

Interpretative Elements for Time-Lapse Video

Joyce Ma

May 2002

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

Imaging Station - Formative Evaluation Interpretative Elements for Time-Lapse Video

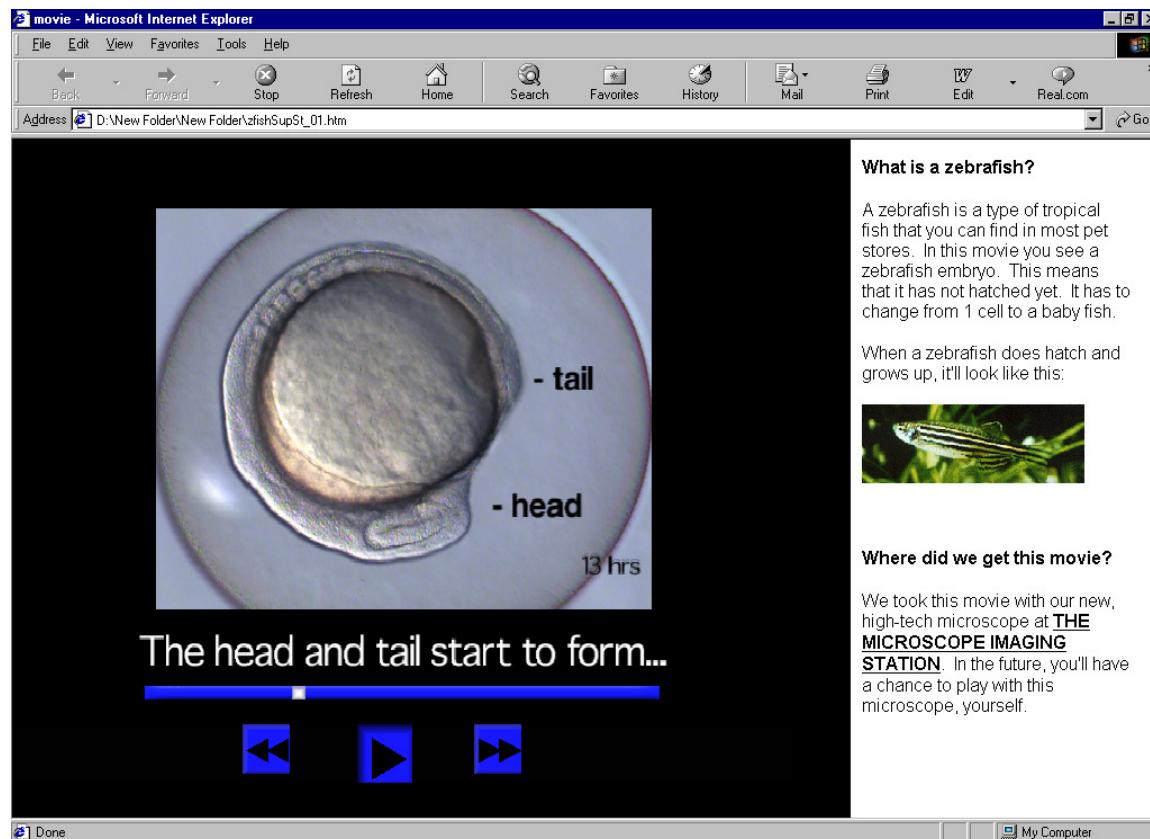
Joyce Ma
May 2002

PURPOSE

Background

The Imaging Station team added annotations to a time-lapse video of Zebrafish development to see if the annotations would help visitors interpret time-lapse videos captured at the Imaging Station. These annotations consist of subtitles that describe the Zebrafish development process and labels that point to different parts of the embryo as they formed. The annotated video was embedded in an HTML file with background information about the Zebrafish and the Imaging Station. See Figure 1.

Figure 1. Screenshot of annotated time-lapse video of Zebrafish development.



Study Question

Do the annotations make a difference in visitors' experience? More specifically,

- Are visitors more interested in watching the annotated video compared to the non-annotated video?
- Do visitors notice and remember more when they watch the annotated video?
- Are there qualitative differences in the types of questions and comments that visitors make about the annotated video compared to the non-annotated version?

