

Biomechanics Unit Overview



The Physical Education Students of Dimensions Academy work on a Biomechanics Unit in cooperation with the University of Wisconsin River Falls undergraduate students and Dr. Debra Allyn. Students will use Dartfish Technology to complete two labs. The labs consist of Linear Acceleration (Remote Control Car Lab) and Trajectory (Water Balloon Slingshot Lab). After the completion of the labs the students will use the Media Book component of the software and do an analysis of a novice versus an expert on a sport skill of their choosing.

Unit Day	Content Covered
1	Intro to Dartfish – Representatives from Dartfish will present on the uses of Dartfish around the world.
2	Field Trip to University of Wisconsin River Falls Student will be working with the undergraduates at UWRF on various Biomechanics concepts. (Dr. Debra Allyn – University of Wisconsin River Falls Guest Teacher) Video 101 – (lab) Basics of using handheld cameras, lighting, distance, angles etc.
3	Stromotion and Simulcam Students will make two short motion clips using both Simulcam and Stromotion technology for their clips.
4	Trajectory – (lab) Students will be using water balloon slingshots and various size and weighted balls to measure trajectory and distance using video.
5	Remote Cars Experiment – (lab) Students will be using video analysis and remote control cars to determine acceleration.
6	Introduction to Analysis Project and Presentation
7-16	Students will work on their individual or group analysis project.
17-20	Student Presentations

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Tragetory Lab



Stromotion Example



Simulcam Example



Stromotion Example



Simulcam Example

Analysis View SlideShow View Student Example Media Book Fc

Analysis Selection Alex and Cedric Final Project

Media Book

Comments

Key Positions 1-5 / 6

- Starting Position
- The Swing
- The Leap
- The Impact
- Follow Through

This analysis was made with Dartfish software. More information on www.dartfish.com

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Dimensions Academy Videotaping Activity

Name _____

Purpose:

The purpose of these activities is for you to understand the importance of proper videotaping techniques. When analyzing movement using video the quality of the video affects the analysis process. Upon completion of these activities you should

- 1) understand the value of videotape as an analysis tool, and
- 2) acquire basic videotaping techniques (shutter speed, focus, filming angles, and filling the frame).

Activities:

1. Tennis ball rebound on the racquet
 - a. With the racquet face parallel to the ground have the ball rebound about 2- 3 feet high
 - b. Videotape a couple of seconds at each shutter speed
 - c. Change the shutter speed and re-tape the tennis ball rebound
 - d. Indicate the change of the shutter speed with a hand signal, or a visual aid
 - e. Change the shutter speed to 4 different speeds

Trial #	Shutter speed
_____	_____
_____	_____
_____	_____
_____	_____

2. Videotape a stopwatch or clock for about 10 seconds. Have the stopwatch running before recording with the camera.

3. Free Throw - Videotaping to understand difference in perspective
 - a. Videotape and view with the “naked” eye a person shooting a free throw
 - b. “Naked” eye - Record your observations. **Wait** to share your observations with your classmates.
 - c. Film from both sides, the front and the rear of the performer. Change your view (position) at the same time you change the camera view and record your observations.

Sagittal View (non-dominant)

Observations

Sagittal View (dominant)

Observations

Rear view

Observations

Front view

Observations

4. Tennis serves
 - a. Set up the camera at what you think is the appropriate position to videotape this activity.
 - b. Film two performers
 - c. Film a minimum of 5 trials for each performer
5. "In the action"
 - a. Walk through the field of view of the camera
 - b. Go to the computer and view your walking
 - c. Analyze your performance
6. Videotape a skill of interest (if time)

Analysis:

Review the videotape and discuss the following questions.

1. Tennis ball rebound on racquet
Note the difference in the ball/racquet interaction with the different shutter speeds and describe the differences.
 - a. What did you notice with the different shutter speeds?

- b. Did you (camera) ever capture the ball racquet impact?
- c. Is capturing the interaction of the racquet/ball dependent upon shutter speed?

