

# Lift II

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September 2005

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

# Outdoor Exploratorium: Formative Evaluation

## Lift II

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### PURPOSE

The previous prototype of Lift was changed to address issues we discovered from the earlier June evaluation at Rincon Park:

- The airfoils were moved further out, away from the railing over the water. This was meant to discourage people from touching the airfoils and therefore increase the durability of the exhibit.
- Three different sets of airfoils, each set of different sensitivity, were built. See Figure 2. This way the more sensitive airfoils would lift even in light wind.

The purpose of this evaluation was to determine

- How did visitors try to interact with the revised exhibit?
- What did visitors find interesting/ not interesting?
- What did visitors find confusing about the exhibit?
- What did visitors notice about the wind at the exhibit?
- What did visitors become curious about?
- Would visitors stop at the exhibit if they were to pass by the area again?

### METHOD

- The prototype was mounted along the railing next to the bay, as shown in Figure 1 and Figure 2.
- An evaluator sat and observed visitors who stopped in front of the exhibit for more than 3 seconds and approached them for interviews as they were leaving the exhibit. The observation and interview instruments can be found in Appendix A.
- We observed and interviewed people on Thursday, September 22, Friday, September 30, and Saturday, October 1. We tried to interview people only when there was at least a slight breeze.

Figure 1. Prototype Location

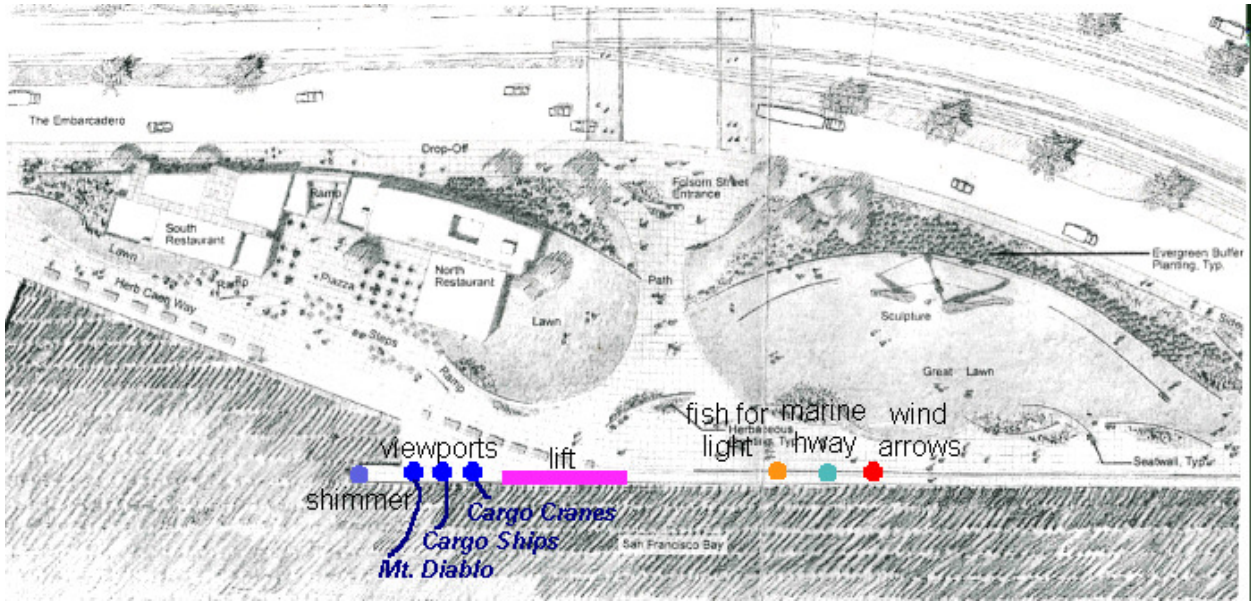


Figure 2. Prototype Setup



**DATA**

- Demographics

Group Type	Count
Adult - peer	17
Adult - singleton	6
Multi-generational	0
Total	23

## RESULTS

### *What did visitors do at the exhibit?*

- No one reached out and tried to touch the airfoils.
- A few visitors did try to otherwise interact with the exhibit:
  - Visitor8: Holding body in way of wind, but couldn't affect exhibit. <sup>1</sup>
  - Visitor18: Blew on foils

