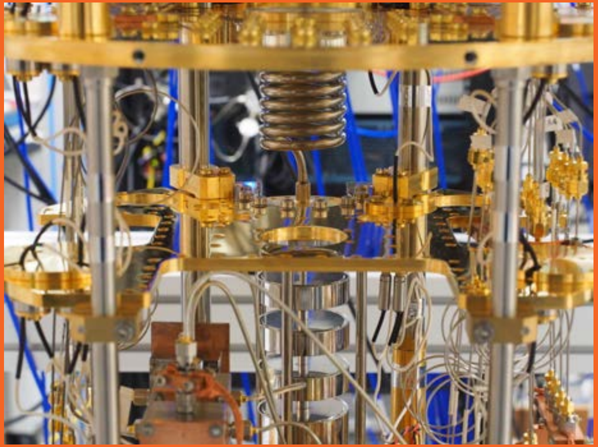


Conquering Complexity with Active Engagement

ASTC 2019
Room 701B (3:15-4:30PM)

https://www.epiqc.cs.uchicago.edu/astc2019

Presenters:

Randall H. Landsberg
University of Chicago

Donna Francis
Ontario Science Centre

Katherine Culp
New York Hall of Science

Danielle Harlow
University of California, Santa Barbara

Mark SubbaRao
The Adler Planetarium

The Plan

Introduction

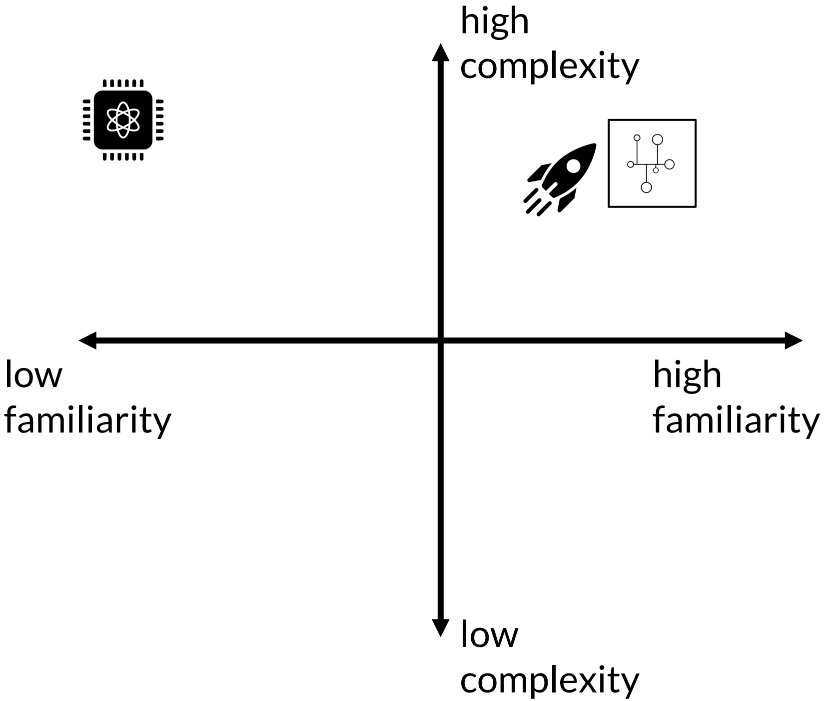
Three (3) Case Studies:

- Quantum Computing Activities @ MOXI & OSC
- Connected Worlds Exhibit @ NYSCI
- “Astronomy Conversations” @ Adler Planetarium

Panel Discussion (Q&A)

<u>Workshop w/ Report Out</u>

Wrap Up



Session Goals

- **Inspire ideas** for your institution
- **Increase your toolkit:**
    - Examples, **best/worst practices**, resources
    - Designing for **visitor engagement:** responsive, active, visitor-centered, & appealing
    - Working with **external experts:** how to partner, what motivates scientists, situations to avoid, and how to build sustainable relationships
    - Strategies for **overcoming barriers:** internal, external, and visitor centered

Why:

- Interest (in the news)
- Impact people's lives


The New York Times

Darkness Visible, Finally: Astronomers Capture First Ever Image of a Black Hole

Astronomers at last have captured a picture of one of the most secretive entities in the cosmos.

