

Axiovert Standalone XYZ Control with Interactive Media for Zebrafish

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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

Imaging Station Formative Evaluation **Axiovert Standalone** **XYZ Control with Interactive Media for Zebrafish**

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PURPOSE

This study looks at visitors' experiences at the first prototype of a standalone Axiovert station. Specifically, it determines baseline information about:

What visitors do

- how long visitors stay (holding time)
- if visitors use the joystick and knob controls (to move and focus, respectively)
- if visitors can find a specimen to look at

What visitors look at

- on the main viewing monitor
- on the accompanying media piece
- if visitors notice the microscope behind the glass

What visitors thought

- how interesting visitors found the experience
- questions visitors had about their experience
- what connections visitors made between the microscope and the image they saw
- what visitors remembered seeing

This study looks at visitors' experiences with zebrafish only. Other studies will look at visitors' reactions to other specimens.

SETUP

Figure 1. Stand-alone exhibit setup



Details of the setup can be found in Appendix A.

METHOD

- Observations:
 - An evaluator sat 15 feet away from the stand-alone station and observed visitors as they used the exhibit. If visitors came in a group, the first visitor to stop was observed. The evaluator noted when a visitor stopped at the exhibit, when s/he looked at the main monitor, the media monitor, and the microscope, and when that visitor left the exhibit. Demographic information was also noted.
 - A video camera was set up to record what visitors were looking at on the main monitor.

- Adrian Van Allen created a tracking program to log what media screens visitors were looking at on the media piece.
 - The above three data types were then coordinated based on a common clock, to determine what a visitor did and saw at the standalone. (The clocks used by the evaluator, the video camcorder, and the tracking software were synchronized to each other before each day's observation.)
- Uncued Interviews
 - When possible, a visitor whom we had just watched was then approached and asked a series of questions about the experience and about what s/he saw. These questions are in Appendix B. We selected visitors to interview based on age (must be 8 or above) and holding time (must be longer than 15 seconds).

DATA COLLECTED

- Times. Data were collected during these days:

Day	Date
Wednesday	2/5/03
Friday	2/7/03
Saturday	2/8/03
Sunday	2/9/03

- Demographics

Gender	Count
Male	36
Female	18
Total	54

Age Group	Count
Under 8	9
Child	7
Teen	6
Adult	32
Total	54

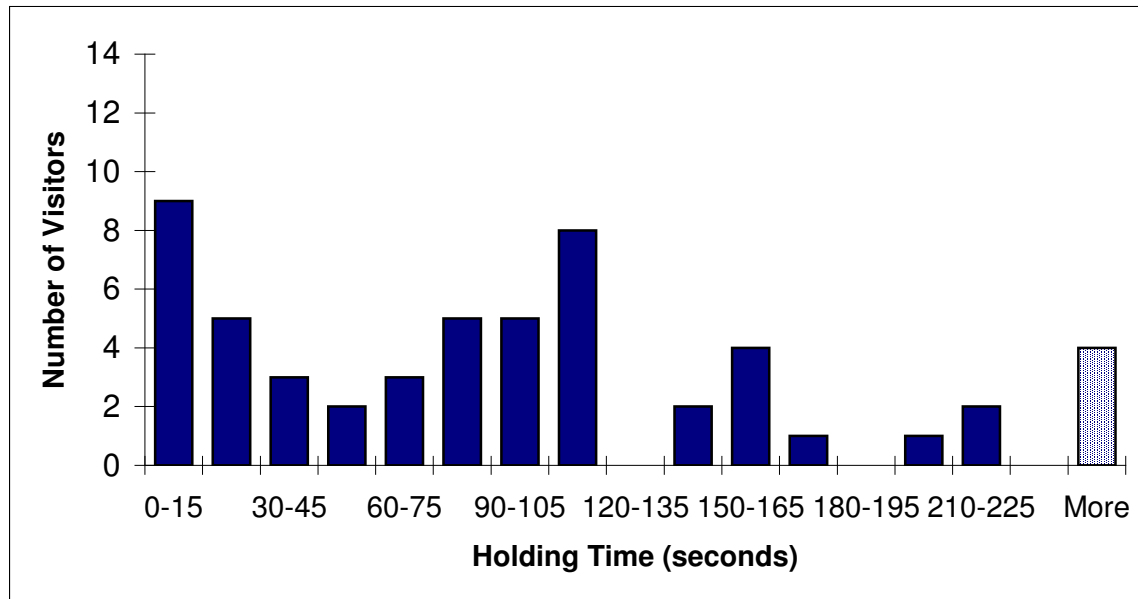
FINDINGS

What did visitors do

How long did visitors stay at the exhibit?

