

XYZ Control with Interactive Media for Sea Urchin Embryos/Larvae

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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 Sea Urchin
Embryos/Larvae

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PURPOSE

This study looks at visitors' experiences at a prototype of a standalone Axiovert station showing sea urchin embryos/larvae. 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 is the third in a series of studies looking at visitors' interactions with the Axiovert station with different model organisms. The previous two studies have looked at the zebrafish and the amoeba 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 recorded.
 - 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
Sunday	6/15/03
Wednesday	6/18/03
Thursday	6/19/03
Saturday	6/21/03
Wednesday	6/25/03
Saturday	6/28/03

- Demographics

Gender	Count (out of 73)
Male	40
Female	33

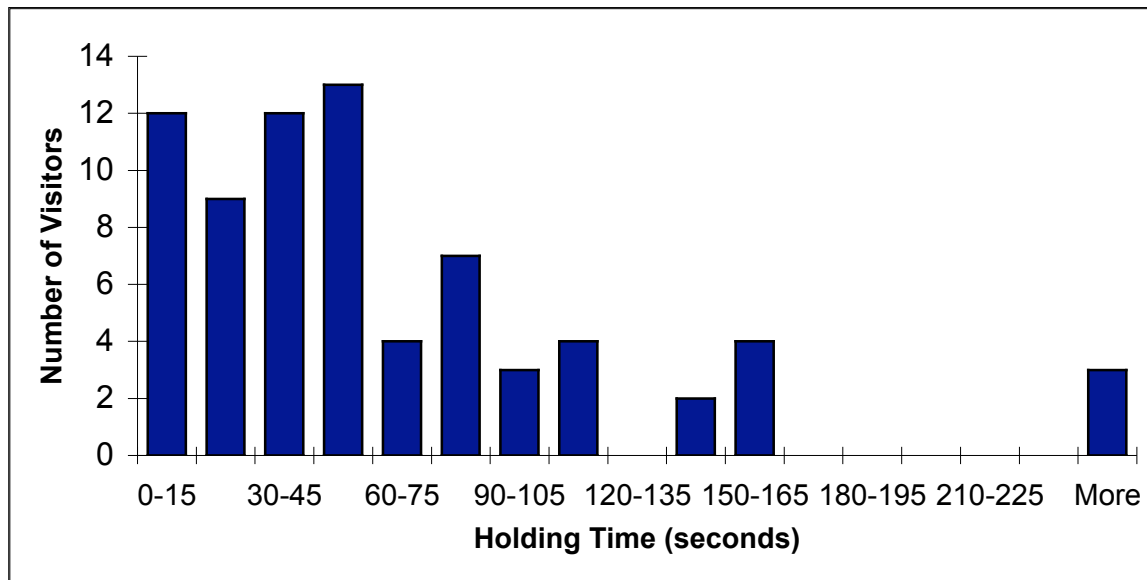
Age Group	Count (out of 73)
Under 8	21
Child	14
Teen	8
Adult	30

What did visitors do

Holding time

- Figure 2 shows the histogram of how long visitors stayed

Figure 2. Histogram of the holding time for the standalone exhibit with sea urchin. N=73. Mean = 70 seconds. Median = 55 seconds. Maximum time =272 seconds.



- Table 1 shows the holding time for each age group. There is no detectable statistical difference between age groups; $F(3,69) = .275$; $p = .813 > .05$.¹

Table 1. Holding time according to age group

Age Group	Holding Time (seconds)		
	Mean	Median	Maximum
Adult	81	58	272
Teen	47	50	75
Child	57	44	154
Child under 8	54	47	164

- There is no detectable statistical difference between gender groups¹; $t(71) = -.670$, $p = .505 > .05$.

