

FAST

Flexible, Accessible Strategies for Timely Digital Exhibit Design

 **Museum of Science.**

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How to use this booklet

This booklet was developed for museum professionals to quickly create digital tabletop interactives for educational purposes. It is an overview of our development process, and a starting point for anyone who wants to experiment with FAST digital exhibits.

You can review this booklet by reading all the way through, or you can skip around to sections that are most relevant to you.

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Introduction to FAST

Museums can play a critical role in engaging their communities around urgent issues that emerge in the public sphere. However, typical exhibit development timelines can stretch for years, and “what’s new” can change swiftly before an exhibition is even launched.

What if museums could stay agile and dynamic, changing out content as community needs shift, science progresses, and the world changes? What if timely exhibit offerings could be not just efficiently produced, but accessible and welcoming to all visitors? This vision of **efficiency** and **accessibility** is at the center of FAST.

Supported by a grant from the Institute of Museum and Library Services (IMLS), an interdisciplinary team of exhibit developers at the Museum of Science, Boston collaborated over a period of three years to fulfill the goals of a National Leadership Grant called *Flexible, Accessible Strategies for Timely (FAST) Digital Exhibit Design*. Our ambition was to create an infrastructure for interactive tabletop exhibits that is both nimbly responsive and broadly accessible.

The FAST project team:

- **Consulted** external professionals working at the intersections of informal learning, technological innovation, accessibility, and inclusion
- **Designed** and iterated on physical and software infrastructure
- **Tested** prototypes with general museum visitors, as well as recruited accessibility and community groups
- **Created** products and resources for the museum community

This booklet introduces the “FAST table”—an interactive, projection-based table that can be used to educate on limitless content topics.

Available to Museums

We hope that museums will use the FAST exhibit infrastructure to create their own experiences, share them with other institutions, and contribute to a common supply of exhibit offerings.

Our free, [digital toolkit](#) shares exhibit development resources for three experience templates (including all hardware and interactive software specifications), each with a “sample experience” (a content package comprised of text, graphics, images, video, and audio files).

Our Process

Development of the FAST Toolkit was driven by milestone events, through which the team received feedback on product ideas and prototypes over time.

Workshop 1: FAST project kickoff

- Introduced the FAST table project to external professionals
- Discussed pros and cons of early FAST prototypes

Workshop 2: FAST digital tools and concepts

- Solicited feedback from external colleagues on our FAST tools and experience demos
- Brainstormed potential content themes for future FAST tables

Accessibility advisory board review

- Solicited feedback on prototypes from accessibility advisors

Prototyping with general and recruited visitors

- Conducted general visitor testing with FAST templates
- Recruited accessibility and community groups for additional testing

Workshop 3: FAST Toolkit dissemination

- Shared evaluation findings
- Shared toolkit draft
- Solicited feedback on draft materials from colleagues

FAST Table Elements

Basic elements (any tool)

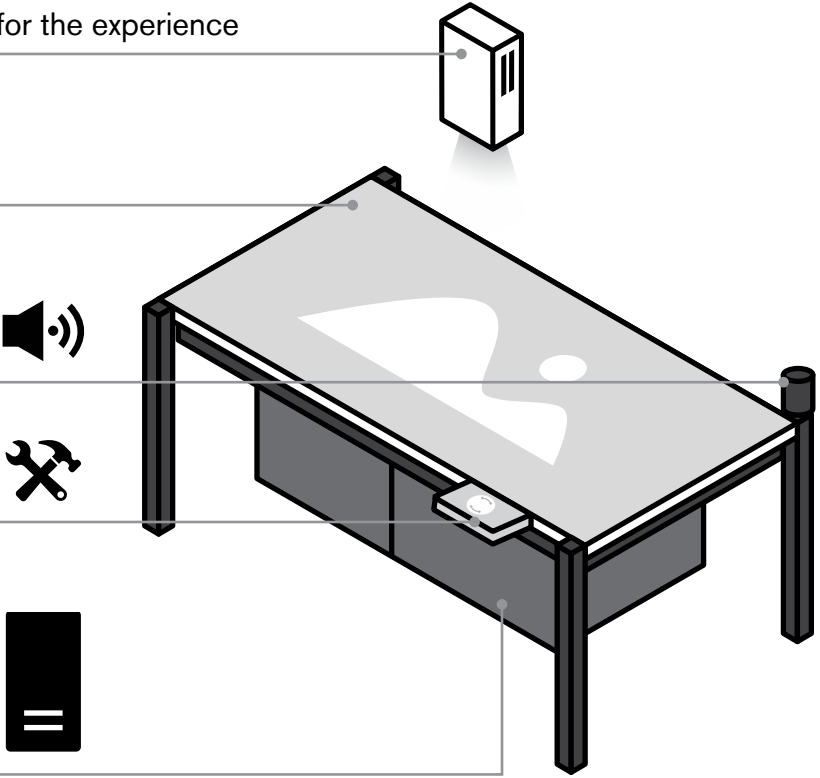
Projector: Displays the visuals for the experience

