

Time-Lapse Video - Visitors' Questions and Comments

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March 2002

Imaging Station - Front-End Evaluation Time-Lapse Video - Visitors' Questions and Comments

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PURPOSE

- To gauge what visitors find interesting and uninteresting in time-lapse videos of different specimens and processes that can be taken with the Axiovert200M. This feedback can be used to make the videos more engaging to the visitors.
- To collect visitors' questions about time lapse videos of microscopic specimens to inform design of interpretive elements
- To get preliminary indications of what visitors do and do not notice in time lapse video, again to inform future design of interpretive elements

METHOD

- Semi-Structured Interviews
- Visitors were recruited (either as individuals or as groups) from the Life Sciences Area on the Mezzanine of the Exploratorium
- Visitors were shown 3 time-lapse videos, one at a time, of the following specimens.

Specimen	Description
Zebrafish Development	From 4 cells to tail separation. Video was taken in color with Axiovert200 at the Imaging Station
Macrophage	Macrophage engulfing E. Coli. Video is black and white and was downloaded from the web.
Mitosis	Synchronous cell division during the development of a fruit fly. One color (florescent green).

- The order of viewing was changed with every interview to reduce sequence bias.
- Visitors were asked a set of questions (see Appendix A) after viewing each video to determine what they noticed and what questions each video provoked.

- Each interview was structured as a question-answer conversation in which the evaluator gave short answers to visitors' questions that then precipitated follow-up questions from the visitors. This was done to elicit a sequence of questions from the visitors.
- When the visitors finished viewing and discussing each of the 3 videos, they were asked a set of summary questions (see Appendix B) to ascertain which video was the most and which was the least interesting.

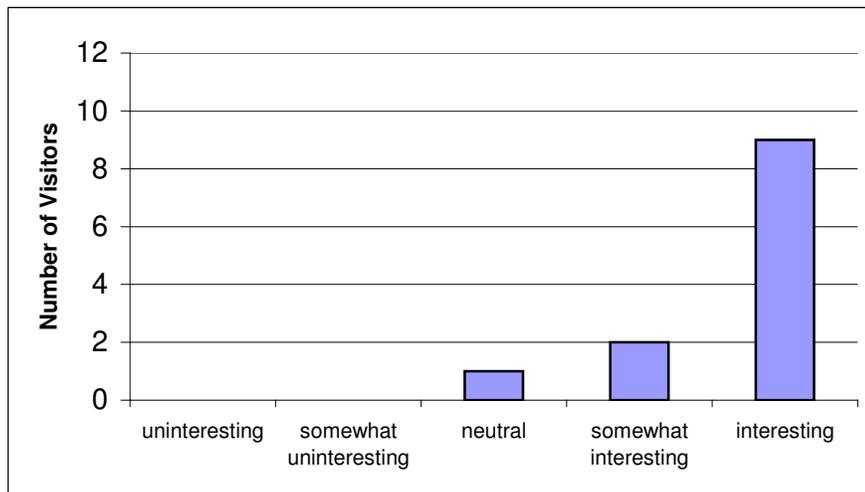
RESULTS

Reactions to Individual Videos

Zebrafish Development

- Visitors' Interest
 - Tally. Visitors were asked to rate how interesting the Zebrafish Development video was to them immediately after seeing the video. A histogram of their responses is shown in Figure 1. Most visitors found the video interesting.

Figure 1. Histogram of Visitor Interest for Zebrafish Development Time-Lapse (N=12)



- Positive Reactions. Visitors found the Zebrafish Development video interesting for the following reasons:
 - Color and Visual Appeal (6) – Visitors talk about the video's visual aesthetics, its colors, its shape, and its quality.
 - Action (5) – Visitors mentioned they liked seeing things change in this video although these same visitors did not always articulate what exactly changed and sometimes

misidentified the parts of the embryo (e.g., mistaking the yolk for the head). Visitors also mentioned being fascinated with seeing development and growth.

- Connections (1)– One visitor was interested in this video because she made a connection between what she saw and her own pregnancy.
- Negative Reactions. The visitors complained about:
 - Too Little Action (2) – Visitors felt that the process was too slow and there was not enough action in the video to hold their attention.
 - Not Enough Details or Identifiable Parts (3) – These visitors were frustrated with not being able to see identifiable parts of the embryo. “There wasn’t much detail, “ one visitor explained. One visitor also remarked that at the beginning of the clip, he didn’t even think that this video showed anything biological but instead looked like molten metal.

- Visitors’ Questions

Visitors asked the following types of questions about what they saw in this video. These questions are organized into five different categories that suggest different types of interpretative supports.

