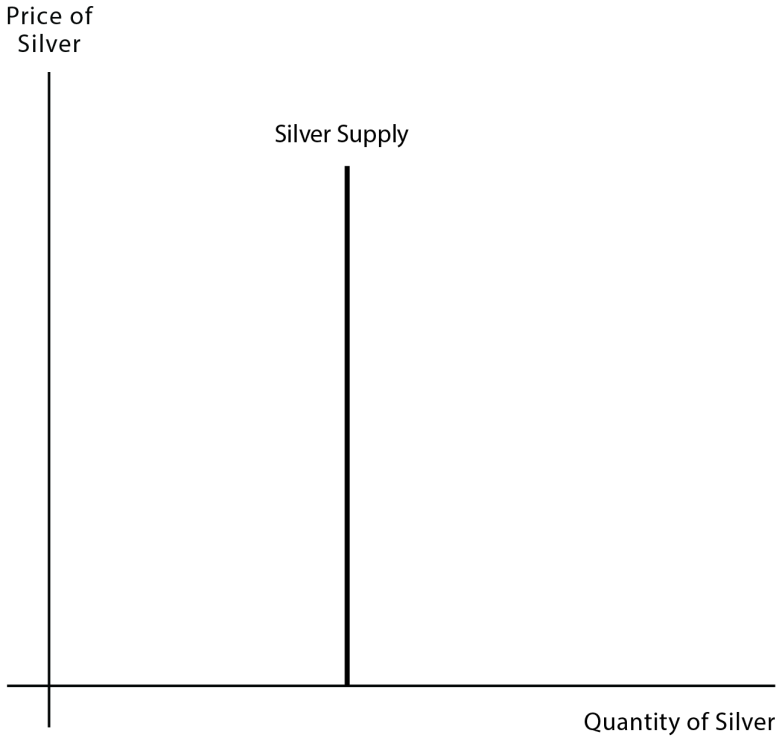


Figure 1. Silver Supply Stock

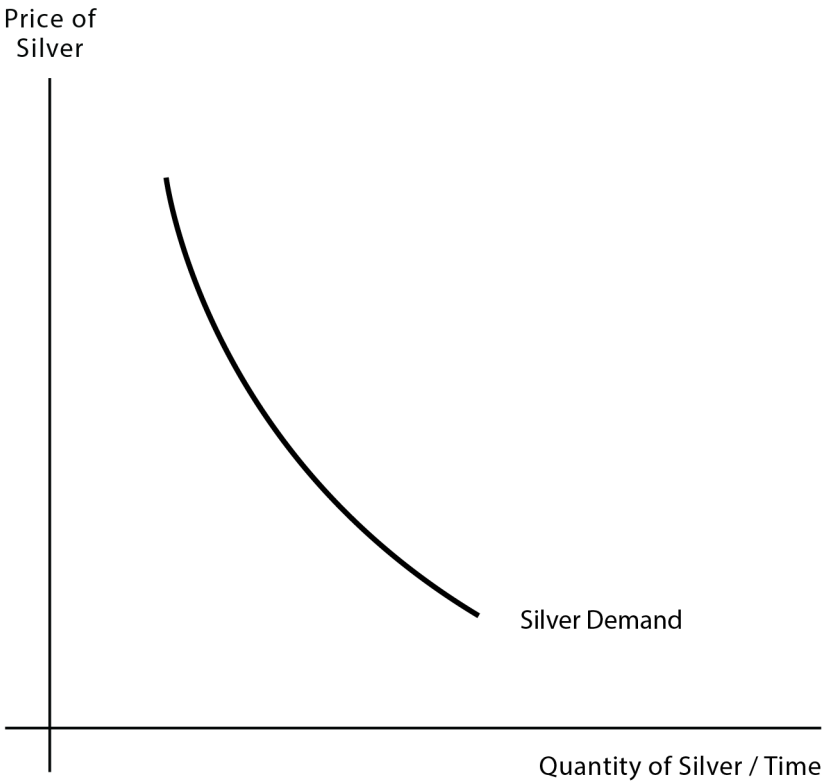


Figure 2. Silver Demand

Laws of Supply and Demand

Having survived shock from such a mistake, I enlisted collaboration of mathematical economist colleague, Kerry W. Doherty, unrealistically expecting him to help eliminate my technical contradiction within a few weeks. It actually took three years (mired in confusion most of the time) for Kerry and I to generate demand-and-supply functions that eliminated my contradiction. When the mathematical model finally yielded, not one, but three distinct demand functions – to be explained at an intuitive level in a moment – we were initially incapable of comprehending either mechanisms or implications of our own model. Only later came recognition that three equally-distinct supply functions could be combined with our demand-side model. We had unintentionally generated what I now call "Laws of Supplies and Demands" (both plural), a model that we gradually came to realize expands upon conventional textbook "Laws of Supply and Demand" (both singular) in ways that still seem shocking to me.[8]

Usefulness of any theoretical device depends upon explanatory power, of course, so we turn next to application of a simple, intuitive version of the model – the Hydraulic Metaphor.[9] Although Figure 3 portrays only static images on the printed page, the reader is asked to mentally visualize model dynamics: (1) liquid volumes are held within containers, (2) additional liquid flows into containers, and (3) liquid flows out of containers. Production Supply (PS) refers to freshly-created units of a good that flow into and therefore augment Inventory Supply (IS, existing stocks), Sales Supply (SS) refers to an outflow of the good that reduces seller Inventory Supply (IS), since ownership of units sold is transferred away from the seller and onto the buyer. In sum, Production Supply adds to (producer) Inventory Supply over time, while Sales Supply subtracts from (seller and producer) Inventory Supply over time. Odd as it may seem to non-economist readers, these common-sense observations – new production raises inventories, while sales reduce inventories – contradict the conventional Law of Supply, which treats production supply and sales supply as synonyms The Hydraulic Metaphor shows that PS and SS for goods cannot be identical, however, because PS enhances producer holdings while SS depletes seller/producer holdings. Production increases inventories. Sale decreases seller inventories. The two supply concepts should not be conflated.

Inventory Demand (ID) refers to quantity of an item the party wishes to hold at an instant (freeze-frame) in time, and is depicted in Figure 3 as capacity of the container (not to be confused with actual volume of liquid within the container, IS, since a container need not necessarily be filled to capacity at a given time). [One may wish to hold 30 bottles in a wine cellar (ID wine), for instance, while actually holding just 20 bottles in that wine cellar (IS wine) at a point in time.] Purchase Demand (PD) adds to Inventory Supply (IS) over time; indeed, buyer PD is the same thing as seller Sales Supply (SS) in Figure 3, since transfer of inventories from one party to another can be viewed from the perspective of either buyer or seller. [Note that dark-shaded bubbles denote addition to holdings,