Microscope control

- 96% (70/73) visitors used the joystick to move the stage
- 85% (62/73) visitors used the focus knob to focus on a specimen

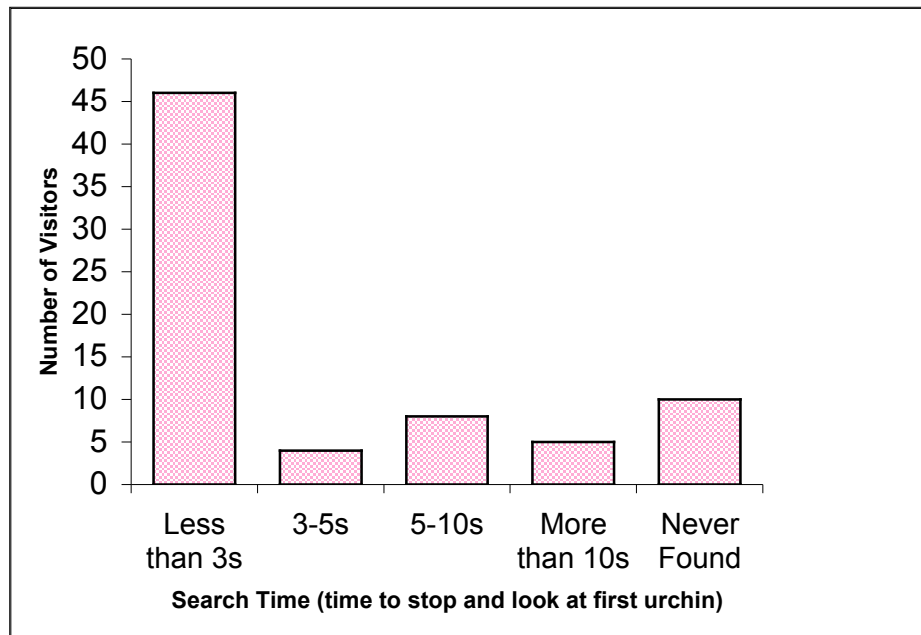
Finding a specimen

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

- Most (86%; 64/73) visitors managed to find a specimen to look at either by moving the stage or waiting for an urchin to drift into view (See Figure 3.)
 - 63% (46/73) visitors found their first specimen within 3 seconds.
 - 68% (50/73) visitors found their first specimen within 5 seconds.
 - 80% (58/73) visitors found their first specimen within 10 seconds.
 - 7% (5/73) visitors took more than 10 seconds to find their first specimen. The maximum time a visitor took to find a specimen was 35 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.

Figure 3. Search Time



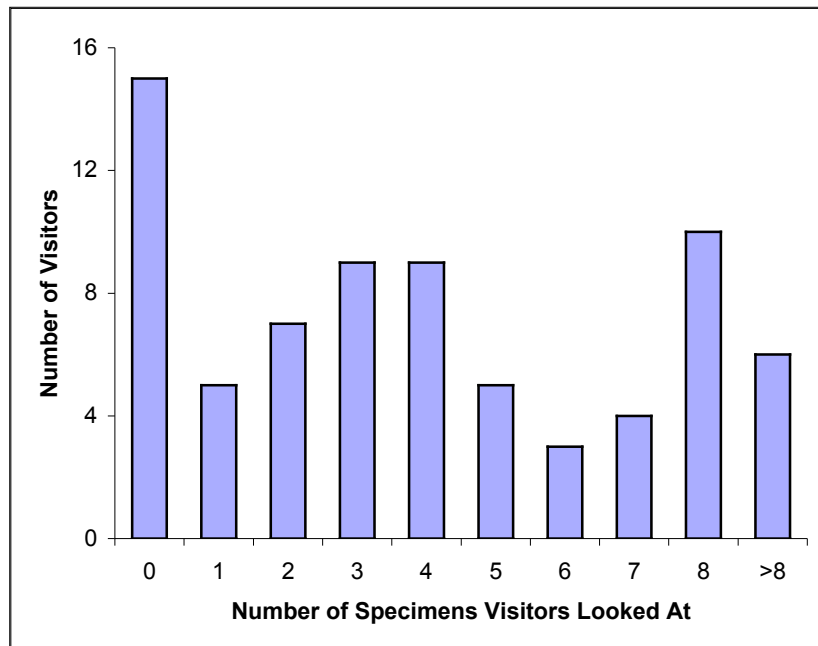
- 14% (10/73) visitors never found a specimen. That is, they never stopped for 3 or more seconds on a specimen.

