Formative Evaluation

Illustrations - Human Bloodstream and Butterfly

Joyce Ma

November 2007

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

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PURPOSE

This formative evaluation looks at the first version of two illustrations, one that zooms into the human bloodstream and the other that zooms into the structure of a butterfly's wing, both of which aims to show that *Everything is made of atoms.* In particular, we wanted to gauge

What did visitors think was the main message of the 2 illustrations?

Did visitors recognize the objects shown in the illustrations? Which ones? More specifically, did visitors recognize the atoms?

Did visitors see one thing as being smaller than the other as depicted by perspective in the illustrations?

Did visitors want annotations?

This work was done as part of the NISE Net initiative.

SUMMARY OF FINDINGS

Most visitors thought the two illustrations showed how one thing is made of other things. Although, when asked what they thought everything was made of, slightly less than half said molecules or atoms. This may be because only about half (8/14) of the visitors recognized the depiction of the atoms used in the illustrations.

Most visitors recognized the macroscale objects in the human illustration. Slightly fewer were able to identify the butterfly as a butterfly. In both cases, visitors were much less familiar with the micro and nanoscale objects and recognized few of them, particularly for the butterfly illustration.

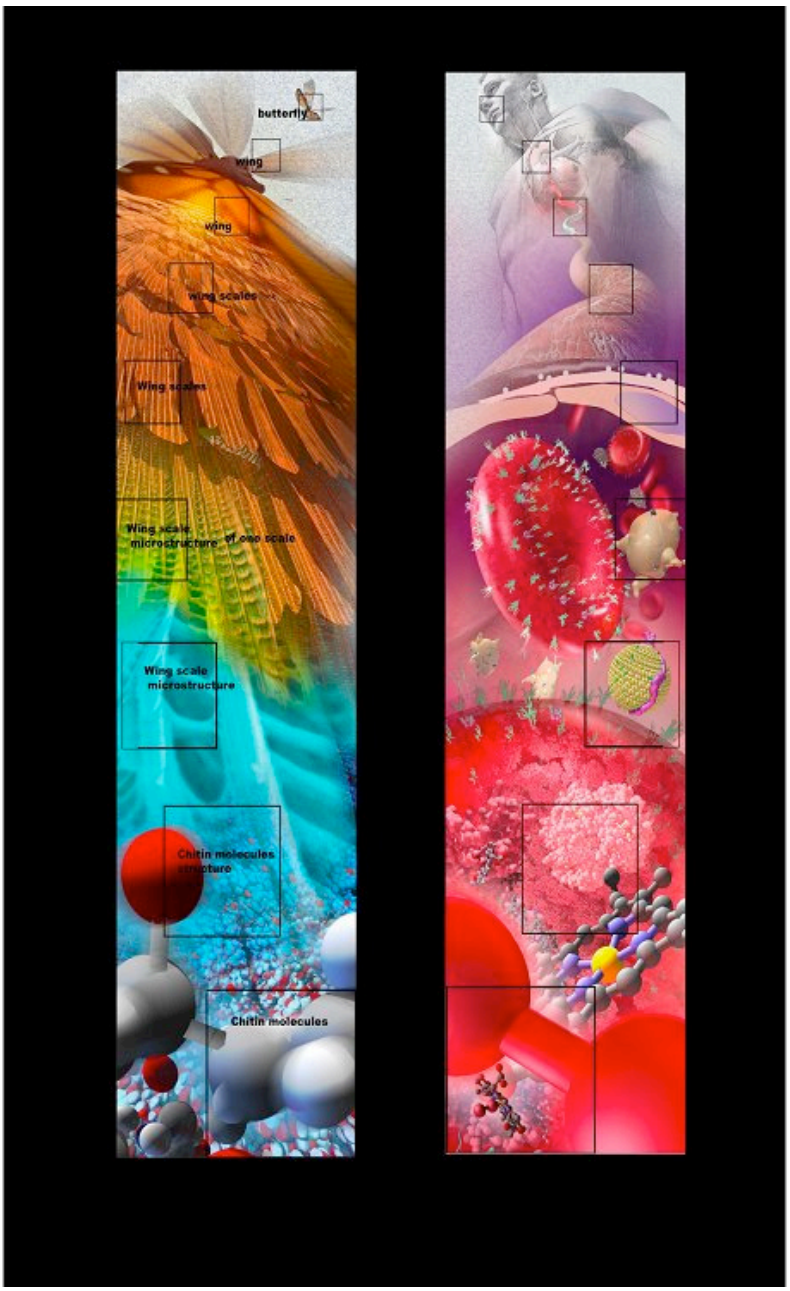
In general, a majority of the visitors saw the illustrations as a zoom. There were a few points of confusion, however:

- Some (5/14) visitors did not realize that the small balls in the background were the same as the big balls in the foreground, even though they all represent atoms of about the same size.
- Some visitors (5/14) were unsure if objects on the same level (e.g., red blood cells and platelet) were in the same size scale.

It is not clear if visitors wanted labels to identify the objects in the illustrations; half said yes, and the other said no.

Detailed findings along with the method used are documented in the rest of this report.

Figure 1. Poster with the 2 illustrations. Note that there were no call-out boxes in the poster used in the evaluation with visitors.



DATA

We interviewed a total of 14 visitors on Sunday, November 11, 2007 for this evaluation. Their demographic information is as follows:

Gender	Count (out of 14)
Male	7
Female	7

Age Group	Count (out of 14)
Child (10-12)	4
Teen	2
Adult	8

RESULTS

What visitors thought was the main message

Most (9/14 or 64%) thought that the poster was trying to show what things are made of (Table 1).

Table 1. What visitors thought the poster was trying to show

Q: What do you think these posters are trying to show people, if anything?	Count (out of 14)
What Things Are Made Of	9
How Things Work	3
Scale Of Things	2
Life Cycle	1

When we asked visitors to complete the sentence, *Everything is made of …*, slightly less than half (6/14 or 43%) said atoms and/ or molecules (Table 2).

Table 2. Visitors' response to *Everything is made of …*

Q: Looking at these posters, how would you complete this sentence: Everything is made of …	**Count** (out of 14)
Atoms	3
Molecules	3
Stuff	2
Cells	1
DNA	1
Life	1
Plastic	1
Shapes	1
Don't Know	1

What visitors recognized

Not surprisingly, visitors were more likely to recognize the depiction of macroscale objects in both posters, and had more difficulty with the microscale and the nanoscale objects. See Table 3, Table 4, and Table 5.

Visitors seemed to struggle more with finding familiar objects in the butterfly illustration, as indicated by the prevalence of misidentified objects listed in Table 4.

Table 3. What visitors recognized in the human bloodstream illustration. Those items in red and shaded grey are objects that were misidentified.

Scale	In the human bloodstream	Count (out of 14)
Macro	Human	11
	Body	3
	Torso	2
	Heart	9
	Aorta	1
	Artery	3
Micro and smaller	Bacteria	1
	Amoeba	1
	Blood cell	3
	Blood clots	1
	Grass	1
	Prickly fruit	1
	Red blood cells	2
	Sponge	1
	Shells	1
	Trees	1
	Virus	1
	Proteins	1
	Cell structure	1

Table 4. What visitors recognized in the butterfly illustration. Those items in red and shaded grey are objects that were misidentified.

Scale	In the butterfly	Count (out of 14)
Macro	Bee	1
	Bug	3
	Butterfly	10
	Insect	2
	Mosquito	1
	Moth	2
	Wings	1
Micro and smaller	Cables	1
	Electricity	1
	Fiber optics	1
	Lava	1
	Nerves	1
	Pipes	3
	Tubes	1
	Wires	1

Table 5. What visitors recognized in both illustrations. Note that atoms and molecules are the only objects that are common across the human and the butterfly illustrations. Those items in red and shaded grey are objects that were misidentified.