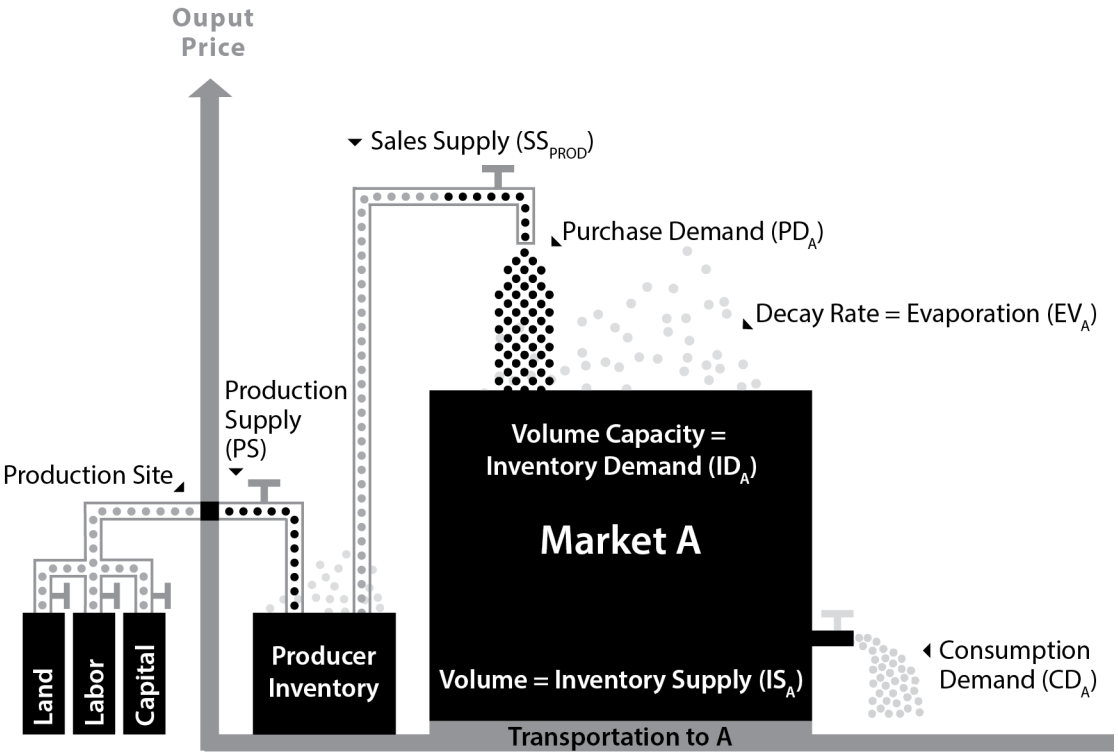


Figure 3. Hydraulic Metaphor: Supplies and Demands

while light-shaded bubbles denote subtraction from holdings.] Consumption Demand (CD) reduces inventory holdings (IS), on the other hand, consistent with the commonsense adage that "one cannot have a cake and eat it too." These demand-side observations once again contradict the conventional Law of Demand, which conflates consumption demand and purchase demand while defining them as synonyms. In contrast, the Hydraulic Metaphor acknowledges that PD and CD are distinct activities. Purchase (PD) enhances buyer inventory holdings of a good, while consumption (CD) depletes consumer inventory holdings of the good; for instance, wine purchase increases the quantity of wine in the cellar, whereas wine consumption depletes the quantity of wine in the cellar. Such distinctions are necessary in order to properly describe and analyze how and why individuals and groups accumulate components of wealth over time.

Origins of Globalization in the Sixteenth Century

The birth of modern globalization was intimately linked to production and exchange of silver, which formed the first truly global market in human history. Application of the Hydraulic Metaphor sketched above enables visualization of Globalization's 16th-century birth, a phenomenon stumbled upon while colleague Arturo Giráldez and I were simply trying to follow logic of the model.

Prior to voyages of Columbus, China contained the largest and most dynamic economy on earth. An astonishing array of inventions originated in China, including paper money (backed by silver) at least a millennium ago. Subsequent over-issuance of paper money – far beyond amounts justified by quantities of silver that backed it – led to total collapse of China's paper-money system by the mid-15th century. Private-sector actors understandably responded by vigorously switching to physical silver itself in place of increasingly-worthless paper promises (supposedly, but not actually, backed by silver). Alarmed Ming Dynasty officials reacted with numerous proclamations designed to thwart the ensuing, relentless spread of "silverization" throughout the realm.[10] Ming authorities eventually acquiesced (by the 1570s, over a century later) to preeminence of silver market forces; tax payments in silver became explicitly specified. Due to powerful silver-demand-side forces within China, the silver-gold exchange rate in China fell to approximately 6:1 in China compared with around 12:1 in Western Europe c.1590; this means that twelve ounces of silver purchased two ounces of gold in China, whereas twelve ounces of silver exchanged for a single ounce of gold in Western Europe. Thus, the value of silver in Chinese markets was double its value in the rest of the world, a phenomenon widely acknowledged by contemporaries worldwide (as was gold's price premium outside of China). Unsurprisingly under such circumstances, staggering quantities of silver – mined mainly in Peru

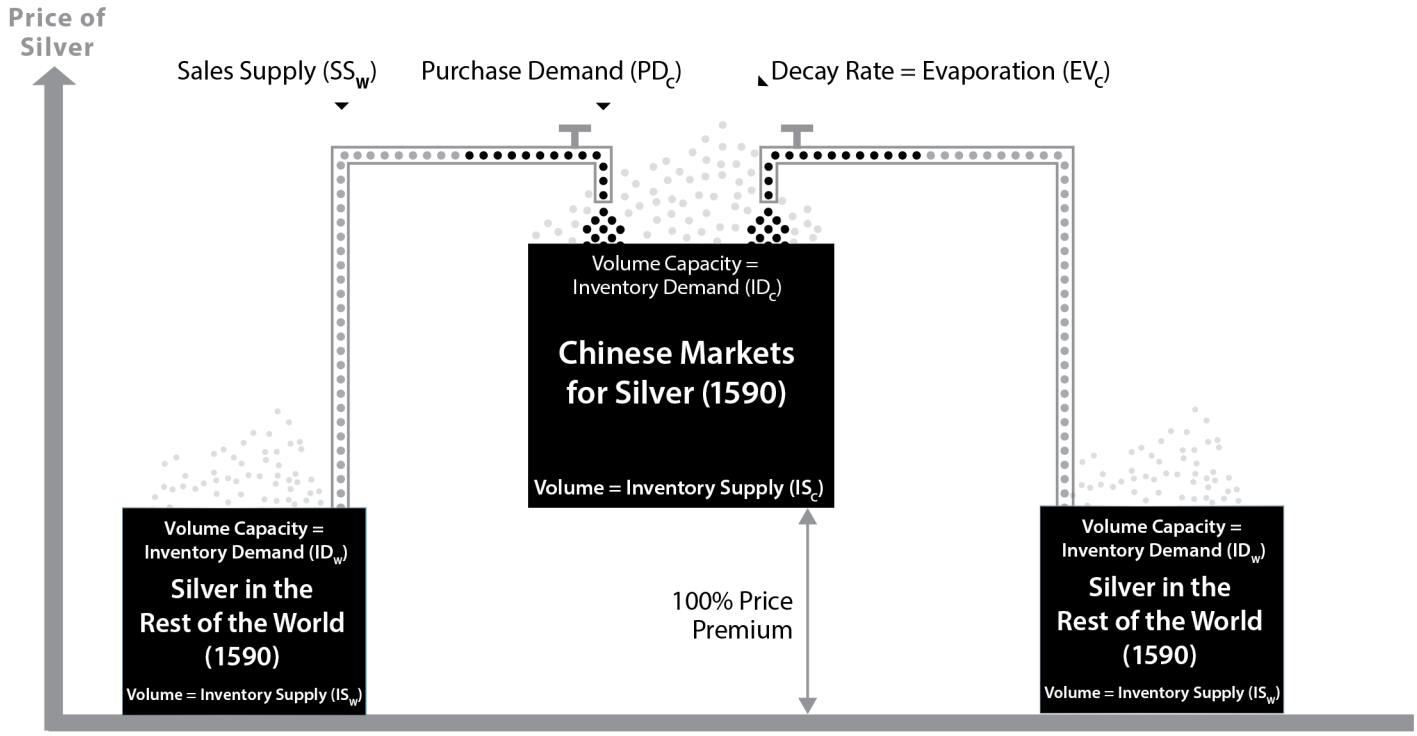


Figure 4.

(especially Potosí), Mexico and Japan – flooded relentlessly into China. The Hydraulic Metaphor in Figure 4 permits visualization of dynamics at work, with special emphasis on expansive growth of "Inventory Demand" (container capacity) for silver within China – as a result of "silverization" – the dynamic demand-side root cause of the escalating price of silver within China vis-à-vis the rest of the world. (Note that vertical elevation of China's container base, relative to container-base heights outside of China, signifies a price premium for silver in Chinese marketplaces.)

