In Brief

Explore this master timeline of the cosmos, Earth, life, and human experience. ChronoZoom unifies a wide variety of data and historical perspectives, enabling researchers, educators, and students to examine historical events, trends, and themes and synthesize unexpected relationships and historical convergences that help explain the sweep of Big History.

Walter Alvarez
Professor of Geology
University of California, Berkeley

Roland Saekow
Community Project Leader
University of California, Berkeley

Sergey Berezin
Associate Professor
Moscow State University

Chris Engberg
Geophysics Major
University of California, Berkeley

Robbie Bruens
History Major
University of California, Berkeley

Rane Johnson
Principal Research Director
Microsoft Research Connections

Michael Zyskowski
Program Manager
Microsoft Research Connections

Websites:

chronozoomproject.org

research.microsoft.com/chronozoom

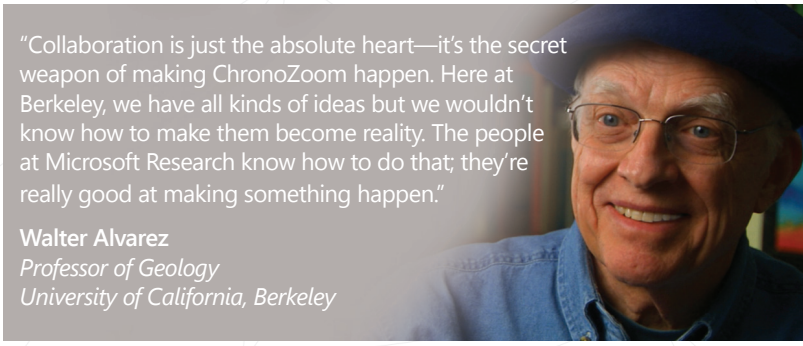
outercurve.org

eps.berkeley.edu

msu.ru/en

An Infinite Canvas in Time: Visualizing the History of Everything

We are living in an age of seemingly endless data. As the volume of information available throughout the world has continued to grow, information storage technology has become cheaper and more accessible. Together, these factors have created a wealth of historical information that is a boon to academics and researchers. Now, a new tool is bringing history to life.



ChronoZoom is a unique online tool that takes viewers on a visual journey into history that is comprised of documents, images, data, and videos—all displayed in chronological order on a vast, zoomable timeline. ChronoZoom offers unprecedented depth; it enables viewers to explore the past, starting with the Big Bang billions of years ago and up to the present day: a zoom factor of nearly 5 trillion. The tool is the result of an international collaboration led by the University of California, Berkeley (UC Berkeley), in collaboration with Microsoft Research and Moscow State University in Russia.

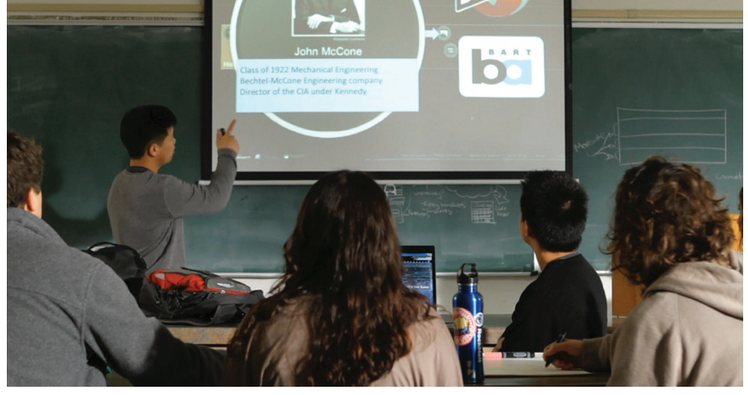
FINDING A MODERN SOLUTION TO AN AGE-OLD ISSUE

ChronoZoom's own history began in 2009 when Roland Saekow, an undergraduate student at UC Berkeley, had the idea for ChronoZoom while enrolled in a Big History course taught by Walter Alvarez, professor of Geology at UC Berkeley. Big History is a field of historical study that attempts to understand, through an interdisciplinary approach, the history of the cosmos, Earth, life, and humanity. One of the greatest challenges in teaching a Big History course is conveying and exploring the vast time scales of the past.

"I had a wonderful time with just wonderful students in [the class], but there was always a really big problem: how do you convey those scales of time from human history all the way back to cosmic history?" Alvarez reflects. "I tried various kinds of drawings. I'd drawn it in linear scales and I'd drawn it in logarithmic scales and I'd tried this way and that and I never could find a way of conveying the difference of those time scales."

Alvarez had developed a series of timeline handouts that were created by using a number of different methodologies, but did not have a single,

ChronoZoom was built as a collaboration between UC Berkeley, Moscow State University, and Microsoft Research.



"The first thing people usually comment with ChronoZoom is experiencing that 'wow' factor of zooming from humanity all the way to the 13.7 billion years of cosmos," says Chris Engberg, shown here with Roland Saekow.