- Figure 2 shows the histogram of how long visitors stayed

Figure 2. Histogram of the holding time for the standalone exhibit with zebrafish. N=54. Mean = 104 seconds. Median = 90 seconds. Maximum time =416 seconds.



- Table 1 shows the holding time for each age group. There is no detectable statistical difference between age groups; $F(3,50) = .275$; $p = .843 > .05$.¹

Table 1. Holding time according to age group

Age Group	Mean Holding Time	Median Holding Time	Maximum Holding Time
Adult	107 seconds	92.5 seconds	416 seconds
Teen	100 seconds	107 seconds	164 seconds
Child	145 seconds	77 seconds	400 seconds
Child under 8	63 seconds	65 seconds	113 seconds

¹ Calculations were performed on the ln-transform of the holding time data. The ln-transformed data passed the Kolmogorov-Smirnov Test to assess normal distribution.

- There is no detectable statistical difference between gender groups¹; $t(52) = -.299$, $p = .766 > .05$.

Microscope control

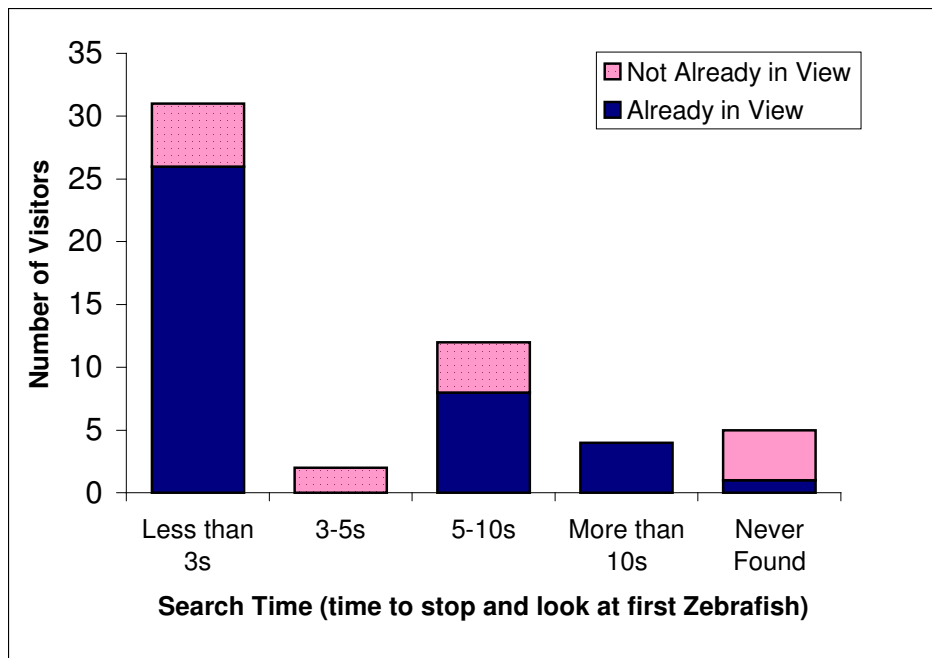
- 83% (45/54) visitors used the joystick to move the stage
- 61% (33/54) visitors used the focus knob to focus on a specimen²

Finding a specimen

In this analysis, finding a specimen means that the visitor stopped and looked at a specimen for 3 seconds or more. Scanning past a zebrafish embryo without stopping does NOT count as finding that specimen.

- Most (91%; 49/54) visitors managed to find a specimen to look at. (See Figure 3.) The specimens that visitors looked at were all either already in focus or were brought into focus.
 - 57% (31/54) visitors found their first specimen within 3 seconds.
 - 61% (33/54) visitors found their first specimen within 5 seconds.
 - 83% (45/54) visitors found their first specimen within 10 seconds.
 - 7% (4/54) visitors took more than 10 seconds to find their first specimen. The maximum time a visitor took to find a specimen was 53 seconds.

