

IEEE VIS 2024

DeLVE into Earth's Past: A Visualization-Based Exhibit Deployed Across Multiple Museum Contexts

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THE UNIVERSITY OF BRITISH COLUMBIA

Previous Museum Vis Studies - Single Contexts!



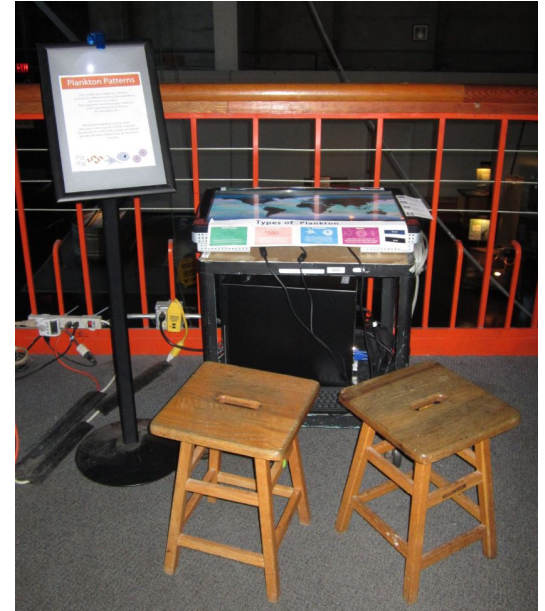
EMDialog, Hinrichs et al., 2008



DeepTree, Block et al., 2012



Sea of Genes, Dasu et al., 2021



Living Liquid, Ma et al., 2012

Context?



EMDialog, Hinrichs et al., 2008

Context?

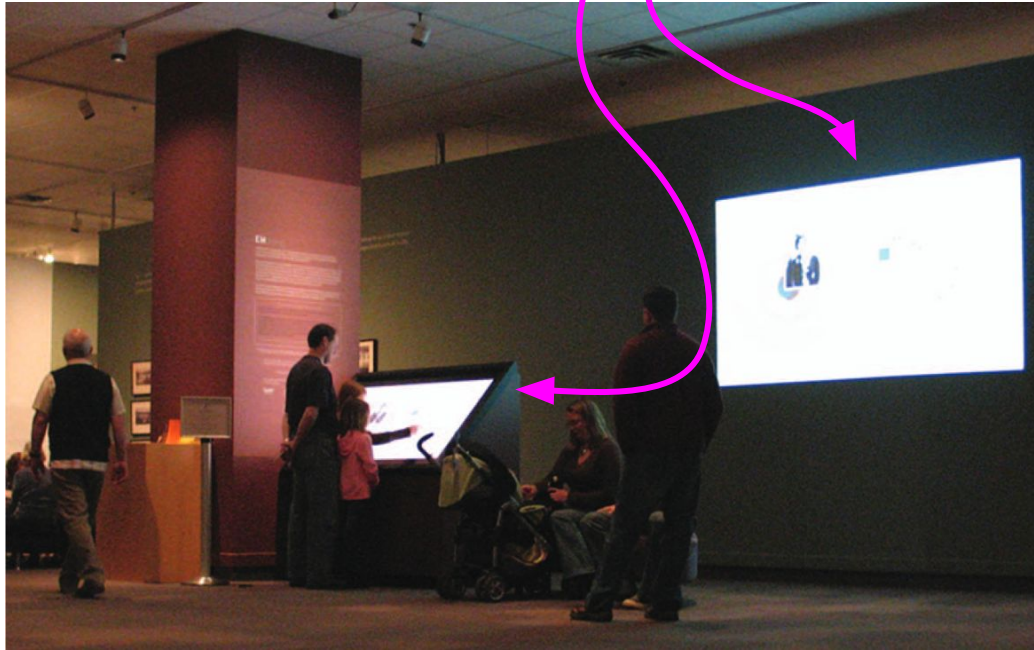


Room theme,
style, size

EMDialog, Hinrichs et al., 2008

Context?

Display type & size



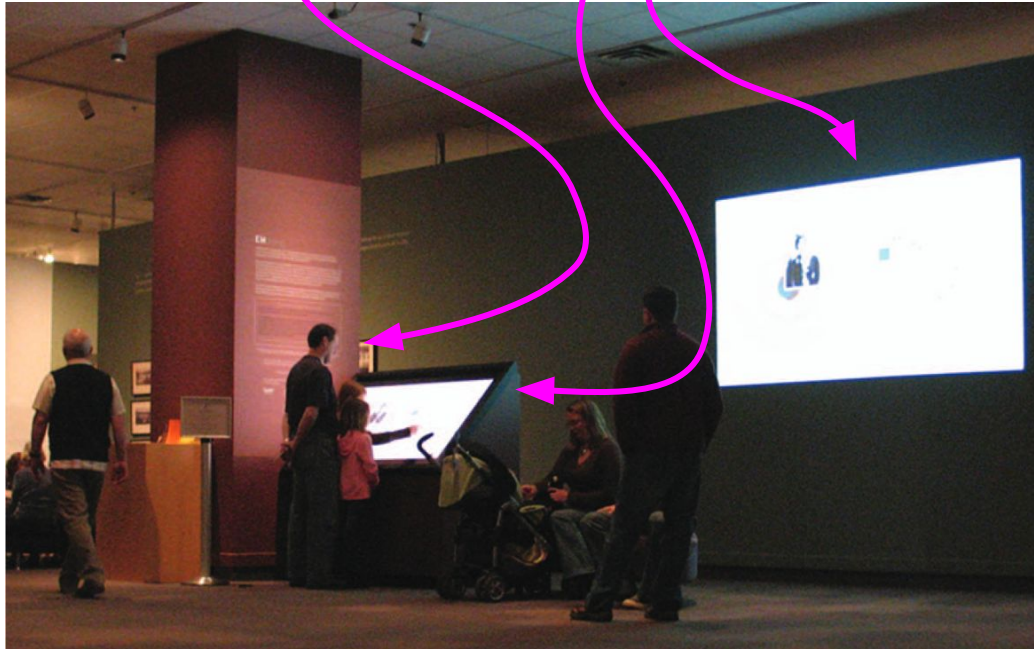
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Context?

Audience

Display type & size



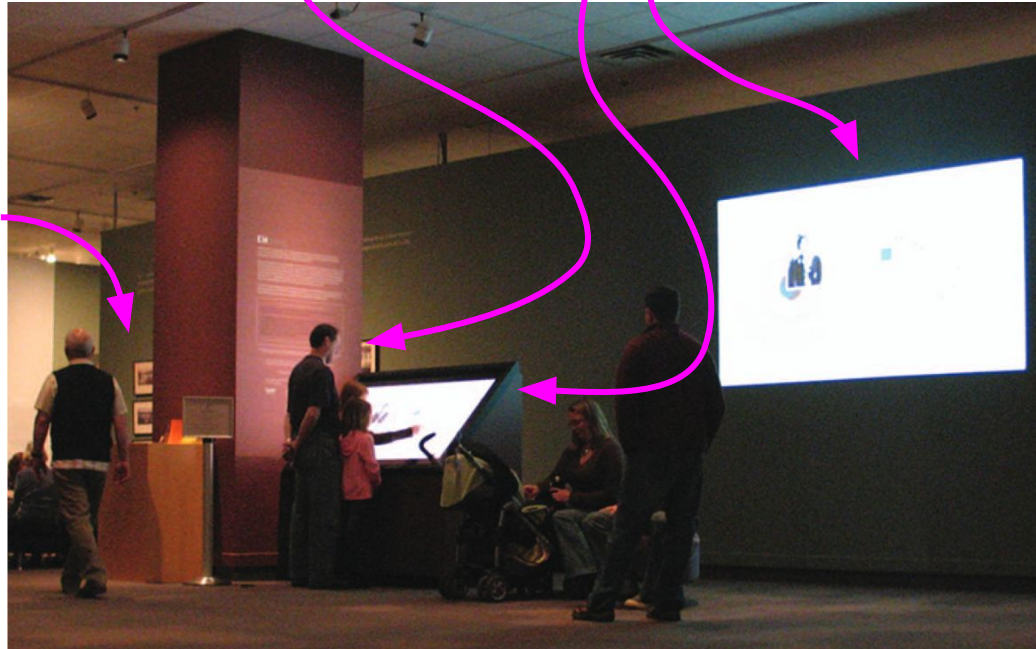
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Audience

