

Nudging People Into Log-Scale Thinking

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<http://www.cs.ubc.ca/~tmm/talks.html#hackers24>



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Why did we want to nudge people into log-scale thinking?

- museum exhibit about deep time
- deep time: very long periods of time of geological processes
 - or other long timescales: evolutionary/biological, astronomical...
- museum exhibits: informal science education
 - a few seconds to engage, a few minutes if you're lucky
 - not trapped in a classroom, they can and will wander away
- collaboration
 - visualization researchers, geoscience education researchers, museum curators

From goals to project requirements

- goal: support museum visitors in improving their proportional learning skills by facilitating comparisons between historical events on exponentially increasing time scales
 - unpack into five project requirements
- **Staff facing**
 - **R-Deploy**: find/build collaborations that lead to deployment
 - **R-Curate**: enable non-technical museum staff to curate datasets
- **Visitor facing**
 - **R-Engage**: engage visitors through enjoyment or interest
 - **R-Inspire**: inspire curiosity to foster positive relationships with science
 - **R-Compare**: support task of **comparing varied-magnitude time periods**

What Have Others Done?

Trail of Time: Multi-hour walk

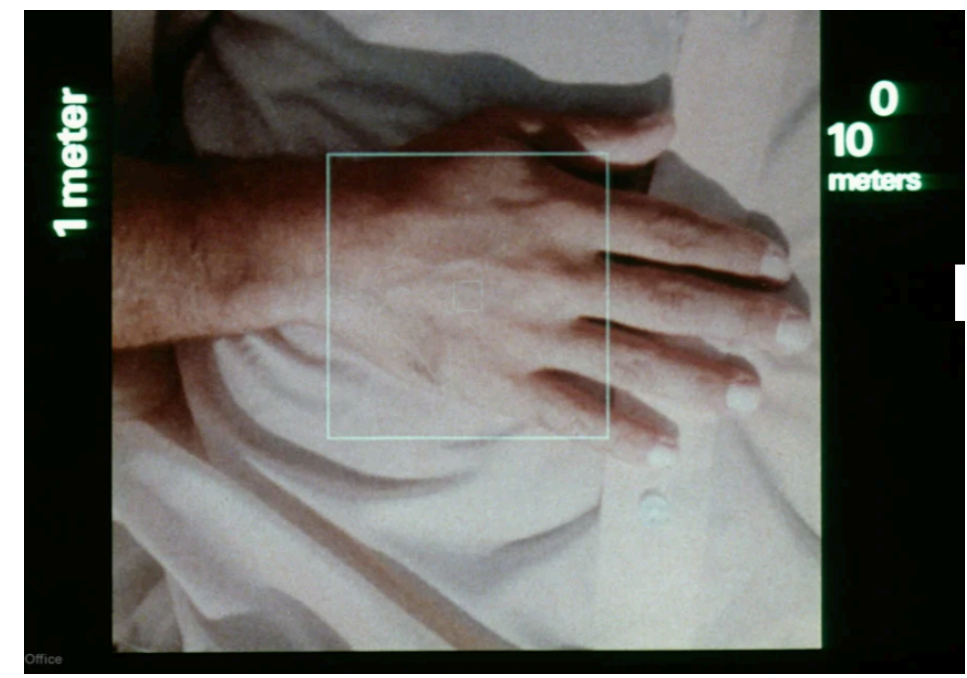
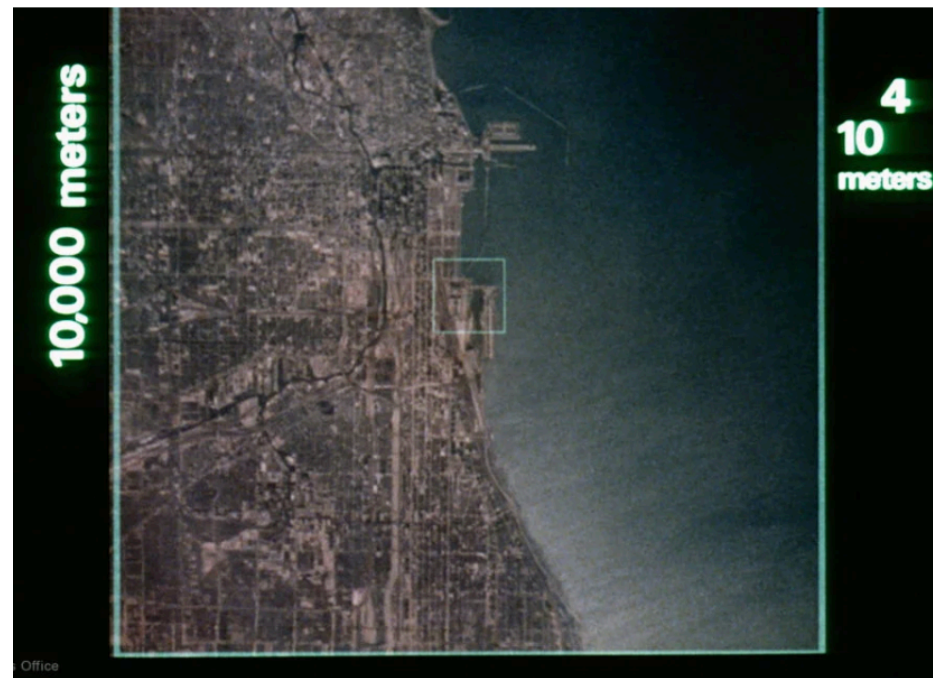
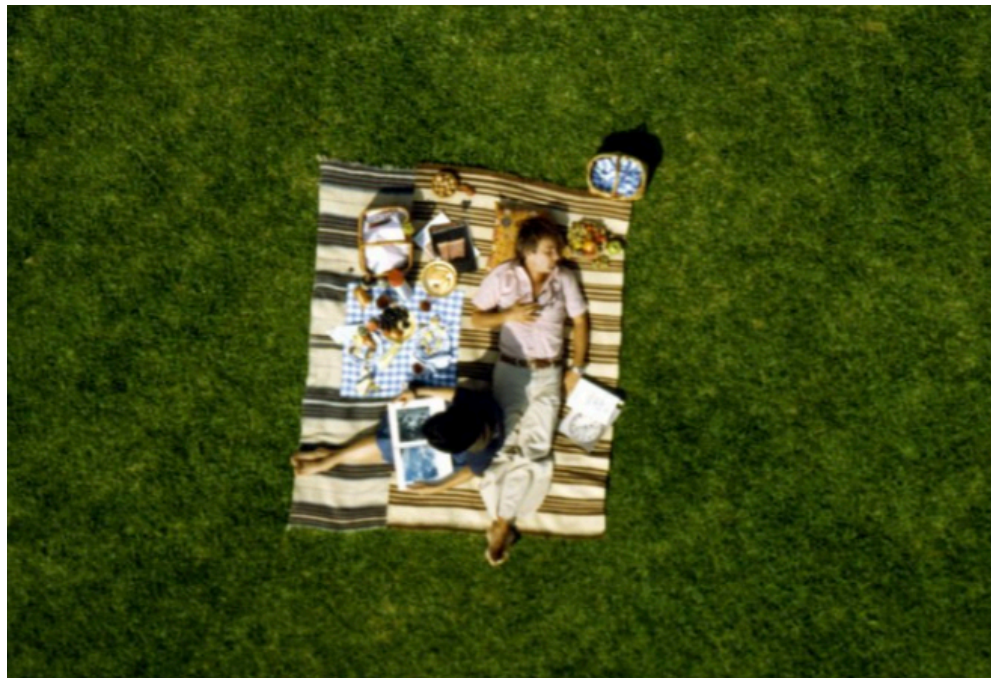
- interpretive trail in Grand Canyon
- 1 meter represents 1 million years
- visceral experience unfolds over hours & kilometers