Figure 3. Search Time



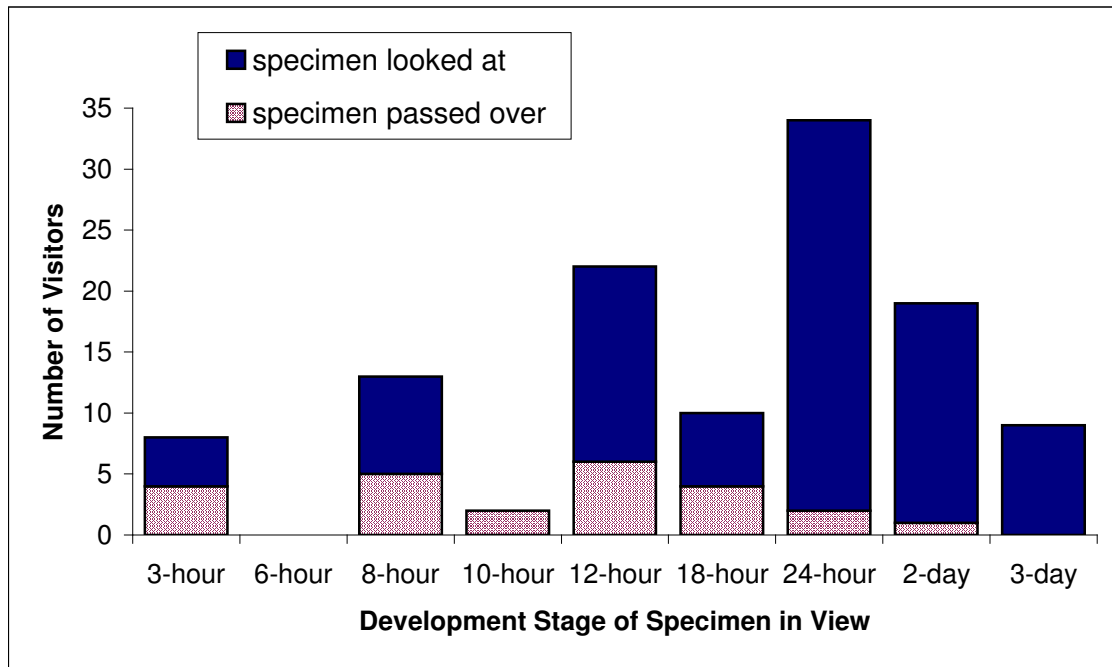
² We set the focus range so that a part of the zebrafish embryos is always in focus.

- 9% (5/54) visitors never found a specimen. Three of these visitors were children under 8, and three of the five stayed less than 10 seconds at the exhibit.
- 72% (39/54) visitors did NOT have to move the stage to find a specimen to look at; a specimen was already in view. Only 1 out of these 39 visitors never stopped and looked at a specimen. Alternatively, 28% (15/54) visitors did have to move the stage to find a specimen to look at. Four out of these 15 visitors never found a specimen. There is a significant difference between these two groups. That is; it is less likely that a visitor will find and look at a specimen if there isn't one already in view. Fisher's Exact Test, $p = .018 < .05$

What did visitors look at

Viewing Monitor

- 100% (54/54) visitors looked at the main viewing monitor
- Visitors spent 66 seconds (mean) and 50 seconds (median) looking at the main monitor. The maximum length of time any visitors spent was 290 seconds.
- How many embryos and what type
 - On average, visitors looked at 2 (mean) or 1 (median) embryo. The most a visitor looked at was 6 different embryos.
 - Figure 4 and Table 2 shows the count of the developmental stages visitors looked at. Note that we only counted those specimens that came within view. These include those that visitors stopped and looked at (for 3 seconds or more) and those that visitor passed over without stopping to look.
 - Visitors were more likely to pass over embryos between 3-hours to 8-hours than to pass over embryos older than 24 hours; Fisher's Exact Test, $p = .0001 < .05$.
 - Likewise, visitors were more likely to pass over those embryos between 10-hours to 18-hours old than to pass over those embryos older than 24 hours. Fisher's Exact Test, $p=.0002 < .05$.

