

# Blow Out Your Toaster

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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

# Blow Out Your Toaster

## Interview Results

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10/3/99

### Goals:

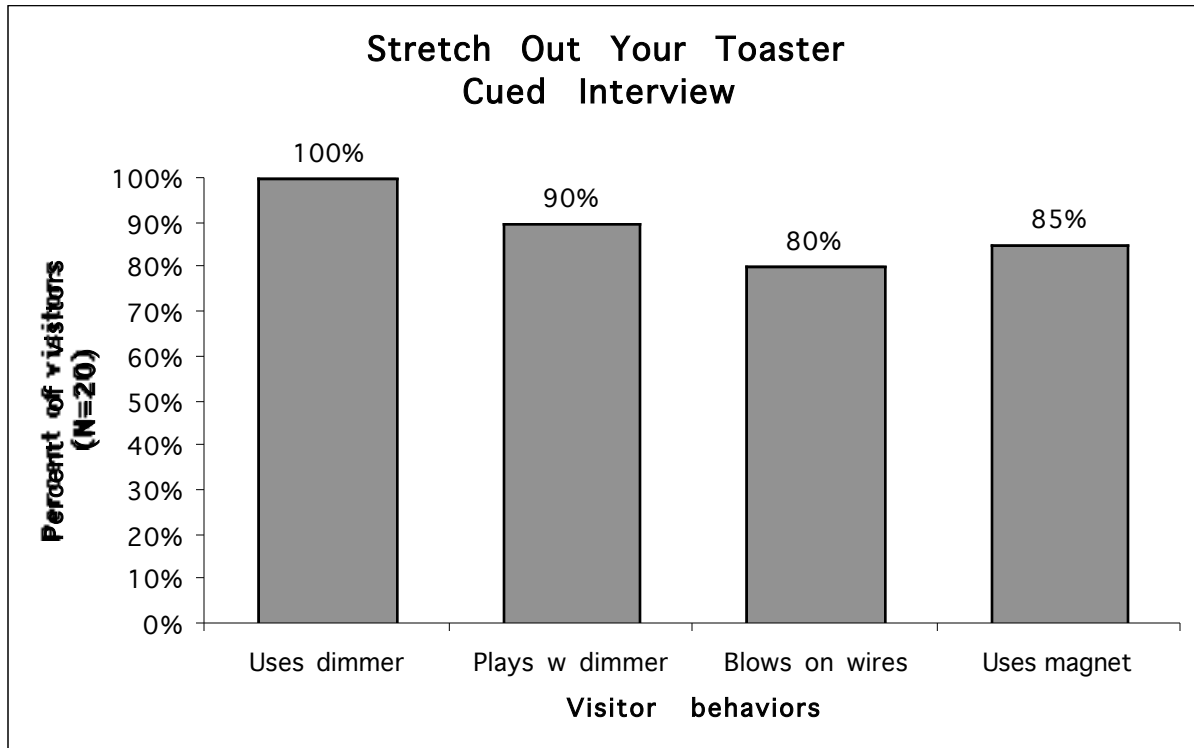
The developer on this exhibit, Erik Thogersen, added a dimmer switch to the exhibit, introducing another variable that visitors could explore. He was unsure whether visitors would understand why the wires stretch when electricity passes through them. Also, he was concerned that the exhibit had too many things to try that weren't fully related to each other. Would visitors want to do all of the activities? Would they understand the phenomena underlying the wire-stretching activity? Would they find it interesting?