2. Stopwatch

- a. View the stopwatch/clock video and count the number of frames per second (fps). Repeat this 3 times and record your results. _____
- b. What is the rate of filming of a standard DVD camera?
- c. Import the video into the Dartfish program. Count and record the number of fps. _____
- d. What is the advantage of using a motion analysis system?

3. Free throw

Compare the analysis with the videotape to your “live” observations.

- a. View the videotape of the free throw. Record your observations.
- b. Compare these observations with your notes of the observations during the live observation.
- c. What were you able to see from the different perspectives?
- d. What was the best vantage point and why?

4. Tennis serves

Critique the videotape for the quality of the filming.

- a. How many trials did you “capture” the total movement?
- b. In the trials where you did not capture the total movement, what positions of the movement were missing?
- c. How many trials did you “capture” the racquet contacting the ball?
- d. What affects the ability of the camera to capture the contact?

5. “In the action”

a. Why or how would a professional use this feature (a coach, teacher, physical therapist, occupational therapist, athletic trainer, fitness leader, etc.)?

Videotaping Plan

From what you learned from these activities, develop your filming plan for your skill analysis project.

StroMotion Tips

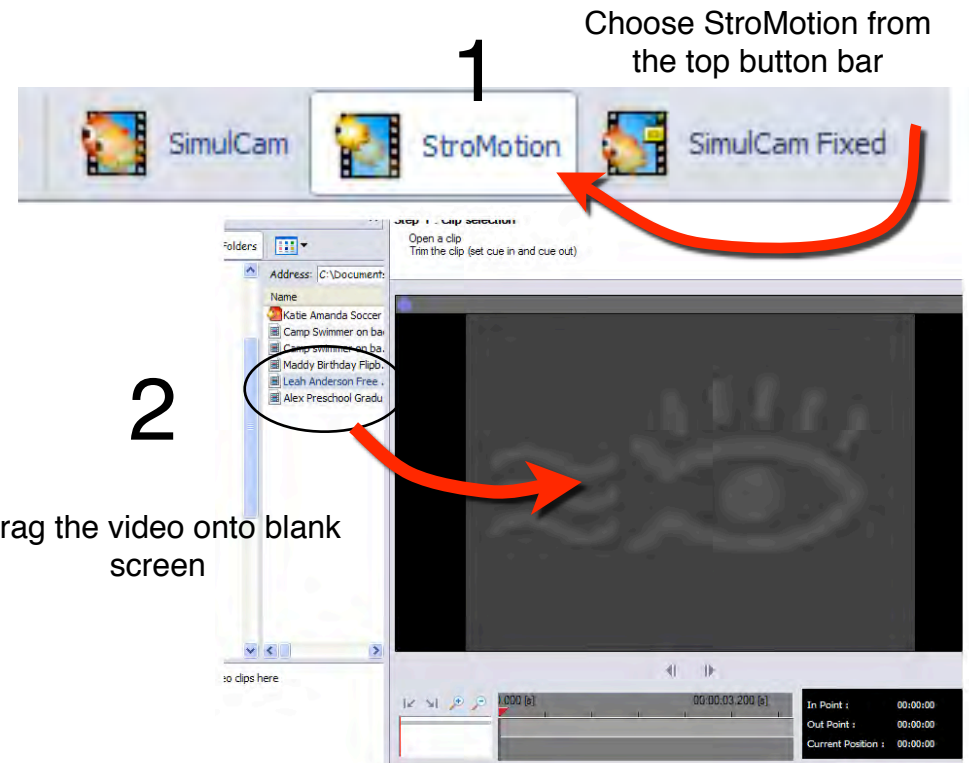
GOAL: to familiarize the students with the Dartfish Component StroMotion.

VIDEO: The video must be movement from left to right or right to left across the viewing area. It can be video of an object or a body. It is best to stro motion the entire body if it is moving or the entire object. For example the arm of a pitcher or the tennis racquet during a serve would be impossible separate the motion from the person and make it look decent.