Table: Provides a physical structure for the experience

Speakers: Provide broadcast audio and sound effects

Tools: Allow visitors to interact with the experience

Computer: Runs the user experience software; sends audio to the speakers and visuals to the projector



Additional Elements (computer vision tools only)

Infrared lights and camera: Tracks the tools

Checkerboard: Used for camera calibration (to reduce lens distortion when setting up an experience)

Additional computer: Processes camera input using computer vision software

Computer Vision Tools vs. Wired Tools

Tools like buttons, sliders, dials, and other objects can be implemented through computer vision technology or traditional wired methods.

Computer vision tools

are read and tracked by computer vision software. They do not need to be fixed in place.

We used fiducial markers in our computer vision tools. The markers encode a unique integer identifier and can be detected when in view of a camera.



Wired tools

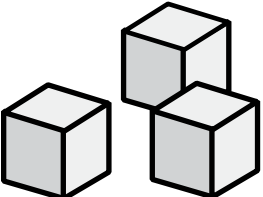
are physically connected to the table in a fixed position.



Tool Summary

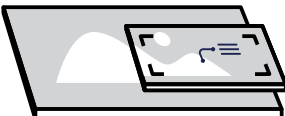
A tool provides a way for visitors to interact with the table. Here are some options we explored.

Computer vision only



Dice

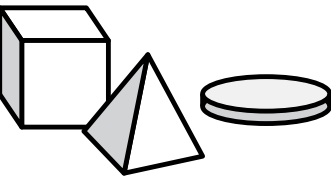
Can be placed on the table in a specific orientation to activate a unique response



Magic window

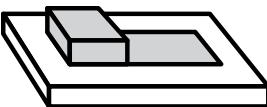
Allow users to “reveal” different states based on their position on the table

Wired or computer vision



Tangible objects

Can be placed on the table and uniquely identified



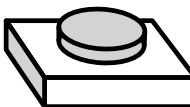
Toggle switches

Allow for toggling between two choices



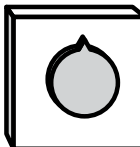
Sliders

Allow for exploring multiple discrete or continuous values



Buttons

Allow for a single selection or activation



Dials

Allow for toggling between continuous values (or discrete values, if detents are used)

Templates

for FAST tables

We launched the FAST Toolkit with three experience templates that allow museum professionals to create their own FAST tables without having to start from the beginning.

Each template is comprised of:

- software
- design drawings
- assets for assembling a “sample experience”

Anyone is free to use the sample experiences at their own institution, we encourage you to also use the templates to develop brand-new experiences. Our intention is that the Toolkit will grow over time, with additional contributions from the Museum of Science, Boston and others.

The following sections provide an overview of each template, and takeaways from our design process.

Template A:
Object Investigation

Template B:
Quiz Show

Template C:
Node Exploration

Template A:

Object Investigation

Tool used:

Tangible objects

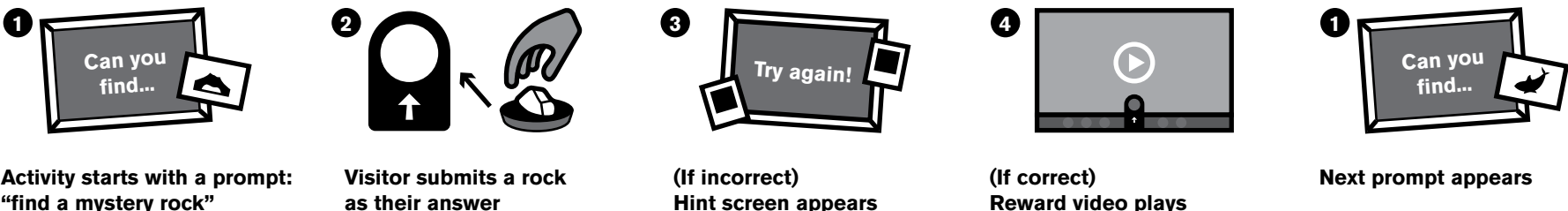
About this template:

- Exploration of real objects or physical models
- Identification or classification
- Learning about a variety of items



Sample experience: Geology

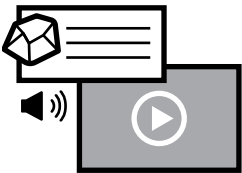
In this experience, visitors identify “mystery rocks” based on how they formed. Visitors can press a square button to switch between English and Spanish.



Key ingredients

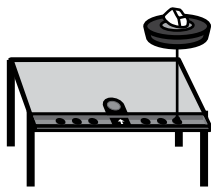
Activity development

- A set of curated objects and their stories convey one underlying message: “Rocks form in many different ways.”



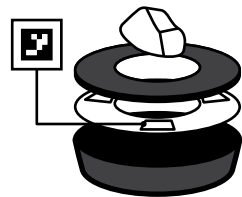
Physical construction

- The table has a tray to house the objects.
- Each object is secured with resin in a round puck.
- A tactile arrow points to a raised circle on the table where the puck can be placed to select an answer.



Software/technical design

- Fiducial markers are embedded in the pucks, allowing each object to be uniquely detected using computer vision.



Main takeaways

Curate a set of distinct objects: Ensure the objects can be differentiated from one another using touch.

Provide supportive feedback: If a visitor answers a question incorrectly, encourage trying again.

Ensure the “reward” is not just visual: Add sound effects to make the experience more meaningful for visitors who are blind/low vision (and, for everyone).

Test lighting and camera placement: Shadows and bright spots from reflected light can affect what the camera is able to capture.

Test any materials that will cover the markers: Print materials, glues, and films can interfere with computer vision if they are reflective or obscure the markers.

Consider graphic instructions: Illustrate instructions to make them accessible to a broader range of visitors.

Make multiple copies of each puck: These unattached objects may become lost or damaged.

How else could we use this template?

- Seashell identification
- Animal guessing game
- Leaf matching

Template B:

Quiz Show

Tool used:

Buttons

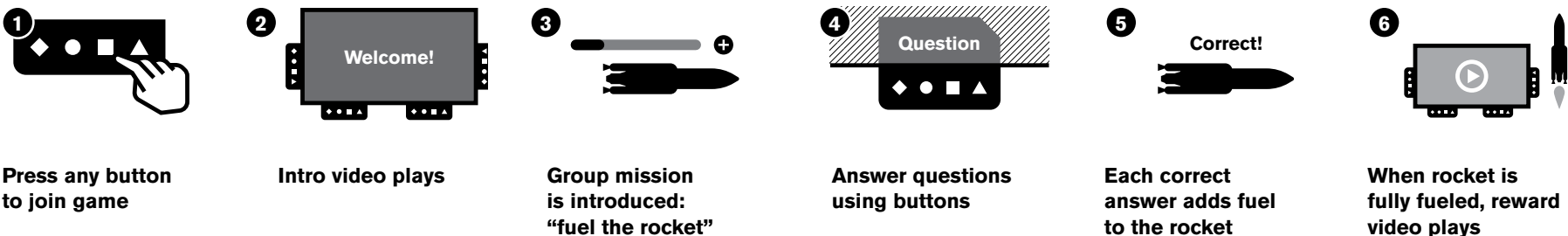
About this template:

- Multiplayer participation
- Test knowledge or introduce a new topic
- Multiple-choice questions
- True/false questions



Sample experience: Mars

In this experience, visitors learn about rover-based Mars exploration as they answer quiz questions.



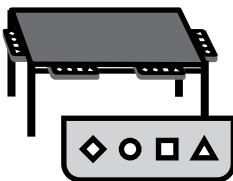
Key ingredients

Activity development

- The experience has a clear beginning, middle, and end.
- A series of questions encourages visitors to engage with a topic. Questions are answered based on either video content, guided observation, or prior knowledge.
- A shared progress bar (e.g., a “fuel tank”) motivates teamwork by advancing with each correct answer from any player.