Display type & size



Other exhibits

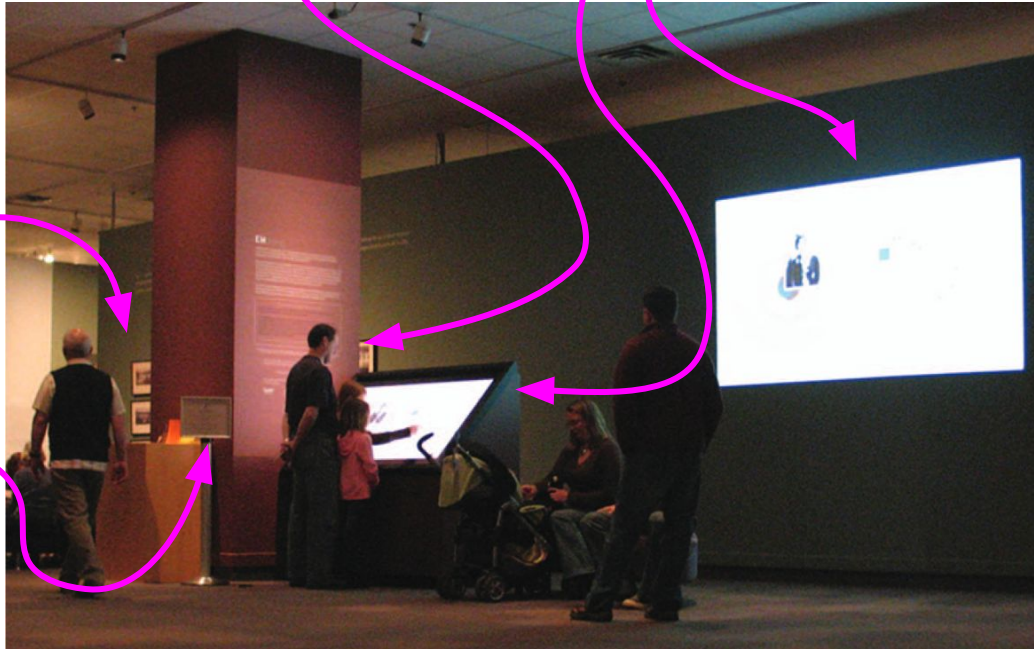
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Context?

Audience

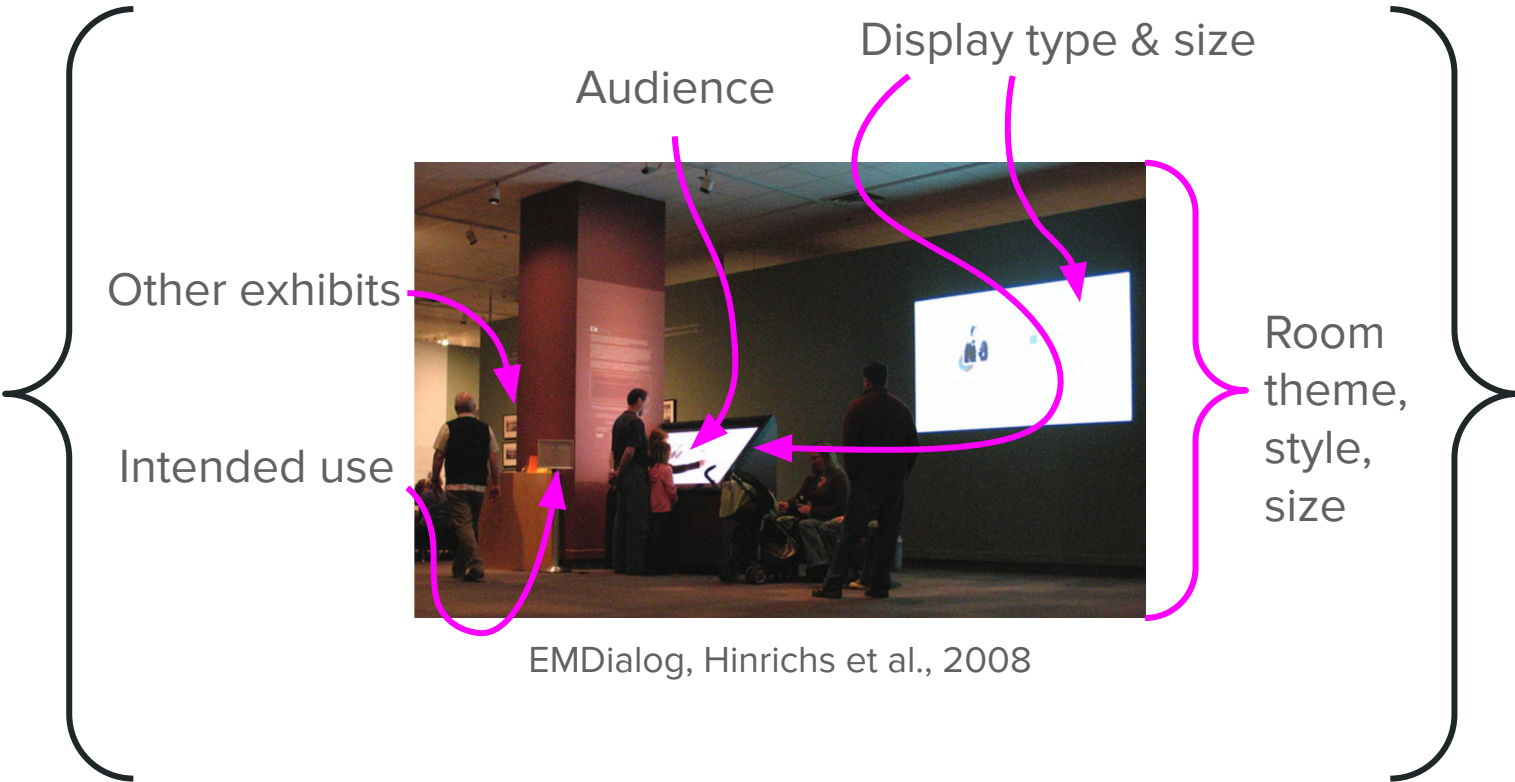
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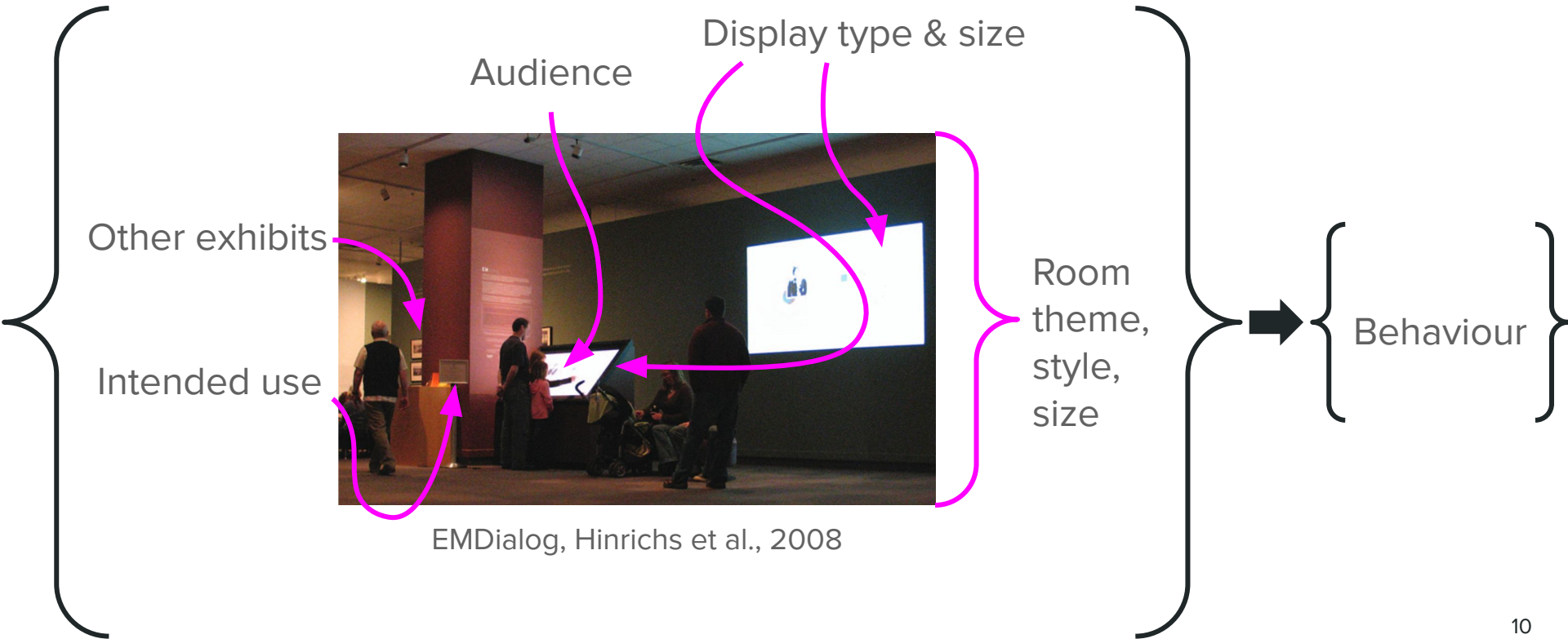
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Context → Behaviour