The first image of a black hole, from the galaxy Messier 87.
Event Horizon Telescope Collaboration, via National Science Foundation


The New York Times

As Fires Ravage the Amazon, Indigenous Tribes Pray for Protection

By Reuters

Sept. 2, 2019


THE WALL STREET JOURNAL.

How Google's Quantum Computer Could Change the World

The ultra-powerful machine has the potential to disrupt everything from science and medicine to national security—assuming it works

How:

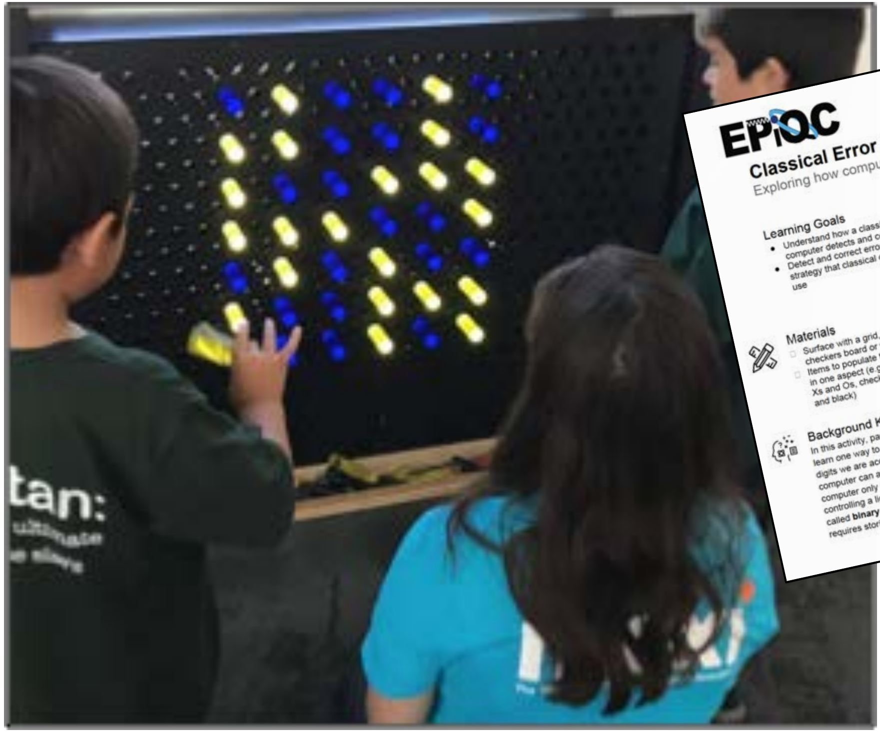
- Agency
- Engagement
- Social/Fun

Case Study 1: OSC/MOXI Quantum Computing

Prepare, prepare, prepare

Real, Engaging, People

Facilitated Interactive Activities



15 min
10+ years
< 10

EPiQC

Classical Error Detection

Exploring how computers correct errors

Learning Goals

- Understand how a classical computer detects and correct errors
- Detect and correct errors using one strategy that classical computers use

Importance in Quantum Computing

This activity introduces participants to the binary system and error detection and correction in classical computing.