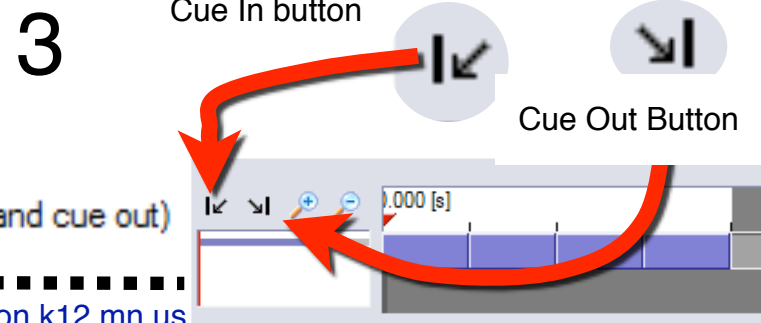


Stromo vs. Stro motion fixed

Stromo fixed will do the cloning for you. Stro motion you can circle the object with the tools and it makes for a cleaner look. It all depends on your quality of the video.



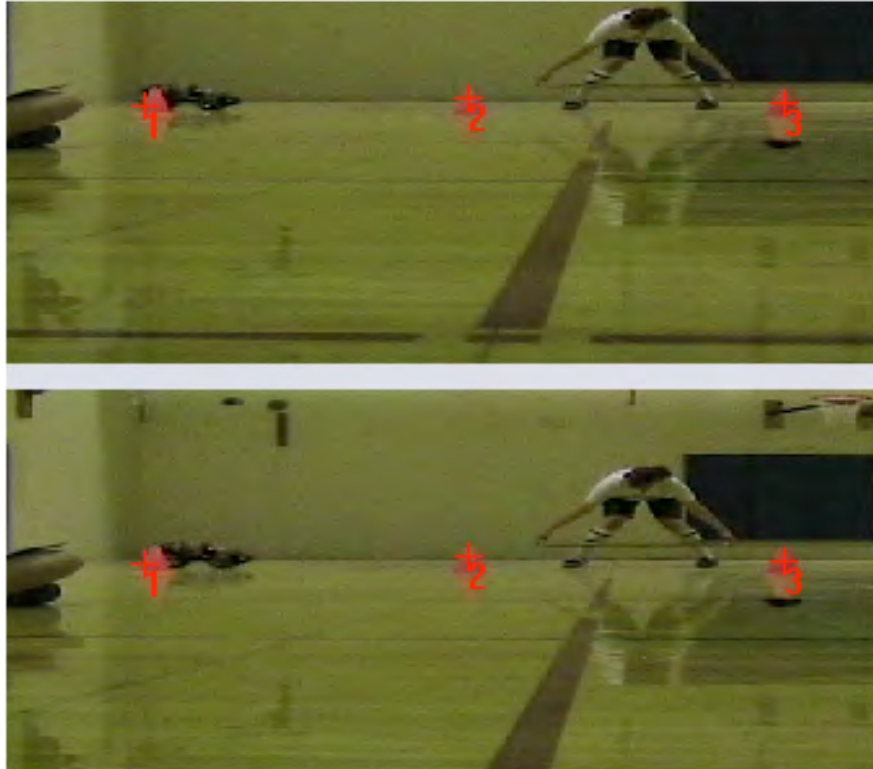
2
Drag the video onto blank screen



4

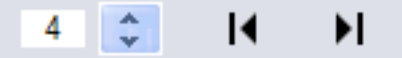
Step 2 : Computation of camera movement

Set at least 2 alignment points in the background of each image
Click to add points. Right click to remove points.



