



# An Introduction to Big History: Thresholds of Increasing Complexity or Four Movements?

*By Bob Bain*

The Big History story of the universe – and human's place in it – is told from two perspectives that are outlined in this article. The first, from historian David Christian, is based on thresholds of increasing complexity. The second, from geologist Walter Alvarez, concentrates on four movements: the Cosmos, the Earth, Life, and Humanity.

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## Introduction

Everyone and everything has a history, from your grandmother to a World War II battle. There's a history of the planet and even a history of the entire universe. In order to make sure an account of history fits together, you need to periodize it. That's a fancy way of describing how historians divide history into different chunks of time.

The Big History story of the universe and humankind has been told from many different perspectives. Two of those perspectives are described in this article.

## Thresholds of Increasing Complexity: David Christian's Big History

David Christian is a historian who focuses on the stories people tell about the universe and the history of humankind. Some of these stories are origin stories. They explain where humans came from. The story of Adam and Eve in the Christian and Jewish Bible is one example of an origin story. Dr. Christian explains that every culture had an origin story.

With more than seven billion people on the planet, there is no one origin story for all humans. However, Christian claims that one has been emerging over the last 50 years. He calls this "Big History."

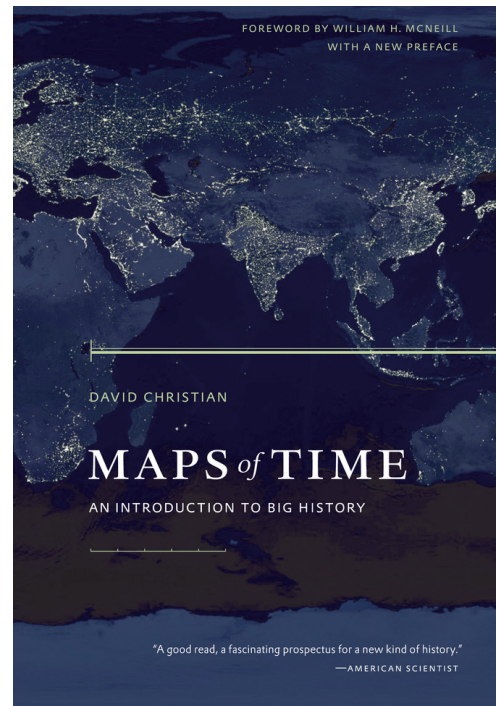
Christian's story centers around the idea that sometimes completely new and more complex phenomena (or things) comes into existence. These phenomena are more complex because they have more parts. Christian created the term "thresholds of increasing complexity." A threshold refers to a key moment when everything changes. For Christian, a threshold of increasing complexity is a time when new complex phenomena emerged. He and other Big Historians identified eight such thresholds of increasing complexity. Together, they tell a Big History of the universe.

So, what's the story?

The story begins with the beginning of the universe: the Big Bang. Recently, we learned that stars are moving away from us, which indicates that the universe is expanding. Scientists reasoned that the universe must have been smaller at one point in time. From these deductions they created the Big Bang Theory, or the theory that there was a time when the universe first emerged. Early on in the universe, there were only a few elements.