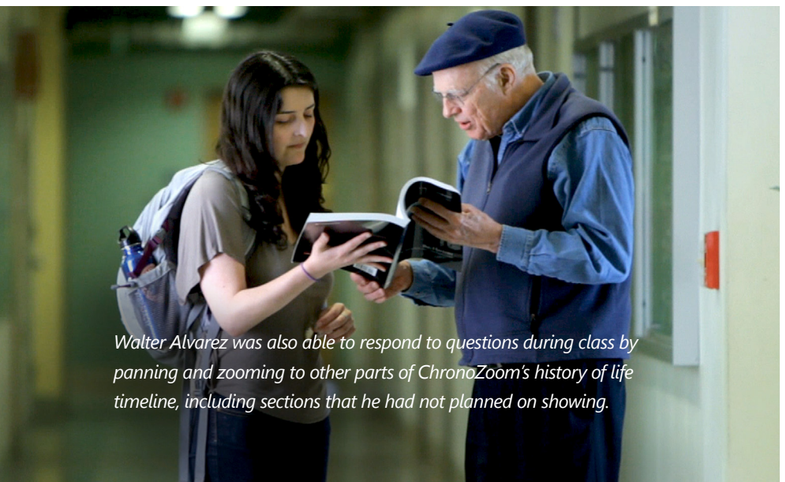
comprehensive method for presenting the time scales of Big History. After class one day, Saekow approached Alvarez with a proposal. "He said, 'Professor, I think we could show those time scales by using computer zoom technology'," Alvarez remembers.

Alvarez and Saekow began meeting after class to discuss ideas for creating a zoomable, visual, interactive timeline. They first attempted to use Adobe Illustrator to create mockups, but they quickly discovered that contemporary graphics applications could provide only a fraction of the zoom capability they needed.

Saekow then remembered a TED Talk about Seadragon, a Microsoft zoom technology that was being applied to exploring very large high-resolution images. Saekow proposed that it might possible to use Seadragon deep zoom technology, rather than photos, to visualize time. Alvarez and Saekow did not know how to get in touch with the developers behind Seadragon, so they turned to the Office of Intellectual Property and Industry Research Alliances (IPIRA) at Berkeley for help. IPIRA helped Alvarez and Saekow arrange a conference call with Microsoft Research. The professor and student team produced a seven-minute video that explained both the Big History time scale problem as well as an initial prototype—and ChronoZoom was conceived. The next step: turning their idea into a reality.

BRINGING HISTORY TO VISUAL LIFE

Microsoft Research connected Alvarez and Saekow with Microsoft Live Labs, the team that was actively developing Seadragon zoom technology. A small but dedicated team at Live Labs joined forces with UC Berkeley to create the first alpha version of ChronoZoom. The first version was a built as a giant rasterized image that zoomed smoothly and could be explored by using deep zoom technology.



Walter Alvarez was also able to respond to questions during class by panning and zooming to other parts of ChronoZoom's history of life timeline, including sections that he had not planned on showing.

It made its debut to a packed standing-room only event during the UC Berkeley 97th Annual Faculty Research Lecture given by Alvarez in 2010.

"What we wanted to do was go back to the drawing board and create ChronoZoom, a tool that [could handle] all types of multimedia and had information from researchers and experts all over the world. And that's what we've done," says Rane Johnson, principal research director at Microsoft Research Connections. The UC Berkeley team shifted its focus to a new goal: creating an easy-to-use, database driven version that could easily incorporate new timelines and data. The new tool should be able to use a variety of content types, including video, charts, graphs, images, and articles. The team also expanded its target audience to include members of the humanities and science communities, who were interested in using ChronoZoom for research and teaching.

The Microsoft Research Connections team was instrumental in establishing the collaboration between the Microsoft Live Labs and UC Berkeley teams. With an investment in a dedicated engineering effort as well as funding for student contributions, the next phase of ChronoZoom was secured.

A GLOBAL COLLABORATION

As the project goals and strategy unfolded, the team needed a new perspective to help advance the project. They were fortunate to have the opportunity to bring on a new set of highly skilled student developers from Lomonosov Moscow State University. Led by Sergey Berezin, an associate professor at Moscow State University, the developers joined the ChronoZoom project in the latter half of 2011.

Undergraduates and graduates from Moscow State University utilized the latest web standards along with JQuery to produce a dynamic rich HTML5 experience that could function on a wide variety of browsers and devices.

"It was a challenge for us to create an application such as ChronoZoom, which will be used by a million people around the world," says Berezin.

"We got a lot of experience working with the Microsoft Redmond team and with the Berkeley team."

Working together, the UC Berkeley and Moscow State teams produced the ChronoZoom 2.0 beta. This version harnesses the power of Windows Azure for flexibility and scalability to support a complex zoomable canvas.