In both the human and the butterfly	**Count** (out of 14)
Atoms	1
Balls	1
DNA	3
Double helix	1
Medicine capsules	1
Molecule	4
Sphere	2
Tylenol	1
Christmas bulb decoration	1

A little more than half (8/14 or 57%) recognized the ball-and-stick depiction as representing molecules and/ or atoms. (Table 6)

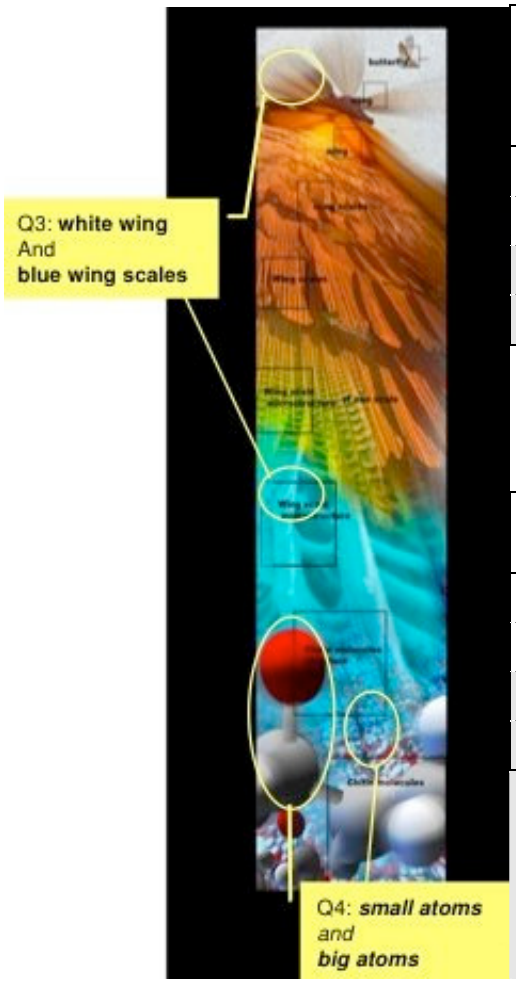
Table 6. What visitors thought the ball-and-stick depicted

Q: What do you think these things are [*point to atoms*]**?**	**Count** (out of 14)
Molecules	7
Atoms	1
DNA	7
Dumb bells	1
Neutrons	1
Protons	1

(Size) Relationships visitors saw between objects in each poster

For the butterfly illustration, more than half (9/14 or 64% to 10/14 or 71%) of the visitors were able to tell that the poster was zooming in closer and closer to the structure of the butterfly wing. See Table 7.

Table 7. Relationship between the macro, nano and atomic scale depictions of the wing. Misinterpretations are shaded grey.