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Different Contexts?

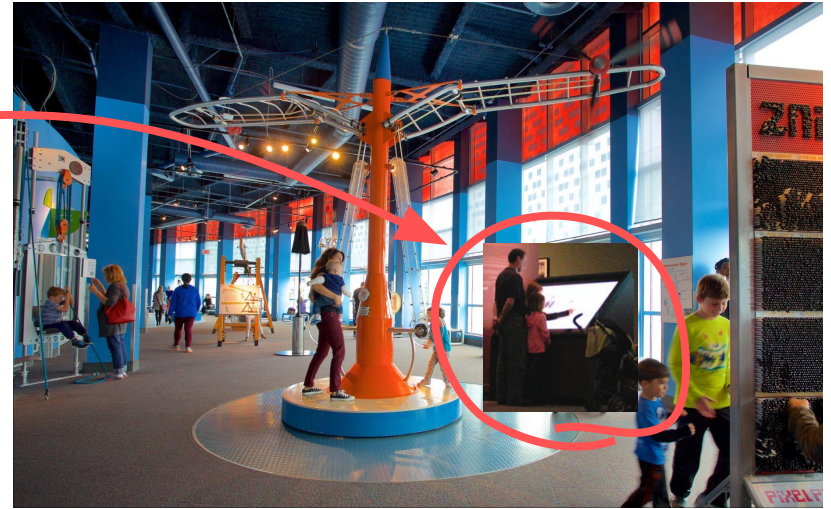
EMDialog, Hinrichs et al., 2008



{ Behaviour }

Different Contexts?

EMDialog, Hinrichs et al., 2008



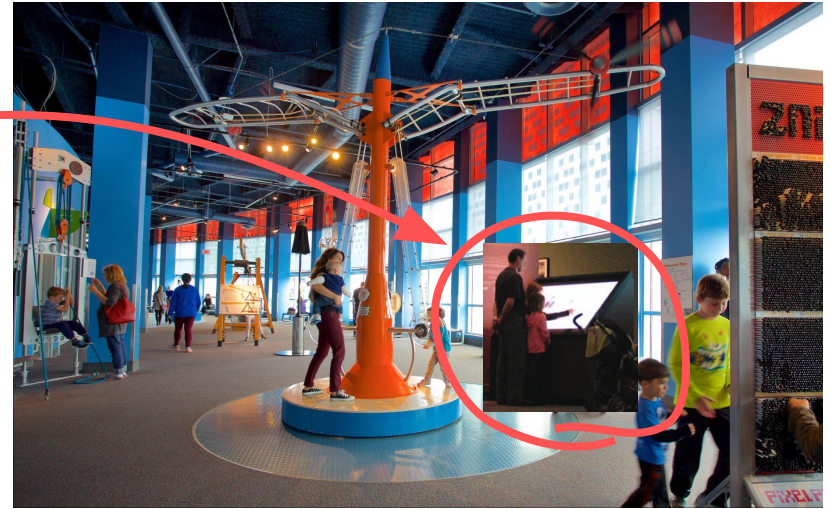
↓
{ Behaviour }

Different Contexts?

EMDialog, Hinrichs et al., 2008



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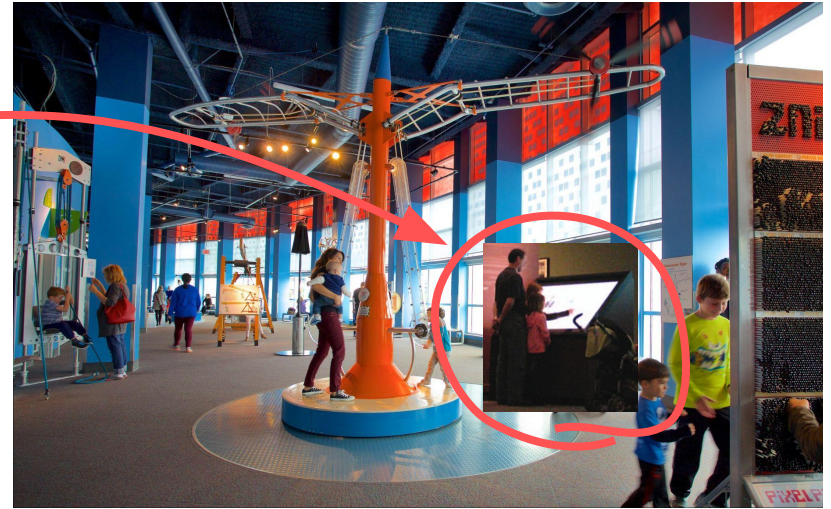
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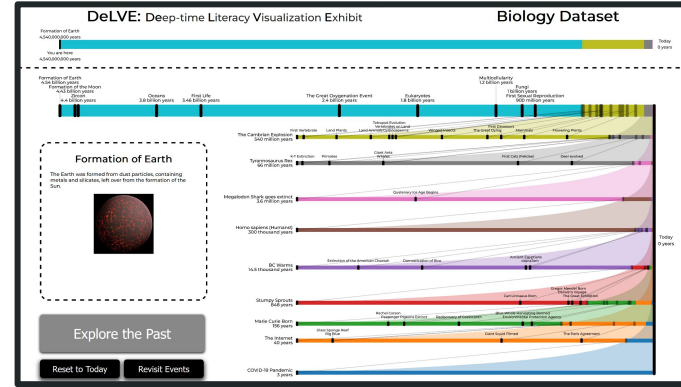
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↓
{ Behaviour }

