

Flow Trough Version 1

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THIS IS **NOT** A DEFINITIVE FINAL REPORT

FORMATIVE evaluation studies like this one often:

- **are conducted quickly**, which may mean
 - small sample sizes
 - expedited analyses
 - brief reports

- **look at an earlier version** of the exhibit/program, which may mean
 - a focus on problems and solutions, rather than successes
 - a change in form or title of the final exhibit/program

Flow Trough Version 1

Formative Evaluation

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Goals

The main goal was to obtain baseline information about visitor behavior at Flow Trough. Specifically, we wished to assess:

- Holding time
- Whether and how often visitors point out patterns to one another
- Whether visitors make references to real-world phenomena as they use the exhibit
- Whether visitors seem off-task, using the exhibit simply to splash water
- Whether visitors found the exhibit engaging or frustrating
- What visitors were thinking about or trying to do while at the exhibit
- Why visitors moved on from the exhibit; why they left

Summary of Findings

Video results

- Mean holding time was 131 seconds (2.2 minutes). The median was 83 seconds (1.4 minutes).
- 22 of 40 (55%) visitor groups pointed out at least one pattern while using the exhibit.
- 13 of 40 (33%) visitor groups referred to real-world phenomena at least once while using the exhibit.
- Only 1 visitor group (3%) ever splashed around at the exhibit and never settled down to use it properly.

Interview results

- On average, visitors reported in the interview that they found the exhibit to be “engaging” and cited observing the flow patterns as one of the most engaging aspects of it.
- Most (7 of 13) visitors interviewed found nothing frustrating about the exhibit. Those who felt some frustration typically mentioned sharing the exhibit with others as the cause of their frustration.

- When asked what they were thinking and doing at the exhibit, visitors reported trying to create flow patterns, talking about why patterns form and thinking about related phenomena.
- The exhibit phenomena reminded visitors of flowing water or air, bridges, airplanes, weather, cloud formations and bathtubs.
- About half the visitors left the exhibit for extrinsic reasons, and half for intrinsic reasons. This is consistent with data from other APE exhibits studied to date.

Methods

We videotaped visitors at the exhibit for four hours on 2/14/04. From the tapes, we coded 40 visitor groups, 10 from each hour of tape, while they used the exhibit, noting the various behaviors listed in the Goals section above.

We also interviewed 13 adult visitors as they exited the exhibit area. We asked them about their experience with the exhibit and why they left the exhibit. (See *Detailed Findings – Interview data* for specific interview questions and responses.)

Detailed Findings – Videotape data

Holding time

The holding time data are shown in Table 1 below.

Table 1. Holding time results in minutes

Mean	St Dev	Median	Maximum
2.2	2.9	1.4	14.5

The distribution is shown in Figure 1 below.

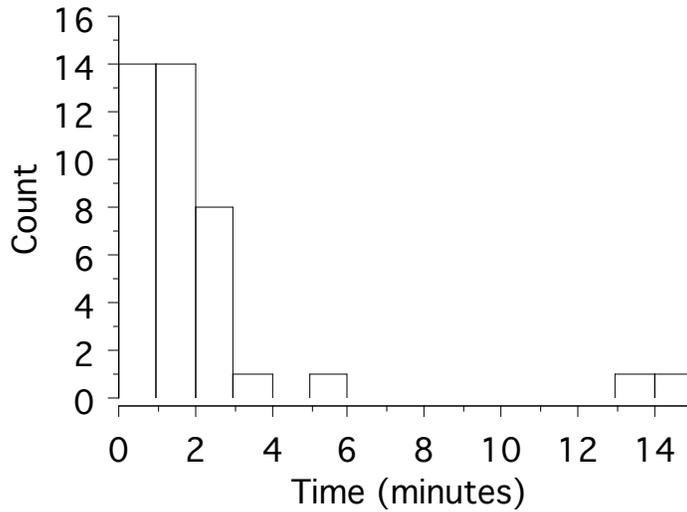


Figure 1. Holding time distribution.

This distribution, along with the discrepancy between the mean and median holding times, suggests that the mean time was inflated by a small number of outliers.

Visitors pointing out patterns

22 of 40 (55%) visitor groups pointed out at least one pattern at some point during their interaction with the exhibit. Those 22 visitor groups pointed out a pattern 3.9 times on average. The maximum number of times any group pointed out a pattern was 16. There was not a significant correlation between pointing out patterns and spending a long time at the exhibit ($r = .22$, $p = .35$).