Ignoring many details, the Potosí-Japan Cycle of Silver lasted a century (1540s-1640) because it took a century of unprecedented silver flows worldwide in order for sufficient accumulation of silver within China (i.e. Chinese inventory supply) to eventually force the market value of silver in China down to levels prevailing in the rest of the world (shown in Figure 5). Gradual descent of silver price worldwide eventually depressed excess profits in silver markets to zero. Super-profits from silver prior to 1640, however, had (a) provided the economic foundation of the Spanish Empire, (b) underpinned unification of Japan (in 1600) under the Tokugawa Shogun, and (c) fueled global trade

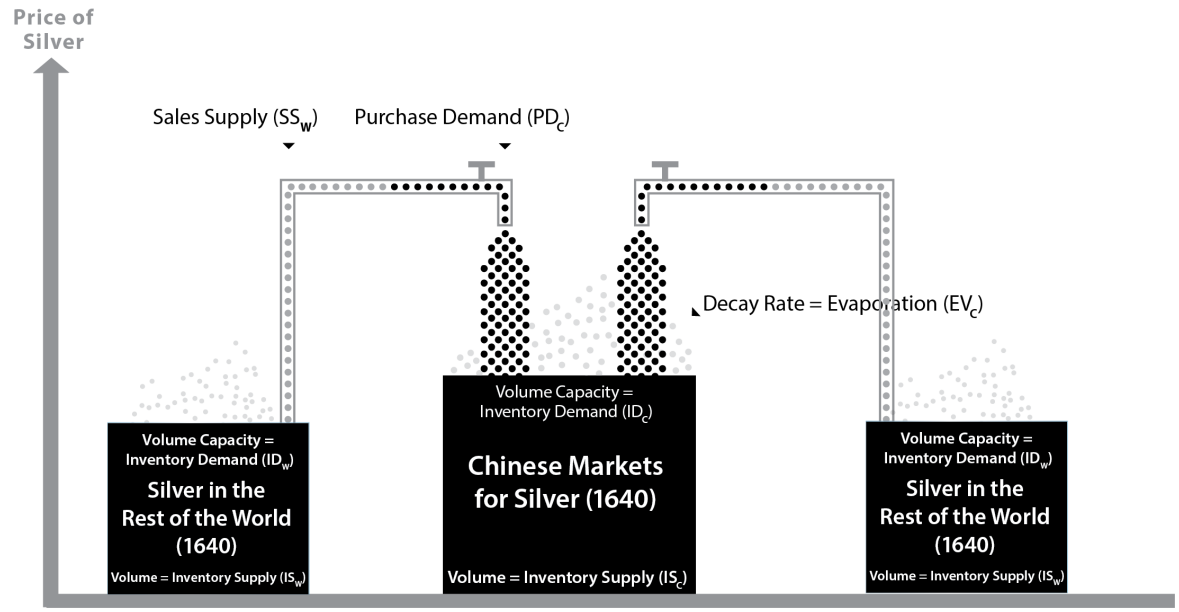


Figure 5. End of the Potosí-Japan Cycle of Silver

in silver and myriad markets connected to trade in silver (e.g. Chinese exports of silks and ceramics) for a century. Indeed, elimination of super-profits was part and parcel of a widespread "17-century crisis" much discussed in historical literatures (which typically ignore key non-European facets). Prior to end of the first global cycle of silver in 1640, global trade's silver-market-motivated birth in 1571 was the explanation for European maritime presence in Asian waters;[11] in turn, Asian powers tolerated European intrusions because Asians also profited enormously from trade in silver, as well as from myriad businesses connected directly and indirectly with the global silver trade.

We next fast-forward to the 18th-century Mexican Cycle of Silver, including discussion of its intimate 16th/17th-century-Potosí-Japan Cycle historical roots (back when a truly global economy was born). During this initial 1540s-1640 cycle, the 'Columbian Exchange' and the 'Magellan Exchange' led to staggering ecological consequences that unfolded over multiple generations.[12] The intense profit motive – centered on the global trade in silver and manufactured items (exchanged for silver) – had unleashed unintended ecological consequences throughout planet earth. In turn, ecological and demographic time lags impacted back upon international trade via fundamental alteration of factor (input) markets and end-markets throughout the world.

Globalization's 18th-century growth spurt

Arturo Giráldez and I were surprised to discover in the late 1990s that such a heavily-discussed phenomenon as "globalization" had either been left ill-defined, or more often undefined entirely. Unable to find an operational definition that enabled identification of a birth date for globalization, we proposed a definition based upon geography and history:[13]

> Globalization began when all heavily populated land masses initiated sustained interaction – both directly with each other and indirectly through other land masses – in a manner that deeply and permanently linked them.

The phrase "Born Again" was invoked to reflect plausibility of reasoning that initial global expansion occurred when humans first migrated out of East Africa and settled in all of today's heavily populated land masses a minimum of 12,000 years ago,[14] prior to interglacial warming that ended the most recent ice age. Seen from this perspective, our modern sixteenth-century birth of globalization could be considered a rebirth – rather than original birth – in terms of global connections among humans. Melting ice caps raised sea and ocean levels hundreds of feet beginning early in the Holocene era, such that the Americas (New World) became mutually isolated from the AfroEurAsian Old World due to rising seas over 10,000 years ago. In other words, a sort of "de-globalization" occurred over 100 centuries ago when global warming caused seas to rise, thereby de-linking existing global connections (tenuous as they were). In this context, the term Holocene (from Greek holos, meaning whole or entire) seems somewhat ironic. The whole/entire world became disconnected during the first 96 percent of the 11,700-year Holocene period. In other words, earth's largest landmass groupings – Old World Eastern Hemisphere versus New World Western Hemisphere – entered a period of near-zero human contacts between hemispheres because of rising seas that led to mutual isolation.

Interglacial isolation yielded radically-divergent evolutionary outcomes within the Americas vis-à-vis evolutionary outcomes within the AfroEurAsian Old World in terms of both flora and fauna. While muscles of domesticated animals were powering much of production throughout the Old World, human muscles were overwhelmingly required to power New World production simply because there were no large beasts of burden to share the load in the Americas. This muscle-power deficit turned catastrophic when Old World diseases – having passed back and forth in the Old World between domestic animals and humans for millennia – annihilated two-thirds to ninety percent of New World humans without immunity to AfroEurAsian measles, small pox, and other deadly diseases. Between ten and twenty million chained Africans crossed the Atlantic in partial compensation for ensuing labor shortages, but the

Western Hemisphere remained sparsely populated by Old World standards for centuries. (Indeed, Africans comprised a majority of non-native populations in the Americas as late as the mid-nineteenth century.) In addition, introduction of unfamiliar Old World crops and animals radically altered landscapes throughout the Americas. It is difficult to imagine histories of Canada, the USA, Mexico, Argentina, Venezuela, indeed anywhere in Latin America, in absence of cattle, horses, pigs, sheep, wheat, sugar, oranges, and numerous other essential building blocks of New World societies. Physical transformation of the Americas over the past five centuries – due exclusively to introduction of Old World flora and fauna – is fundamental to understanding evolution of human societies everywhere beginning with reconnection of both Hemispheres five centuries ago.

Moreover, impacts from the Americas upon the AfroEurAsian Old World have been no less stunning than external impacts upon the Americas. Alfred Crosby contends that perhaps one-third of all foods consumed by humans and domesticated animals worldwide today are generated by plants of American origin exclusively, including most beans, potatoes, corn, peanuts, tomatoes and scores of other agricultural products (plus tobacco, rubber, and other basics ubiquitous throughout the world today).[15] Africa was arguably most heavily impacted by introduction of American plants, according to Crosby. Our focus upon the birth of global connections in the 16th century inevitably shifts attention to China, however, because China's landmass doubled and its population more than doubled during the 18th century, due in large part to gradual dissemination of just three (of many) essential American crops: maize (corn), sweet potato, and peanut. Already the world's largest economy, population had previously been concentrated in areas of rice (South China) and wheat (North China) cultivation prior to arrival of American plants. Thanks in large measure to arrival of American crops, however, tens of millions of Chinese migrated into previously inhospitable lands (including mountainous regions such as Tibet) where American crops thrived, and population densities rose in traditional locations as well. The impact of China's resultant geographical expansion and population explosion on the global economy is difficult to overemphasize, including (but certainly not limited to) the pivotal role played by Chinese demand for silver.[16]

Burgeoning Chinese population and landmass inevitably augmented Chinese demand for silver, visually depicted in Figure 6 via enlargement of volume capacity of the container labeled "Chinese Markets for Silver (1700)"; it was this expansion of inventory demand that helped raise the price of silver within China to a 50% premium vis-à-vis the rest of the world by 1700. Since 18th-century trade routes had expanded and developed significantly since the 16th-century, this 50% price premium within China was responsible for unprecedented silver mine activity – mostly in Mexico this time around – along with super-profits throughout global trade routes (reminiscent of boom-time profits during the Potosí-