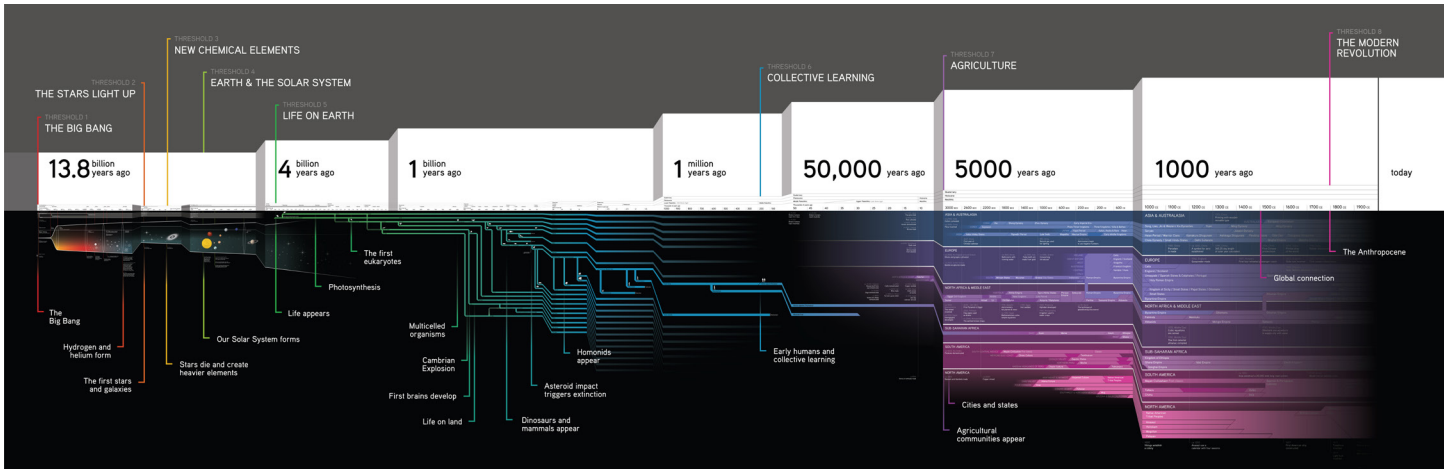
This was enough for more complex phenomena to emerge, such as stars and galaxies. In Christian's system, this was Threshold 2. Then, more complex and heavier elements emerged (Threshold 3). Eventually our Solar System and Earth (Threshold 4) emerged. About 4.5 billion years ago, our Sun and the moons and planets of the solar system formed. One of those planets was our Earth, a rocky planet with a single moon.

The development of life is Threshold 5 in Christian's Big History. This is another example of complex things emerging from less complex things. The first organisms were single-celled bacteria. Some of these bacteria gave off oxygen, which helped to form the ozone layer. Ozone protects us from the harmful rays of the sun. More complex life evolved from single-celled organisms to give us the wide range of organisms that exist on Earth today.



*Cover of Maps of Time, by David Christian.  
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This story is not only a story of how the universe became more complex. It is also the story of how humans came to understand the universe we live in. By understanding the science of natural forces around us, we can better understand the past, present, and future.



*Quite a Big History, wouldn't you agree?*

There are three final thresholds of increasing complexity. There is the Emergence of Humans and Learning (Threshold 6). Next is the Emergence of Agriculture or farming (Threshold 7). Finally, there was the Emergence of Modernity and Use of Fossil Fuels (Threshold 8). Humans have used fossil fuels such as coal and oil to power new technologies that define the modern world. These thresholds are three major turning points in the history of humanity.

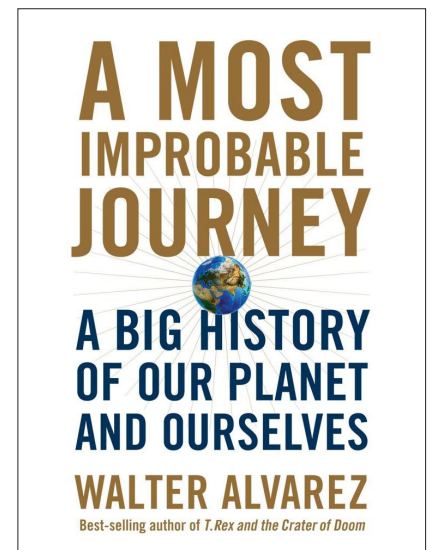
This story covers over 13.82 billion years of time. It explains how our universe has grown more complex from the Big Bang to modern times.

## Another Big History story: Walter Alvarez's Improbable Journey in Four Movements

Not all Big Historians use Christian's threshold system to structure their history. Indeed, not all Big Historians are even historians. Walter Alvarez is a geologist who studies Big History, and he does not use thresholds. Geology is the study of the Earth's structure. Alvarez structures his Big History around four periods: the Cosmos, Earth, Life, and Humanity. For Alvarez, every period is an orderly system with consistent patterns over time.