### *How interesting did visitors find the exhibit?*

Interest Rating	Lift
Interesting	13
Somewhat Interesting	9
Neutral	1
Somewhat Uninteresting	0
Uninteresting	0

- Visitors found Lift interesting because of:
  - How it looks or behaves (9 visitors)
    - Visitor3: Very exciting when it works.
    - Visitor6: The movement and colors, mostly that it's dynamic.
    - Visitor10: The way it goes up and down.
    - Visitor11: The colors, shapes, and mobility.
    - Visitor15: F1 rated it a 5, Boy rated it a 4. F1: The design, shapes, color and movement. Boy: I just like it when it goes up and down.
    - Visitor17: Betting on it. It's like dog racing, colorful. It's fun to cheer things on.
    - Visitor18: That it moves. I like things that move.
    - Visitor20: V1: I like the color
    - Visitor23: V1: The primary colors caught my eye.  
V2: The shape of the airfoil.
  - Its (elegant) design (6 visitors)
    - Visitor3: The movement and sound - the colors. And where it is, it's almost a piece of art.
    - Visitor8: M: Ingenuity of design, the simplicity of it.

<sup>1</sup> This was suggested in the text, which had not changed from the June version.

- Visitor12: Once I realized the elegance of how it was demonstrating the phenomenon, it really impressed me.
- Visitor13: It's easy and basic, doesn't involve a great deal of thought or intelligence, but it's still interesting.
- Visitor14: Male: Because it's obvious what will happen, but it is neat how it's set up.
- Visitor22: It looks like something simple, but if you read it, it's very interesting.
- The concept it demonstrates (4 visitors)
    - Visitor1: Because I saw, I understood the idea of pressure/lift. Cool to see it in horizontal rather than vertical orientation
    - Visitor7: It teaches people about science.
    - Visitor14: Female: Because I was relating it to flight.
    - Visitor21: V2: It tells me how airplanes go up, because of their airfoils.
  - Its combining art and science (2 visitors)
    - Visitor16: It's a combination of science and kinetic art.
    - Visitor19: Mixing art and science, letting you see what you normally don't see.
  - Its novelty (2 visitors)
    - Visitor5: You don't see it every day, but kind of random.
    - Visitor21: V1: Because I've never seen anything like it.
  - A connection to prior experience (1 visitor)
    - Visitor9: We have some really interesting air sculptures at Launer Park in Missouri. So I think outside sculptures are neat.
  - Its game-like quality (1 visitor)
    - Visitor17: Betting on it. It's like dog racing, colorful. It's fun to cheer things on.
- A few visitors complained that:
    - There was not wind (1 visitor)
      - Visitor2: For today, because there's no wind.
    - There wasn't enough information (2 visitors)
      - Visitor4: Male: I thought it was hooked up to a website that shows ALL the wind directions on the whole bay. So I was a little disappointed that it wasn't.
      - Visitor8: F2: Would be a 5 if it had more context - I want more to think about. F1: I don't know WHY some of the foils are more sensitive.

### ***What did visitors find confusing about the exhibit?***

- A large majority (17/23) of the visitors did *not* find anything confusing about the exhibit.

- However, a few visitors requested more explanation about the exhibit, particularly how the airfoils respond to the changing wind:
  - Visitor1: The description could be more thorough- didn't talk about pressure- or connection to sailing which is basically wing on end
  - Visitor5: What its purpose is [guess?] test for engineering design, or a weathervane.
  - Visitor8: Could have used more explanation ... M: Without the context, it seems to be more of an art installation
  - Visitor11: It was a catalyst of conversation --wondered what it was trying to show. I wish the label had talked more about how it worked.
  - Visitor15: F1: Couldn't figure out if they all weighed the same... F1: There was a picture of a bird on the label, but nothing on the explanation to connect that. We were making up a connection for it.
  - Visitor22: Maybe the instructions. (Q: "What would you want explained?") Why is the orange one more resistant to the wind?
  - Visitor23: V3: [I wanted] More of an explanation of what the wind was doing, a visual. V1: (to V3) Just read Bernoulli.