"What's great about ChronoZoom is that it's built on Windows Azure, a cloud computing platform. So they don't need to worry about being able to maintain it, worry about too many people hitting it, or when it gets terabytes and terabytes of data in it, what they're going to do," Johnson explains. Because maintaining content in the cloud removes the storage limitations that organizations face with hardware storage, "Students and the computer science departments who work on ChronoZoom can focus on making an amazing tool while we take care of everything on the backend."

A BRIEF HISTORY OF TIME

The ChronoZoom 2.0 beta is now available for teachers, students, and researchers to provide their feedback. Visitors can browse through history on ChronoZoom to find information in the form of articles, images, video, sound, and other media in a rich, visual experience.

By drawing upon the latest discoveries from many different disciplines, visitors can visualize the temporal relationships between events, trends, and themes. Some of the disciplines that contribute content to ChronoZoom include biology, astronomy, geology, climatology, prehistory, archeology, anthropology, economics, natural history, and population and environmental studies.

"The first thing people usually comment with ChronoZoom is experiencing that 'wow' factor of zooming from humanity all the way to the 13.7 billion years of cosmos," says Chris Engberg, an undergraduate at UC Berkeley in the Earth and Planetary Sciences Department. "It's a great sensation as it disappears into a pixel and then you just keep zooming and zooming out, to see all of the cosmos."

"Down the road, we hope ChronoZoom really grows in the matter of content it has inside of it. We set the framework but, of course, its greatest use is when we will have lots of data so people can make comparisons, so people can see trends and patterns to their history. So it's going to be really exciting for students, teachers, and researchers and that's what we're looking forward to in the future."

Roland Saekow
Community Project Leader
University of California, Berkeley

CHRONOZOOM IN ACTION

Robbie Bruens, a history major at UC Berkeley, wanted to do something special for his senior thesis presentation. He wrote his thesis on the changing perceptions of time in Great Britain during the industrial revolution, so he was naturally drawn to ChronoZoom's timeline capabilities. Instead of giving a standard slide show presentation, Bruens

"ChronoZoom is a window into the world of big data. It bridges the gap between the humanities and sciences through an infinite canvas, allowing the exploration of data throughout all of time."

Michael Zyskowski
Program Manager
Microsoft Research Connections

used ChronoZoom to bring his story to life through an interactive tour.

Bruens accomplished this in just a few hours by creating a timeline that encompassed several important events, each revealed through thought-provoking images and articles. ChronoZoom enabled Bruens to arrange the events chronologically, producing a dynamic, interactive backdrop for his talk. By using ChronoZoom from a web browser, he zoomed in and out of events, exposing their relationship to other events. Bruens ended his interactive presentation by putting the industrial revolution in the context of the history of all of humanity, and then showing humanity in the context of all of human pre-history. Bruens continued zooming out to the history of the cosmos, reminding his audience to reflect upon the bigger scales of history and to investigate the past from as many different angles as possible. Lastly, he was able to invite others to view his timeline since he could easily share a URL to his ChronoZoom interactive tour.

UNDERSTANDING BIG HISTORY

Meanwhile, in the graduate-level Big History course, Alvarez was using ChronoZoom to introduce the history of life to a new incoming class of students by showing the phylogenetic tree of life leading to humanity. Big History courses are unique in that students often have very diverse backgrounds. Students majoring in engineering, psychology, biology, English, and art might all be enrolled in the same course. In such an interdisciplinary course, students and professor alike must learn the languages of each other's fields.

To introduce his students to this unfamiliar topic, Alvarez used ChronoZoom to engage his audience as they zoomed through time—viewing organisms' names with pictures or representative illustrations in the chronologically correct sequence on the timeline. After spending time with ChronoZoom, students with a minimal background in biology began asking questions about the history of life. Similarly, biology students, upon seeing all of history laid out on a linear scale for the first time, began asking about the timing of key events and whether events in other timelines, such as Earth history, shaped the history of life.

Alvarez was also able to respond to questions during class by panning and zooming to other parts of ChronoZoom's history of life timeline, including sections that he had not planned on showing. A pre-scripted slide show presentation would not have allowed for this flexibility. Soon, students from science and humanity backgrounds were participating in a discussion about the history of life.

"What's really amazing about ChronoZoom is that it's built by the academic community."

Rane Johnson
Principal Research Director
Microsoft Research Connections

THE FUTURE AWAITS

With the framework of ChronoZoom established, the ChronoZoom team looks forward to opening the project up to more partners so that ChronoZoom can become a useful teaching, learning, and research tool. The team encourages computer science researchers and students to help build the features and capabilities required for ChronoZoom to function optimally. And professors, researchers, and students in the humanities and sciences are encouraged to contribute content that chronicles the history of the humanities and the sciences—and that demonstrates how these fields have influenced one another.