### Methods:

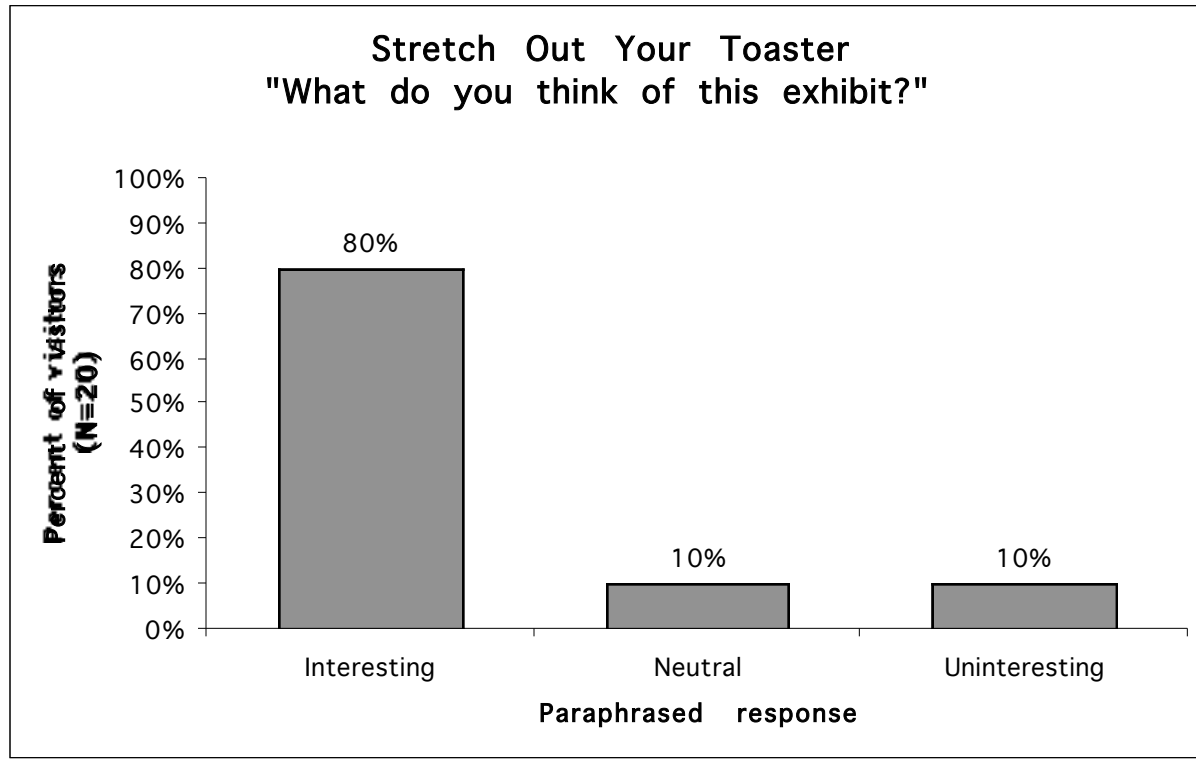
- Cued interview.
- Prototype toaster with wires oriented horizontally. Dimmer switch installed.

### Summary of findings:

- Over 80% of the visitors engaged in all of the activities.
- 80% of the visitors mainly found the exhibit interesting.
- 75% of the visitors had a fairly strong understanding of what makes the wires sag.
- The most interesting activity to visitors was using the magnet, mainly because it was surprising.

**Detailed findings:****Observations: What activities do visitors engage in?**

## 1. What do you think of this exhibit [interesting/boring]? Why?



### *Interesting*

Pretty interesting. Pretty neat, especially the way when you blow on it, it cools the wires. Reactions from the magnet is pretty interesting.

Pretty interesting. [What's pretty interesting about it?] The part where you're generating heat, see wires heat and glow - pretty interesting. Magnet is something I hadn't thought of before - I learned from it.

It's interesting. I wouldn't have looked at it - it's just a toaster. But the bow is really interesting. See how much the wires change. Yesterday, I plugged my vacuum in and it sounded like it was dying, and then I realized that it was plugged into a dimmer and the dimmer wasn't turned all the way up.

50F: Didn't hold my attention but the kids are interested. 30F: I think it's interesting - see what's inside a toaster. Also electricity is interesting..

It's cool. [What's cool about it?] It seems abnormal a little - what happens. [How so?] Something stiff stretches.

40M: I like it. Nice exhibit. Works pretty well. Things cooling and shrinking. 40F: I like it. Interesting to see the metal deform - lots of metals deform in the house.

Cool. It's interesting. I like the way the magnet vibrates the wires. It's hard to see.

It's good. It's nice - illustrates the point. Can't play with it like the magnetic exhibit (Black Sand) because it's hot. It does what it's supposed to do.

Pretty cool. [What's cool about it?] Does a bunch of things - lighting up, moving and magnet. Visually cool.

Nice demonstration of the bending and mechanical motion of the wires. Fact that current heats them and makes them glow, but bending is the really interesting science part of it.

M1: Interesting. Already have a basic understanding. Interesting for kids. [What's interesting about it?] Glowing wires - hot wires. See the electricity going through it. Very visual effect. M2: I'm an electrician, not new. But neat that blow on wires and cool because they're so thin.

I like it. [What do you like about it?] Neat that you can see the inside of a toaster. Heat. Interactive. So many things to do.

Interesting. [What is interesting about it?] I've often looked inside a toaster, and seen wires shrink. I know when you heat things up, they expand. But didn't know that electricity flows and magnet makes it oscillate. Pretty cool. Interesting. Having a little trouble comprehending this (vibrations) a little. Make this more clear (in the label).