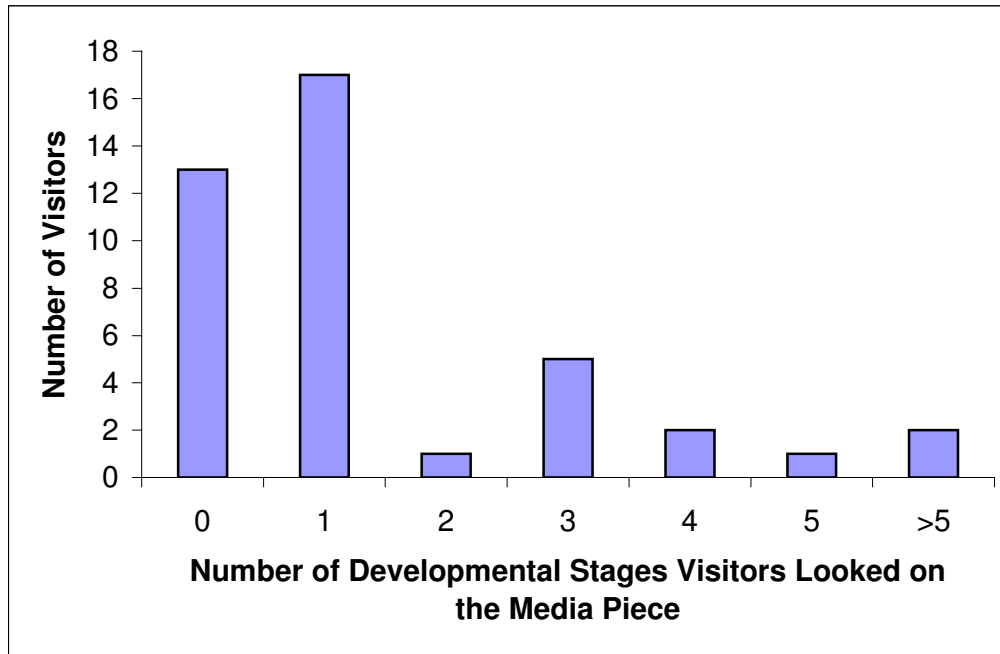
Figure 4. Developmental Stage of the Specimens Visitors (N= 54) Looked At.**Table 2. Developmental Stage of Specimens Visitors Looked At.** N/A denotes that there was no embryo at that stage of development on that day.

	3-hour	6-hour	8-hour	Early total	10-hour	12-hour	18-hour	Middle total	24-hour	2-day	3-day	Late total
Stopped and looked	4	0	8	12	0	16	6	22	32	18	9	59
Passed over	4	0	5	9	2	6	4	12	2	1	0	3
Percentage who stopped to look	50%	N/A	62%	57%	0%	73%	60%	65%	94%	95%	100%	95%

Media Piece

- 76% (41/54) visitors looked at the media piece
 - 88% (29/41) visitors who looked at the media piece, used the touch-screen to jump to a different screen.
 - 68% (28/41) visitors, who looked at the media piece, looked at a screen that describe a particular stage in zebrafish development. The number of developmental stages they looked at is shown in Figure 5.
 - 51% (21/41) visitors looked at the QuickTime movie

Figure 5. Number of Development Stages Visitors Looked at in the Accompanying Media. Mean = 1.5; Median = 1; Maximum = 7.



- Visitors (N=54) spent 28 seconds (mean) or 12 seconds (median) looking at the media monitor. The maximum time a visitor spent was 136 seconds.
- On the average, visitors spent 19% (median) of their total time looking at the media piece. The most a visitor spent on the media piece was 67% of his time.

Correlation between what visitors look at on the media piece and the main monitor

- An evaluator looked through the video data and tracking data to determine what each visitor looked at on the main viewing screen and what screens s/he jumped to during his/her interaction with the stand-alone. We found no significant correlation between the developmental stage visitors looked at on the main viewing screen and the media screen describing that stage for embryos at the 3-hour, 24-hour, or 2-day stage. We found a low (Cramer's $V < .4$) correlation for the 8-hour, 12-hour, 18-hour and 3-day stages. This may indicate that visitors do not use the media piece to immediately inform what they see on the main monitor.

Microscope

- 48% (26/54) visitors looked at microscope behind the glass

What visitors thought (results of the uncued interviews, N=17)

Visitors' Interest

- Most visitors found the exhibit *interesting or somewhat interesting*.

Interest Rating	Count (out of 17)
Interesting	11 (65%)
Somewhat Interesting	5 (29%)
Neutral	1 (6%)
Somewhat Not Interesting	0 (0%)
Not Interesting	0 (0%)

- Visitors found the exhibit interesting because
 - It showed different stages of development (8/17)
 - There was something alive (3/17)
 - The media piece was interesting (2/17)
 - Embryos are interesting (2/17)
 - Other reasons: seeing recognizable things, seeing something new, seeing something move, the high image quality.
- Visitors found the exhibit not interesting because
 - They've already seen another exhibit about zebrafish (2/17)
 - There was not enough information about what they saw (2/17).