### **What did visitors become curious about at the exhibit?**

Visitors became curious about:

- The wind (9 visitors)
  - Visitor7: It does make me curious how there can be that much variation in lift in such a small area. There isn't as much pattern as I'd expect.
  - Visitor8: F2: I'm a sailor - so I think a lot about wind, so I like the subtleties of the exhibit. F1: I'm curious why one in the middle can go up without the others. why there aren't more patterns.
  - Visitor9: I love to sail, so I'm interested in wind. (Q: "Would you like to learn more about it?") There's always more to find out about what wind does to surfaces.
  - Visitor10: Can it generate electricity by using it?
  - Visitor17: Interested to see how strong a gust it would take to get the red ones up.
  - Visitor18: Why don't we have more wind power in this country?
  - Visitor19: I'm curious about the wind patterns.
  - Visitor20: We sail, so we're interested in wind and all the things the wind does.
  - Visitor22: Yeah, does it measure lateral wind or the one from the bottom?
- The exhibit itself (6 visitors)
  - Visitor1: Curious about weight of tubing... Not really more curiosity- but made me contemplate Wright bros who were really experimenting with lift as well as power
  - Visitor6: No. Other than where did this come from, and how are they going to keep it from getting ripped apart.

Visitor14: Female: How to make one, put it in the yard. Male: Maybe it would drive off the gophers in our yard, especially the noise.

Visitor15: F2: The weights - why reds didn't go up. F1: There was a picture of a bird on the label, but nothing on the explanation to connect that. We were making up a connection for it.

Visitor16: I was curious construction-wise about if there were differences in the angles on the 3 levels. I'm still not sure.

Visitor17: What would happen if the curved one is on the bottom, so the colors were red, orange, blue, rather than blue, orange, red.

- Birds (1 visitor)

Visitor3: It reminds me of birds, is that why birds can fly higher?

### ***What did visitors notice about the wind at the exhibit?***

- Visitors noticed the wind's direction (10 visitors)

Visitor1: you can tell where the wind is coming from because they turn toward the wind

Visitor3: You can tell when the strength of the wind changes, and the direction. The wind may be stronger on one side than the other.

Visitor4: Female: Yes, the wind is blowing when they're up, not blowing when they're down, and you can see them change direction.

Visitor5: You can tell the direction of the wind, and how strong it was.

Visitor12: Yes, could tell speed, direction, and whether it was focused or uneven.

Visitor16: Two of the dimensions - speed and direction, and in a sense a 3rd one - variation.

Visitor17: Having gusts - can see the foils turn when the wind changed direction.

Visitor18: Seeing the gusts and the direction of the wind.

Visitor22: Steady wind, coming in from the ocean.

Visitor23: V3: It's definitely changing direction, and in gusts, because it's going up and down in bursts.

- Visitors noticed the wind's speed/strength (8 visitors)

Visitor5: You can tell the direction of the wind, and how strong it was.

Visitor7: Oh yeah, it was definitely gusting, and the strengths of the gusts are reflected in the exhibit.

Visitor8: Yes, at least to some degree, the wind is stronger when all of them went up.

Visitor12: Yes, could tell speed, direction, and whether it was focused or uneven.

Visitor14: After we read the label, we noticed that all the colors went up in heavier wind.

Visitor15: Yes, the wind was blowing in a fast stream as they moved up.

Visitor16: Two of the dimensions - speed and direction, and in a sense a 3rd one - variation.

Visitor21: V2: The wind speed has an impact on it.

- Visitors noticed how the wind changes (8 visitors)

Visitor3: You can tell when the strength of the wind changes, and the direction. The wind may be stronger on one side than the other.

Visitor6: With a light wind, the blue ones react, when gusts pick up, it's exciting to see them all go to the top.

Visitor11: The more windy it got, the more activity I saw. Also, the more I look at it, the more I like it.

Visitor12: Yes, could tell speed, direction, and whether it was focused or uneven.

Visitor16: Two of the dimensions - speed and direction, and in a sense a 3rd one - variation.

Visitor17: Having gusts - can see the foils turn when the wind changed direction.

Visitor18: Seeing the gusts and the direction of the wind.

Visitor23: V3: It's definitely changing direction, and in gusts, because it's going up and down in bursts.

- Visitors noticed the presence / absence of wind but gave no additional details (7 visitors)

Visitor2: Sure could - there's no wind.