Interesting. [What's interesting about it for you?] Never thought about how a toaster works. Gives you a good idea about that.

Great. Something new. [Why is that great?] New things I never knows like a toaster works like this. It's interesting. I know very little about electricity. I feel like I'm learning something about electricity (at this exhibit). Not as fun as tactile stuff than from reading. If I had read this stuff in a book, it would've stayed as jibberish, rather than seeing it. Interesting what you use in a toaster or a heater.

#### *Neutral / mixed*

As an adult, I understand it and know it. I have a toaster at home. Probably wouldn't hold enough interest for kids. It's interesting, but depends on the group.

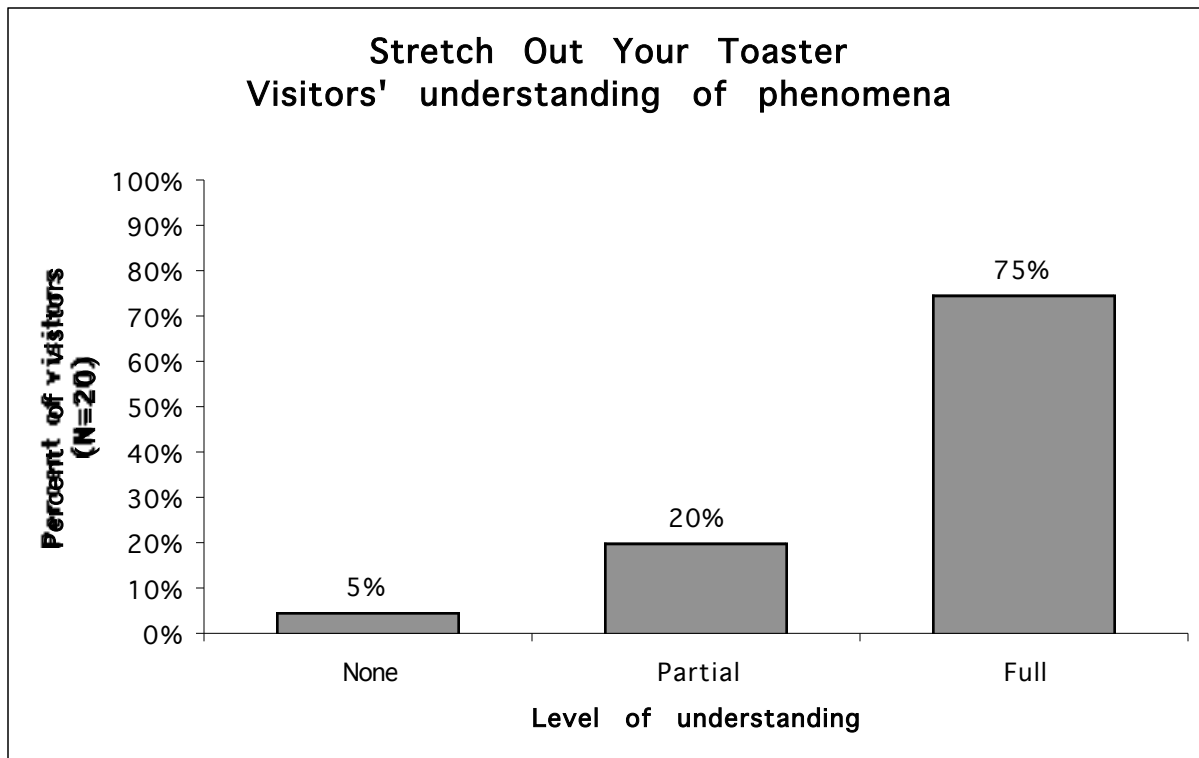
It's cool. I understand why it's working so it's not very intriguing. [What about it is cool for you?] Allows you to work with something like your toaster - ordinarily can't play with a toaster.

#### *Uninteresting*

So many strong ones here, this one is extremely weak. Don't see a lot of vibrations. Dimmer is limited. Lacks involvement that the others [exhibits] have by far.

Not so impressive [What's not so impressive about it?] It's too dark. Not so inviting to play with. Configuration is not convenient (dimmer and magnet on opposite sides). Have to know about electricity or current - not so intuitive. Guitar or magnet (black sand) exhibits are more impressive. It works at least.

2. What do you think is happening when you turn on the switch [What makes the wires sag]?



*Full Understanding*

It's heating up and the metals expand when they heat up, so What do you think makes the wires sag? Expand which creates slack.

Change the amount of current flow in the wires [What do you think makes the wires sag?] Heat wire, metal expands.