Process

- What’s going on?
 - What does it become?
 - Is it dividing?
 - Is this the start of a baby?
 - Is that [embryo] eating the embryo [yolk]?
 - Why is their so much more movement at the end?
- How long does this take?

Internal Structures

- Is this an egg?
 - Is that the yolk?
 - What the circle outside (the shell)?
- Is it an embryo?
 - Where are the fish parts?
 - Where are its limbs?
 - Is that the tail?
- Is it one cell? How many cells are there?

Larger Context

- What kind of embryo is it (what kind of animal)?
 - Where can I find Zebrafish?
- How big is it?
 - How much does it weigh?

What is this exhibit going to be?

How is this related to the other exhibits?

Technology

How was it lit?

Is it done with x-rays?

- What visitors noticed

The following lists the processes and structures that visitors identified or misidentified during the course of the interview. They give a *preliminary* indication of what visitors noticed and how they described what they notice.

- Process

- Visitors described the development process as
 - Development (2 visitors)
 - Growth (4 visitors)
 - Eating¹ (2 visitors)
 - Divide (3 visitors)
 - Bubbling (1 visitor)
- None of the visitors decomposed the process into subprocesses such as cell migration, or differentiation.

- Structure

- 9 out of the 12 visitors tried to identify structural parts in what they saw
- The following lists the structures visitors tried to identify while watching the video. Note that some visitors misidentified the parts.

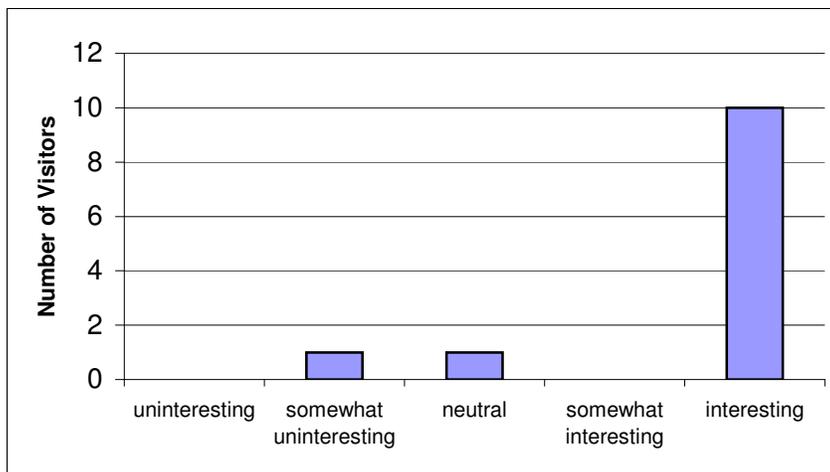
¹ These visitors thought that the embryo was eating itself or that the thing on the outside of the yolk was a foreign body eating the embryo in the yolk.

Structure	Correctly Identified	Misidentified as (count)	Asked Interviewer
Tail	3 visitors	Arm (1) Heart (1)	3 visitors
Head	3 visitors	No Head (1)	0 visitors
Yolk ²	1 visitor	Head (3) Nucleus (2)	2 visitors
Eyes	0 visitors	No Eyes (1)	0 visitors
Shell	3 visitors	Egg (1)	2 visitors
Spine	2 visitors	0	0 visitors
Muscles	0 visitors	Scales (1)	0 visitors

Macrophage

- Visitors' Interest.
 - Tally. Visitors were asked to rate how interesting the Zebrafish Development video was to them immediately after seeing the video. The results are shown in Figure 2.

Figure 2. Histogram of Visitor Interest for Macrophage Video (N = 12)



² Conjecture: visitors may misidentify the yolk because their conception of embryo development is based on images and videos of *human* embryo development. A pilot study that used still images of Zebrafish development also suggests that visitors focus on the yolk while ignoring the embryo that is forming around the yolk; the embryo is described as a secretion, and one visitor expected the creature to burst forth from the yolk.

- Positive Reactions. Visitors found the Macrophage video the interesting because:
 - Action (8) – Visitors were interested in the way the macrophage moved. But, it was not just the movement itself that interested the visitors; some visitors ascribed a ‘plot’ to the movie and talked about eating and predation as ‘drama’. Two visitors sang the theme to JAWS while the video played and two others mentioned the movie, the Blob.
 - Internal Structures (5) – Visitors also mentioned the ‘details’ or ‘complexity’ of what they saw happening inside the macrophage as a major draw of the video.
- Negative Reactions. Visitors had the following negative comments about this video:
 - Too Little Action (1) – One visitor explained that there was too little happening.
 - Poor Video Quality (1) - This same visitor also complained about the pixilated look of the video and suggested that we increase the resolution. (Because this video was downloaded from the web, we had little control over its resolution. We should be able to take better quality videos with the technology at the Imaging Station.)
 - Seen That, Done That (1) – One visitor was not interested because she had already seen this video before.
- Visitors’ Questions

Visitors asked the following types of questions about what they saw in this video.