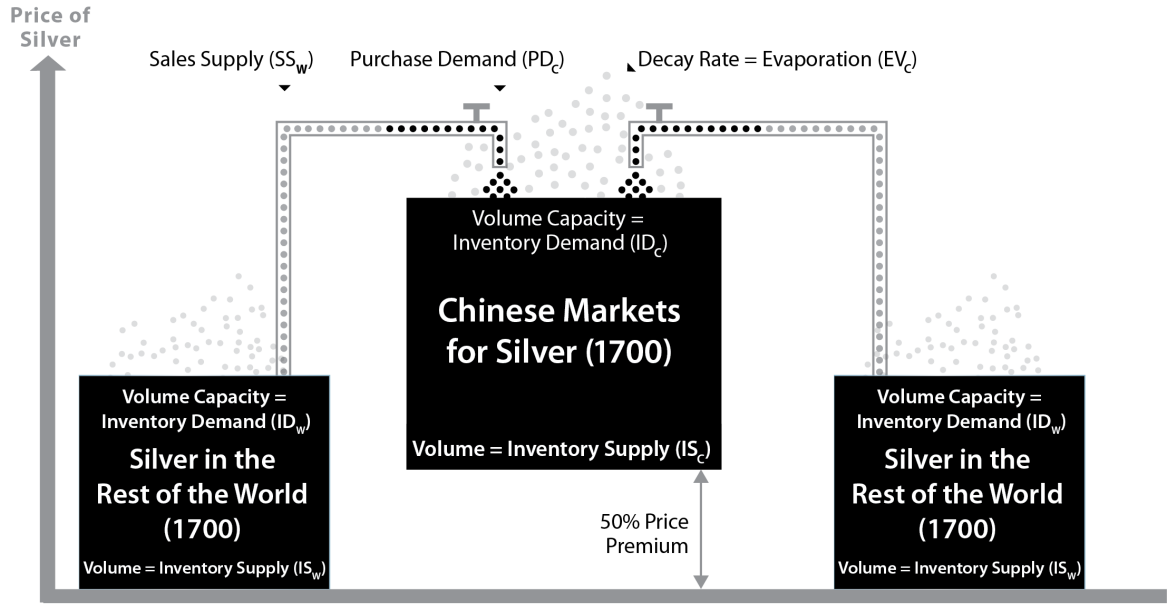


Figure 6. 50% Chinese Silver Price Premium, 1700

Japan Cycle of Silver between the 1540s and 1640). Fifty years of unprecedented silver mine output flowed relentlessly through trade networks worldwide, eventually saturating Chinese as well as world markets by 1750, at which date the price of silver in China had once again descended to the white metal's price in the rest of the world (as had been the case in 1640). In other words, the Mexican Cycle of Silver lasted until 1750, by which time trade crisis struck merchants worldwide yet again (as had happened 110 years earlier in 1640).

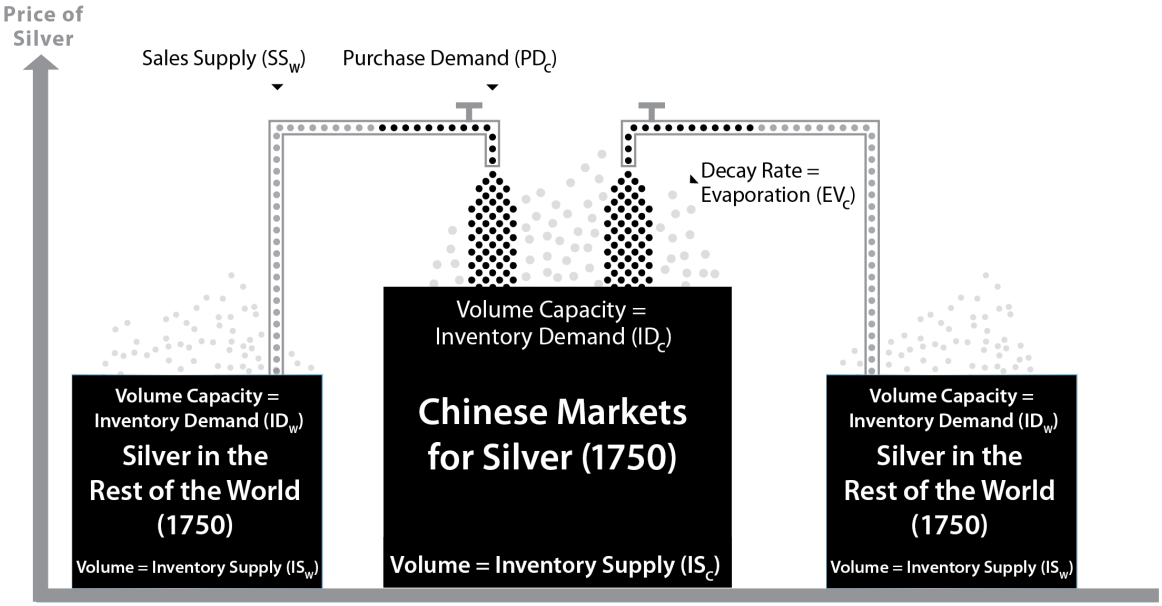


Figure 7. Global Price Equilibration, 1750

Economic Theory and Interdisciplinary Conversation

Although he disavows expertise in economic theory, David Christian confided at the IBHA meeting in Grand Rapids last year that he sensed need for a new type of economic theory, one that could integrate with natural sciences. The economic model sketched in this essay provides a first step toward such integration. Recall that this model poses three distinct supply concepts – production supply (adds to inventory stocks), inventory supply (stocks themselves), and sales supply (subtracts from seller inventory) – as well as three distinct demand concepts – purchase demand (adds to purchaser inventory), inventory demand (desired stocks), and consumption demand (subtracts from consumer inventory).

Imagine imposition of two simplifying assumptions: (1) the item is incapable of being stocked, and (2) economic agents participate on either the supply-side or demand-side of the market, but not both. Well, inventory demand (volume of container) and inventory supply (liquid in container) vanish under assumption (1). And production supply merges with sales supply (since sale later on requires inventory, which is precluded), and purchase demand merges with consumption demand (consumption later on also requires inventory). What we are left with is just one supply function and one demand function – namely, conventional Laws of Supply and Demand. Implications are profound, since any item incapable of being stocked is by definition a "service," in contradistinction to items that can be stocked, which are by definition "goods." This means that the fundamental building blocks of economic theory – the Laws of Supply and Demand – apply only to services.[17] Laws of Supply and Demand cannot apply to goods, since goods are inventoried (and inventories are not acknowledged). In other words, tangible items are precluded from analysis (notwithstanding routine references to goods as examples in economics textbooks). No wonder economics is not currently a physical science: tangible items are precluded from analysis. Observation of theoretical neglect of the tangible world is not intended to be facetious. Conventional Laws of Supply and Demand are a special case of our more general Laws of Supplies and Demands. The Laws of Supply and Demand pertain to services, whereas the Laws of Supplies and Demands pertains to goods and services.

Not only does the model sketched herein include tangible items, its central focus is indeed accumulation of inventories through time (i.e.

components of wealth). Substitution of the word "populations" for "inventories" perhaps clarifies connections between economic and non-economic entities. I see potential for integration of economic theory with theories from physical sciences. After all, it is accumulation of greenhouse gases, accumulation of nuclear waste, diminution of wild fish stocks, diminution of forest coverage, and other cumulative processes that concern scientists. At each moment, an individual human is a product of her/his personal history, and so too each society is a product of its respective social history (including global society). In order for economics to become a physical science and thereby embrace the historical past in all forms, theoretical structures must allow interaction with all academic disciplines, which must be related (directly or indirectly, I suspect) to accumulation through time.

Arturo and Dennis plan to finish a short book on Origins of Globalization by the end of 2014. Also, further development of a module on Globalization's Birth, for the ChronoZoom project directed by Walter Alvarez at UC Berkeley, should occur next year. After that, attention can turn to Taking Stock: Laws of Supplies and Demands, a book project (aimed at a general audience) intended to elaborate economic theory mentioned herein.

References

* Arturo Giráldez and I have enjoyed lecturing often (individually and jointly) in Big History classes at the University of Amsterdam since the 1990s. This essay is a result of ongoing encouragement by Fred Spier and (in recent years) Esther Quaedackers.

[1] Methane, CO2, and greenhouse-gas evidence all suggest that human activity fundamentally altered environments – and therefore climate – at a global level beginning 5,000 years ago, according to William F. Ruddiman, Plows, Plagues, and Petroleum: How Humans Took Control of Climate. Princeton and Oxford: Princeton University Press, 2005. Specifically, see Chapters 8,9, and 10.

