Exploring Museum Visitors’ Learning and Interaction with an Augmented Circuit Exhibit
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Introduction
We explore learning with multiple representations of scientific phenomena in a museum. We developed a science museum exhibit for visitors to experiment with electrical circuits and observe a simulation of electron flow. We compared four versions of the exhibit combining an interactive tabletop, an augmented reality display, and physical circuit components.

Methods and Data Sources
We recruited 80 parent-child dyads to try a series of tasks followed by an interview with the children about electricity. We video recorded families’ interactions with the exhibit and children’s post-interview responses.

Research Questions

RQ1. Does combining two circuit representations enhance children’s learning?
RQ2. Are there differences in children’s learning and engagement across the three experimental conditions?
RQ3. How do parent-child dyads interact with the exhibit and make sense of circuits in each condition?

Findings: Children Learning
Our analysis of post-test interviews with children shows:

- Children did significantly better in all three experimental conditions compared to a control condition with no electron simulation.
- Children performed best in the AR condition, then the tangible condition, and lastly the single-display condition.
- Children in the AR condition, and then the tangible condition, were more likely to attend to the electron simulation and the behavior of electrons moving in the circuit.

Our findings show that AR can enhance children’s learning with the exhibit, but we found no significant learning benefit for using tangibles.

Findings: Parent-Child Interaction
Our analysis of videos of visitor sessions shows:

- Parents in the single-display condition commonly took the role of educator while using the exhibit. However, parents in the AR and tangible conditions were significantly less likely to take on the role of educator and instead acted as a co-learner.
- Families in the tangible condition were more likely to design their own experiments than the other two groups.

Findings: Parental Roles

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<thead>
<tr>
<th>Code</th>
<th>Description</th>
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<tbody>
<tr>
<td>Absent</td>
<td>Parent has no interaction with the exhibit or content of tasks</td>
</tr>
<tr>
<td>Observer</td>
<td>Parent has some interaction, but the extend of interaction excludes learning</td>
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<tr>
<td>Educator</td>
<td>Parent tries to teach the child by prompting questions, directing child’s attention, and providing explanations</td>
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<tr>
<td>Co-learner</td>
<td>Parent is engaged in the learning process with the child and offers ideas</td>
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Summary & Significance
We studied how families learn with an augmented circuit exhibit and how parent-child dyads collaboratively engage with different versions of the exhibit. Our findings have implications for design of interactive exhibits and considerations for improving the family experiences with interactive science exhibits.

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