Visitors' Questions

We then looked at the kinds of questions visitors still had after their experience. And, we categorized visitors' questions into 3 types:

- No questions. 8/17 Visitors did not have any questions about the exhibit.
- Questions that were answered in the media piece, including: What was it? Was it a beating heart? Two of the 3 visitors who asked these questions, spent less than 10 seconds looking at the media piece. The remaining visitor spent a little over 1 minute looking at the media piece; when interviewed, she mentioned that she found the exhibit hard to understand.
- Questions not answered in the media piece. Visitors wanted to know:
 - More about zebrafish
 - Visitor: How does a zebrafish look [when it's] full grown.
 - Visitor: How big does it [zebrafish] get?
 - Visitor: Why do they call it zebrafish?
 - Visitor: What happens [to the zebrafish] after the exhibit?
 - Visitor: The reason for choosing zebrafish
 - More about the microscope
 - Visitor: More about the equipment on other side [of the glass]

- More information (nothing specific)
Visitor: *More details, information-wise*

Connections visitors made between the scope and the image

- 100% of the visitors interviewed thought the image was live, as opposed pre-recorded.
- Furthermore, 88% (15/17) visitors interviewed thought the live specimens were on the microscope, although they were not sure exactly where. The other 12% did not know where the live specimens were.

What visitors remember seeing on the viewing monitor

As part of their interviews, visitors were asked to draw or describe whatever they remembered seeing on the main viewing monitor. These descriptions were then coded for: 1) which general stage of development – early, middle, or late, they represented³ and 2) which parts they included. In addition, we noted what they described the embryo doing.

- Developmental stages visitors described.

Developmental Stage	Count (out of number of visitors who looked at that stage)
Early	4 /6 (67%)
Middle	7 /13 (54%)
Late	12 /15 (80%)

Note that there is no significant difference between the developmental stages visitors remembered and described.

- What parts did they describe
 - Early Developmental Stage. (Note that 2 visitors who did NOT see an embryo in the early stages of development, nonetheless, drew an early stage embryo. These visitors did spend time looking at the media piece. They are included in the following count.)

³ To do this, each drawing was matched to one of 9 still images, each taken from the beginning, middle or end of development. 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. Descriptions were then grouped according to 3 general stages of development: early (3, 6, and 8 hours), middle (10, 12, 18 hours), and late (24 hours, 2 and 3 days).

Parts⁴	Count
cells	3 /6 (50%)
yolk	1 /6 (17%)
egg	1 /6 (17%)
tail	1 /6 (17%)

– Middle Developmental Stage

Parts⁴	Count
tail	3 /7 (43%)
yolk	2 /7 (29%)
brain	1 /7 (14%)
eyes	1 /7 (14%)
spine	1 /7 (14%)
sac	1 /7 (14%)
muscles	0 /7 (0%)

– Late Developmental Stage

Parts⁴	Count
eyes	9 /12 (75%)
spine	5 /12 (42%)
yolk	4 /12 (33%)
heart	3 /12 (25%)
tail	3 /12 (25%)
body	3 /12 (25%)
head	2 /12 (17%)
blood	2 /12 (17%)
brain	2 /12 (17%)
muscles	1 /12 (8%)
stripes	1 /12 (8%)
gullet	1 /12 (8%)

Except for the eyes, most visitors did not describe a specific part of an embryo they saw.

⁴ The parts in bold font are those mentioned in the accompanying media piece.

- Processes/ actions visitors described

- Early Developmental Stage

Process ⁵	Count
cell division	1 /6 (17%)
differentiation	2 /6 (33%)

- Middle Developmental Stage

Process ⁵	Count
movement	1 /7 (14%)

- Late Developmental Stage

Process ⁵	Count
heart beat	3 /12 (25%)
movement	4 /12 (33%)
circulation	3 /12 (25%)

Again, most visitors did not describe a specific process related to that stage of development for the embryos they watched.

SUMMARY WITH RECOMMENDATIONS

- The holding time for this exhibit prototype is about 1:40 (mean). This is roughly comparable to the exhibits with the highest holding power in the Traits of Life collection. (See Table 3.)

Table 3. Traits of Life exhibits with the highest holding times. Preliminary data from the Summative Evaluation for the Traits of Life Collection - G. Hein.

Traits Exhibit	Holding Time
Genetic Inheritance	01:49
Zoom in on Cells	01:45
Demo Station	01:34
Rotifer	01:30

- Most of the visitors interviewed rated the exhibit *interesting* or *somewhat interesting*.
- A few visitors interviewed thought there should be more information. A list of questions that visitors asked but which were not answered in the accompanying media piece is given in this document.