5

Jumpsize:



You can set the jumpsize to any frame amount that you feel you would like to skip to draw the next clone

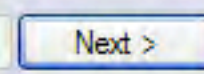
Cloning Tools



Square Drawing

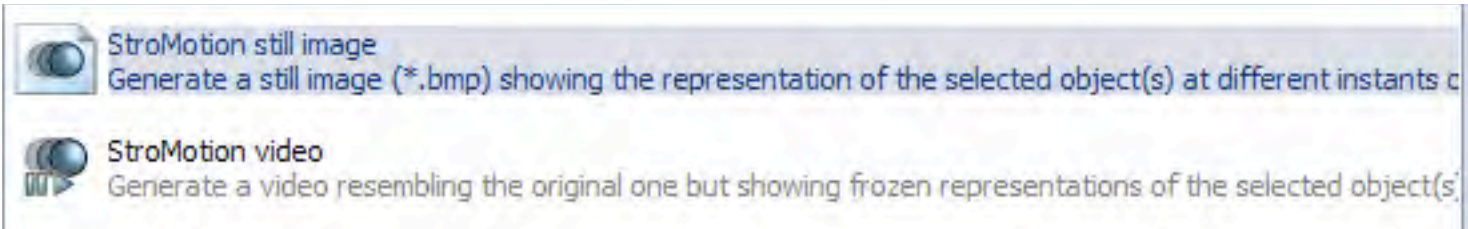


Free Hand Drawing



When you have completed a step click next. Preview it when you can clock back if you don't like it.

When you are all done click on Stromotion video. Make sure you know where you are saving it to. AVI I is the correct format. Have it put a copy on your tray to view later. Go to file: Save. Save this as your name and Stromoproject. Now click on PLAYER find your clip on the tray and watch it.



Linear Acceleration Lab - Analysis/Interpretation

Average speed is computed by dividing the total distance by the total time

1. Show all your calculations and calculate the average speed between each of the **EQUALLY SPACED CONES**
2. Graph your calculations from the manually collected data.
3. Use DARTFISH to calculate the same data. (Using the stopwatch)
4. After examining the results, what can you say about the acceleration of the remote car?
 1. Did it continue to speed up throughout the entire distance, or slow down a bit at the end or another area?
 2. Where was peak velocity reached?
 3. What kind of differences were noticed from using the software and the manual calculations?
5. List ways you can use linear acceleration outside of the sports world.

Use a separate piece of paper for your answers

Remote Car DARTFISH Assignment

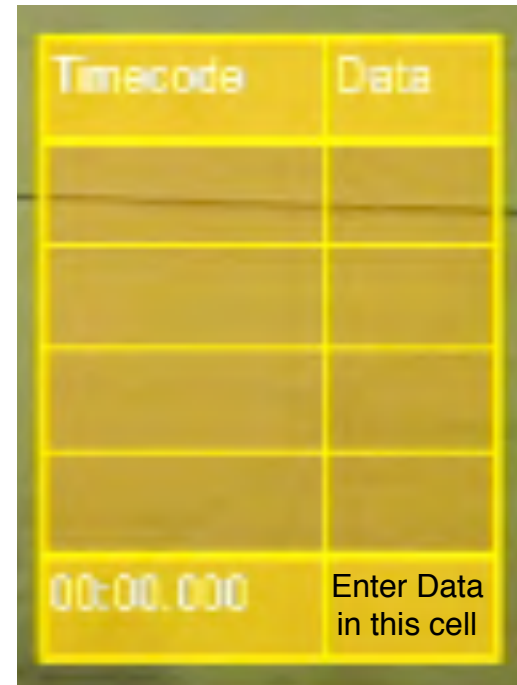


Drawing Toolbar

All the tools that are changeable have a black arrow just below the tool on the right. If you RIGHT click on the arrow you will be able to select the tool you wish. For the remote car lab we will need the Data Table Tool.

1

Find it. Then Click on it. Go to the viewing screen and click to drop one on the screen.



2

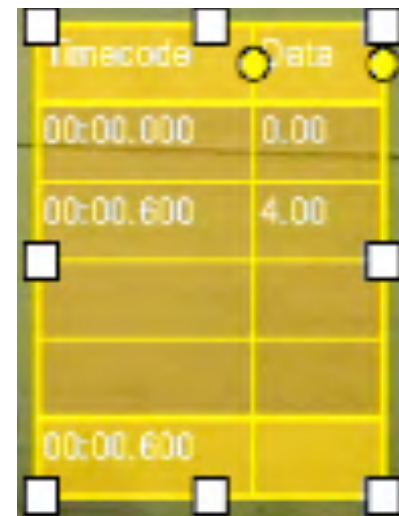
To start with just make a simple table with time code and Data columns.