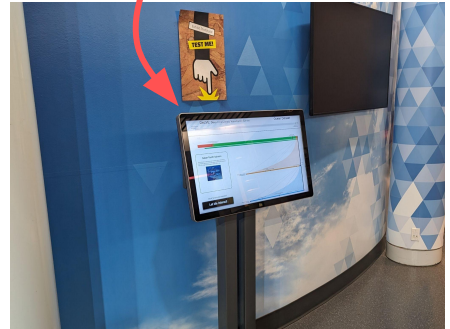
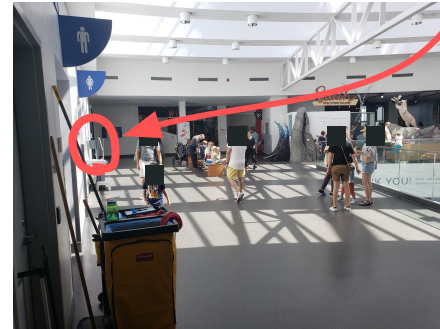
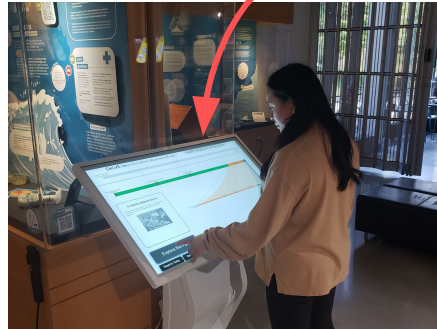
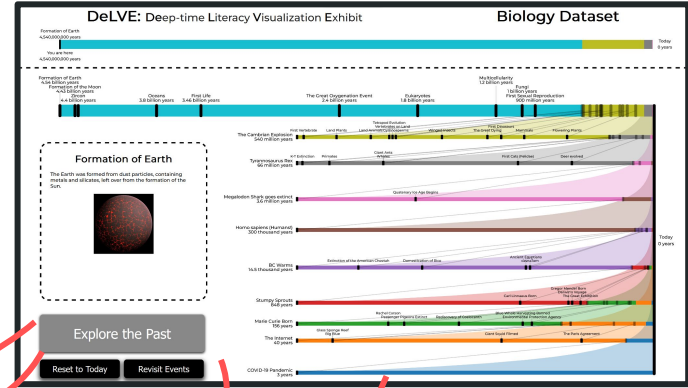
Let's Take a Look!

- DeLVE: **D**eep-time **L**iteracy **V**isualization **E**xhibit
 - Deep time: geoscientist term for the long periods of time of geological processes
 - Interactive tool for exploring past events on different scales of time
 - Promote proportional reasoning through comparisons of scales
- Deployed in four locations across three institutions

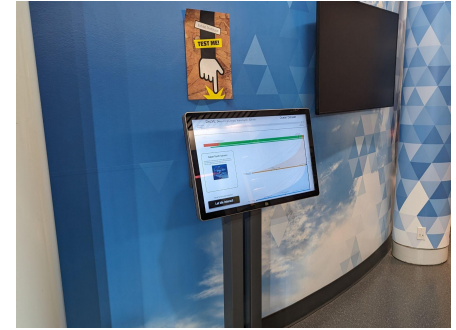


Let's Take a Look!

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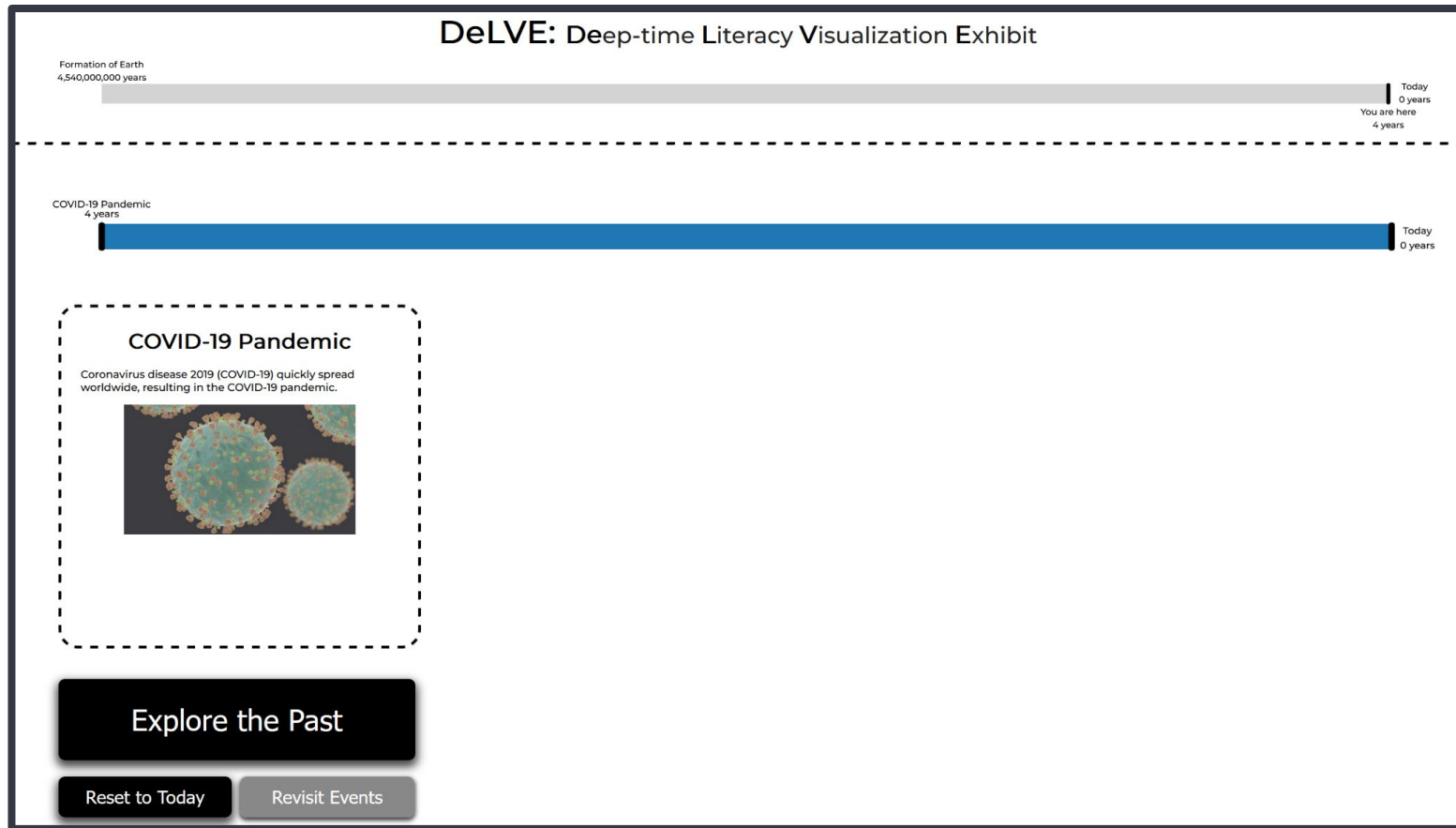
Visitor Behaviour Differs!