[2] David Christian, *Maps of Time: An Introduction to Big History*. Berkeley, Los Angeles, London: University of California Press, 2004, pp.364-5.

[3] Fred Spier, "Histories Big and Small: a Critique of Wolf Schafer's New Global History," *Erwagen, Wissen, Ethik* 14 (2003), pp.118-20.

[4] Although Africans were dispersed throughout the Pacific Ocean since the 16th century – Mexico, Philippines, Indonesia, China, Japan, aboard ships and on-land everywhere in between – insufficient attention has been devoted to the African diaspora throughout the Pacific region.

[5] Although each editor worked independently, widespread Chinese impacts across the vast Pacific are mentioned repeatedly in diverse contexts throughout the 17-volume series, *The Pacific World: Lands, Peoples, and History of the Pacific, 1500-1900*. Aldershot, Ashgate (2001-2010, for which Arturo and I served as General Editors).

[6]Alfred Crosby, *Ecological Imperialism: The Biological Expansion of Europe, 900-1900*. Cambridge: Cambridge University Press, 1986, p.271.

[7] Alfred W. Crosby, *The Columbian Exchange: Biological and Cultural Consequences of 1492*. Westport, CN: Greenwood Press, 1972.

[8] At the inaugural IBHA meeting in Grand Rapids in 2012, my presentation on "Economics as a Physical Science" focused on a basic distinction in economics: "goods" are tangible products that can be stored, while "services" are products that cannot accumulate by definition (e.g. it is not possible to take a six-pack of haircuts home). It turns out that conventional Laws of Supply and Demand apply exclusively to services, which means that everything that has accumulated through time – namely, the physical universe – is excluded from analysis. Overlooking the tangible world seems a significant oversight. See our website www.unifiedtheoryofprices.org for additional information on theory and history mentioned herein.

[9] The Hydraulic Metaphor has been developed during a three-year collaboration with colleague Marie A. Lee, Department of Visual Arts, University of the

Pacific. Applications can be found in Flynn and Lee, "A Restatement of the Price Theory of Monies," in G. Depeyrot (ed.), *Three Conferences on International Monetary History*, pp.293-314. Wetteren, Belgium: Moneta, 2013; Flynn and Lee,"East Asian Trade before/after 1590s Occupation of Korea: Modeling Imports and Exports in Global Context," *Asian Review of World Histories* 1:1 (January 2013), pp. 83-116; and Flynn and Lee, "Hydraulic Metaphor: A Model of Global and Local Connectivity," in Tsukasa Mizushima, George Bryan Souza, and Dennis O. Flynn (eds.), *Place, Space, and Time: Asian Hinterlands and Political Economic Development in the Long Eighteenth Century*. Leiden: Brill, forthcoming 2014 [An earlier version of the "Hydraulic Metaphor" can be found in *Empires, Systems, and Maritime Networks: Reconstructing Supra-Regional Histories in Pre-19th Century Asia*, Working Paper Series 05 (December 2011), pp. 1-31, a research project by FUJITA Kayoko, Ritsumeikan Asia Pacific University, and supported by the Grants-in-Aid for Scientific Research program of the Japan Society for Promotion of Science.]

[10] A classic work on Chinese monetary history is Richard von Glahn, *Fountain of Fortune: Money and Monetary Policy in China, 1000-1700*. Berkeley: University of California Press, 1999.

[11] Initial argument favoring birth of global trade in 1571 can be found in D.O. Flynn and A. Giráldez, "Born with a 'Silver Spoon': World Trade's Origin in 1571," *Journal of World History* Vol.6, No.2 (September 1995), pp.201-221.

[12] To my knowledge, first usage of highly-descriptive Magellan Exchange terminology occurred in John R. McNeill, *Environmental History in the Pacific World*. Aldershot: Ashgate, 2011, p.xix.

[13] A definition repeated in D.O. Flynn and A. Giraldez, "Born Again: Globalization's Sixteenth-Century Origins," *Pacific Economic Review*, 3: 13, pp.359-387.

[14] David Christian, *Maps of Time: An Introduction to Big History*, Berkeley, Los Angeles, London, 2004.

[15] See Charles C. Mann, *1493: Uncovering the New World Columbus Created*. New York: Alfred A. Knopf, (2011) for an entertaining and enlightening account of such global exchanges.

[16] For the massive extent of regional specialization of production (and thus environmental change) that resulted from doubling of China's land mass, see Robert B. Marks, *Tigers, Rice, Silk and Silt: Environment and Economy in Late Imperial South China*. Cambridge: Cambridge University Press, 1998.

[17] Conventional Laws of Supply and Demand do not fully explain markets for services either, since production of a service requires inputs ("factors of production") that are themselves inventory stocks; stocks of inputs are "given" by assumption and thereby left unexplained. To access visualization of how three sets of supply and demand functions (Laws of Supplies and Demands) reduce to a single set of supply and demand functions (Laws of Supply and Demand), press the "Services Model" button within the "Dynamic Models" segment at http://www.unifiedtheoryofprices.org.

ChronoZoom: New Thinking in Timelined Knowledge for History & Historical Sciences

段会川 *Huichuan Duan*
School of Information Science and Engineering,
Shandong Normal University, Jinan 250014, China
hcduan@vip.126.com

Abstract: ChronoZoom is an online tool for expressing and presenting Big History. In this article, it is introduced from the perspective of computer technology and Chinese scholarship. ChronoZoom's outstanding technical features include zoom-based interface design, browsing-based knowledge exhibition and touch-based Human-Computer Interface mode. These features are particularly suitable for expressing and displaying strongly timelined events and knowledge, and thus imply substantial potentialities as a teaching tool. The article also points out that ChronoZoom can be further developed into a universal paradigm for representing and presenting any non-linearly distributed knowledge along any dimension beyond time and hence has broad application prospects. Furthermore, the article outlines the trial deployment and practicing of ChronoZoom at Shandong Normal University in Jinan, China. The author expects ChronoZoom to get much attention from teachers of History or other fields and those seeking proper tools to exhibit timelined materials. The author plans to inject representative Chinese history elements into ChronoZoom through further research and development. Localizing and tailoring ChronoZoom so that it can be easily adapted to any "small history" teaching are also on the agenda.

1 Introduction

ChronoZoom was first proposed in 2009 by Roland Saekow, who was a student at the University of California in Berkeley. The inspiration was triggered while he was attending a Big History course of Professor Walter Alvarez [1]. The original goal was to provide a convenient, efficient and vivid tool with which to support the course and display its tremendous and diversified materials [2] [3].
Big History spans cosmic time, 13.8 billion years, from the Big Bang to the present. Its materials and research are so diversified and non-linearly distributed along a super timescale that no tool – before ChronoZoom – had been able to effectively present this information. Roland Saekow and Walter Alvarez designed the initial version of ChronoZoom and demonstrated that it could solve the representation problems for Big History. Thereafter, ChronoZoom gained funding and support from Microsoft Research. Led by Microsoft Research Connections, the ChronoZoom development team is now a cooperative of academics from the University of California at Berkeley, Moscow State University, and the University of Washington.

ChronoZoom has evolved from its initial, rather plain, presentation of Big History materials into a sophisticated knowledge representation platform. The newest 2.0 beta version has elaborated the basic functions [4], and its R&D team is intensively working to develop the next more powerful version. ChronoZoom is open-sourced, so its code is free, allowing all to transplant and improve it.
In March 2013, Dr. Barry H. Rodrigue, from the University of Southern Maine (USA) and the International Coordinator of the International Big History Association, visited Shandong Normal University for three weeks as a visiting scholar [5]. During his visit, he lectured on the concept, development and research of Big History to the faculty, graduate, and undergraduate students. During this time, he arranged for Roland Saekow to join him,

and, so, Mr. Saekow presented a technical report on ChronoZoom at the School of Information Science & Engineering.

The Big History lectures and the ChronoZoom report inspired interest in Big History among faculty members, as well as graduate and undergraduate students. Dr. Sun Chao of the History Faculty at Shandong Normal University is planning to initiate research and courses in the framework of Big History. And I am developing ChronoZoom for use in China and the Chinese-speaking world, and will then apply it to teaching, as well as other scholarly timeline purposes.

