Disappearing Glass Rods
Post-Redesign Evaluation
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THIS IS A POST-REDESIGN EVALUATION REPORT

After an exhibit has been renovated, redesigned, or refurbished in preparation for the Exploratorium's move from the Palace of Fine Arts to Pier 15, an interview and observation study is conducted. The purpose of the study is to identify any major issues that would require immediate attention prior to the move. This collection of redesign evaluations will serve as a baseline of information for the Exploratorium's new exhibit set at Pier 15.

Post-redesign studies like this one **are conducted quickly,** which may mean:

- small sample sizes
- expedited analyses
- brief reports

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Study Goals

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General goals:

- To confirm that visitors are able to access and use the exhibit
- To confirm that visitors can build a basic understanding of the exhibit's content
- To uncover visitors' frustrations and confusions
- To understand whether visitors move on from an exhibit for intrinsic or extrinsic reasons

Exhibit Description

A bundle of glass rods can be immersed into a liquid in a glass tank. All of the rods disappear except for a single rod in the middle of the bundle. This is because all of the rods (except for the one that remains visible) have the same index of refraction as the liquid, so that light passes through both the liquid and glass without bending and the rods become invisible. The rod with a different index of refraction bends the light and renders itself visible. On the other end of the dipping mechanism is a magnifying lens, which ceases to magnify when it is immersed in the liquid.

Methods

Uncued observations and interviews were conducted. A researcher randomly selected visitors who crossed an imaginary line on the floor that stopped facing the exhibit with two feet planted and either looked at or touched the exhibit for approximately 15 or more seconds.

Uncued visitors do not know they are part of the study until after they finish using the exhibit so their behavior can be considered representative of normal use patterns. This means that some of the visitors in this study may have used the exhibit only briefly.

Visitors were approached after they left the exhibit and asked if they would be willing to participate in a 7-question interview about their experience at the exhibit.

Demographics

Gender	Count (N=12)
M	7
F	5

English as a Second Language?	Count (N=12)
N	9
Y	3

Estimated Age	Count (N=12)
8-12	1
13-17	3
18-29	3
30s	2
40s	2
50s	0
60+	1

Visitor Group Composition	Count (N=12)
Adults-only	8
Adults with children	1
Adults w/ teens	3
Adults w/ teens and children	0

Findings

Holding Time

This is the time the visitor spent using or otherwise engaged with this exhibit. The amount of time a visitor spends at an exhibit is influenced by many factors and can indicate level of engagement or interest, but not as a measure on its own.

Time at exhibit	mm:ss (N=12)
Mean	1:05
Median	0:52
Minimum	0:26
Maximum	2:58

Visitor Behaviors

Visitors were observed as they used various parts of the exhibit.

Start state: which submerged?	Count (N=12)
rods	8
magnifier	4

First turn	Count (N=12)
rods	0
magnifier	8
none	4

Views partly submerged?	Count (N=12)
rods	0
magnifier	2
both	10

Views from side or top?	Count (N=12)
Yes	4
No	8

Visitor Interest

Visitors were asked about their interest in the exhibit and why they rated from "not interesting" to "very interesting" (1 – 7).

Interest Level	Count (N=12)
High Interest (6-7)	6
Moderate Interest (4-5)	6
Low Interest (1-3)	0

Visitor responses:

H	Interesting. [Tell me more?] Because…(looks at the instructions) I don't know really how to say what it is I want to say. [That's ok]. (Takes me to look at the instructions together).
H	To see how elements can be hidden and be blinded by this, that you don't see something.
H	Interesting. [Tell me more?] Illusion of disappearing rods.
H	Easy way to explain the difference index of refraction of material. Oil has same index as the glass that's why the illusion happens.
H	Because never thought about that. [Tell me more?] Learned something about refraction. [Anything else?] No.
H	Because I already heard about that. [Oh, from where?] On TV. You know what it's about, but you haven't seen it.
M	I'm a teacher; my kids are interested in seeing something disappear.
M	Don't know how it works and that's interesting to me.
M	Just one rod, interesting to see what was the oil and what was the lens, trying to see if oil was running off the lens.
M	Cool that it disappears in the water. That one looks more clear in the water (the lens).
M	Because it was interesting to see how it would disappear like that.
M	It's interesting because they disappear, I don't understand the right side. [What about it is unclear to you?] What does it do?