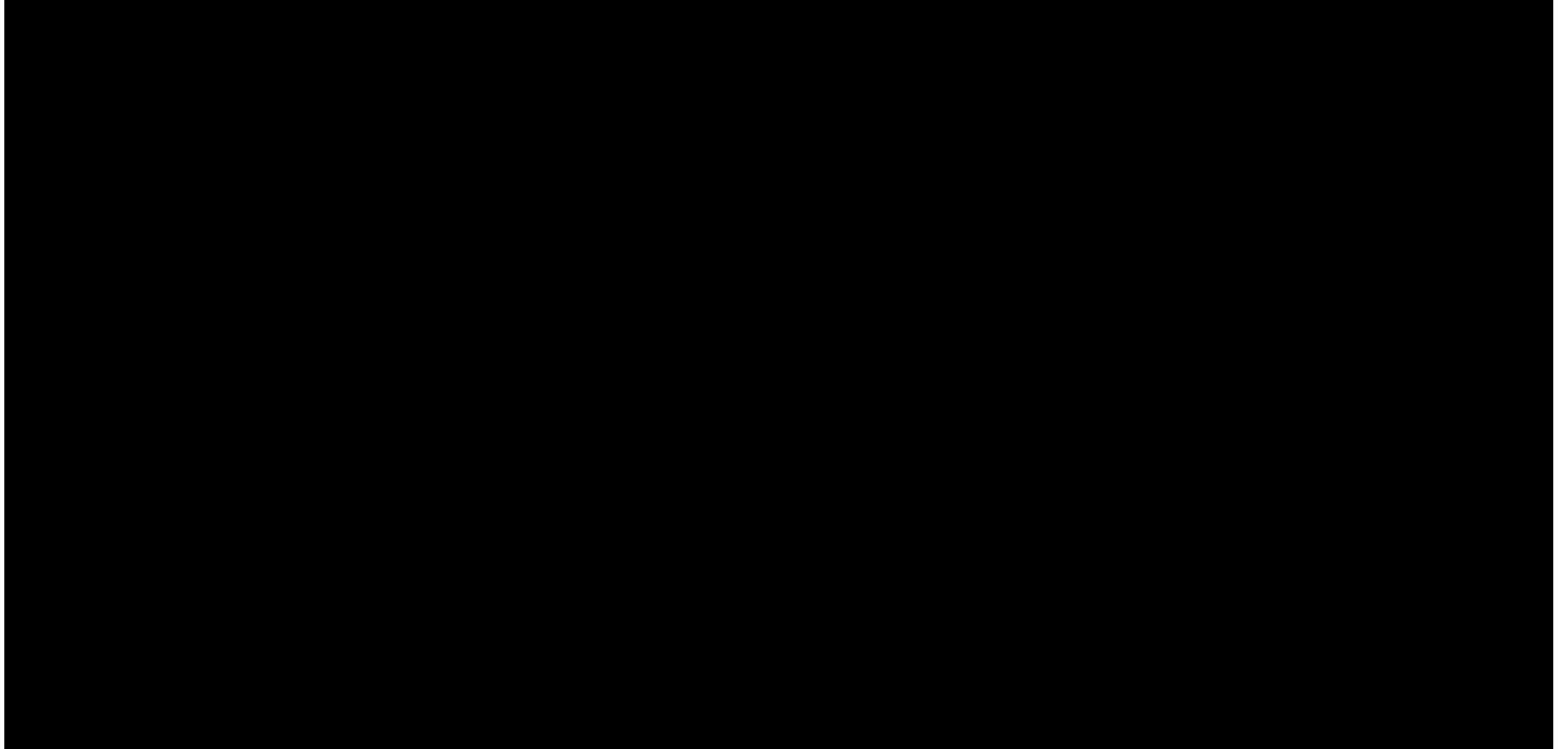
{ Behaviour } ≠ { Behaviour } ≠ { Behaviour } ≠ { Behaviour }

- Studied visitor behaviour when interacting with DeLVE
- Data suggests context **does** impact visitor behaviour!

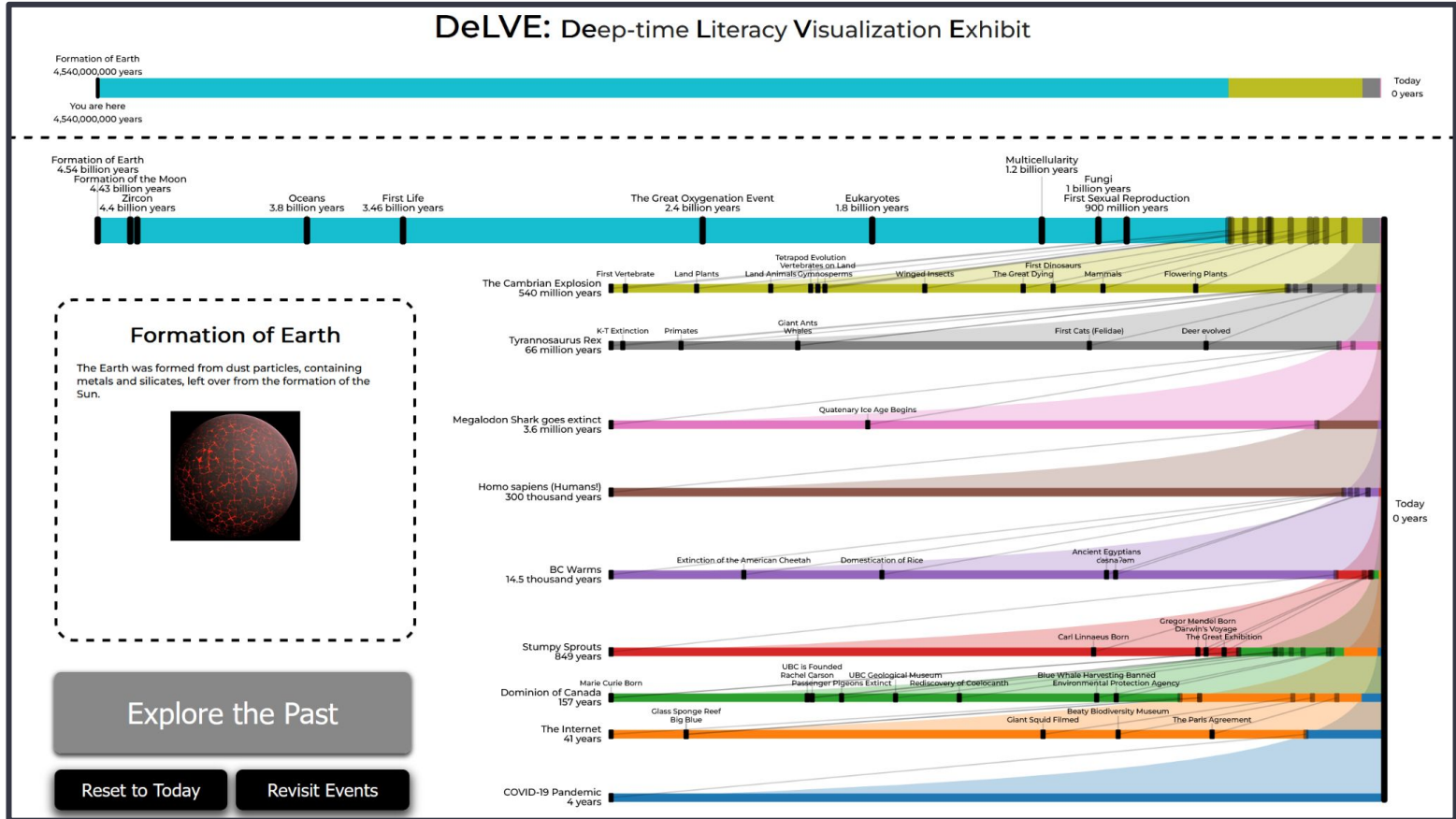
How Does DeLVE Work?