What did visitors look at

Viewing Monitor

- 100% (73/73) visitors looked at the main viewing monitor
- Visitors spent 47 seconds (mean) and 35 seconds (median) looking at the main monitor. The maximum length of time any visitors spent was 192 seconds.
- How many sea urchin and what type
- On average, visitors looked at 5 (mean) or 4 (median) embryos/larvae. The most a visitor looked at was 15 different embryos/larvae.

Figure 4. Number of specimens visitors looked at (that were in focus)



- Table 2 shows the count of the developmental stages visitors looked at. Note that we only counted those specimens that came within view and that were focused. 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 most likely to stop and look at a moving pluteus larva.
- Alternatively, visitors were least likely to stop and look at dividing cells.

Table 2. Developmental Stage of Specimens Visitors Looked At.

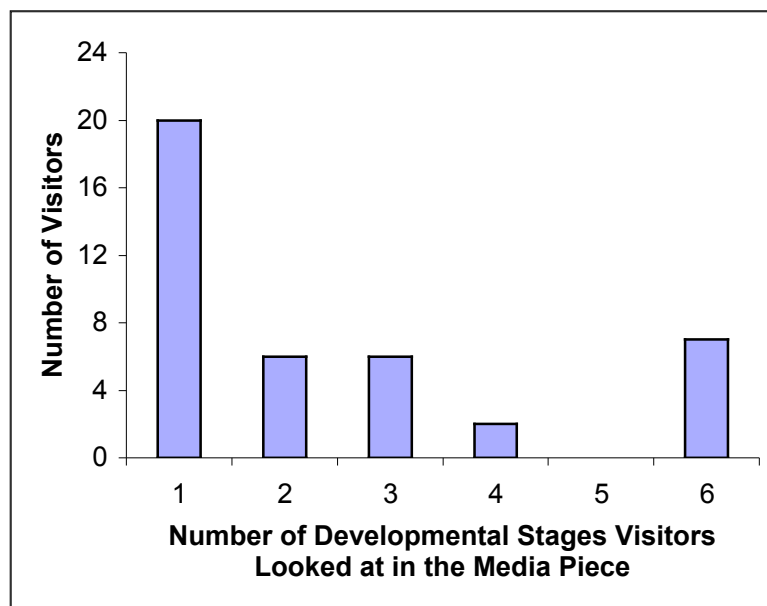
	unfert eggs	dividing cells	blastula		gastrula		prism		pluteus	
			stationary	moving	stationary	moving	stationary	moving	stationary	moving
Stopped and looked	9	12	9	18	11	13	29	24	18	9
Passed over	6	17	4	9	4	6	17	13	15	1
% stopped to look	60%	41%	69%	67%	73%	68%	63%	65%	55%	90%

Media Piece

- 78% (57/73) visitors looked at the media piece
 - 88% (50/57) visitors who looked at the media piece, used the touch-screen to jump to a different screen.
 - 72% (41/57) visitors, who looked at the media piece, looked at a screen that describe a particular stage in sea urchin development. The number of developmental stages they looked at is shown in Figure 5.

Figure 5. Number of Development Stages Visitors Looked at in the Accompanying Media.

Mean = 1.4; Median = 1; Maximum = 6.



- Visitors (N=73) spent 14 seconds (mean) or 8.5 seconds (median) looking at the media monitor. The maximum time a visitor spent was 66 seconds.
- On the average, visitors spent 15% (median) of their total time looking at the media piece. The most a visitor spent on the media piece was 76% of his time.

Microscope

- 30% (22/73) visitors looked at the microscope behind the glass

What visitors thought (results of the uncued interviews, N=20)

Visitors' Interest

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

Interest Rating	Count (out of 20)
Interesting	7 (35%)
Somewhat Interesting	12 (60%)
Neutral	1 (5%)
Somewhat Not Interesting	0 (0%)
Not Interesting	0 (0%)

- Visitors found the exhibit interesting because
 - The urchins looked 'cool' (6/20)
 - They can see how urchins develop (5/20)
 - The exhibit is interactive (5/20)
 - The specimens were alive (4/20)
 - They are interested in microscopes (4/20)

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. 14/20 Visitors did not have any questions about the exhibit.
- Questions that were answered in the media piece, including: What was it? Only one visitor asked, "What is it?" and he did not spend any time looking at the media piece.
- Questions not answered in the media piece. Visitors wanted to know:
 - About how the embryos and larvae they see turn into an adult urchin
 Visitor: I'm interested in showing more transition stages to what we're used to seeing, the spiky ones.
 Visitor: Is the end stage [pluteus] the adult? Maybe showing an example of an adult one next to it.
 Visitor: how long does it take them to grow into the spiky ones?