Electricity goes through the wires and heating them [What do you think makes the wires sag?] Expand when they heat up.

Increase current through the wires. They're resistively heated, get hot. Might put a light going straight up.

The heat going through the wires and expanding the wire. Didn't get to the bottom (of the label) so don't know why they vibrate.

When it heats, it's red. Cools down, gets darker. [What do you think makes the wires sag?] They're expanding. Electricity goes through wires. They're hot and they expand.

Changing the amount of electricity that runs through it. [What do you think makes the wires sag?] They expand when they heat up and shrink when they cool. [Watches 40F use the magnet] So the magnet doesn't work when the wires are off? Electricity not metal is what the magnet reacts to. It's cool.

Changing the current applies to the wires. [What do you think makes the wires sag?] Metals as they heat and cool, expand and contract.

Different - more current through the wires. [What do you think makes the wires sag?] Electrical heat makes the wires thinner, heavier. More like expansion, actually.

Electricity creates heat, the wires drop because the atoms expand and makes the wires What do you think makes the wires sag? Because wires are so thin, when I blow, the wire cools and shrinks up.

Increasing amount of power or current through the wire. Wires become more pliable when it's hot. More flexible - gravity has more effect on it.

Current flows through. When you heat up with electricity, the size of the wire is too small for the heat. If regular wire, start a fire in your house. [What do you think makes the wires sag?] They're stretching and expanding - not only in distance but in diameter.

Power turned on. Electricity delivered to wires or allowed to flow to wires. Not just on/off opportunity - gateway that opens gradually. [What do you think makes the wires sag?] Heat expands wires, so they take up more space. But have to think about why all go down - gravity. Atoms expanding, take more space. Why in that direction?

Heating wires more or less, with more or less power. [What do you think makes the wires sag?] As they get hotter, they get looser - they expand.

Current in the wire increases. Wires become hot. Electrical resistance causes heat loss. Effect between electricity and heat. Wire is - length increases proportionally to temperature. Another effect is connection between electricity and magnetism.

#### *Partial Understanding*

Change in resistance in wiring, so changes current. [What do you think makes the wires sag?] Electricity changes the makeup of the wires. I don't know why it gets longer.

Heat makes the wire melt and makes it stretch.

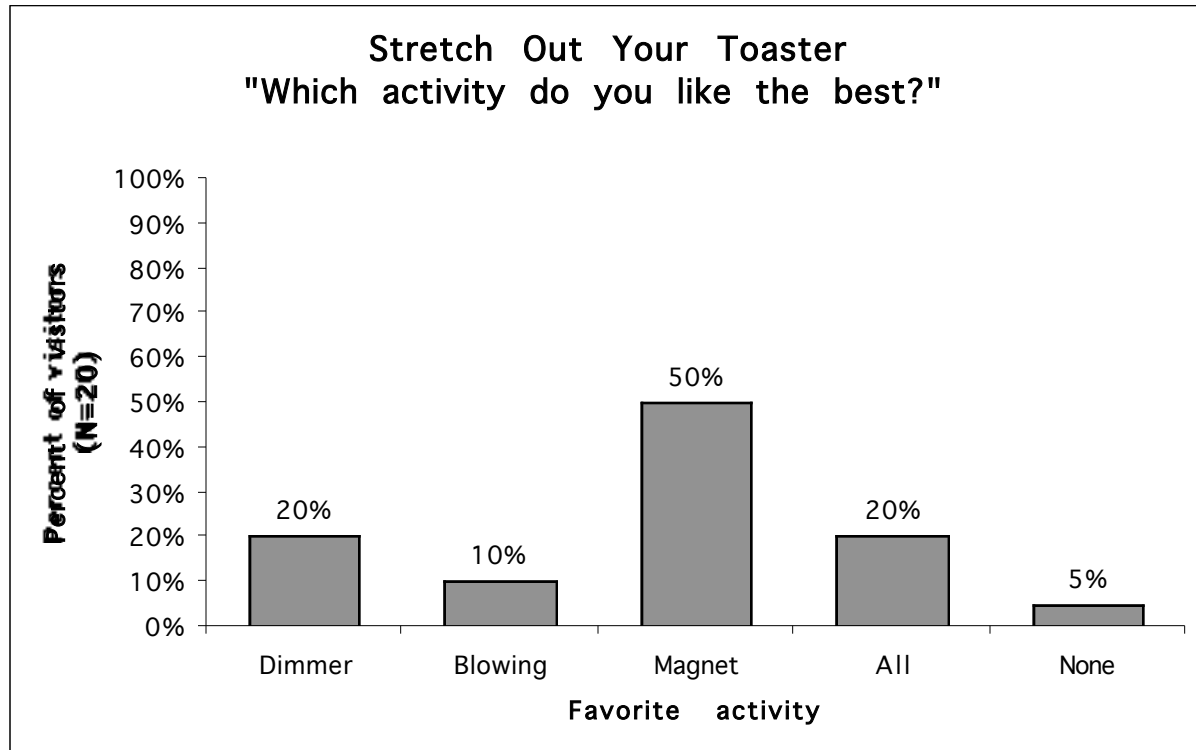
Power on. Electricity going through the wires. [What do you think makes the wires sag?] I don't know.