2. The Concept & Methodology of ChronoZoom

ChronoZoom designers focus on matters beyond just the construction of an electronic tool. This enables me, in my work with the ChronoZoom team, to engage in its creative and intellectual potential. In the first place, ChronoZoom is a way of thinking. It immerses the function as a computer tool into the knowledge and events of Big History in a natural way. It effectively solves the super time-scaling, from 10 billion years to single years, by zooming, along with the presentation and browsing of knowledge and events that are non-linearly distributed with respect to time. Considering that non-linearity to time is an intrinsic property of knowledge and events, the powers of ChronoZoom is far beyond just that of a timeline tool.

Since ChronoZoom represents and presents data about the universe, geography, life, humanity and other fields in a unified framework, it reflects a core idea of Big History: Big History is everything. Traditional knowledge-providing programs generally employ simple search tools, but ChronoZoom uses browsing and presenting tools, while implementing search-modes within these wider functions, which is more natural and user-friendly.

Undoubtedly, it is necessary to implement ChronoZoom by making good use of advanced and innovative technologies. However, ergonomics is strongly incorporated in ChronoZoom – in the way it is implemented as well as in the look and feel with which it is conceived. This softens the stereotypy of technology to a certain extent. ChronoZoom blends 1) Technology and its intrinsic logic, rules, efficiency and determinism, with 2) History and its intrinsic need for evidence, thought, and culture. This process elegantly reflects Big History thinking.

ChronoZoom mimics the popular touch and gesture operating mode of intelligent mobile phones and pads, presenting knowledge-browsing in a "dazzle" and "cool" manner. However, ChronoZoom is not designed just for showing-off fascinating technological gadgets. It reflects the fact that computer technology has developed to a new stage that is much closer to ergonomics, as well as the arts and humanities, while these novel crafts also enable appropriate presentation of Big History knowledge.

3. Prospects of ChronoZoom

ChronoZoom, as a universal tool to represent and present knowledge and events that are non-linearly distributed, has far more extensive research potentialities and application fields than are even now employed in its beta-version. There is much exciting

Statue of Mao Zedong on campus at Shandong Normal University

Photograph by Dr. Barry Rodrigue

Huichuan Duan

work to do.

In the first place, ChronoZoom can be applied to the presentation of any time-lined knowledge, which is particularly suitable to history courses, so it is natural to apply it to the teaching of History. Secondly, by reducing the macroscopic length of time, such as from a billion years to a thousand or less years, and raising the time resolution to months, days or even seconds and milliseconds, it can be shaped to demonstrate distribution of knowledge and events in respect to conventional or microscopic time scales. And thirdly, the time axis of ChronoZoom can be converted to any knowledge dimensions, such as spatial, hierarchical or even organizational.

Along with the augmentation of features that enhances ChronoZoom's capacity to present Big History, it can also present conventional history and other fields of non-time dimensions. ChronoZoom provides novel tool support for classroom teaching as well as for scientific, technological, industrial, and even commercial exhibition. In addition, exploring attributes and features of Big History from the point of view of ChronoZoom is an exciting prospect. At the 20th Annual World History Association Conference in 2011, while introducing his new book, Big History and the Future of Humanity [6], Fred Spier, from the University of Amsterdam, proposed the idea of modeling the future of humankind in the spirit of the Big History. Obviously, with its advantages in computer tooling, model representation and data checking, ChronoZoom can substantially help to set up such models.

4. Preliminary Practicing of ChronoZoom

In order to effectively use ChronoZoom and promote the dissemination and research of Big History, we initiated BHDGcn, Big History Discussion Group in China [7], on ScienceNet China (www.sciencenet.cn), which is sponsored and hosted by the China Science Daily and supervised by the Chinese Academy of Sciences, Chinese Academy of Engineering, and the National Natural Science Foundation of China. The lead members of its steering committee include Dr. Barry H. Rodrigue of the University of Southern Maine, Dr. Sun Yue of Capital Normal University, and Professor Duan Huaichuan and Dr. Sun Chao of Shandong Normal University. The current main tasks of BHDGcn include publishing materials relevant to the research and progress of Big History on the associated Big History blog site [8], providing a venue for interested researchers to communicate, and encouraging undergraduate and graduate students to study Big History.

ChronoZoom cannot be applied in China without substantial localization, because of differences in technology availability and security administration. For example, a major hurdle that we have had to

ChronoZoom on the campus network of Shandong Normal University with Chinese elements

jump is the fact that Windows Azure has not been allowed to access in China. As a result, developing, installing and deploying a stand-alone ChronoZoom system is the first step. Combining our own efforts with Dr. Rodrigue's outstanding and effective coordination with the ChronoZoom Development Team and its supervisors at Microsoft Research Connections, we have successfully deployed a trial version of ChronoZoom on the campus network of Shandong Normal University [9], and have put a few Chinese historical elements on it, see Figure 1. In order to access them, just enter the site, click on "Humanity" on the top, and then the Chinese panel will zoom in.

However, many of the ChronoZoom features strongly rely on services and resources that are unavailable in China, such as user accounts, electronic material storage, video hosting and playing, which form the high priority issues we are settling. Our mid-term and long-term goal is to achieve complete localization of ChronoZoom, which will be the foundation of further substantive work. We expect our ChronoZoom work to contribute as a supportive pillar in the dissemination and research of Big History in China. We also expect to explore the feasibility of applying ChronoZoom to the teaching of some "small history" courses with historians in China. Furthermore, we will explore the application of ChronoZoom in more generalized education, scientific and technological presentation, among others.

5. Conclusions

ChronoZoom reveals nice applicability in representing and presenting Big History knowledge and events. It is a successful attempt in the seamless integration of technology and knowledge. Its excellent intrinsic idiosyncrasy in handling timelined knowledge and events determines that history teaching will be the primary application area. Its further research and development will certainly permit it to find more and more fields and dimensions to apply to.

References

[1] Microsoft Research, ChronoZoom Background, http://research.microsoft.com /en-us / projects/chronozoom/about.aspx

[2] Big History Project, https://www.bighistoryproject.com

[3] Big History on Wikipedia, http://en.wikipedia.org/wiki/Macro_history

[4] ChronoZoom, http://www.chronozoom.com

[5] Barry Rodrigue, International Big History Association Members' Newsletter, No. 6, Vol III, Jun

2013.
[6] Fred Spier, Big History and the Future of Humanity, Wiley-Blackwell, Jan 2011.
[7] Big History Discussion Group in China (BHDGcn), http://bbs.sciencenet.cn/forum.php?mod=group&fid=709
[8] Big History Blog in China, http://blog.sciencenet.cn/u/RiverWalter
[9] ChronoZoom at SDNU, http://www.csdream.sdnu.edu.cn

福 成功 和平 力

CALL FOR PAPERS

INTERNATIONAL BIG HISTORY ASSOCIATION CONFERENCE

AUGUST 6 - 10, 2014

DOMINICAN UNIVERSITY OF CALIFORNIA

SAN RAFAEL (SAN FRANCISCO BAY AREA), CALIFORNIA

TEACHING AND RESEARCHING BIG HISTORY: BIG PICTURE, BIG QUESTIONS

DEADLINE FOR ***PAPER*** / ***PANEL*** SUBMISSIONS IS FEBRUARY 10, 2014

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 2014 conference is "Teaching and Researching Big History: Big Picture, Big Questions." The conference seeks to continue the dialog begun at the first IBHA conference in 2012. In addition IBHA seeks to create a forum for the articulation, discussion, and distillation of questions central to Big History. Among the topics that are to be addressed at the conference through a series of panels, roundtables, and discussions are:

- *Big History and energy*
- *Big History in education*

- *Big History pedagogy*
- *Big History scholarship*
- *Big History research agenda*
- *Evolution of complexity*
- *Identification and analysis of thresholds*
- *Continuity and Contingency in our Universe*
- *Big History: interdisciplinary, multidisciplinary, or trans-disciplinary?*
- *Big History and the future*
- *Big History and meaning*
- *Big History outcomes and assessment*
- *Politics and Big History*
- *Little Big Histories*

International Big History Association

Along with regular panels and roundtables, presentations might consist of:

- *Question and answer sessions – where Big Historians will be able to answer questions and discuss research questions that are worth pursuing*
- *Brainstorming sessions – with very short, provocative papers*
- *General discussion panels – where different points of view about Big History can be addressed in 5 minute increments, specifically addressing the different cultural perceptions of Big History*
- *Workshops – where participants will view short film fragments and other art forms chosen by Big Historians, and presentations on Big History from the artistic point of view from artists, musicians, and storytellers*
- *Conference roundup – with a keynote address that summarizes the most important things outcomes of the conference*

We encourage proposals on any topic related to Big History. A select group of papers will be included in a compilation of Big History Research that will be published after the 2014 conference.