Connections visitors made between the scope and the image

- 90% of the visitors interviewed thought the image was live, as opposed pre-recorded.

- Furthermore, 68% (13/19) visitors interviewed thought the live specimens were on a microscope. Three out of the 19 thought the specimen were somewhere in the Imaging Station room and the remaining visitors did not know where the 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 which stage of development we thought they represented. We also note if the visitors themselves were able to identify what stage of development they were drawing. Then we looked at what parts and what actions, if any, visitors labeled or described when they explained what they drew.

- Developmental stages visitors described.

Developmental Stage	Count (out of number of visitors who looked at that stage)
Unfertilized egg	1/8
Dividing cells	3/6
Blastula	4/7
Gastrula	4/7
Prism Larvae	5/5
Pluteus Larvae	6/13

- Note that **only one** visitor actually identified what stage of development she drew. Most visitors did not identify the developmental stage; so, we categorized the drawings into the different stages. Based on our coding, visitors were the least likely to describe the unfertilized eggs they saw.

- What parts did they describe

Stage	Parts ²	Total
unfertilized eggs	circle on inside	1
blastula	red dots	1
pluteus larvae	rudimentary gut	1
	skeletal structure	3
	mouth	1
	hair	1

- Few visitors described any substructure in what they drew. In all, 5 out of the 19 visitors who drew a picture mentioned any details. Instead, what they remember was a more holistic impression of the shapes of what they saw. This may be because the stationary embryos lacked obvious structures and the moving larvae moved too quickly. It may also be possible that the structures in a sea urchin embryo are not familiar enough to visitor and are passed over.
 - In most cases, when a visitor identified a part for a sea urchin, s/he had also looked at the media screen describing that stage of development. There was only one case where a visitor described a part (skeletal structure) but did not navigate to the corresponding screen on the media piece.
- Processes/ actions visitors described

Stage	Process ³	Total
Unfertilized eggs	stationary	2
Dividing cells	stationary	2
	moving	1
Blastula	stationary	1
	moving	7
Gastrula	moving	3
Prism larvae	moving	5
Pluteus larvae	moving	7

- Most visitors (18/19) mentioned whether or not the sea urchin were moving. No one described the other activities described in the media piece.

² The parts in bold font are those mentioned in the accompanying media piece.

³ The processes in bold font are those mentioned in the accompanying media piece.

SUMMARY WITH RECOMMENDATIONS

- The holding time for this exhibit prototype is about 1:10 (mean). This falls in the upper half of the Traits of Life exhibits. However, it is lower than the average holding times for the zebrafish and the amoeba specimens. A subsequent analysis will compare visitors' experiences for the 3 specimens studied to date.
- Most of the visitors interviewed rated the exhibit *Interesting* or *Somewhat Interesting*.
- A few visitors had questions that were not answered in the accompanying media piece. These questions all center on the development of the urchin larvae to the mature sea urchin they are more familiar with. Since this evaluation, Kristina, the microscopist, has incorporated this information into the media piece.
- Most (86%) visitors managed to find a specimen to look at either by moving the stage or waiting for a sea urchin to move into view.
- We did not detect any difference in what visitors chose to stop and look at.
- Few visitors identified the parts or the processes (beyond moving) associated with the embryos/larvae 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/larvae, supporting visitors in drawing what they see).
- Close to 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.
- About 30% of the visitors looked behind the glass at the microscope. Of those interviewed (N=20), 68% connected the microscope with what they saw: They thought the live specimens were on the microscope.

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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) : Projector_urchin_0615

Setup

- Magnification 20x
- Limits
 - Search Area = 3000 r microns
 - Focus Range = 350 microns

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?