Visitor Frustration or Confusion

Visitors were asked to tell us if there was anything confusing or frustrating, what the source of the frustration was, and whether or not it made them want to leave the exhibit and move on to another one.

Source of visitor frustration or confusion*	Count (N=15)	# that wanted to move on
Unsure what to do. Unsure why picture is there	1	0
Magnet magnified view	1	0
Height of exhibit	1	0
Nothing Frustrating or Confusing	12	--

*Totals may add up to more than N = 12 because visitors gave more than one response.

Visitor Understanding

Visitors were asked what they think the exhibit was about with the goal to determine whether or not they have a basic understanding of the concepts presented and to identify possible areas of misunderstanding. We acknowledge that this study has a small sample size and that these findings illustrate trends and may not be representative.

It appears that visitors DO have a basic understanding of concepts presented.	X
It appears that visitors DO NOT have a basic understanding of concepts presented.	

Visitor responses:

- Optical illusions. [Anything else?] No.
- Illusion, basically you see an object, the strips in the back have to do something about it.
- Understanding oil and water, makes them disappear.
- The different index of refraction of material.
- Components out of the oil in comparison of the components in the oil.
- Light reflection.
- Optical properties of several different materials, air, oil, different rods and the lens.
- (Looks at adult, pause) How it disappears.
- Kinda, fraction, and the way the light change with oil.
- Rods disappear in oil as opposed to e.g. water.
- Visual? How looking at vials in oil makes them disappear.
- Water lets the glass you see disappear, it looks quite, well, like a magic trick, but it isn't. [Anything else?] No.

Visitor Reasoning for Leaving the Exhibit

The goal of this question is to explore how open or closed-ended the exhibit seems to be for the visitor. Visitors tend to leave exhibits for intrinsic reasons, such as feeling bored, or finished with the experience, or for extrinsic reasons, like having to go to lunch or being distracted by another exhibit. Leaving for intrinsic reasons could suggest a more close-ended exhibit experience.

Reasons for moving on to the next exhibit	Count (N=12)
Intrinsic	9
Extrinsic	0
Unclear / Uncodable	3

Visitor responses:

Intrinsic	Done it.
Intrinsic	Done.
Intrinsic	I knew what was going on here, done it.
Intrinsic	Done with it.
Intrinsic	Done everything that was here.
Intrinsic	Done with it.
Intrinsic	I think I've seen it.
Intrinsic	I did it.
Intrinsic	I've done it.
Unclear / Uncodable	I don't know.
Unclear / Uncodable	(Goes on explaining about the exhibit, does not give a reason).
Unclear / Uncodable	I'm gonna go back and do it again.

Conclusions

Based on this small sample, we conclude that the redesigned exhibit does not require immediate remediation. This evaluation did not identify sufficient impediments to visitor use, engagement or basic understanding.

APPENDIX: Graphic Panel

5989_L1_DisapperingGlassRods_MainLbl (13" x 11") 0.5" round corners Laminate + 1/8" ABS

disappearing glass rods

You see transparent objects because they bend light.

- Turn the **knob** to lower the glass rods into the clear oil. Notice that all but one of the glass rods seem to vanish in the liquid.
- Also notice that when the lens is submerged it no longer magnifies the picture.

What's going on?

When light passes from one clear medium into another, it (usually) bends—a phenomenon called *refraction.* Distortions caused by refraction are part of why you can see objects that are clear.

The oil in this tank is optically similar to glass, so light doesn't bend when it passes from oil to glass. Without the telltale distortions of light caused by refraction, the glass rods disappear. Meanwhile, since lenses magnify images by bending light, the lens doesn't work anymore either.

The one rod that doesn't disappear is made of a different type of glass (flint glass) that refracts light differently than oil, so it doesn't disappear.

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