Visitors referring to real-world phenomena

We noted whenever visitors would mention other phenomena in relation to the exhibit, such as, “It looks like clouds swirling.” 13 of 40 (33%) of visitor groups explicitly mentioned some related phenomenon at least once during their interaction with the exhibit. Of those who referred to related phenomena, those groups made such a reference 2.2 times on average.

Visitor splashing behavior

We also coded to see whether visitors were “just splashing around” or really using the exhibit. Here are the codes we used:

- P: Visitor group plays with exhibit or makes observation and never splashes (best type of behavior)
- SP: There is some splashing with some play or observation
- S: Visitor group will only splash around and not ever slow down to play with or observe the exhibit
- N/A: Not applicable. Visitor group....

Table 2 shows the visitor groups’ splashing behaviors.

Table 2. Visitor groups’ splashing behaviors

Behavior	Code	Count	Percent
Plays/observes without splashing	P	22	56%
Some play/observation & some splashing	SP	13	33%
Only splashes	S	1	3%
N/A	N/A	3	8%

Forced

Interview choice Engage long answer

Enjoys observing patterns

- 4 4 I'm a canoe-ist -- looking at patterns of flow to see fast currents and eddies.
- 8 4 Because you have an airflow, different shapes.
- 12 4 It was interesting to look at how the current moved. for some shapes, I expected what happened. For others, I didn't expect the flow around them. it was fun to play (laughs)
- 2 3 Looking at chaos patterns and the soap rings - they are pretty cool. Being able to change them.... The bubbles are like a plain, once we got it damned up, made it 3-d. It was really interesting. made it interactive. I like everything else. ???
- 3 3 watching different patterns in the water.
- 6 3 Because Pete liked showing air resistance. I liked the patterns. [man chimes in] I like doing science. I've done it before.
- 7 3 Pretty good visuals, and you get wet!
- 9b 3 never thought to look at it before

Other enjoyable aspects

- 9a 4 I am interested in aerodynamics
We come here every weekend. They get to touch things and see
- 11 4 immediate cause and effect - plus it let's them get their hands wet!

Not very engaging

- 1 2 It needs more information - kinda sparse with just pictures and one line.
It was somewhat engaging because of the size and water - but not very interesting once you really look at it. also, child who was already
- 5 2 there had complete control of it.
- 10 2 It is the early part of the visit, so I wanted to see what else is here.

Question 2: Was there anything frustrating about using the exhibit?*Crowding / sharing with other visitors*

- 5 Child was monopolizing the exhibit
- 9a Little kids taking my blocks
- 9b Other people moving the blocks you were wa???
- 1 No. Over crowding [what about at this particular exhibit?] not enough examples
- people putting lots of things in - not getting idea

Problems with exhibit itself

- 2 No, I wouldn't say so. Where are the hand towels? (laughs)
 11 No, the water was a little slow - if it moved a little faster, you could see the effect sooner.

Nothing frustrating

- 3 No, not really.
 4 No, not at all
 6 No, I didn't even have to wait to see it.
 7 No, I'm an engineer - so I like explaining this stuff to my daughter
 8 No, not at all.
 10 No
 12 No

Question 3: Can you sort of go over with me what you tried at the exhibit and what you were thinking while you using it?*Trying to create / alter flow patterns*

- 1 I was thinking about pr?????. How to create swirling vortices - how to get that going.
 2 First of all noticing what it is. Seeing what's going on with the soap. Then you drop something into the pattern. Then you see that you can alter patterns, then you can use different blocks to alter the patterns on purpose.
 3 Just trying to see what different patterns I could make. [what did you do to make different patterns?] Moving shapes around, moving combinations of shapes. [did you make the patterns you expected?] Yes, I did.
 4 I was trying narrow passages, joining of two rivers and looking for the fastest flow of the water. Trying to relate it to rivers and river flow.
 6 [man] I tried to show how the air goes around the shape of a wing.
 [interviewee] I made patterns and listened to Pete's stories, of course.
 10 Converting from flow of water to air flow with the wing.
 12 I was trying to move shapes in different directions - first in middle, then on the side, then I put more of them in the way.