Physical construction

- Questions, answer options, videos, and scores are displayed at each players’ station.
- Each station has a four-button box; each button has a unique shape and color.



Software/technical design

- Buttons are kept in an “inactive” state until it’s time for visitors to answer a question.
- A dynamic timer is employed—visitors have 15 seconds to answer, but if everyone responds sooner, the remaining time is reduced to 3 seconds.
- The point system for progress tracking adapts to the number of players.

Main takeaways

Consider the vantage point of each player: Display text and visuals at each station rather than in the center of the table. Ensure that no one will struggle to read/watch from their location.

Limit playthrough time: Limit the number of questions and length of videos to maintain visitor interest.

Consider tactile differentiation of buttons: Think about whether visitors will be able to quickly find a button by feeling for shape.

Manage cognitive load: Limit the number of things the visitor needs to pay attention to at one time.

Mini wins: Include opportunities to celebrate progress toward a goal.

How else could we use this template?

- Fact or fiction
- Who am I?
- 3 truths and a lie

Template C:

Node Exploration

Tool used:

Dial

About this template:

- Explore nodes in a network
- Investigate a common theme across nodes
- Visualize connections between nodes

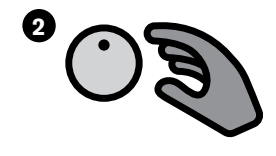


Sample experience: Global Climate Change Impacts

In this experience, visitors navigate between different cultural heritage sites to learn about climate impacts.



Table displays a world map with locations tagged.



Rotate the dial to move between locations.



A callout box displays information about predicted climate impacts at that location.



Table displays an animation of temperature and precipitation data over time.

Key ingredients

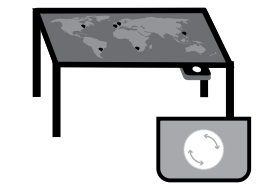
Activity development

- When a node is selected, animations and graphic callouts communicate content about that node.
- Observing a series of nodes and their associated content collectively tell a story.



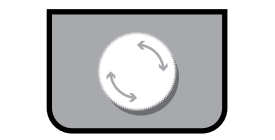
Physical construction

- The table has a single dial that can be turned in either direction to navigate between nodes.
- As visitors turn the dial, detents provide tactile feedback.



Software/technical design

- Arrows are projected on the dial to prompt rotation.



Main takeaways

Minimize the number of tools: Keep the interaction simple, with one way to interact at a time.

Minimize the content layers: Visitors want you to get to the point.

Minimize barriers to entry: Make sure you are not asking visitors to look at multiple places on the table at once.

Use backgrounds for all body text: Make sure to check contrast for all locations where text will be projected.

Other uses/ideas for the template

- Train stations around the world
- Neuron map exploration
- Doors in a neighborhood

Acknowledgements

Development of the FAST table infrastructure was truly a collaborative effort. We are grateful to the following individuals for contributing their expertise and perspectives to this project:

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Denver Museum of Nature & Science	North Carolina Museum of Natural Sciences
Detroit Zoological Society	Oakland Museum of California
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EdTogether	Science Museum of Minnesota
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Field Museum	TERC
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And finally, a thank you to all of the Museum visitors and recruited groups who tested our prototypes. We appreciate their time, input, and willingness to try out something new!

Design Tips and Resources

- **Stick with one main message** to ensure clarity within an experience.
 - **Consider availability and quality of media** when choosing topics to highlight.
 - **Pick one tool** that is most suitable for your experience design.
 - **Use more than one modality** to communicate messaging and rewards.
 - **Help visitors answer correctly**, especially if a correct response is required to proceed.
 - **Avoid overloading the visitor** with too much content.
 - **Display smaller segments of label text** rather than large paragraphs.
 - **Make sure the table is accessible** to visitors who are either sitting or standing.
 - **Use a matte, non-reflective tabletop surface** to improve image quality.
 - **Do not be afraid to experiment**, the templates are a starting point.
 - **Think about location and proximity of speakers** to avoid audio bleed.
 - **Test and adjust audio settings** across multiple components to support accessibility across an entire gallery.
 - **Ensure captions are viewable** to all users and legible when projected on the table at scale.
 - **Ensure tactile feedback** makes orientation easy and clearly distinguishes the parts of an experience (e.g., buttons, 3D objects)
-
- [UDL Guidelines](#)
 - [Rooted in Rights](#)