- Move the video frame by frame to the point where the car is at the first cone. This would mark time zero. Right click in the Time code column bottom cell and set the time code to zero.
- Right click in the lower data column cell and type a zero. Then hit return.

3

Move the video frame by frame until the car is at the first cone. Then right click in the lower data column cell again and type 4. Repeat this for 8, 12, and 16 feet.

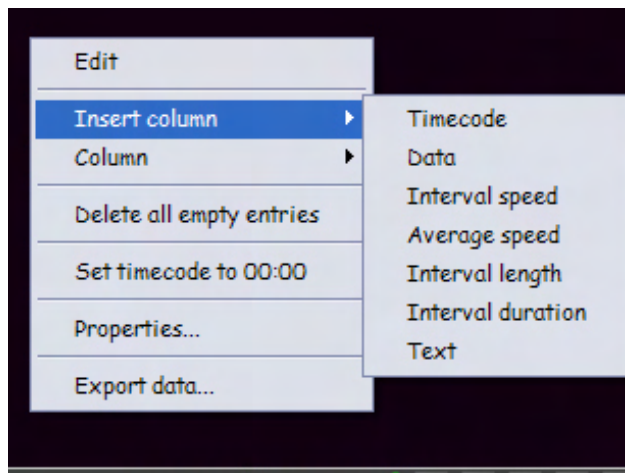
4



Next Right click on the data table and add additional columns.

- Interval Speed
- Interval Length
- Interval Duration

5



Label	Contents of Cell
Time code	Actual total duration of the video
Data	Hand entered feet (4, 8, 12, 16)
Interval Speed	Interval Length/Interval Duration
Interval Length	Feet Between Cones
Interval Duration	Total Time between cones taken

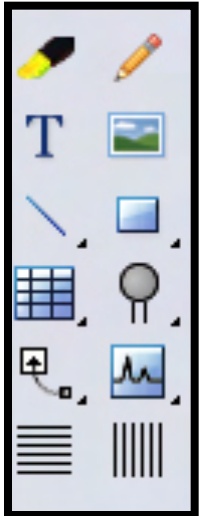
Timecode	Data	Interval speed
00:00.600	4.00	6.66
00:01.034	8.00	8.27
00:01.468	12.00	10.42
00:01.901	16.00	9.22
00:01.901		

When you have completed the video analysis. Go to file and save. Save it to the desktop. Once there drag it into Mr. Walsh's drop box. If on the black PC just save to the desktop, **MAKE SURE TO HAVE GROUP MEMBERS FIRST NAMES AS FILE NAME!!**

6

Timecode	Data	Interval speed	Interval length	Interval duration
00:00.600	4.00	6.66	4.00	00:00.600
00:01.034	8.00	8.27	4.00	00:00.483
00:01.468	12.00	10.42	4.00	00:00.383
00:01.901	16.00	9.22	4.00	00:00.433
00:01.901				00:00.433

Projectile DARTFISH Assignment



Drawing Toolbar

1

All the tools that are changeable have a black arrow just below the tool on the right. If you RIGHT click on the arrow you will be able to select the tool you wish. For the projectile lab we will need the Angle Tool.

Find it. Then Click on it.