⁵ The processes in bold font are those mentioned in the accompanying media piece

Recommendation: We may wish to review this list of questions to determine if and how we could help visitors answer these questions.

- A majority of the visitors used the joystick to move the stage and the focus knob to focus on an embryo.
- Most (91%) visitors managed to find a specimen to look at. Because the specimen does not change its position on the slide, in most cases (72%), there was already a specimen in view when a visitor first approached the exhibit. Upon closer analysis, we found that it is less likely that a visitor will find and look at a specimen if there isn't one already in view.

Recommendation: We may want to implement a position reset, so that the slide automatically centers on a specimen after a few minutes of inactivity.

- There was a significant difference in what visitors chose to stop and look at. Visitors were more likely to stop at an embryo in the later stage of development and to pass over embryos in the early and middle stages of development, before recognizable features (e.g. eyes) have developed.

Recommendation: We may need to prepare slides that always have a few embryos in the later stages of development for visitors to see.

- However, there was no detectable difference in the stage (early, middle, or late) a visitor remembered and subsequently described if s/he stopped to look at an embryo in that stage of development.
- Few visitors identified the parts or the processes associated with the embryos they saw. Descriptions and drawings were more holistic, conveying shapes.

Recommendation: If we are interested in having visitors notice the details of what they see, we need to experiment with new ways to encourage noticing (e.g., comparing similar embryos, supporting visitors in drawing what they see).

- Close to $\frac{3}{4}$ of the visitors looked at the media monitor. And, a majority of these visitors jumped to at least one screen that described a particular developmental stage of the zebrafish embryo. A little over half of the visitors who looked at the media monitor looked at part of the QuickTime time-lapse movie of zebrafish development.
- However, we were unable to detect a significant or a high correlation between the developmental stages visitors saw on the main viewing monitor and the screens they accessed on the media piece. This may indicate that visitors do not use the media piece to immediately inform what they see on the main monitor. Furthermore, results from the uncued interview showed that many visitors did not recall specific parts or processes that were described in the media piece.

Recommendation: It is unclear how visitors are using the information on the media piece. Further studies can explore different formats and their impact on helping visitors make sense of what they see.

- Close to half of the visitors looked behind the glass at the microscope. Of those interviewed (N=17), most (88%) connected the microscope with what they saw: They thought the live

specimens were on the microscope. A future study can look at what effect seeing the microscope has on the overall experience at the exhibit.

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APPENDIX A

Equipment used for stand-alone

- Axiovert200M
- MCU28
- Display
 - Optronics DEI750D camera
 - HP L1800 LCD Monitor – 18inch
- Metamorph version 5.0
- Game pad control: joystick2002_11_21_limits_scaled
- Interactive Media (on touch screen) : z-fish (rev.2) Projector

Setup

- Magnification 5x
- Limits

Day	Search Area (micron)	Focus Range (micron)
2/5/03	4000 r	350
2/7/03	4000 r	350
2/8/03	4000 r	350
2/9/03	4000 r	350

- Number and Stage of Specimens

Day	Total Number of Specimens	Early (< 10 hours)	Middle (>= 10 hours < 24 hours)	Late (>= 24 hours)
2/5/03	6	2	2	2
2/7/03	7	1	2	4
2/8/03	7	1	2	4
2/9/03	7	2	2	3

APPENDIX B

Interview Questions

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

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

2. What made it _____ for you?

3. Did you have any trouble using the exhibit? What?

4. Do you have any questions about what you saw? What would you like to know about what you saw at that exhibit?

5. When you were playing with this exhibit, did you think that what you saw on the monitor was live or pre-recorded (for example, from a video tape)?

LIVE *PRE-RECORDED*

6. [Only if they said it's LIVE] Where do you think the living things that you saw are?

7. Did you see this [show photo of setup and gesture to area behind the glass]? *YES/NO*

Do you believe there is any relationship between this [point to microscope on photo], this [point to main screen on photo] and this [point to media monitor on photo]? [For example, does this have anything to do with that in any way?] *YES* *NO*

How do you think they are related?

8. We're interested in how memorable this exhibit is. Could you draw for me a quick sketch of whatever you remember seeing on the main monitor [the big one right in front of the joystick]? (Probes: Just draw whatever you remember seeing, as if you were showing a little kid what you saw.)

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 seeing that you thought was too hard to draw or you decided not to draw?

Did you see anything happening?