Adding current to the wires. [What do you think makes the wires sag?] I don't know. Might be air or just vibrations. Expansion of heat makes them vibrate - movement of molecules.

#### *No Understanding*

Heat's coming through. [What do you think makes the wires sag?] I don't know.

### 3. Which activity do you like the best [dimmer, blowing or magnet]? Why?



#### *Using the dimmer*

Using the dimmer. [Why?] Convenient - eye level for kids. Magnet is over there - have to search for it.

Dimmer switch - most dramatic thing. Magnet is OK, but not that exciting.

Playing with the switch. You see light. Magnet is OK, but not too much of an effect. The whole thing is not too much of an effect at all.

#### *Blowing on wire*

Blowing on the wire. [Why?] Just felt like that (was best).

Blowing on the wires. [Why is that?] Neat to see you're interacting with it. See how the coolness affects the wires.

#### *Using the magnet (because it's surprising / learned something new)*

Something I hadn't. I've seen a toaster before - wires heat and glow. But see the interaction with the magnet and wires vibrate was the part I hadn't expected.

I didn't use the magnet. [Would you like to?] Sure. [Uses it and reads label.] I think the magnet is the best part - it's interactive and shows the magnetic force on electricity. [Why is it best?]

Interactive shows something I didn't know before about electricity.

They're cool. Because switch is kind of predictable, but the magnet isn't.  
 I have dimmer switches at home so not that interesting.  
 Magnet was most interesting - other outcomes I knew when I went to do it. [More on magnet?]  
 The one outcome I didn't know when I did it (was the magnet).

*Using the magnet (because "other")*

Didn't do them all. [Go ahead.] (Blows). Cooling them down. (Uses magnet). The effect of the magnetic field and moving the dimmer is neat. Both [Why?] Magnet - see the effect the magnetic field puts on the wires. Obviously something going on. Dimmer is interesting fact of temperature changing the length of the wires.

Magnet [Why?] Could actually see the vibrations change. As the magnet gets closer to the wire and further, it does a different thing.

40M: Magnet. [Why?] The difference between ac and dc - if you had a switch to flick it from ac to dc would be cool. 40F: I liked the whole thing. I think do the ac/dc and put the lightbulb on Can watch the reaction. Probably wouldn't expect it. Would a bigger magnet magnify the vibration? [What made you think about that?] Size of the magnet. If it vibrated more, might be more appealing.

When I could see what was going on - with the power up. [Why was the magnet the most interesting?] I don't know.

*All three equally*

All 3 were good. I'm a kid at heart. Want to see it better when cool.

All 3. The color is cool.

All equally. This piece is more the reading and thinking than the activities. The activities are just a way to get what I'm reading.

All, but I like to see thr color. Blowing is kind of fun. Vibration is neat.

*None*

Found none of them interesting.

Date:                      Day:                      Time:                      Location:

Age/Gender:                      ESL: N    Y    Yes, but fluent

Others in Group:                      Blow Toaster.horiz dimmr.iv.01

Excuse me, my name is XXX and I work here. I'm trying to find out what Vs think of one of these exhibits so that we can improve it. Would you be willing to talk with me? It'll take about five minutes.

First, I'd like to ask you to spend a few minutes playing with the exhibit, reading about it, whatever, so that you get a bit familiar with it. Then when you're ready, I'd like to talk with you about it. [leave them alone with the exhibit]

Observations:

Uses dimmer switch                       Plays with dimmer switch  
 Blows on wires                       Uses magnet

1. What do you think of this exhibit [interesting/boring]? Why?

2. What do you think is happening here when you turn on the switch? [What makes the wires sag?]

3. Which activity do you like the best [dimmer, blowing, magnet]? Why?

## Methods

Age  $\geq$  10 years

Let them refer back to the label during the interview

Grab the first person who crosses an imaginary line in the floor. If in a group, take person closest to myself.