Results from this study can help inform the future design of effective interpretative elements for the time-lapse videos captured at the Imaging Station.

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 assigned to one of two groups: Visitors in Group A (Annotation) were shown a time-lapse video of Zebrafish development *with* annotations of the different stages of the development process, the elapsed time, and different parts of the Zebrafish as it changed. Alternatively, visitors in Group B (Baseline) were shown the same time-lapse video but *without* any annotations.
- Visitors were asked a set of questions after viewing the video to determine how interesting they found the video and what questions the video provoked.
- At the end of these questions, visitors were then asked to draw whatever they remember from the video and to label their drawings. If a pair of visitors viewed the video together, they were asked to draw separately without looking at the other person's work. The interviewer also asked if there was anything else each visitor remember that s/he decided not to draw or was too difficult to draw at the end of this drawing task.
- Finally, visitors were asked to describe in their own words what they thought the video was about.

DATA COLLECTED

- Times. Data were collected during these days:

Group A	
Day	Date
Wednesday	4/24/02
Sunday	4/28/02
Sunday	5/5/02
Wednesday	5/15/02

Group B	
Day	Date
Wednesday	5/1/02
Thursday	5/2/02
Sunday	5/5/02
Sunday	5/19/02

- Demographics

Group A	
Gender	Count
Female	21 (55%)
Male	17 (45%)
Total	38 (100%)

Group B	
Gender	Count
Female	17 (59%)
Male	12 (41%)
Total	29 (100%)

Group A	
Age Group	Count
Adult	17 (45%)
Teen	12 (31%)
Child	9 (24%)
Total	38 (100%)

Group B	
Age Group	Count
Adult	19 (65%)
Teen	6 (21%)
Child	4 (14%)
Total	29 (100%)

RESULTS

Visitors were asked to rate how interesting the Zebrafish development video was immediately after seeing the video. The results are shown in Table 1. Most visitors in Group A (Annotation) found the video *somewhat interesting*, while most visitors in Group B (Baseline) found the video *interesting*. A Chi-square test¹ did not detect a significant difference between the two groups; $\chi^2(2, N= 67) = 5.2, p=.071 > .05$, although there was a marginal difference, with visitors in the Group A more inclined to rate the video as *somewhat interesting*.

Table 1. Visitor Interest for Zebrafish Development Time-Lapse

Interest Level	Group A	Group B
	(With Annotation) N= 38	(Without Annotation) N = 29
not interesting	1 (3%)	2 (7%)
somewhat not interesting	0 (0%)	0 (0%)
neutral	4 (11%)	3 (10%)
somewhat interesting	21 (55%)	8 (28%)
interesting	12 (32%)	16 (55%)

¹ The *not interesting*, *somewhat not interesting*, and *neutral* categories were combined in this Chi-Square test.

What visitors noticed and remembered

Analysis

We analyzed visitors' drawings to see what visitors remember from the video they just saw. In particular, we were interested in seeing if there were quantitative differences between what visitors remember with an annotated video, Group A, and a non-annotated video, Group B.

More specifically, in this analysis, we looked to see if visitors noticed and remembered: 1) the processes of development, and 2) the structures, or parts, of the Zebrafish that develop. We also included a more holistic measure, by which we coded the stage: beginning, middle or end, which a visitor drew or described. A second rater independently coded the data to assess coding consistency.

Structure/ Parts

We coded visitors' drawings and descriptions to see if they mentioned the parts of the developing Zebrafish that were labeled in the annotated video. More specifically, drawings were coded for the following

- Cell
- Yolk
- Head
- Tail
- Muscles
- Spots

Note that the coder did not count those parts that visitors drew but did not describe in the interview.

Process

We coded visitors' drawings and descriptions to see if they mentioned the processes that were described in the annotated video. More specifically, drawings were coded for descriptions of the following

- Division
- Migration
- Twitching
- Hatching
- Swimming

Development Stage (Holistic Measure)

Finally, we categorized each visitor drawing into a depiction of 3 different stages of development shown in the video:

- *Beginning*, before differentiation
- *Middle*, when cells begin to migrate and differentiate but no readily recognizable structures are present, and
- *End*, when recognizable structures such as the eyes and the tail emerge.