Visitor4: Female: Yes, the wind is blowing when they're up, not blowing when they're down, and you can see them change direction.

Visitor9: Blowing, shifting a little.

Visitor10: The wind was lifting them up and down.

Visitor13: Yes, the breeze is lifting the things. I would expect them to act the way they're acting.

Visitor19: yes. At the moment it's calm, so they're all down, but earlier you could tell.

Visitor20: V2: I saw the lift, so I said, "I wonder how that whole thing moves; it would have to have a lot of wind."

### Did the different colors indicate anything to visitors?

- All the visitors thought that the different colors indicated something different about the 3 sets of airfoils. They thought:

- Different color foils have different sensitivity to the wind (no further explanation) (9 visitors)

Visitor2: There should be a difference. The blue should be more sensitive, go up easier.

Visitor4: Female: The blue ones seem more sensitive than orange, which are more sensitive than red.

Visitor5: Wind speed - different ones show different wind speed.

Visitor6: I didn't think about the blue ones being more sensitive until I read the label.

Visitor7: There are various airfoils with different sensitivities to wind.

Visitor11: Seems to me that they have a different role. The ones at the top move easier.

Visitor12: Not that the colors themselves meant anything, but yes, the colors indicated differences between the rows. The airfoils are different. Some require more energy to go up.

Visitor20: V1: No, except what we read on the sign

Visitor23: V2: It had nothing to do with colors -- the blue ones had more resistance, which is lift.

– Different color foils are of different weights (9 visitors)

Visitor1: No- good to have them because they correspond with different weights

Visitor10: I think they are either different weights, or they're different shapes, different designs.

Visitor13: Weight or shape - or a combination. The blue ones look more angled than the others.

Visitor14: There's a stronger wind when they lift - it must be because the red plastic is heavier, and how bent they are. Are they the same size? Female: It's also tied to the color - blue is light like air, orange is in the middle, and red is heavier because it's

Visitor15: The reds have more weight, or maybe not?

Visitor16: By reading the panel, it's related to their sensitivity. But how does the sensitivity come about? I presume it has to do with the hollow tube adding a little weight to be lifted. And the angle of the foils may also be different. Blue may be more curve

Visitor18: The blue are lighter, the others heavier.

Visitor19: They're weighted differently, so red is least sensitive.

Visitor22: They seem to be different in weight, and the resistance level.

– Different color foils have different curvatures or shapes (9 visitors)

Visitor3: Blue is more curved and more sensitive. Orange is moderate, red is not as sensitive.

Visitor8: F1: It seemed they were different - when I got really close, I could tell the angles were different on the different foils.

Visitor9: Yes, a difference in the shape.

Visitor10: I think they are either different weights, or they're different shapes, different designs.

Visitor13: Weight or shape - or a combination. The blue ones look more angled than the others.

Visitor14: There's a stronger wind when they lift - it must be because the red plastic is heavier, and how bent they are. Are they the same size? Female: It's also tied to the color - blue is light like air, orange is in the middle, and red is heavier because it's

Visitor16: By reading the panel, it's related to their sensitivity. But how does the sensitivity come about? I presume it has to do with the hollow tube adding a little weight to be lifted. And the angle of the foils may also be different. Blue may be more curve

Visitor17: The curve of the foils are different from color to color. Blues are curved more.

Visitor21: V1: The blue has more lift; just how the wind hits it.

V2: The contours are different.

### **Would visitors stop again at Lift?**

Count	
Yes	19
No	4
Total	23

- People who said they would stop again explained they would stop because
  - They expect to see something different about the wind (11 visitors)
    - Visitor1: Because the wind is always doing different things- always interesting to see what this entity is doing.
    - Visitor6: I WOULD enjoy walking past it, though. It makes you aware of the wind in a way you might not notice as long as it's not really in your face.
    - Visitor20: V2: I'd like to have more time with it, maybe on a windier day.
    - Visitor21: V2: On a day with more wind.
    - Particularly how the exhibit responds to the wind
      - Visitor2: I'd like to see it briefly, especially if it were working.
      - Visitor3: Just hope to see it move.
      - Visitor5: If the orange and red ones were going up.
      - Visitor15: If the red ones were going up.
      - Visitor18: If it were moving. I'd like to see all of them raised.
      - Visitor19: Just to see the subtle changes in the sculpture.
      - Visitor23: V3: If it was moving more
  - It's artistic, soothing and mesmerizing (8 visitors)
    - Visitor1: It's also entrancing and entertaining- like looking at a fire
    - Visitor3: Very soothing, like a waterfall, piece of art.
    - Visitor9: Because it's interesting.
    - Visitor11: The longer I was here; the more I'd ponder it.
    - Visitor13: Just want to remind myself what it is, normal curiosity.
    - Visitor14: because it's mesmerizing.
    - Visitor16: That's the kinetic art part. Anything dynamic is attractive, especially if it's generated naturally.
    - Visitor17: It's almost artistic and fun, almost soothing.