The time limit for presenting papers will be 20 minutes, and the deadline for submitting papers to the session moderator is three weeks in advance of the conference. Individual paper proposals must include a 250 word abstract with the title of the paper, name, institutional affiliation, e-mail address, phone and fax numbers, and brief curriculum vitae, all integrated into a single file, preferably in MS-Word. Proposals for complete sessions or panels must contain the same information for each participant, as well as contact information and a brief C.V. for the moderator if you suggest one. (The program committee can help find moderators, if necessary.) Please submit your ***paper*** or ***panel*** proposal by clicking on one of these links, which allow for submission information. The deadline for paper and panel submissions is February 10, 2014.

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 the campus of Dominican University of California in San Rafael, which is located twelve miles north of the Golden Gate Bridge. Attendees will have the option of selecting from one of several hotels in San Rafael and the surrounding area or staying in on-campus accommodation.

San Rafael is a wonderful destination in Marin County surround by woods and beaches. For all things San Rafael go to http://www.sanrafael.com. For a complete guide to San Francisco and its many attractions, visit http://www.sanfrancisco.com/. And if you have more time to explore the larger Bay Area, see http://www.visitcalifornia.com/Explore/Bay-Area/.

Please find more details on the conference at www.ibhanet.org. We hope you can join us for this fantastic second IBHA conference!

Program Committee: Mojgan Behmand, Cynthia Brown, Lowell Gustafson, Fred Spier, and Joseph Voros

Transportation to/from San Rafael

Flying into SFO
We suggest taking the Marin Airporter from SFO to Marin and disembarking at the Central San Rafael Transit Center. Approximate travel time is 1.5 hours. Buses pick up passengers at SFO every 30 minutes, on the hour and half-hour, beginning at 5:00 AM. The last bus of the night departs from SFO at midnight. Fare is currently $20. http://www.marinairporter.com/schedules_sfo_to_marin.html
From the Transit Center in San Rafael, there are taxis available to take you to your hotel. If you are staying at the Four Points by Sheraton in San Rafael, it is approximately 3.3 miles from the Transit Center to the hotel.

Flying into OAK
We suggest taking the Sonoma County Airport Express to Marin and disembarking at the Central San Rafael Transit Center. Fare is currently $26. Please refer to the Airport Express website for travel times and pick-up times. http://airportexpressinc.com/schedules.php
From the Transit Center in San Rafael, there are taxis available to take you to your hotel. If you are staying at the Four Points by Sheraton in San Rafael, it is approximately 3.3 miles from the Transit Center to the hotel.

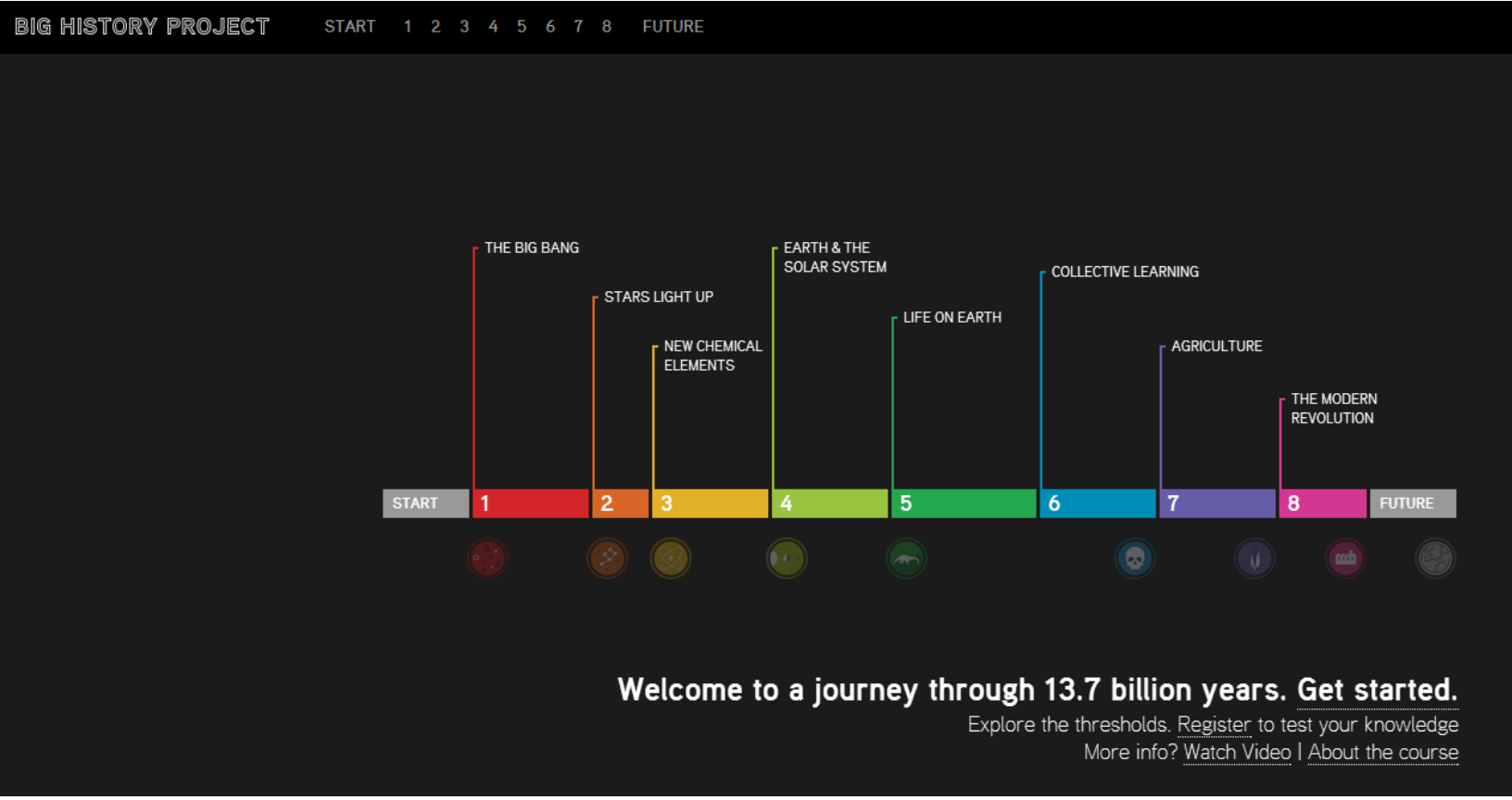
Hotel
Four Points by Sheraton
1010 Northgate Drive
San Rafael, CA 94903