2

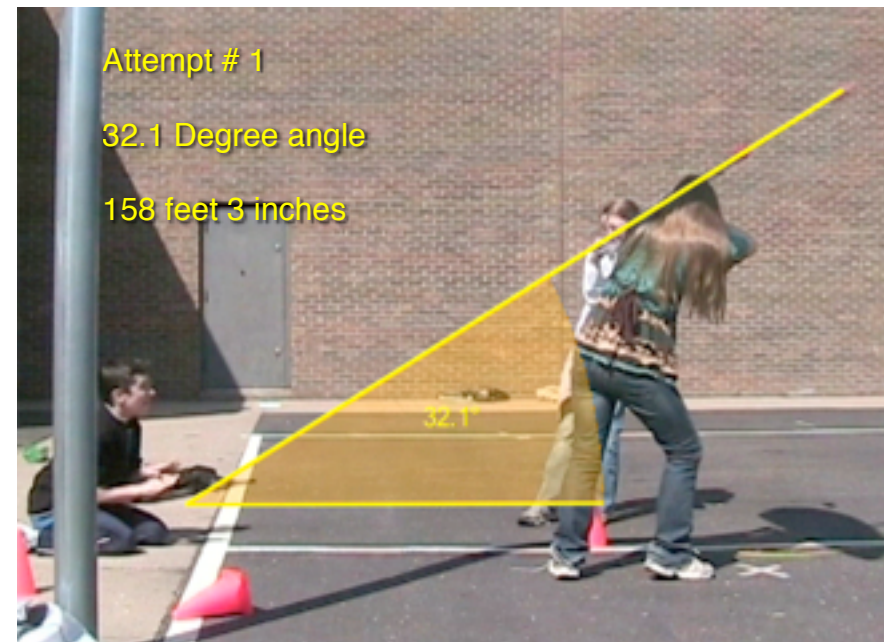
To start with Find the frame just before release of the slingshot.

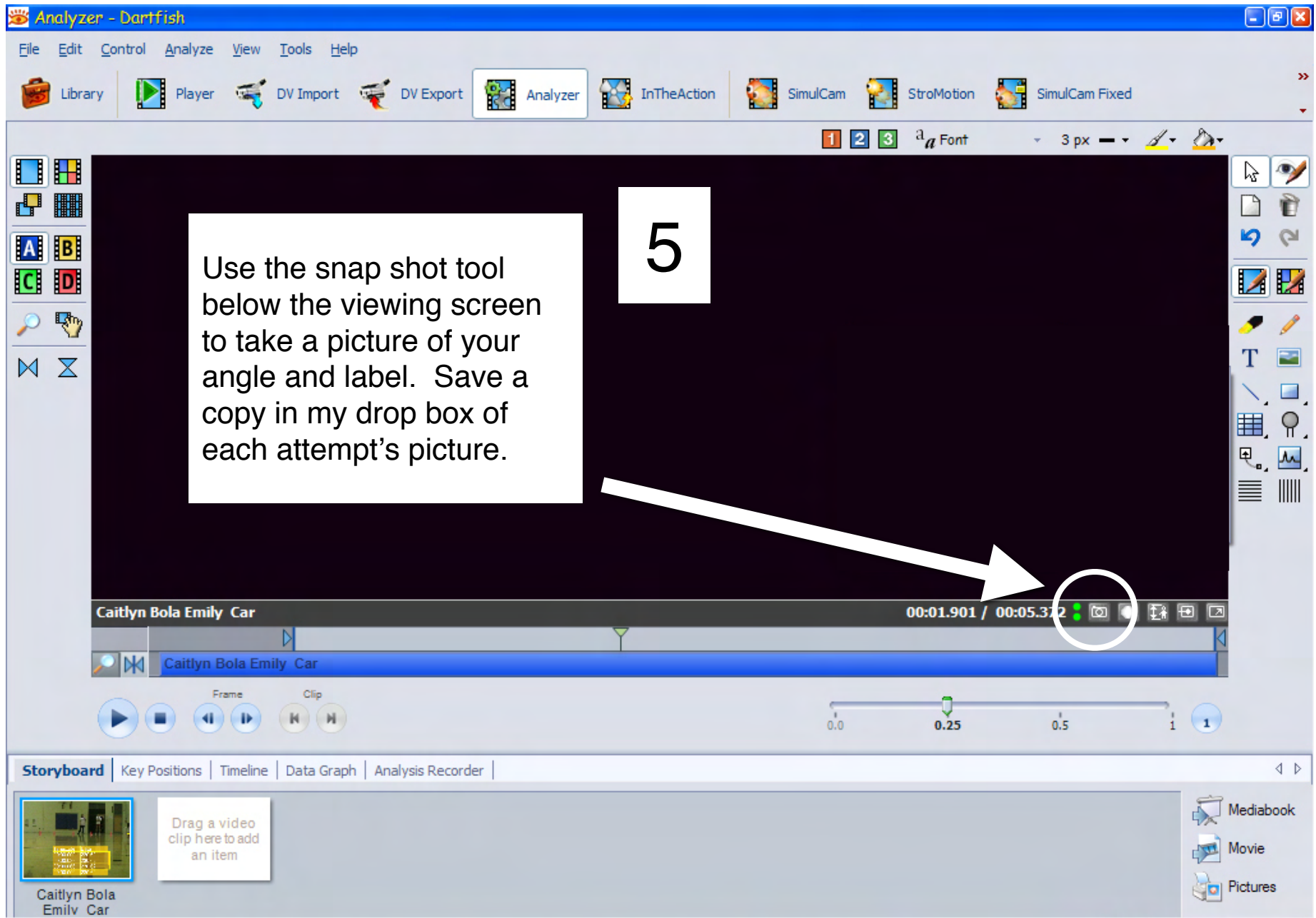
Place the beginning point of the angle at the hands of the "Slinger". Then trace straight across to make your zero axis (About at the knee of the front holder. Release and drag the top line of the angle on top of the slingshot band.

