Make-A-Vis: Learning Sciences Research

Advancing Public Understanding of Scientific Data

Anna Keune | UC Irvine
@akeune
akeune@uci.edu

Dr. Kylie Peppler | UC Irvine
@drpeppler
kpeppler@uci.edu

The Creativity Labs @ UCI
Overview
Overview of Research

Phase 1: What type of visualization personalization of the exhibit design leads people to initially engage with and maintain engagement with a data visualization?

Phase 2: How can we increase museum visitors’ data visualization learning and literacy? What role does digital and physical construction play in improving learning outcomes?
Timeline of the Phases

- **2019**
  - Jul
  - Aug
  - Sep
  - Oct
  - Nov
  - Dec

- **2020**
  - Jan
  - Feb
  - Mar
  - Apr
  - May
  - Jun
  - Jul
  - Aug
  - Sep
  - Oct
  - Nov
  - Dec

- **2021**
  - Jan
  - Feb
  - Mar

- Phase 1. Internal Data Report
- Phase 1. Publication
- Phase 2. Data Collection
- Phase 2. Internal Data Report
- Phase 2. Publication
Overview of Phase 1

- Importance of data visualization literacy
- Data visualization is frequently taught with curated data sets (e.g., Lyons & Roberts, 2014)
- Within science museums the physical set-up of the exhibit plays a role in scaffolding data visualization engagement (Lyons & Roberts, 2014)
- Constructionist approaches to learning suggest that learning happens best when people construct personally meaningful projects (Papert, 1980; 1992)
- Make-A-Vis: Making meaning of personal, emergent, and real-time data
- Phase 1: Video-data analysis of purposes of engagement and physical engagement typologies at COSI with Make-A-Vis as part of the Walk exhibit
Context
Setting | Data Entry

Walking Area

DATA INPUT

DATA OUTPUT

Touch Screen

Touch Screen
Setting | Data Entry

Walking Area

Touch Screen

DATA INPUT

Touch Screen

DATA OUTPUT
Setting | Data Entry
Setting | Data Entry
Setting | Task Types

1. Find yourself in the data
2. Make yourself look good
3. Compare yourself to others
4. Change your data
5. Find a group member in the data
Select Graphic Variables

Quantitative: Data may take on any value within a finite or infinite interval and are commonly acquired via measurement.

Qualitative: Data take on only specific values with no values in between and are frequently determined by counting.
Data Sources

Demographic survey
- Paper and pencil self-reports of age, race, ethnicity

Length of engagement
- Minutes of engagement: Starts at entry; ends at exit
- Number of walks

Data queries
- Task types visitors engaged with

Semi-structured interviews
- What do you enjoy most about the exhibit?
- What do you find surprising about the exhibit?
- How do you recommend to improve the exhibit?
Phase 1 Participants

Number of participants (N) 195
Number of groups (N) 74
Average group size 3
Hours of observation (hours) 20
Phase 1 Participants

Ethnicity
- Latinx: 8.21%

Race
- White: 76.92%
- Black: 11.79%
- More-than-one: 9.23%
- Asian: 3.59%
- Other: 1.54%

Gender
- Male: 53%
- Female: 44%
- Non-binary: 3%
- No response: 3%
Emerging Findings
## Findings: Length of Engagement

<table>
<thead>
<tr>
<th>Metric</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean dwell time</td>
<td>5:16 minutes</td>
</tr>
<tr>
<td>Minimum dwell time</td>
<td>00:40 minutes</td>
</tr>
<tr>
<td>Maximum dwell time</td>
<td>16:13 minutes</td>
</tr>
<tr>
<td>Average walks</td>
<td>3 times/group</td>
</tr>
<tr>
<td>Minimum walks</td>
<td>1 times/group</td>
</tr>
<tr>
<td>Maximum walks</td>
<td>12 times/group</td>
</tr>
<tr>
<td>No data entry walks</td>
<td>23 groups</td>
</tr>
</tbody>
</table>

“Normally (I) come in third on bike race(s), but (in the) foot race I came in second.”
Most frequent: Finding oneself in the data

“(I can) see where I live”

Construction of personalized data visualization can support engagement.
Findings: Comparing Aggregates

Within the emergent, real-time data set, visitors purposefully compared data cases and drew conclusions that may or may not be general truths.

It was the purposeful in vivo sense-making of real time data through comparisons that presented engagement with data visualization literacy.

“(It) looks like teens like art more than anything.”

“Retired people and kids walk in (the) same pace.”
Findings: Group engagement

The spread of the exhibit in physical space made it possible for several members of a group to engage at once, through teachable moments, shared data entry, joint creation of visualizations.
Findings: Physical Exhibit Engagement

Technology transparency: The visible motion sensor lead to inquiries about input/output relationships as visitors observed the accuracy of its reading.
Moving Forward
Phase 1 Analyses under Way

Civic data visualization literacy

Purposes
What purposes of data visualization literacy do visitors engage with a real-time data set?

Physical design
What group engagement typologies with the set-up are linked to longer-term engagement?
Phase 2: Learning Objectives

After using the Make-A-Vis,

1. participants can find their own data on the screen.
2. participants can visualize data variables with graphic variable types.
3. participants can compare and cluster data points.
4. participants can explore relationships among multiple data variables.
5. participant can develop hypotheses based on recognized relationships among multiple data variable types.
6. participants can confirm or deny formed hypothesis based on the data visualization.
Thank you!

Anna Keune | UC Irvine  
@akeune  
akeune@uci.edu

Dr. Kylie Peppler | UC Irvine  
@drpeppler  
kpeppler@uci.edu

The Creativity Labs @ UCI

ASTC | September 20th, 2019