Process

- What’s attacking what?
- What’s it eating?
- Why is it eating it?
- What’s going on inside the macrophage?
- How does it move?
- What happens afterwards?

Internal Structures

- What’s the black dot? [the bacterium being attacked]
- Is it a disease?
- Where did it come from?
- What’s inside the macrophage?
- Does it have a special skin?
- Where’s the nucleus?
- Does this thing have a tail?

Larger Context

- Is this immunology?
- How many do you need when you’re sick?
- Is it similar to diseases like colds and viruses?

Is it like a cancer cell?
 Where is this happening?
 Is it normal to have bacteria in you?
 Why is it called a white blood cell?
 Is this similar to other lymphocytes?

Technology

Can you see atoms with that microscope?
 Is this a phase contrast microscope that took these pictures?
 How did you get this on film?

- What visitors noticed
 - Process
 - Visitors described the process shown in the video as
 - Movement towards dot (7 visitors)
 - Eating (6 visitors)
 - Absorption (4 visitors)
 - Attack (3 visitors)
 - Dissolving (1 visitor)
 - Growth (1 visitor - Visitor thought this video showed cell division)
 - Hunt (2 visitors) out of 12
 - Evasion (Running) (1 visitor)
 - Attraction (1 visitor)
 - Visitors seem to have a richer vocabulary for describing the actions in this video. It may be easier for visitors to describe distinct events in this movie (e.g., movement towards, absorption, and then dissolution.) instead of seeing it as only one process, 'eating'.
 - 7 out of 12 visitors were fascinated with the macrophage's movement.
 - Structure
 - The following lists the structures visitors tried to identify while watching the video.

Structure	Correctly Identified	Misidentified as (count)	Asked Interviewer
Organelles	0 visitor	Bacteria (1)	7 visitors
Bacterium	3 visitors	-	5 visitors
(Back-End)	-	Tail / Cilia (4)	-
(Front-end)	-	distinct front-end (1)	-
Nucleus	0 visitor	-	1 visitor

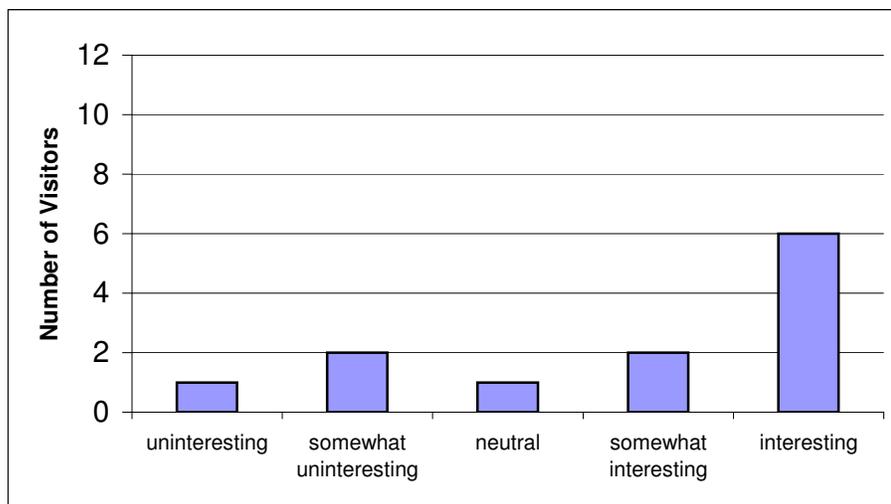
- Some visitors thought they saw a ‘tail’ on the macrophage that might only be a visual artifact. This may point to visitors’ unfamiliarity with how macrophages move and suggests that visitors will ‘notice’ structures that are not there but, nonetheless, fit into a mental model they are constructing.

Mitosis

- Visitors’ Interest

- Tally

Figure 3. Histogram of Visitor Interest for Mitosis Video (N=12)



- Positive Comments. Visitors were interested in
 - Process of Cell Division (4) – Visitors were interested in seeing cells divide. Some of these visitors, however, also complained that there was not enough action in this video clip.
 - The Patterns (1) – One visitor liked the abstract patterns in the mitosis video.
- Negative Comments. Visitors felt that:
 - Nothing/ Too Little Happened (7) – Visitors did not think enough or anything happened that was of much interest.
 - Poor Image Quality (6) – Especially compared to the Zebrafish video, visitors felt that this video lacked color and depth. Some visitors complained about its resolution.
 - Could not Identify Anything Familiar/ Too Abstract (5) – Visitors had trouble recognizing anything in this video that made sense to them. As one visitor

explained, “It could be an ad campaign, for all I know.” The few associations visitors had were to pictures of mitosis they saw in their high school textbooks.