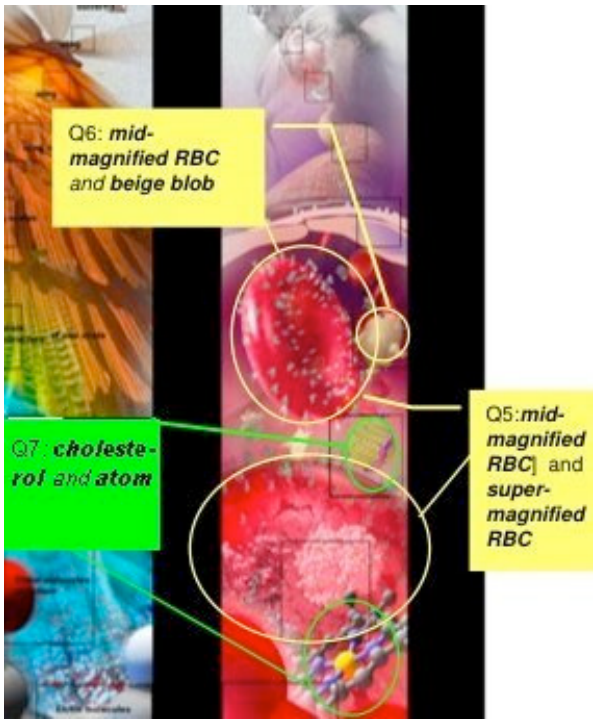


Q3: Can you tell from this poster, how is this [*point to white wing*] **related to that** [*point to blue wing scales*]**?**	**Count** (out of 14)
Shows composition	4
Show magnification	5
No relationship	3
Other relationship	2

Q4: (How) Are these 2 things [point to small atoms and big atoms] **related?**	**Count** (out of 14)
Same balls but magnified	9
Big balls make up the small balls	1
Bigger balls	3
Small balls form bigger balls	1

Most visitors (10/14 or 71% to 11/14 or 86%) were able to correctly identify the relationships between the different objects in the perspective illustration of the human bloodstream. See Table 8.

Table 8. Relationship between the macro, nano and atomic scale depictions of the human bloodstream. Misinterpretations are shaded grey.



Q5: How is this [point to mid-magnified RBC] **related to that** [point to supermagnified RBC]**?**	**Count** (out of 14)
One's the magnification of the other	11
They're the same thing	1
Other relationship	1

Q6: and these 2 [point to mmRBC and beige blob]**?**	**Count** (out of 14)
They're the same size	7
They're both in the body	2
They're both magnifications	1
No relationship	4

Q7: Can you tell if this thing here [*point to cholesterol*], **is bigger than or smaller than that thing here** [*point to yellow atom*] **in real life, or are they about the same size in real life?**	**Count** (out of 14)
[cholesterol] is bigger than [atom]	12
[cholesterol] is smaller than [atom]	2

Did visitors want labels?

Half of the visitors we interviewed wanted labels, or call-outs, on the poster to identify different objects included in the illustrations, but an equal number thought they would be unnecessary. (Table 9)

Table 9. Did visitors want labels?

Q: Was it frustrating not knowing what these objects are or did not knowing add to your curiosity?	Count (out of 14)
Not frustrating. It's not necessary to have labels.	7
Frustrating. Include labels.	7

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APPENDIX A

1. If you were to describe these to a friend who hasn't seen them, how would you describe these posters? What adjectives would you use? [For example, some other people described these as 'other worldly', 'realistic', 'busy', 'simple'.]

2. Can you tell me: what things do you recognize in these posters? [*Let them talk for a bit*]

    a. [*If they don't mention the atoms*] So, what do you think these things are [point *to* ***atoms***]?

    b. Is there anything [else] you recognize? [*probe to exhaustion*]

Looking at this poster [**butterfly**]

3. Can you tell from this poster, how is this [*point to* ***white wing***] related to that [*point to* ***blue wing scales***]? Do they have anything to do with each other?

4. What about these 2 things [*point to* ***small atoms*** *and* ***big atoms***]?

And looking at this poster [**human blood**]

5. Can you tell from this poster, how is this [*point to* ***mid-magnified RBC***] related to that [*point to* ***supermagnified RBC***]? Do they have anything to do with each other?

6. And these 2 [*point to* ***mid-magnified RBC*** *and* ***beige blob***]?

7. These posters include things that in real life are actually different sizes, but we're not sure if that's clear. Looking at the poster, can you tell if this thing here [*point to* ***cholesterol***], is bigger than or smaller than that thing here [*point to* ***ball-n-stick yellow***] in real life, or are they about the same size in real life?

8. We're thinking of adding words to these posters to identify some of these objects. We're wondering, in this version, was it frustrating not knowing what these objects are or did not knowing add to your curiosity?

Now looking at both posters

9. What do you think these posters are trying to show people, if anything?

10. Looking at these posters, how would you complete this sentence:

Everything is made of _____