To do this, each drawing was matched to one of 13 still images, each taken from the beginning, middle or end of the video. If a visitor drew a storyboard, then each panel of the storyboard was matched to a still image. We also coded those stages that visitors described but could not or did not draw. This is so the findings would not depend solely on the artistic ability of the visitors.

Findings

Structure

Table 2 shows the tally of visitors who mentioned the parts described in the annotations.

Table 2. Number of visitors who mentioned each part.²

Part Mentioned	Count	
	Group A (N= 38)	Group B (N= 29)
Cell	6 (16%)	4 (13%)
Yolk	7 (18%)	1 (3%)
Head	14 (37%)	8 (27%)
Tail	20 (53%)	15 (50%)
Muscle*	7 (18%)	0 (0%)
Spots	9 (24%)	6 (20%)

* Indicates significant difference between Group A and Group B.

Overall, visitors from both groups most often mentioned the tail and then the head in their descriptions. They were less likely to mention the cell and the yolk.

There is no significant difference between the parts that Group A and Group B described with one exception. Visitors who watched the annotated video were more likely to recall and describe the muscles in the developing embryo; Fisher's Exact Test, $p = .016 < .05$. However, note that 18% of the visitors who watched the annotated video mentioned the muscles.

Process

Table 3 shows the number of visitors who mentioned the different processes in the video's annotation.

² Inter-rater reliability was at least at 96% agreement for each part coded.

Table 3. Number of visitors who mentioned each process.³

Process Mentioned	Count	
	Group A (N= 38)	Group B (N= 29)
Cell division	2 (5%)	4 (13%)
Cell migration	4 (11%)	0 (0%)
Twitching	12 (32%)	11 (37%)
Hatching	10 (26%)	5 (17%)
Swimming Away	2 (5%)	1 (3%)

Visitors most often remembered the embryo twitching in its sac. There were no significant differences between the two groups for any process mentioned.

Development Stage (Holistic Measure)

Table 4 shows the number of visitors who drew the beginning, middle and end stages of development shown in the video.

Table 4. Number of visitors who described different stages of development.⁴

Stages Described	Count	
	Group A (N= 38)	Group B (N= 29)
Beginning	11 (29%)	13 (43%)
Middle	11 (29%)	9 (30%)
End	30 (79%)	27 (90%)

We found that

- Most visitors drew the end stage of development when parts such as the fish's eyes and tail have developed and can be easily identified.
- There were no significant differences between the two groups for remembering the middle or the end stages; however, there was a significant difference between Group A and Group B for remembering the early stages of development; visitors who saw the annotated video were less likely to recall (i.e., draw or mention) the earlier stages.

³ Inter-rater reliability was at least at 91% agreement for each process coded, except for the twitching process, which had 88% agreement.

⁴ Inter-rater reliability was 91%, 89% and 97% for the early, middle, and end stages of development.

Visitors' Reactions

Points of Confusion and Visitors' Suggestions for Improvement

Looking at the types of comments visitors made about their experiences, we believe that there may be a qualitative difference between Group A and Group B. In Group B, most of the visitors' complaints centered on not having enough explanation accompanying the video. Visitors mentioned that they could not figure out what was happening until the end, with some visitors asking specifically for more information about the elapsed time. As one pair of visitors explained:

Visitor1: Detailed explanations of what's going on would be helpful.

Visitor2: Yeah, like "This is where the heart develops, or this is where the brain develops."
Also, some sense of the time frame would be nice too, like, "This happens at 2 days."

Alternatively, visitors who watched the annotated video commented on the annotations shown in the video:

Visitor1: [It] took you through everything quickly, good details on the description.

Visitor2: [It's] amazing that it's only 60 hours.

So, some visitors took note of the annotations (e.g., 30% of the visitors in Group A commented on the time stamps), and the annotations appeared to enrich their understanding. One visitor even asked for more time stamps to be added to the video. On the other hand, two of the visitors in Group A felt that there was too much information for them to absorb at once.

Visitors' Questions

There was also a qualitative difference between the questions that visitors in Group A asked from those in Group B. Visitors in Group A asked more general, orienting questions such as:

What is that [part or structure]?

What is the process?

How long does this take?

Visitors in Group B asked few such questions.