- Visitors’ Questions

Visitors asked the following types of questions about the mitosis video.

Process

What are they doing?

What is cell division?

Why did they divide?

Why are the cells dividing at the same time?

Will the process repeat?

How long does this take?

Internal Structures

Is this one cell or many cells?

Are those chromosomes?

What’s the stuff in the background?

Is it in the background? How far back are they?

Are the colors for different proteins?

Larger Context

What kind of cell are these?

Is it the same in other animals?

What’s the life span of a fruit fly?

Where is this happening?

Do your cells continue to divide when you’re dead?

Technology

Why is it green?

Why do you get that effect - is it a dye?

What’s causing the florescence?

Is this computer generated or photographed?

- What visitors noticed

- Process

- Visitors described the process shown in the video as
 - Split/ Division (5 visitors)
 - Coming together (1 visitor)
 - Flying / Floating (2 visitors)

- Structure

- The following lists the structures visitors tried to identify while watching the video.

Structure	Correctly Identified	Misidentified	Asked Interviewer
Cells	4 visitors	0 visitors	1 visitor
DNA	2 visitors	0 visitors	0 visitors
Background Stuff	0 visitors	0 visitors	3 visitors
Chromosomes	1 visitor	0 visitors	1 visitor

Overall Reactions to the Three Videos

Most Interesting

- Tally

Specimen	Count (out of 12)
Zebrafish Development	5
Macrophage	9
Mitosis	1

Note: If a visitor or group of visitors identified two videos as being equally interesting, both videos were counted in the above tally.

Least Interesting

- Tally

Specimen	Count (out of 12)
Zebrafish Development	3
Macrophage	2
Mitosis	10

Note: If a visitor or group of visitors identified more than one video as being equally uninteresting, both videos were counted in the above tally.

Overall Impressions

- Of the three videos visitors saw as part of this study, many visitors felt that the macrophage video was the most interesting. These visitors talked about the drama in this video and identified it as the 'eating' process. This data set suggests that visitors are interested in time-lapse videos that not only show action, but also have an easily recognizable storyline (e.g., big monster eats little monster).

- Visitors seem to appreciate video quality, but it is not the sole criterion in keeping visitors' interests. Note that the macrophage video is of a lesser quality visually; it's black and white and has a lower resolution than the Zebrafish video. Furthermore, none of the visitors who selected this video as their favorite video mentioned its visual aesthetics. Nonetheless, many visitors identified the macrophage video as their favorite video.
- Visitors' responses also suggest that it is important for the visitor to understand what they are looking at. The more abstract and unrecognizable the image, the less engaged visitors seemed to be. The mitosis video used in this study may be too abstract without further interpretive aids to hold visitors interest.
- Although many visitors thought that the macrophage video was the most interesting to watch, this does **NOT** mean that they were not interested in watching the other videos. In particular, many visitors thought that the Zebrafish development video was also worth their time. Visitors' ratings of the individual videos were presented in the previous section.

RECOMMENDATIONS

- Consider interpretive means (e.g. labels over the video) to help visitors understand what they are seeing on two levels:
 - The internal structures
 - The subprocesses that make up the action sequence
- Create interpretative elements that answer visitor questions listed in this document.
- Consider creating and showing time-lapse video that has a storyline. A storyline, especially a 'dramatic' one, may help attract and retain visitors' attention as well help interpretation.
- When possible, improve the resolution, especially of already abstract subject matter such as mitosis. Increased resolution may help visitors interpret such images as being 'real' as opposed to computer generated images.

ACKNOWLEDGEMENTS

This material is based upon work supported by the National Institutes of Health Grant R25 RR15627 and the David and Lucile Packard Foundation (Grant 4365).



Department of Health and Human Services • National Institutes of Health

Supported by a Science Education Partnership Award (SEPA) from the National Center for Research Resources

Appendix A – Individual Video Questions

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

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

2. What made it _____ for you?

3. Do you have any questions about what you saw? [What would you like to know about what you saw?]

4. Was there anything you noticed in the video that really stood out for you? Can you describe any interesting changes you saw?

Appendix B – Summary Questions

Of the 3 videos you've seen...

1. Which one out of these 3 would you say was the most interesting to watch?

Macrophage Mitosis Development

2. Can you tell me why you said that this one [point to one identified] was the most interesting to watch?

3. Which one out of these 3 would you say was the least interesting to watch?

Macrophage Mitosis Dev Entire

4. Can you tell me why you said that this one [point to one identified] was the least interesting to watch?