3

Once you are certain to have the correct angle. Label the picture using the "Text" tool - Attempt # and also the distance it traveled.

4





Projectiles Lab – Analysis and Interpretation

Use a separate piece of paper for your answers

Videotaping Instructions:

Step 1: One person should stand with their throwing arm side facing the video camera. Adjust the video camera by zooming in or out until you can see the entire slingshot area. You should zoom in or out to make the picture as large as possible while still being able to see the slingshot throughout the entire motion.

Step 2: Once you have adjusted the zoom on the camera do not change it. Videotape a meter stick for 5-10 seconds. Do this for each taping.

Step 3: Videotape the ball being thrown. Make sure to get at least three different angles per projectile. Indicate to the camera which attempt is being made

Step 4: Measure the distance from the front cones to where the projectile landed FIRST for each attempt.

Analysis/Interpretation

- 1) Create a table to list the projectile used, each angle and each distance.
- 2) After examining the results what can you say about angular projections?
 - a. What change occurred when you changed the angle?
 - b. Was there a point when the angle was too much or too little to maximize distance? What are those angles?
- 3) When would angular trajectory calculations be used in the real world?

Creation of Instructional Video for Basic PE Learner

General Description

Students will use the technology available to describe, demonstrate and instruct future students in a skill of their choice. The final product will give coaching/instruction pointers for the novice learner. The final product will include: a video checklist of "Steps to Success" to assess the technique. The presentation will be divided into parts to utilize a progression for learning the skill. Using the video checklist the students will analyze and compare two performers for the skill. One of the performers will be an experienced performer and one "truly" novice. Show with the technology available the differences between the novice and the skilled performer. Finally demonstrate one drill or skill building activity for the novice learner to use in order to correct a technical error in their performance. Students may use community coaches, the internet or other print media for sources of information for correct technique application for the product. Each source should be noted in your presentation.



Make sure to include in your presentation:

- 1) A description of the basic skill and what method you used to analyze the two performers. (What special Dartfish component was used to compare – Simulcam, Simulcam Fixed, Stromotion, or Stromotion Fixed for example) and what angle the video analysis was taken from.
- 2) Describe in words what perfect form of this skill looks like while showing on video.
- 3) Give a checklist of important technique for each step of the activity. Show the "Steps to Success" of each performer in the presentation.
- 4) Give verbal analysis of each performers 5 key movements
- 5) Demonstrate and describe a drill to build the skills necessary to perform this skill for the novice learner