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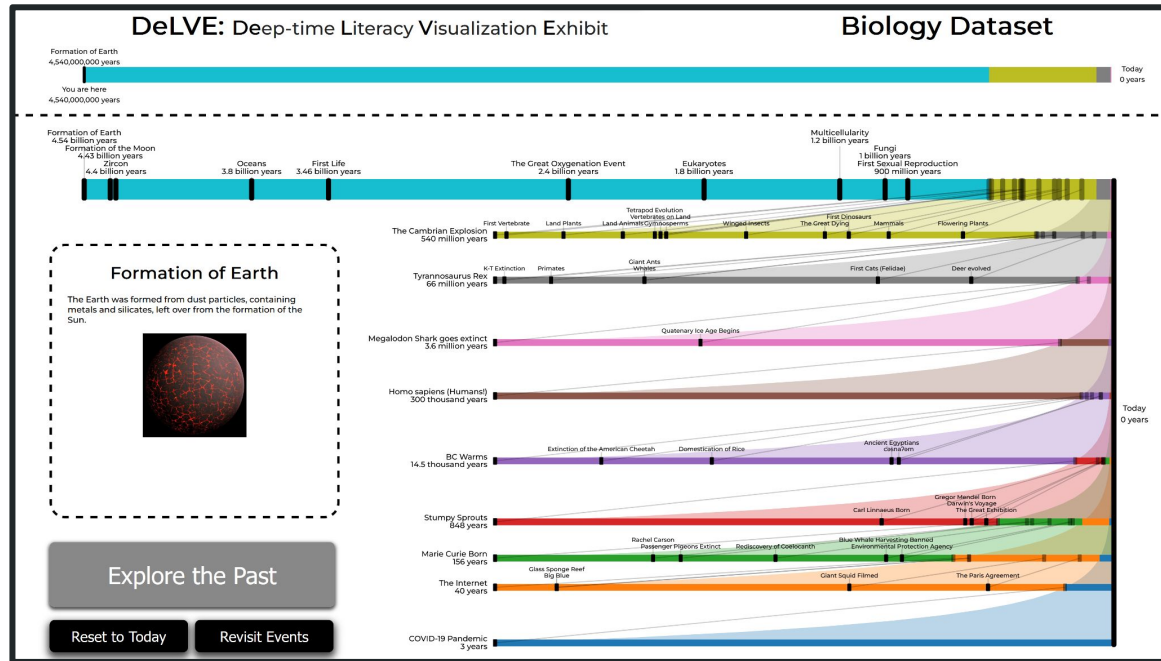
Project Requirements

- **R-Deploy**: find/build collaborations that lead to deployment
- **R-Curate**: enable non-technical museum staff to curate datasets
- **R-Engage**: engage visitors through enjoyment or interest
- **R-Inspire**: inspire curiosity to foster positive relationships with science
- **R-Compare**: support our task of **comparing varied-magnitude time periods**

(staff-facing)

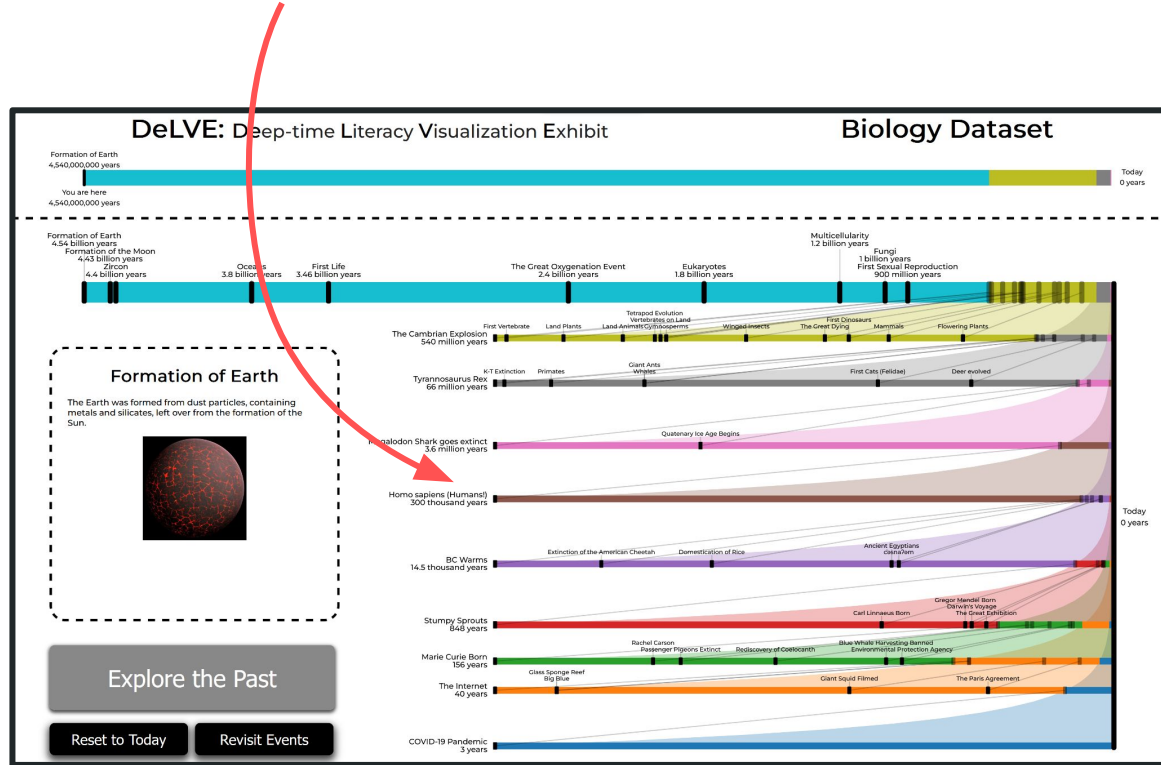
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Design Components