Materials

- ☐ Surface with a grid, such as a checkers board or white board
- ☐ Items to populate the grid that differ in one aspect (e.g., sticky notes with Xs and Os, checkers pieces in red and black)

Preparation

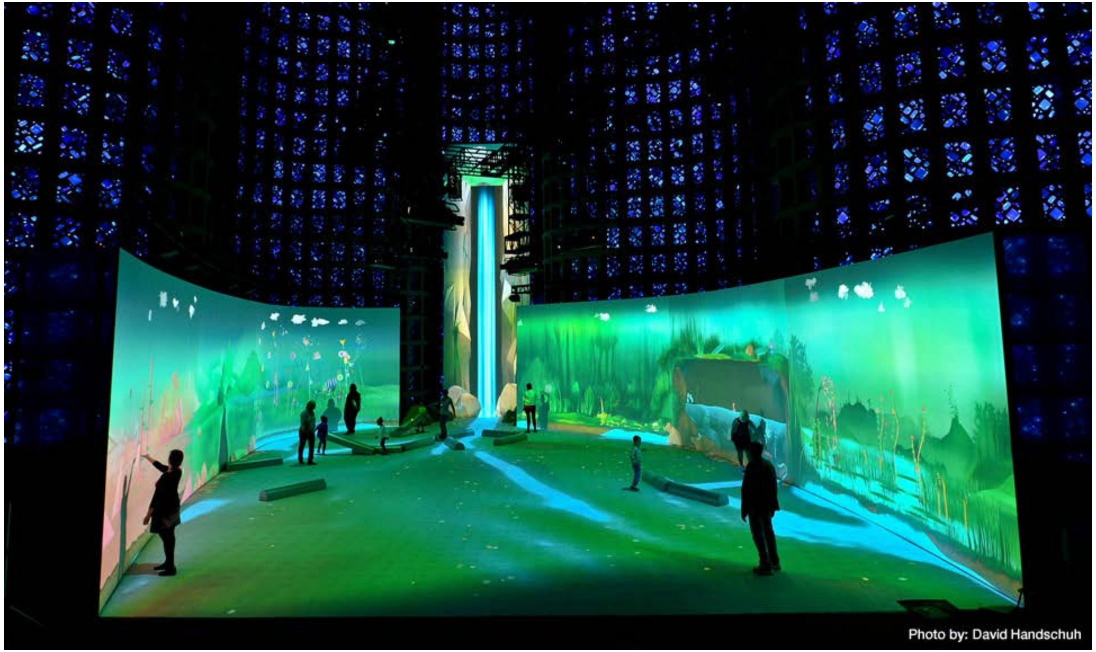
- If necessary, draw a 6 by 6 grid on a white board or piece of chart paper.

Background Knowledge

In this activity, participants will use a two-dimensional grid or array of binary objects and learn one way to detect errors within an array. Classical computers do not use all the digits we are accustomed to—0 through 9—they use only 0s and 1s. The 0s and 1s in a computer can also be interpreted as on (1) or off (0). The storage in a classical computer only recognizes on or off, so the circuits in a computer function like the circuits controlling a light in your home—it switches on or off. This system of 0's and 1's is called **binary**, and each 0 and 1 is a **binary digit**. Everything the computer does requires storing information through binary digits, or **bits**.

Case Study 2: New York Hall of Science - Connected Worlds

Video
https://vimeo.com/141069989



Key Design Decision: Use active play and a fantasy context engage visitors directly with the target concept

Challenges	**Opportunities**
Complex, emergent systems are difficult to understand	Manipulating complex emergent systems is fun!
Unique features of specific ecosystems	Common underlying dynamics across settings
Real datasets have too much of the wrong kind of detail	Simulations can be modified and can support non-realistic skins
Real ecosystems are emergent and dynamic	Multiuser interfaces allow for exploration at multiple scales

Case Study 3: Adler Planetarium

Astronomy Conversations

- Daily Program, running for 12 years
- 500 1hr long programs - 50 scientist presenters - 50,000 visitors per year

Direct interaction with experts facilitated by library of visualizations and multiple displays

Training of experts

Future/Current Directions

SVL > visualization difficulty . expressiveness . embodiment

Skill building > body language . storytelling . empathy and engagement

Future Directions > Interactive simulations . emergence . intelligence

The Panel:

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Panel Discussion

Opportunities & Challenges

Missteps made?