Thinking / talking about why patterns form

- 5 I was thinking of the islands and how the water goes by the islands. I was wondering what made the bubbles that way.
- 7 I was trying to teach her the difference between laminar air flow and turbulent air flow - seeing airflow - wanted to see different air flow ???? and other pieces.
- 8 First, just changing the course of the flow of water. then pretending to build a bridge. then I saw the air flow template - put it sideways in the water because the water is not deep enough. got looking at drag and lift.
- 11 I was trying to demonstrate how wind works with wing - top vs bottom of wing. also, different vortices around circles as opposed to rectangles, which I compared to fish.

Thinking about related phenomena or memories

- 9a Discovering ???/ ch??? Special army core of engineers. Building bridges, modeling flow in a large pool.
- 9b Thinking of where I had seen it before

Question 4: While you were using the exhibit, were you reminded of anything from the world outside the museum? (Did it remind you of anything else you've seen or experienced?)

Flowing water or air

- 4 Rivers and dams. [ae?] That's all.
- 6 A plane. [ae?] Stream, airflow
- 9a Creeks and streams
- 11 Wings, fish [ae?] Streams
- 12 When I was a kid, playing in a small river stream, but it's easier to see the current here.

Bridges and airplanes

- 7 Bridges. because of bridges, talking about wanting to see objects as actual things - wing section of a plane.
- 10 Bridges, planes, boats - which we saw in the objects that are in there.

Weather / clouds / atmosphere

- 1 Horses - because it is a horse trough. Also, the jet steam, weather. There wasn't explanation about what would cause that kind of open space (on picture)
- 2 Remembering how soap goes in the bathtub (laughs). Also, weather, the coriolis effect that you see on the news and clouds, because of the soap bubbles.

Other

- 5 I was also thinking of an experiment we could do in my classroom. we have land mass experiments with negative and positive shapes in my montessori classroom.
- 9b Bathtub

Didn't remind me of anything

- 3 No, but didn't read about it either.
- 8 Not really, just focusing on cause and effect. I know the theorem - trying to see it.

Question 5: We're interested in finding out what makes visitors move on from one exhibit to another. Thinking back on it, what was it that prompted you to move on to the next exhibit? Anything else?

Extrinsic reasons

- 3 I knew there was a lot more to see. Spread time out among exhibits.
- 4 Child was ready.
- 7 People came, so you want to make room.
- 8 Didn't want to take too much time.
- 10 Just knowing that we have a little time, and also I want to catch up with my wife and son. she comes up with really hokey explanations of things and I want to give him real explanations rather than old wives tales.
- 12 The museum is so big - so time, really. so far, I think this one is the most interesting.

Intrinsic reasons

- 5 The child was using ALL of the objects - maybe if there were more objects, I would have stayed longer.
- 6 I tried all of the shapes - thought we would move on. Normally, there are people waiting that makes us move on.
- 9a Run out of objects
- 9b I exhausted the possibilities. I looked at flow around the objects and my hand.

Both extrinsic and intrinsic reasons

- 2 Proximity - where you are and what's nearby [what made you move from flow trough? what made you say, ok, I am done?] she was done. (child leading) once one person gets bored.... if it is parents that get bored first, you see if you can drag them along. if it's the kid, you just go.
- 11 Kids started splashing, so I wanted to get out of there.

Other

- 1 This one seemed more exciting than the other (vibrating pin screen)

Conclusions/Recommendations

Keeping visitors longer

The mean holding time was 2.2 minutes, which is longer than the Planned Discovery exhibits we have studied. However, the distribution of holding time suggests that the mean was pulled up by a small number of outlying groups. Moreover, several visitors interviewed stated that they left the exhibit because they had “tried all of the shapes,” “run out of objects” or “exhausted the possibilities.” This suggests that we may be able to hold visitors for longer periods by adding more (different) shapes to the Flow Trough.

Encouraging more pattern observation

The exhibit seems to be encouraging about half of the visitor groups to point out patterns. About one third of the groups referred to real-world phenomena. As the team has already discussed, these percentages might increase if a label with more images and/or text were presented. One interviewed visitor explicitly asked for more images and text in the label, stating, “It needs more information - kinda sparse with just pictures and one line.” We recommend continuing to pursue the creation of a more in-depth label system.

Discouraging splashing

The majority of visitor groups never splashed around, and only 1 group splashed water without ever settling down to use the exhibit properly. However, about 40% of visitor groups did splash the water at some point during their visit. Although the splashing did not seem to adversely affect most visitor groups’ experience, it does seem like a issue that should continue to be considered.

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