Design Components

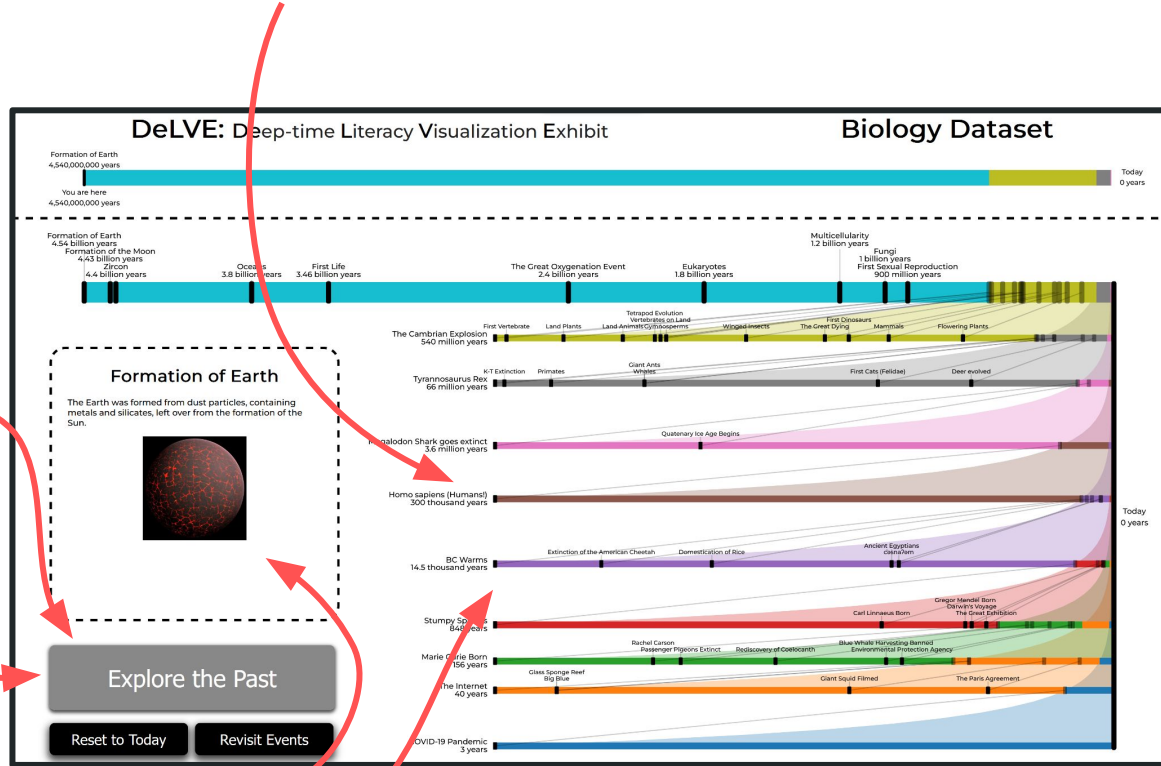
New idiom: connected multi-tier ranges (CMTR)



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R-Engage
Animation
Interactivity
Pictures
Colours



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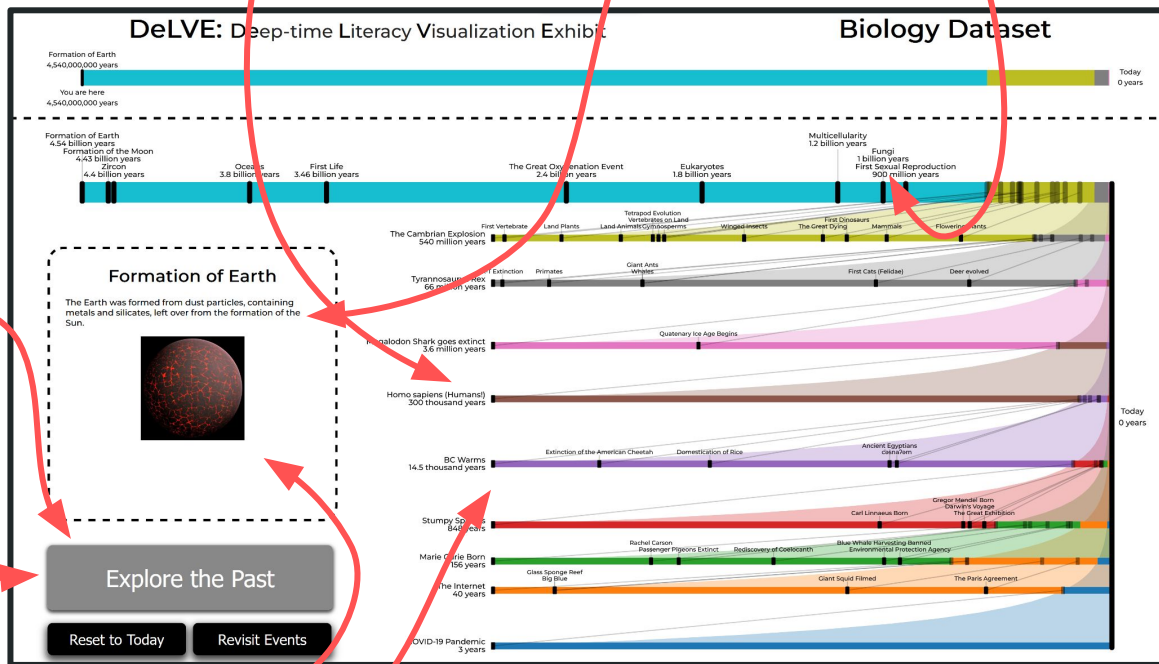
R-Inspire

Descriptions

Times

R-Engage

Animation
Interactivity
Pictures
Colours



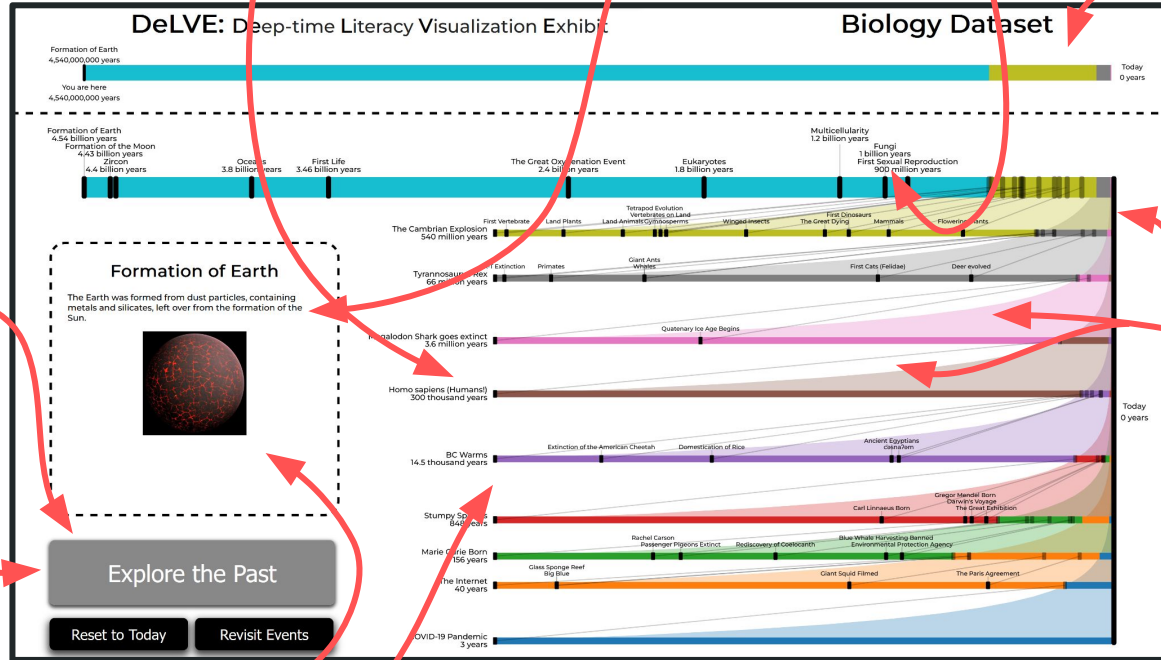
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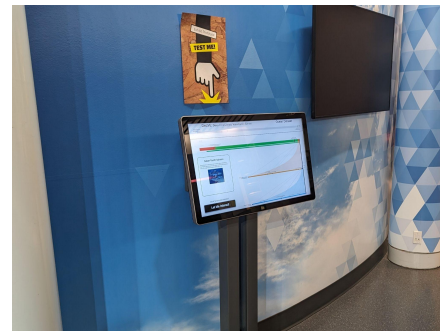
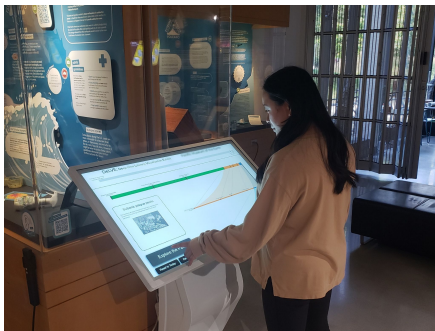
R-Engage
Animation
Interactivity
Pictures
Colours