Key components of the solution?

What do visitors think about it?

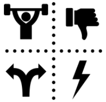
Evaluation?

Value of External experts?

Workshop - group by content area

Work shopping (we need a set of seed challenges - initial list: LEAD(Donna/Danielle)

- ALL (20 min) Break into groups based on topics



10 min Talk about:

Strengths: Why is this complex idea appealing to tackle?

Weaknesses: Why is this complex topic problematic or worrisome to tackle?

Opportunities - What would the benefit be to your visitors if you did this successfully?

Threats: What risks are you taking on by trying to do this successfully?

10 min Talk about:

Come up with ***audacious*** ideas to address your topic.

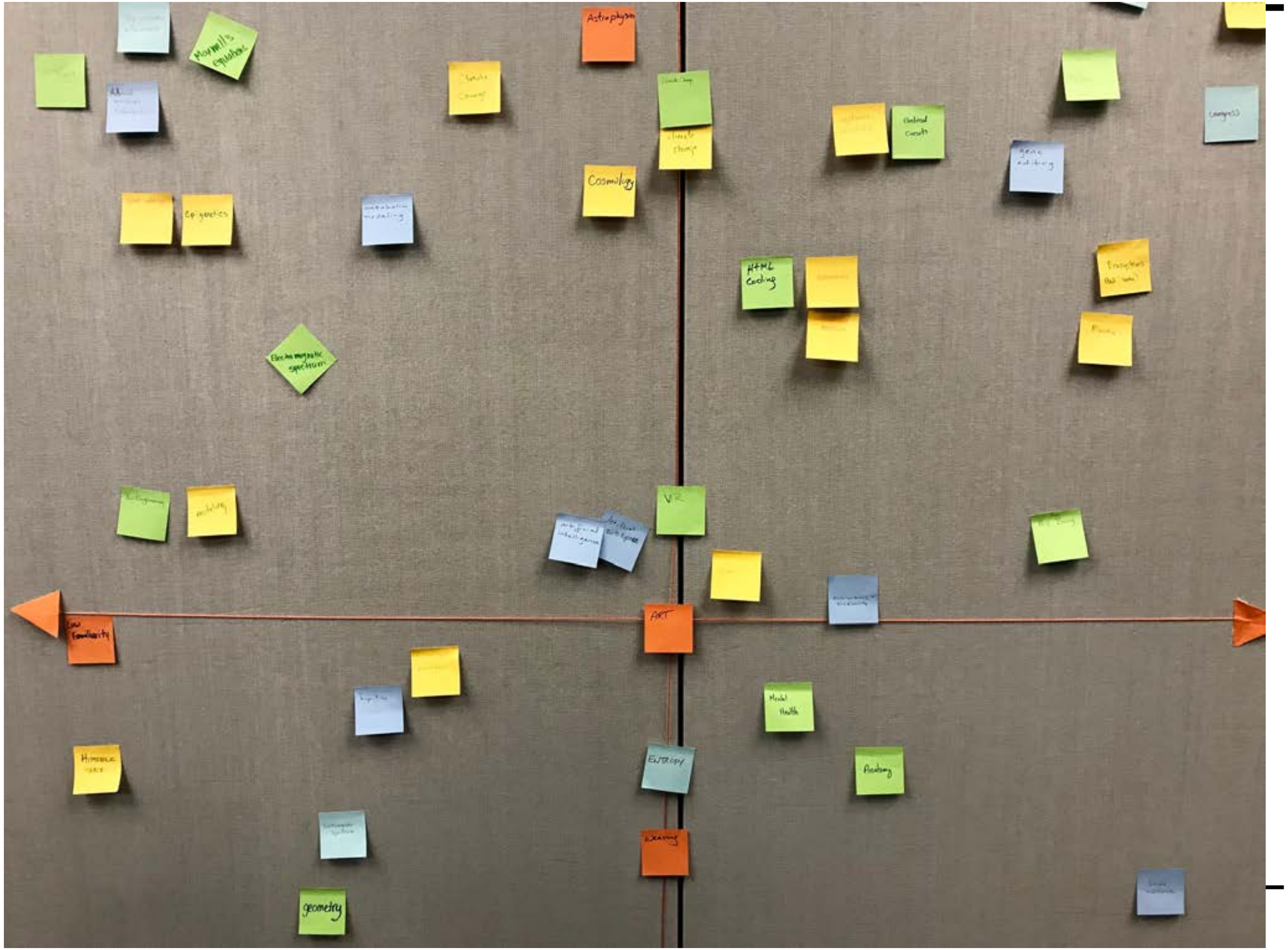
Some big ideas you might use to imagine your design approach:

- Eliciting curiosity: What's compelling about this topic (not just important, but provocative?
- What outside experts could help identify appealing, innovative ways into the topic?
- Relevance for visitors - Why should they care? How does this topic intersect with visitors' everyday lives?
- What makes this topic complex? What's hard to grasp about it? How can you keep your focus on making that core, difficult idea more accessible to visitors?

Workshop – Seed Topics

- Climate Change
- Cosmology/astro
- Genetic Engineering
- AI
- Brain
- Mental health

Workshop – Participant Topics



Take home points

Got a complex concept to explore?
Try these tips:

Why share it with your visitors?

What are the strengths of the topic?

What are the opportunities?

What are the challenges?

Get creative

Engage with Experts

Make it Tangible, Engaging, Exciting and Personal

Acknowledgements

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https://www.epiqc.cs.uchicago.edu/astc2019

ASTC Submission

Track: Content and Design Title: Conquering Complexity with Active Engagement

Session Description: How do you engage visitors with topics that are complex, unfamiliar, or intimidating? This is an important question for the informal science education field as rapid progress in technology and scientific research are impacting visitors' everyday lives. This session is designed to inspire participants to begin thinking about what might be possible at their home institutions and to provide them with resources for incorporating emergent content. We will first examine three approaches for tackling three very different complex topics: (i) delving into the interdependent ecology of an imaginary world via an immersive, digital, interactive at NYSCIs Connected Worlds (ii) demystifying Quantum Computers with staff facilitated activities and games at MOXI and the Ontario Science Centre, and (iii) exploring the universe with real data and real scientists via inviting visualizations and dialogs at Adler Planetarium's Astronomy Conversations. The panel will then discuss lessons learned, missteps made, how evaluations informed, and key components of the visitor experiences including: the importance of active engagement and social interactions, the costs and benefits of partnerships with external experts, and the value of audience appeal. The second half of the session will be an opportunity for work shopping solutions to specific challenges participants face and general questions about introducing complex topics (e.g., how can we engage and train staff who themselves may be uncomfortable with the topic?). Working groups will have the opportunity to report out, followed by a brief wrap up.

Diverse Perspectives: Diverse perspectives are integral to this session. Size: small, medium and large science centers. Geography: East Coast, West Coast, Midwest and Canada. Career level of the presenters: students to senior management. Areas of expertise: education research, quantum computing, astrophysics, environmental science, evaluation, and volunteer management.

Tag(s): Making the Case for Science Centers, Partnerships, Visitor Experience

My format idea description: Panel + Solution Room: panel presents & small group work on solutions & strategies for their institutions

Audience Takeaway(s):

- Session participants will consider how to design experiences that contain the key components that we have learned are important for visitor engagement: responsive experiences, active experiences, visitor-centered, & appealing

- Toolkit for working with external experts including tips on how to partner, insights into what motivates scientists, situations to avoid, and how to build sustainable relationships

- Strategies for overcoming barriers (internal, external, and visitor centered)