Both Groups asked about

- what happens to the fish after it has hatched (e.g., "Is it eaten [after it hatches]?", "What's the survival rate of the fish?" and "How many are eggs laid together?")
- where the video came from, and
- why the fish moved around so much after a certain point in the video.

SUMMARY AND IMPRESSIONS

- The annotations had a marginal to no significant effect on the level of visitors' interest. Note, however, that most visitors' ratings were at ceiling, making it difficult to detect a difference. Also, the nature of the interaction (i.e., watching time-lapse video) is fundamentally similar between the two groups and may be too similar to elicit a significant difference with our rating scale.
- The annotations had few quantifiable effects on what visitors remembered from the video, specifically:

Finding: There were no significant differences between which structures visitors remember after watching the annotated video compared to the non-annotated video, except that more people who watched the annotated video recalled the developing muscles.

Possible Explanations:

- Some of the more familiar parts that were labeled (e.g., head and tail) were readily identified with or without annotations.
- Some labels for parts (i.e., *yolk* and *cell*) are ineffectual because some visitors may not know what the parts are and the roles these parts have in the development process. This may explain why the only difference detected was for the *muscle* label: Although visitors may be unfamiliar with what muscles look like in a developing embryo, they may still be familiar with what muscles are and what they do. Therefore, visitors can identify muscles once they are pointed out to them in the annotated video.
- Labels appear briefly in the annotations. Visitors, especially those who complained about being overwhelmed with information, may not have had enough time to read let alone to make sense of the labels.

Finding: There were no significant differences between which processes visitors remember after watching the annotated video compared to the non-annotated video.

Possible Explanations:

- Familiar processes such as hatching are more readily identified by both groups, but less familiar processes such as cell migration went unnoticed or forgotten because they don't correspond to visitors' pre-existing understanding of the development process.
- Drawing static images of dynamic process may not be conducive to having people talk about the processes they remember.

The above observations suggest that visitors may notice and remember what they are already familiar with and what they can recognize. This finds some support in the finding that most visitors remember the latter stages of development where there are recognizable parts (e.g., eyes and tail).

Finding: There was no significant difference between the two groups in the number of visitors who remember the middle and the last stages of the development sequence. But, there was a significant difference between the number of visitors who remember the first stage of development; more visitors who saw the non-annotated version recalled the early stages of development.

Possible Explanations: Note that this does not mean that visitors who watched the non-annotated video are better at identifying what they see, but they are more likely to remember the visual images from the beginning stages. It is possible that because visitors who watched the non-annotated version are more disoriented in the beginning of the clip, their visual impression of what they see is stronger.

- There appears to be a qualitative difference between the types of questions and comments visitors made. So, although there are few statistical differences in the above measures (i.e., interest level and what is noticed and remembered), there are other indications of a difference in visitors' experiences.

RECOMMENDATIONS

- We may wish to have the labels appear for a longer period of time. Right now, some labels are visible for a short time. This compounded with the fact that the Zebrafish parts are constantly changing may be making it too difficult for visitors to make sense of the labels that appear.
- We should consider providing more information about each labeled part that visitors can ask to see. Visitors may not even understand what some labels mean.
- Qualitative data suggest that visitors were particularly interested in the elapsed time. A time stamp of the elapsed time would be valuable information to include in our time-lapse videos.
- We may wish to explore other activities, beyond watching videos, to help and encourage visitors to become more attuned and to notice the different processes and the different structures shown in a time-lapse video.

ACKNOWLEDGEMENTS

Alyssa Freedman and Suzanne Buennagel helped conduct the interviews and collect the data for this study. Amanda Marr coded the data for inter-rater reliability. 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 – INTERVIEW 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. Was there anything confusing about the video? *Yes/No*

What?

4. Do you have any questions about what you saw?

5. We're interested in how memorable the video was. Would you draw for me a quick sketch of whatever you remember seeing in the video? (Probes: Just draw whatever you remember seeing, as if you were telling a little kid what the exhibit showed.)

Great, and can you tell me what your drawing shows? I just want to be sure I understand it.

Like, what's this here? And this?

Can you tell me what the different parts are?

Is there anything else you remember from the video that you thought was too hard to draw or you decided not to draw?

6. Can you tell me in your own words what you think the exhibit was trying to show?