<https://tot.unm.edu/>



Powers of Ten: Ten-minute animation

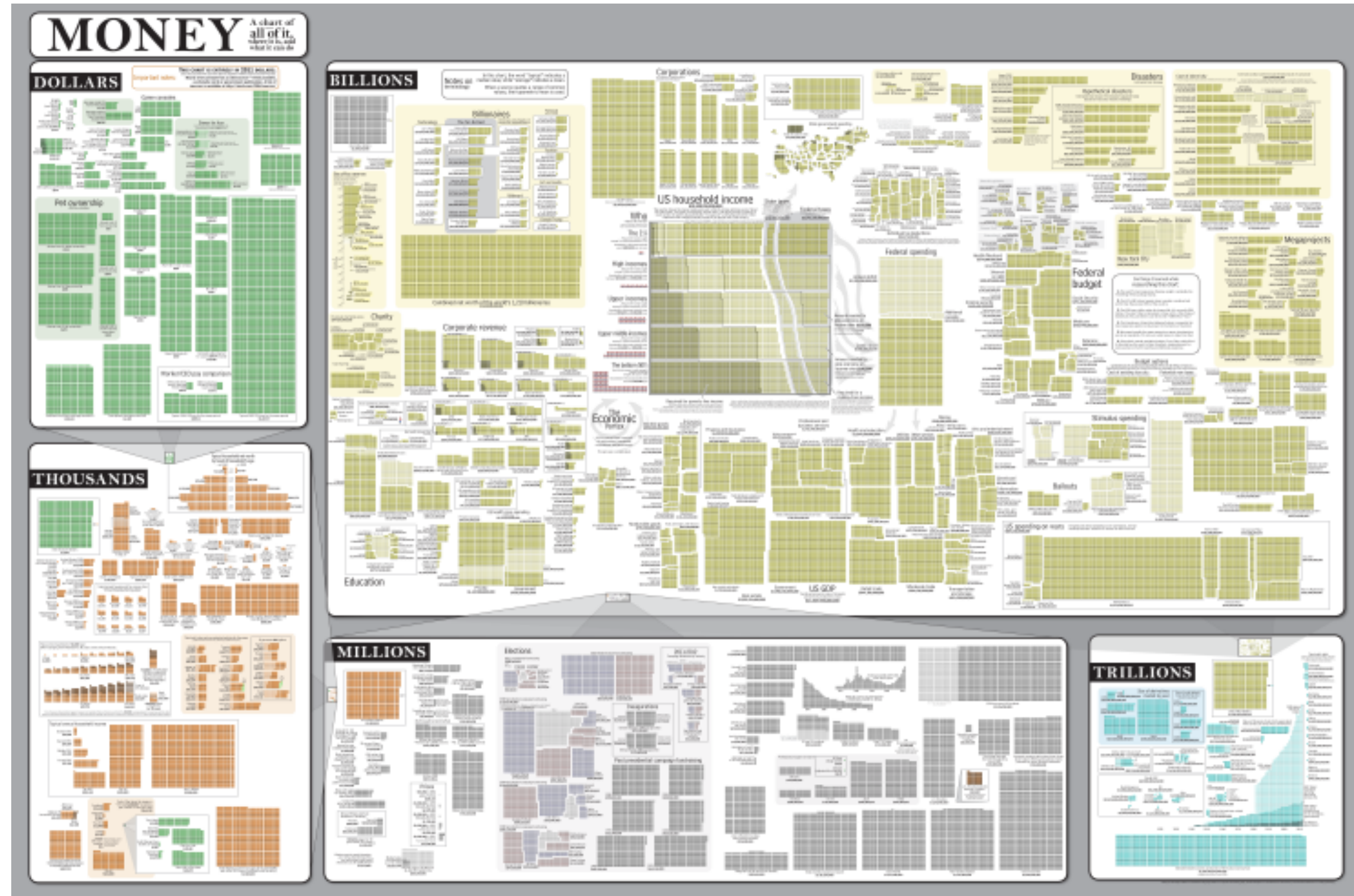
- animation zooms from human out to galactic in to subatomic scales
- visceral sense of time passing over the minutes
- animation costs: duration, plus high memory load



<https://youtu.be/0fKBhvDjuy0>

XKCD Money: Concrete scales

- compare sizes of familiar things
 - I Starbucks latte per day for a year
 - box office revenue of Titanic
 - one fighter jet
- unitization: each box is \$1, or \$1K, or \$1M, or \$1B, or \$1T
- must zoom to read