For example, Alvarez says that the Earth has provided "gifts" for humans. These gifts include silicon. Silicone has played an important role in the tools we have created, beginning with the first stone tools. Using silicone is a pattern that has been seen throughout the entire period of Humanity.

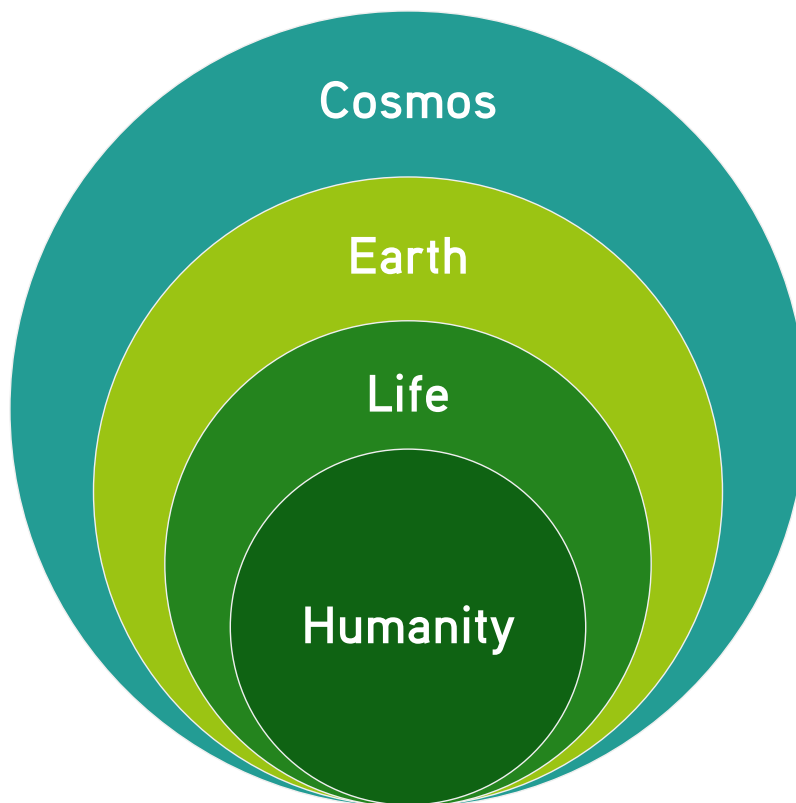
Alvarez's Big History does not simply focus on patterns in a period. He also sees rare events that lead to significant changes in history. He calls these rare events contingencies. Dr. Alvarez and his father discovered that a comet or asteroid wiped out the dinosaurs. This was one example of a contingency that shaped the course of human history.



*Cover of A Most Improbable Journey, by Walter Alvarez. Fair use.*

During the time of dinosaurs, there were very few mammals on Earth. The mammals that did exist were quite small. Since humans evolved from mammals, it is highly unlikely that we could have evolved if not for the extinction of dinosaurs. Evidence suggests that a huge comet or asteroid hit Mexico 66 million years ago. This rare event enabled mammals to thrive. Human life depended upon this irregular event or contingency. Contingencies are essential for Alvarez's Big History.

Alvarez does not create one timeline for his Big History. Each of the four periods is separate, but part of a connected story. It is also a story about the people who discovered the natural laws that govern the universe. It's a story about discovering the laws of gravity, light, and the Earth's elements.



*Table 1: Dr. Alvarez's regimes of history.*

Like Christian, Walter Alvarez stresses events such as the Big Bang. He too appreciates the path that has led to our existence. In many ways, it was extremely unlikely that we humans would exist at this time, on this Earth, and in this universe.

These two versions of Big History help to explain the context of human history. All other events play out on this stage.

## Bob Bain

Bob Bain is Associate Professor in the School of Education, and the Departments of History and of Museum Studies at the University of Michigan. He also is the director of U-M's World History and Literature Initiative and the faculty lead on the Big History Project. Before coming to the U-M in 1998, he taught high school history and social studies for 26 years. Bain's research centers on teaching and learning history and the social sciences in classrooms, on-line, in museums and homes.

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