- They expect to see something different about the exhibit design (3 visitors)
    - Visitor10: I'd like to see a whole row along here. That would be great.
    - Visitor20: V2: You know, you should put some lube on there [on the exhibit rods]. That would really help it. Give that a try.
    - Visitor22: Better instructions
  - They're the type of people who would stop and look (2 visitors)
    - Visitor7: Because I stop anytime there's science.
    - Visitor21: V1: Probably, at our age we'll stop and look at anything.
- Even 3 people, who said that they would not stop, claimed that they would still pause to look.<sup>2</sup>

## SUMMARY

- As a result of the changes, no one tried to reach out and touch the airfoils. In fact, the airfoils were positioned so far away from the railing that visitors were no longer able to block the wind and change how the airfoils move. *The label, which still recommends that people try to block the wind, needs to be changed to reflect the physical modifications.*
- Nonetheless, visitors still found the exhibit engaging. They mainly remarked on its looks (color), its dynamism, and its elegance of design; some visitors even talked about how mesmerizing the exhibit was to watch. Moreover, most (18/23) visitors said that the exhibit make them curious; 9 visitors had additional questions about the wind.
- All the visitors claimed that the exhibit showed them something about the wind (its presence/absence, its direction, its strength, its variability). Furthermore, all the visitors we interviewed thought that the different colors indicated a difference between the 3 sets of airfoils. Some visitors even had hypotheses as to how they are different; 9 thought their different sensitivities had something to do with their weight and 9 thought the difference was due to their curvatures.
- A minority (7/23) of the visitors would have liked more explanation: How are the airfoils responding to the wind? *Future label iterations can experiment with presenting different levels of explanations of the physics behind the phenomenon.*

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<sup>2</sup> One of the 4 who said they would not stop again did not give a reason.

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## APPENDIX A

### *Observations*

Observe and interview every 3<sup>rd</sup> person. Do not observe/interview anyone under 8. Only interview someone <18 if accompanied by guardian.

Note anything of interest. In particular, make note of the following:

1. Did s/he read the label?
2. What were the airfoils doing while the visitor(s) were looking at it?
3. Did the visitor try to reach and touch the exhibit? How?
4. Did s/he try to interact with it (e.g. blowing on it, fanning it, blocking wind with their bodies)?
5. Other observations...

**Questions**

- ❖ Have you been to the Exploratorium before? YES NO
- ❖ [If NO] Have you heard of the Exploratorium before today? YES NO

1. How interesting would you say that was? Would you say that was ...

Uninteresting	Somewhat Uninteresting	Neutral	Somewhat Interesting	Interesting
1	2	3	4	5

2. What made it \_\_\_\_\_ for you?
3. Can you tell me what happened at the exhibit? Did the exhibit do anything?
4. Was there anything confusing about the exhibit?
5. Did the exhibit make you curious about anything? Anything in particular about the wind? Anything you would like to know more about?
6. Can you tell what the wind was doing or how the wind was behaving by looking at this exhibit? [Probe: say more? So, when these things were moving up and down, what did that mean about the wind?]
7. In your opinion, do the different colors indicate anything? [Probe: is there any difference between the blue and the orange wings? What?]
8. If you were to see this exhibit again another day when you're walking by the Bay, do you think you would stop? YES NO
  - a. [if YES] Why would you stop? What would you hope to see?
  - b. [if NO] What would encourage you to stop again at this exhibit?
9. The Exploratorium is interested in putting permanent exhibits by the bay in this area. Can you tell me how often you walk along the Embarcadero, the Bay in this area?