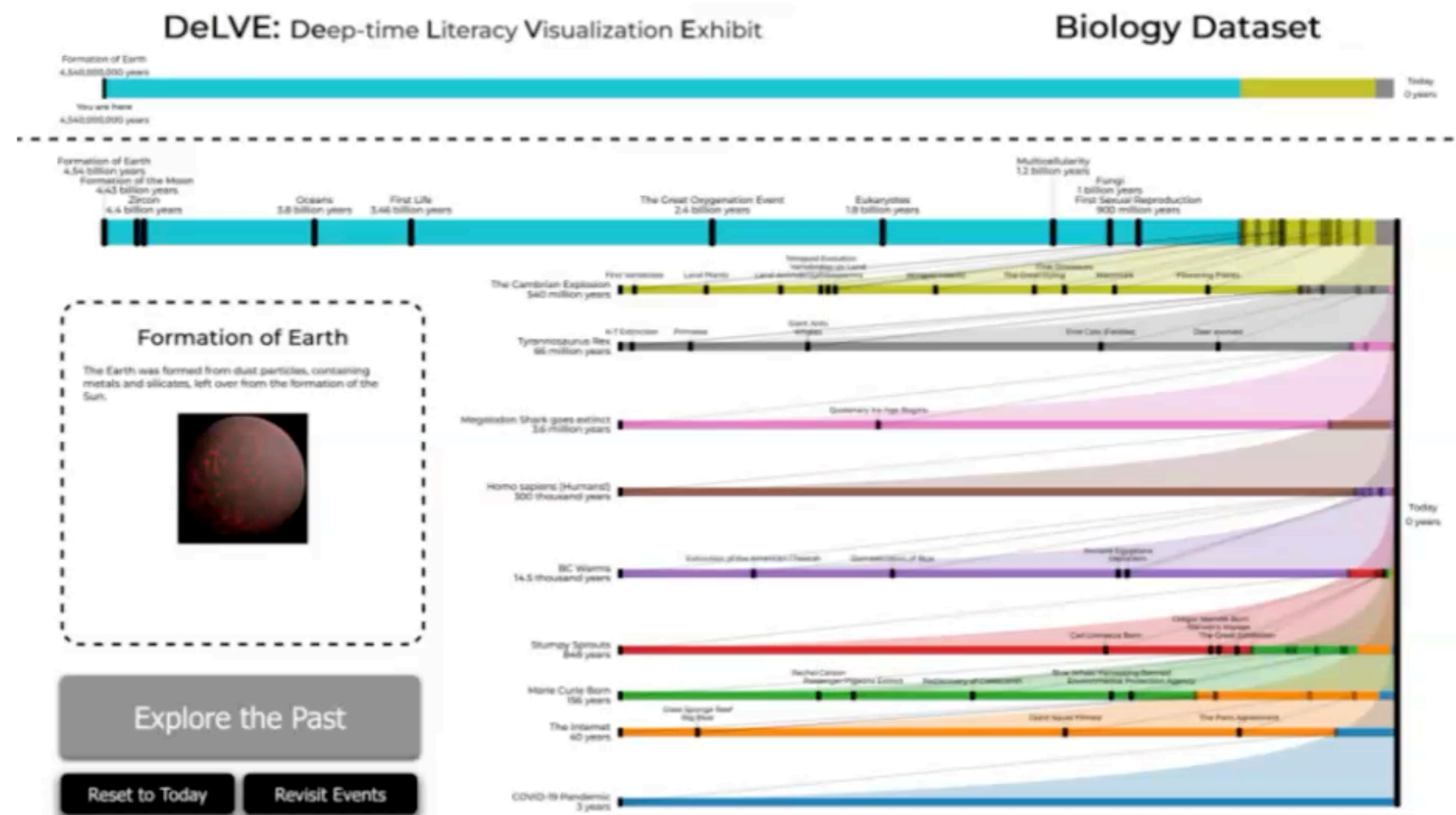


<https://xkcd.com/980/huge>

What Did We Do?