Central Reservations 1-800-325-3535
Hotel Reservations 1-415-479-8800

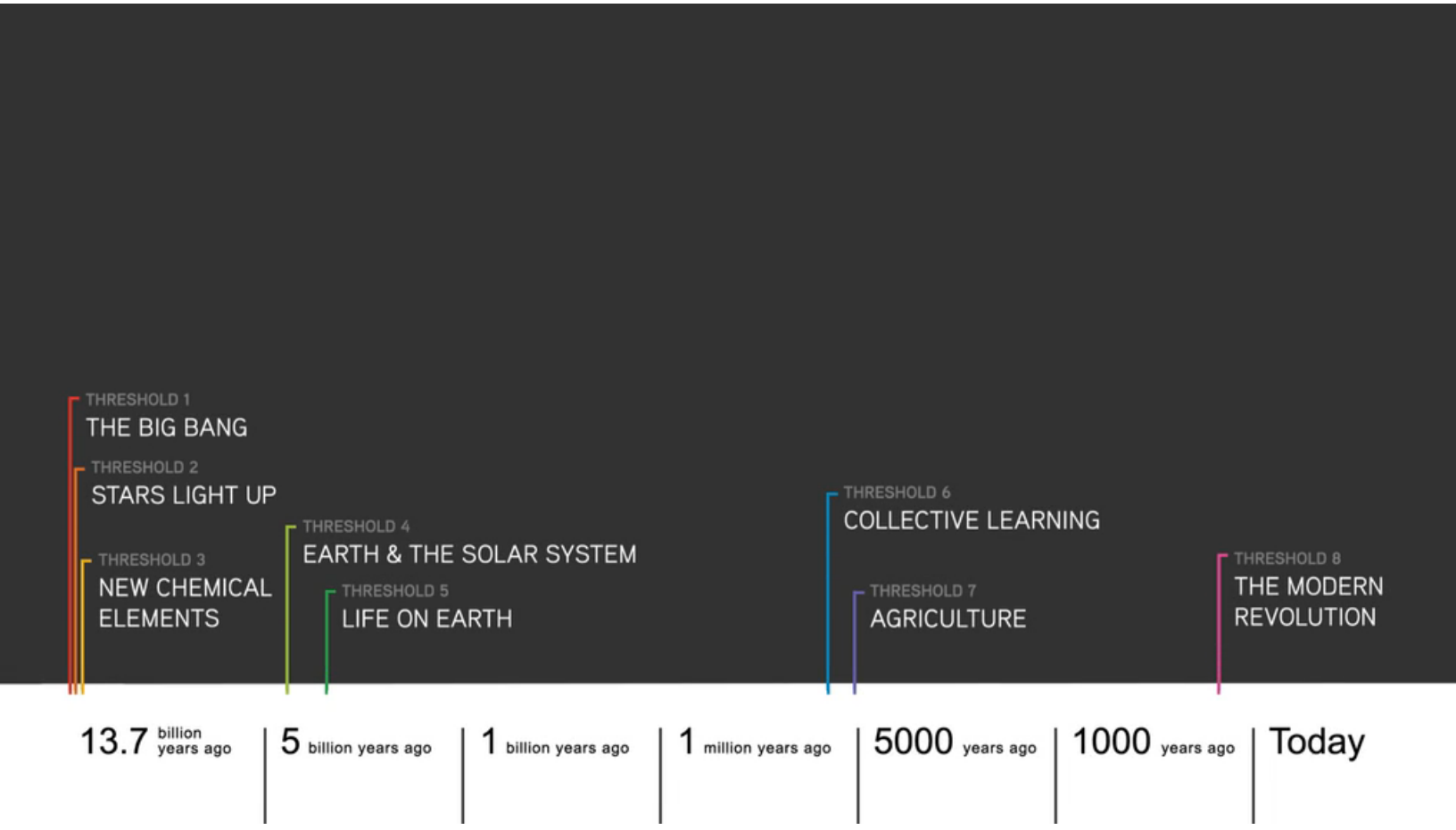
Callers should identify themselves members of "DU-IBHA" arriving on Wednesday, August 6th and departing Sunday, August 10th, 2014 to secure the special rate and receive their confirmation number. Callers should have a credit card ready to guarantee reservation.

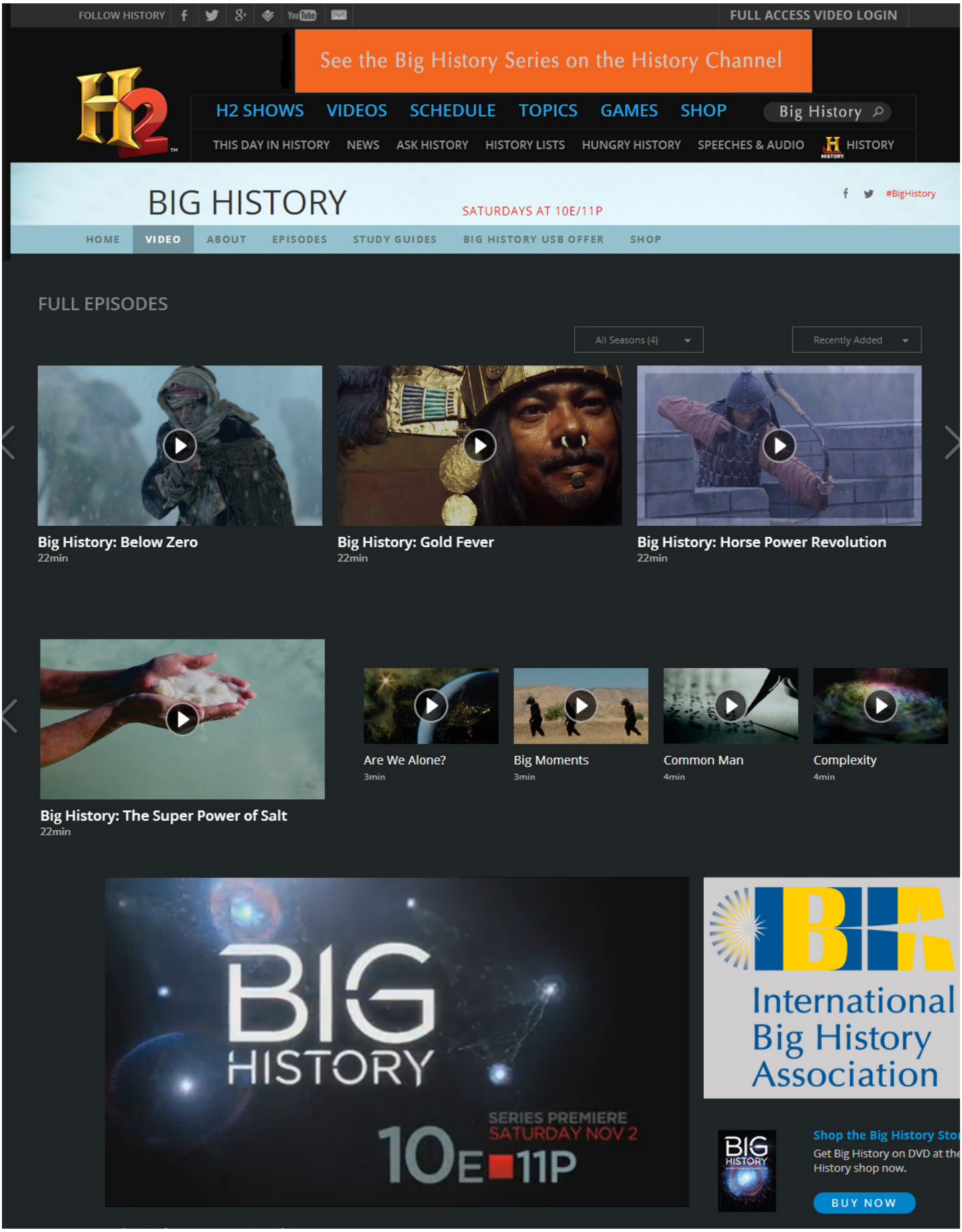
Discounted Rate: $114 (by 5pm local time, June 13th, 2014)
Group Rate: $139 (by 5pm local time, July 11th, 2014)

Reservations may be cancelled without penalty up to 24 hours prior to arrival.



The Big History Project is Now Publicly Available




FOLLOW HISTORY
FULL ACCESS VIDEO LOGIN
See the Big History Series on the History Channel
H2 SHOWS VIDEOS SCHEDULE TOPICS GAMES SHOP
Big History
THIS DAY IN HISTORY NEWS ASK HISTORY HISTORY LISTS HUNGRY HISTORY SPEECHES & AUDIO HISTORY
BIG HISTORY
SATURDAYS AT 10E/11P
#BigHistory
HOME VIDEO ABOUT EPISODES STUDY GUIDES BIG HISTORY USB OFFER SHOP
FULL EPISODES
All Seasons (4)
Recently Added
Big History: Below Zero
22min
Big History: Gold Fever
22min
Big History: Horse Power Revolution
22min
Big History: The Super Power of Salt
22min
Are We Alone?
3min
Big Moments
3min
Common Man
4min
Complexity
4min
BIG HISTORY
SERIES PREMIERE
SATURDAY NOV 2
10E 11P
International Big History Association
Shop the Big History Sto
Get Big History on DVD at the History shop now.
BUY NOW

International Big History Association
Brooks College of Interdisciplinary Studies
Grand Valley State University
1 Campus Drive
Allendale MI 49401-9403

http://ibhanet.org/

International Big History Association

The views and opinions expressed in the International Big History Association newsletter are not necessarily those of the IBHA Board. The IBHA newsletter reserves the right to accept, reject or edit any material submitted for publication.