R-Compare
Timelines
Connecting Lines



Deployment

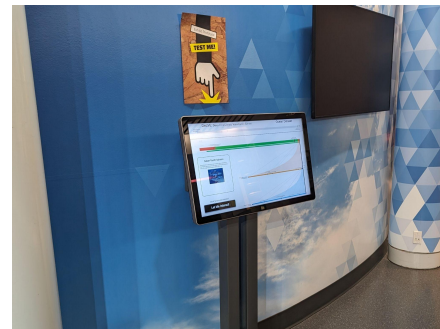
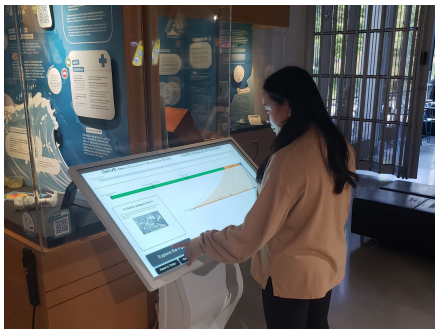
- Deployed in four locations across three institutions
 - Different deployment processes for each museum
 - Deployment-approval meetings with museum staff at each museum
 - 26 total months of deployment between three institutions at submission
 - 47 now!
- Museum staff curated custom datasets to work with DeLVE



Deployment

R-Deploy ✓

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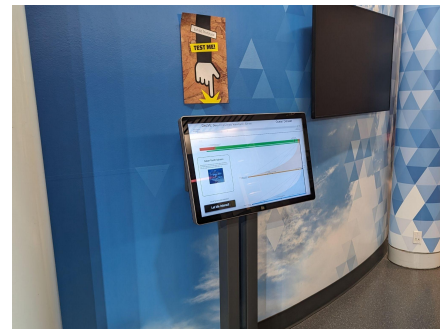
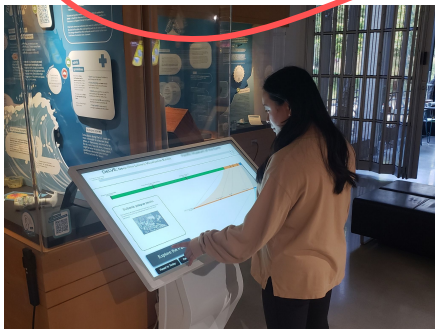


Deployment

R-Deploy ✓

R-Curate ✓

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User Studies and Analysis

- Methods
 - Two data sources:
 - Observational study 🔍 of museum visitors
 - 25 sessions, 37 hours, 95 engaged observations
 - Qualitatively coded for meeting requirements + behaviour differences
 - System trace logs 📄 from museum visitors
 - ~200,000 button presses logged
 - Logs grouped to compute statistics (interaction length, num clicks, etc)
- Did we meet our visitor-facing requirements?
 - **Yes!**
 - **R-Engage:** long interaction times, many button presses, lots of reading text ✓
 - **R-Inspire:** surprised/intrigued facial expressions, discussing info with others ✓
 - **R-Compare:** gesturing between timelines, verbally discussing scales and time differences ✓

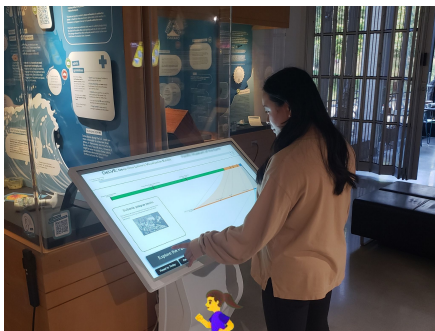
Context Matters Immensely!

- Many differences in visitor behaviour
 - Amount of time spent, number of button presses, amount of text read
- Mirrors O'Reilly and Inkpen white room paper [2007]
 - Quiet lab vs crowded corridor
- Many differences in context
 - Specimens on display vs interactive exhibits
 - Bright room vs dark room
 - Kids/families vs college-students/adults

1: Biology Museum



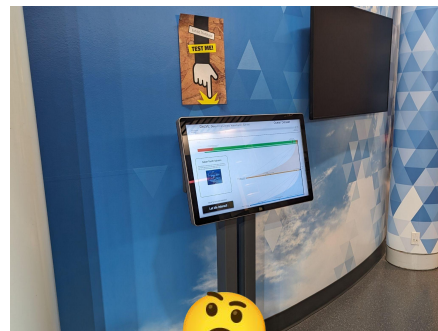
2: Geoscience Mus.



3: Science Center



4: Science Center



Concept-First Design Study Methodology

- Concept-first design study methodology
 - Alternative to Sedlmair et al.'s design study methodology [2012]
 - Project trigger: concept to visualize/communicate
 - Not triggered by connection with collaborators

Sedlmair et al., 2012



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Concept-first alternative



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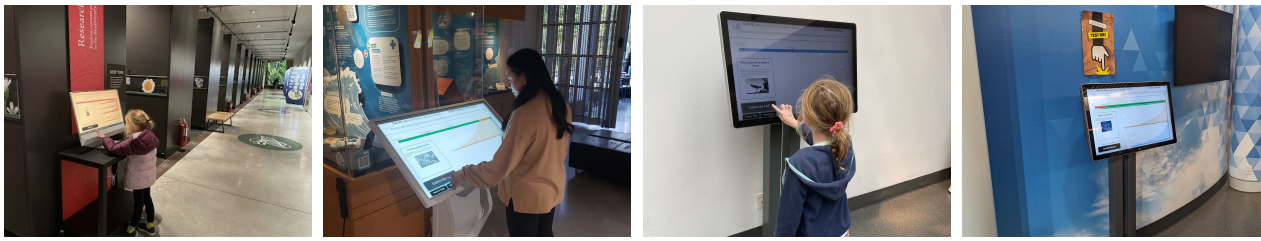
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 - **Deploy:** More in-depth field studies required to validate work

Sedlmair et al., 2012



Concept-first alternative





Conclusion

- Primary contributions
 - Task abstraction, design requirements, and data abstraction
 - Design and development of DeLVE
 - Results of and reflections from studies during deployment: Context matters immensely!
- Secondary contributions
 - Visualization technique: Connected Multi-Tier Ranges
 - Concept-First Design Study Methodology

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