DeLVE Look and Feel Video

Mara Solen, Nigar Sultana, Laura Lukes, Tamara Munzner



Visual encoding: Connected Multi-Tier Ranges

New idiom: connected multi-tier ranges (CMTR)

R-Inspire

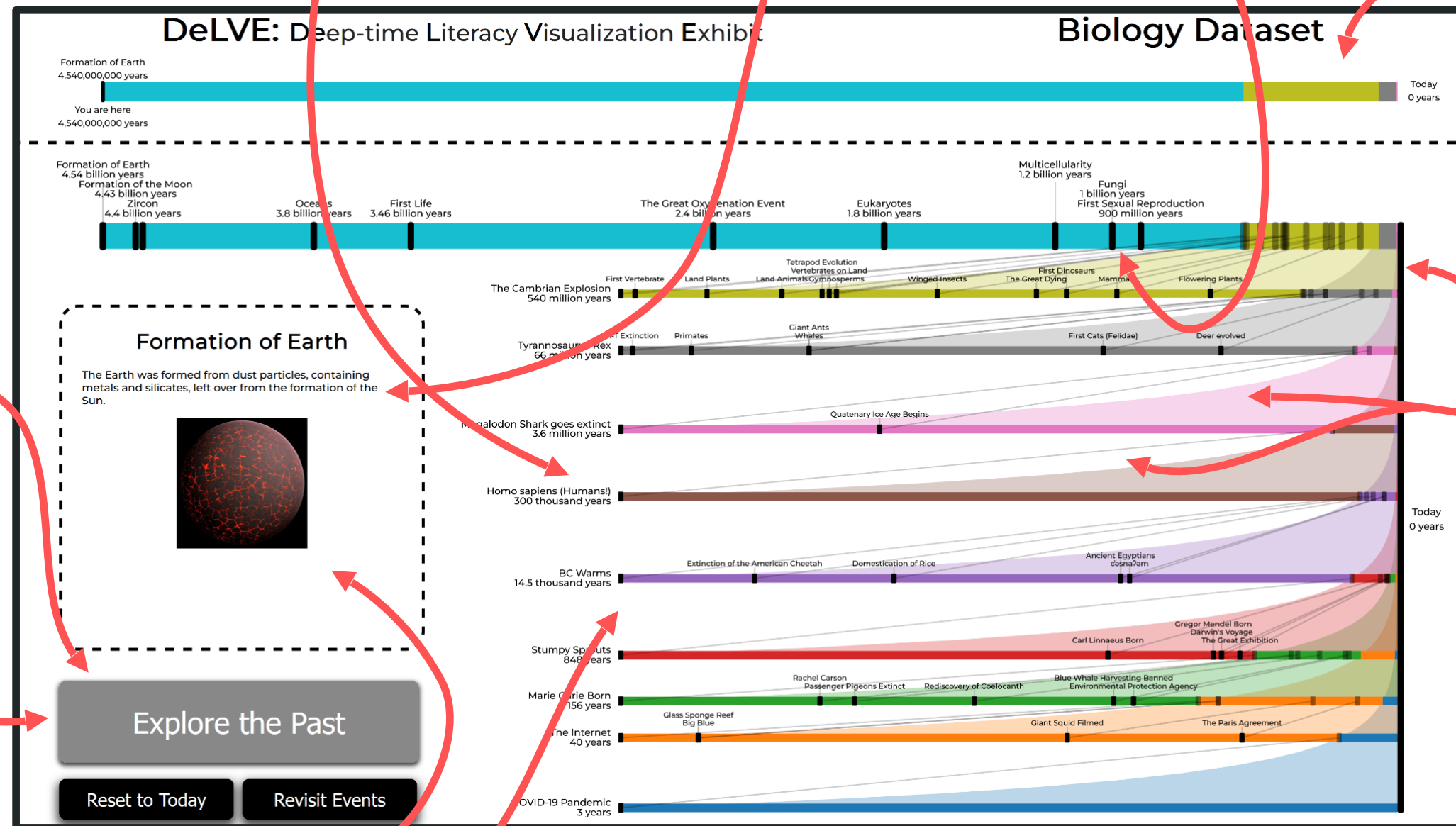
Descriptions
Times

R-Engage

Animation
Interactivity
Pictures
Colours

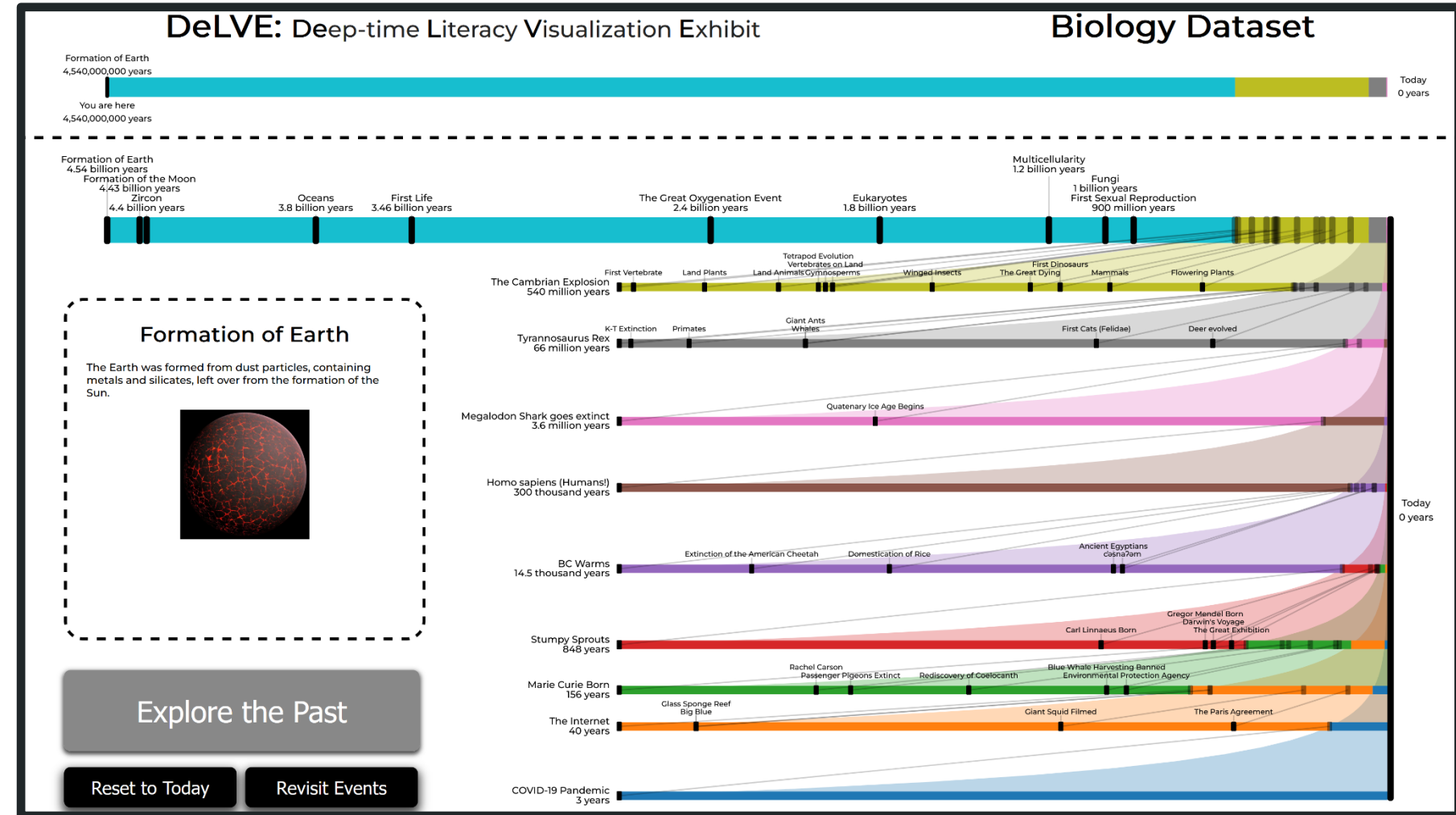
R-Compare

Timelines
Connecting Lines



Visual encoding: Connected Multi-Tier Ranges

- concrete scales
 - start with familiar
- side by side views
 - all ranges stay visible, after builds
 - within range: linear
 - follow log shaped relation curves to see relative length of times on exponentially increasing scales
- animation for transitions only
 - animation for everything would hit limits of human visual memory



Data abstraction

- not the common visualization use cases where datasets known in advance
 - exploratory data analysis
 - communication / presentation
- instead, nudging towards understanding of abstract concept
 - museum curators specify in spreadsheet tied to their particular museum's collection
 - what properties should curated datasets have?
- abstraction: values & ranges
 - monotonic: ordered from smallest to largest
 - contiguous: neighbouring ranges share edges
 - disjoint: individual ranges do not overlap

DeLVE Into Earth's Past:

A Visualization-Based Exhibit Deployed Across Multiple Museum Contexts

joint work with:

Mara Solen, Nigar Sultana, Laura Lukes

paper page:

<https://www.cs.ubc.ca/group/infovis/pubs/2024/delve/>

live demo:

<https://deeptime.cs.ubc.ca/>

More stuff

- this talk

<http://www.cs.ubc.ca/~tmm/talks.html#hackers24>

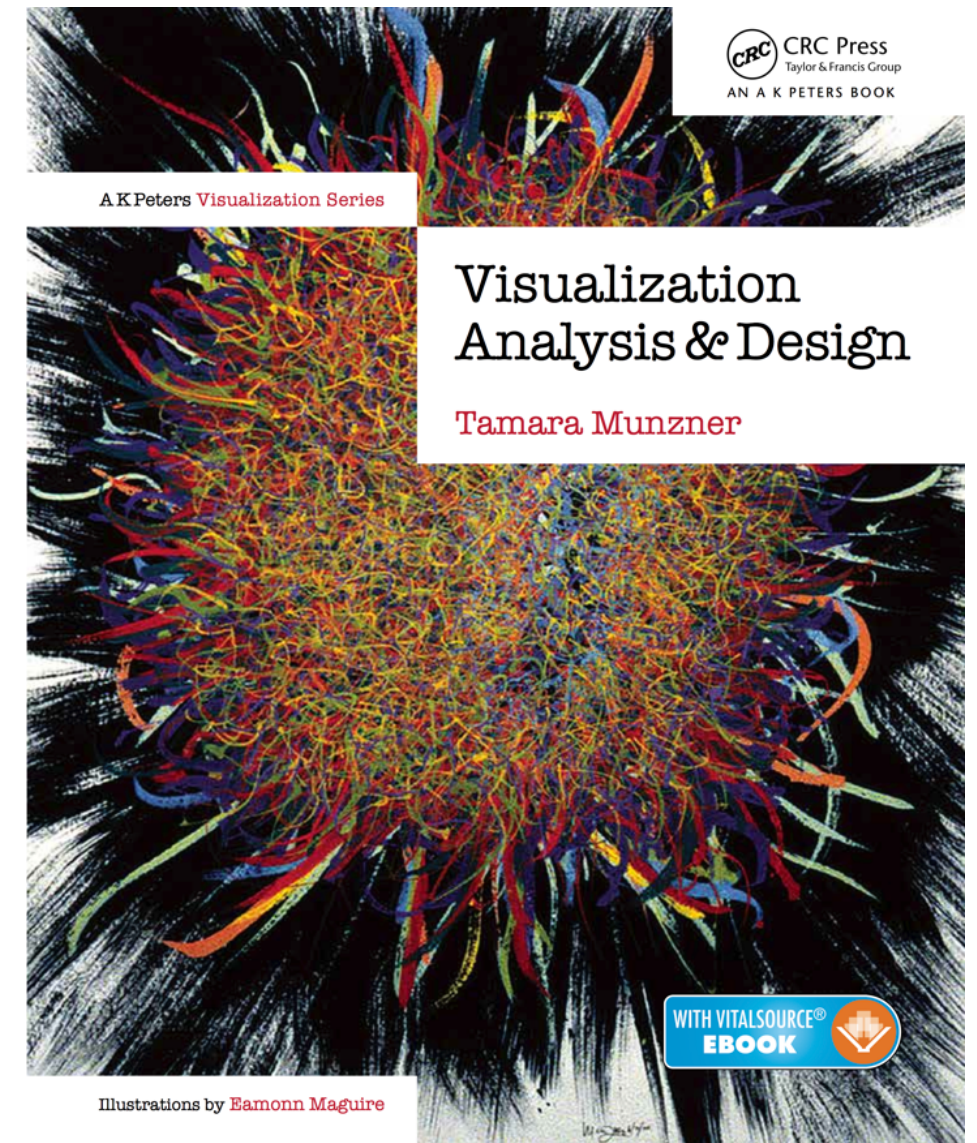
- book

<http://www.cs.ubc.ca/~tmm/vadbook>

- full courses, papers, videos, software, talks

<http://www.cs.ubc.ca/group/infovis>

<http://www.cs.ubc.ca/~tmm>



Visualization Analysis and Design. Munzner.
CRC Press, AK Peters Visualization Series, 2014.

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